

M5 Junction 10 Improvements Scheme

Environmental Statement Chapter 10: Geology and Soils TR010063 – APP 6.8

Regulation 5(2)(a)

Planning Act 2008

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

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M5 Junction 10 Improvements Scheme Development Consent Order 202[x]

6.8 Environmental Statement: Chapter 10: Geology and Soils

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Document accessibility

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10. Geology and Soils

10.1. Introduction

- 10.1.1. This chapter presents the environmental assessment of the M5 Junction 10 Improvements Scheme (“the Scheme”) for Geology and Soils based on the Scheme as it is described in Chapter 2 - The Scheme (Application document TR010063/APP/6.2) and detailed in the General Arrangement Plans (Application document TR010063/APP/2.9). The chapter sets out the standards and methodologies that have been used to carry out the assessment of geology and soils for the Environmental Statement. This chapter contains information on the study area, presents the baseline conditions and describes the likely impacts and effects. Design and mitigation measures which can be used to mitigate potential impacts are also provided.
- 10.1.2. This chapter assesses the following topics in accordance with the methodology set out in the National Highways Design Manual for Roads and Bridges (DMRB) series of ‘LA’ guidance documents, in particular LA104: Environmental assessment and monitoring¹ and LA109: Geology and Soils²:
- Effects on bedrock geology and superficial deposits, including geological designations and sensitive/valuable non-designated features.
 - Effects on agricultural land, including Best and Most Versatile (BMV) agricultural land and on soil resources.
 - Effects from contamination on human health, surface water and groundwater.
- 10.1.3. On the basis that Environmental Protection Areas (Ramsar sites, Local Nature Reserves, non-designated notable habitats, European Union (EU) designated sites etc.) in which the supporting soils could be directly affected were not present within or adjacent to the study area. Direct or indirect effects are therefore unlikely and these features were therefore scoped out of the assessment at the scoping stage³. Geological features of local, regional, national or international importance were also scoped out of the assessment for the same reason.
- 10.1.4. Mineral deposits as a resource, and waste generated by the Scheme are topics discussed in Chapter 12 - Materials and Waste (Application document TR010063/APP/6.10). Effects associated with water quality are provided in Chapter 8 - Road Drainage and the Water Environment (Application document TR010063/APP/6.6) and effects associated with landform are reported in Chapter 9 - Landscape (Application document TR010063/APP/6.7). Impacts on commercial farming activities are discussed in Chapter 13 - Population and Human Health (Application document TR010063/APP/6.11).

Competent expert evidence

- 10.1.5. This Geology and Soils chapter has been prepared by the following individuals who have used their knowledge and professional judgement to undertake this assessment:
- An Associate Environmental Consultant (MSc, BSc, MEnvSc Env) who holds professional membership with the Institute of Environmental Sciences (IES). They have over 16 years of experience in contaminated land, environmental assessment and management.
 - A Principal Environmental Consultant (MSc, CSci MEnvSc, FGS) who holds professional membership with the IES. They have over 19 years’ experience in contaminated land risk assessment, environmental assessment and management.
 - An Environmental Consultant (BSc, MSc) with 10 years of experience in contaminated land and environmental risk assessment.

¹ Design Manual for Roads and Bridges, Sustainability & Environment Appraisal LA104 Environmental assessment and monitoring, 2020

² Design Manual for Roads and Bridges, Sustainability & Environment Appraisal LA109 Geology and soils, 2019

³ Atkins, M5 J10 Scoping Report. Document number GCC M5J10-ATK-EGT-ZZ-FN-LM-000001, 2020

10.2. Planning policy and legislative context

- 10.2.1. This geology and soils assessment has been undertaken in accordance with the following policy, legislation and guidance. It should be noted that the details presented in this section are not intended to provide a full consideration of the relevant documents and their application to the Scheme. This information is provided within the Planning Statement and Schedule of Accordance with National Policy Statement (Application document TR010063/APP/7.1) that accompanies the application for a Development Consent Order (DCO).

National policy and legislation

National Policy Statement for National Networks 2014 (NPS NN, 2014)

- 10.2.2. The Scheme falls within the definition of a Nationally Significant Infrastructure Project (NSIP) under the 2008 Act, making the NPS NN⁴ the primary planning policy against which an application for a DCO for the Scheme would be judged.
- 10.2.3. Paragraphs 5.22 and 5.23 of the NPS NN relate to sites of geological importance and state that where the project is subject to EIA the Applicant should ensure that the ES clearly sets out any likely significant effects on internationally, nationally and locally designated sites of ecological or geological conservation importance. Opportunities to conserve and enhance geological conservation interest should be considered where relevant.
- 10.2.4. Furthermore, paragraph 5.25 states that development should avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives.
- 10.2.5. Paragraph 5.168 of the NPS NN relates to soil resources and land contamination and states that Applicants should take into account the benefits of BMV agricultural land. 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. For developments on previously developed land, Applicants should ensure that they have considered the risk posed by land contamination.
- 10.2.6. Paragraph 5.179 also states that Applicants should minimise the direct effects of a project by the application of good design principles, including the layout of the project and the protection of soils during construction.

National Planning Policy Framework (NPPF) 2023

- 10.2.7. Paragraph 180 of the NPPF⁵ is of particular relevance to geological and soil conservation, stating that 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)’ as well as recognising the ‘economic and other benefits of the BMV agricultural land, and of trees and woodland.’
- 10.2.8. Paragraph 180 also states that plans should prevent new and existing development from contributing to, being put at an unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Where significant development of agricultural land is demonstrated to be necessary, local planning authorities should seek to use areas of poorer quality land in preference to those of higher quality.
- 10.2.9. Paragraph 189 states that policies and decisions should ensure that a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination.

⁴ Department of Transport, National Policy Statement for National Networks, 2014

⁵ Ministry of Housing, Communities and Local Government, National Planning Policy Framework, 2023

- 10.2.10. Building on the NPPF, Planning Practice Guidance (PPG) in 2019⁶, provides the guiding principles on how planning can deal with contaminated land. It describes the stages which should be followed to characterise the site through reference to available published and site specific datasets and the completion of a contamination risk assessment to determine the existence or otherwise of contamination, its nature and extent, and the risks it may pose. The design and implementation of remediation, monitoring and maintenance is also covered, to be followed if the outcome of the risk assessment deems that it is required.

[Environmental Protection Act 1990](#)

- 10.2.11. Part 2A of the Environmental Protection Act (EPA) 1990⁷ introduced a statutory regime for the identification and remediation of 'Contaminated Land'. It provides a statutory definition of 'Contaminated Land' based on significant harm or the likelihood of significant harm or significant pollution or a significant possibility of such pollution of controlled waters (all groundwater, inland waters and estuaries, excluding water perched above the zone of saturation).
- 10.2.12. Local authorities are the primary regulators under the Part 2A regime, with a duty to identify whether the land in their area is 'Contaminated Land', although provision is made for consultation and co-ordination with the Environment Agency in situations when pollution of controlled waters is an issue.

[Environment Act 1995⁸](#)

- 10.2.13. This act allowed for the establishment of the Environment Agency in England and Wales, and the Scottish Environmental protection Agency in Scotland, as a regulatory body and to make provision for control of pollution and conservation of the natural environment.

[The Contaminated Land \(England\) Regulations 2006⁹](#)

- 10.2.14. These regulations make provision for the identification and remediation of contaminated land under the EPA 1990, with reference to the identification of special sites including land affected by radioactivity.

[The Environmental Permitting \(England and Wales\) Regulations 2016¹⁰](#)

- 10.2.15. These regulations provide the requirements for environmental permits in England and Wales covering the rules to be followed for the application, enforcement, and surrender of the permit. The scenarios by which an environmental permit may be required comprise the operation of a regulated facility and to discharge to surface water or groundwater. A regulated facility comprises an installation or mobile plant, waste operation, mining activity, radioactive substances activity, incineration, solvent emission, flood risk activity or water discharge activity.

[The Water Resources Act 1991 \(as amended\)](#)

- 10.2.16. The Water Resources Act¹¹ sets controls of pollution of water sources in Section III. It contains information about water quality objectives, powers to prevent and control pollution, and pollution offences.

[Water Framework Directive \(WFD\) 2015](#)

- 10.2.17. The purpose of the WFD¹² as enacted by the Water Resources (Water Framework Directive) (England and Wales) Regulations¹³, is to establish a framework for the

⁶ Ministry of Housing, Communities and Local Government, Planning Practice Guidance, Land affected by contamination, 2019

⁷ United Kingdom Government, Environmental Protection Act, 1990

⁸ United Kingdom Government, Environment Act 1995

⁹ United Kingdom Government, The Contaminated Land (England) Regulations 2006

¹⁰ United Kingdom Government, The Environmental Permitting (England and Wales) Regulations 2016

¹¹ United Kingdom Government, Water Resources Act, 1991

¹² Department for Environment, Farming and Rural Affairs, Water Framework Directive, 2015

¹³ United Kingdom Government, The Water Environment (Water Framework Directive) (England and Wales) Regulations, 2017

protection of inland surface waters, transitional waters, coastal waters and groundwater. It requires that:

- Environmental objectives should be set to ensure that good status of groundwater is achieved and that its deterioration is avoided. This includes that any upward sustaining trend in the concentration of a pollutant must be identified and reversed.
- A good status of groundwater requires early action and stable long-term planning of protective measures, owing to the natural time lag in its formation and renewal.
- Monitoring programmes should cover monitoring of the chemical and quantitative status of groundwater.

River Basin Management Plan (RBMP) 2015

10.2.18. The RBMP¹⁴ is designed to protect and improve the quality of the water environment. It includes consideration of the following topics:

- Plans for the protection and improvement of the water environment.
- Future plans that may affect the infrastructure sector and its obligations.
- Development proposal considerations regarding the requirements of the RBMP.
- Environmental permit applications.

Regional and Local Policy

Joint Core Strategy (JCS) 2011-2031

10.2.19. The key policies of the Joint Core Strategy¹⁵ relevant to geology and soils are:

- Policy SD9: Biodiversity and Geodiversity: The purpose of the policy is to ensure that individual assets and the quality of the natural environment in the future is planned, protected and enhanced at a strategic scale, recognising that networks extend across local authority boundaries. Harm to the biodiversity or geodiversity of an undesignated site or asset should be avoided where possible. Where there is a risk of harm as a consequence of development, this should be mitigated by integrating enhancements into the Scheme that are appropriate to the location.’
- Policy SD14: Health and Environmental Quality: A new development must consider the quality and versatility of any agricultural land affected by proposals, recognising that the best agricultural land is a finite resource.

Cheltenham Local Plan 2020

10.2.20. The Cheltenham Plan¹⁶ was adopted on 20 July 2020 and covers the period to 2031. Chapter 10 of the plan details the requirement for the protection of geodiversity, with reference back to the JCS summarised above, to consider the importance of protecting sites from development that would have a harmful effect on their conservation. Two regionally important geological sites (RIGS) are identified within the Cheltenham Borough and considered important for their aesthetic, cultural, amenity, historical, wildlife and educational value. A Geodiversity Action Plan for Gloucestershire is anticipated to be developed during the lifetime of the Plan. Agricultural land is covered under the JCS.

Tewkesbury Borough Plan 2011 to 2031

10.2.21. The Tewkesbury Borough Plan 2011 to 2031¹⁷ was adopted on 8 June 2022. Policy NAT1 states that development likely to result in the loss, deterioration or harm to features, habitats or species of importance to geological conservation (local geological sites (LGS) and regional geological sites (RIGS)), either directly or indirectly, will not be permitted unless the need for, and benefits of the development clearly outweigh its likely impact, it

¹⁴ Environment Agency, Part 1: Severn river basin district, River basin management plan, 2015

¹⁵ Gloucester City, Cheltenham Borough and Tewkesbury Borough Council, Gloucester, Cheltenham and Tewkesbury Joint Core Strategy 2011 – 2031, 2017

¹⁶ Cheltenham Borough Council, Cheltenham Plan, 2020

¹⁷ Tewkesbury Borough Council, Tewkesbury Borough Plan 2011-2031, 2022

can be demonstrated that the development could not reasonably be located elsewhere, and measures are implemented that would avoid, mitigate against or compensate for the adverse effects likely to result from development.

Guidance documents

Contaminated Land Statutory Guidance 2012

10.2.22. The principal objectives of the legislation are described in the Department for Environment, Food and Rural Affairs (DEFRA) Contaminated Land Statutory Guidance 2012¹⁸, as follows:

- Identify and remove unacceptable risks to human health and the environment.
- Seek to ensure that contaminated land is made suitable for its current use.
- Ensure that the burdens faced by individuals, companies and society as a whole are proportionate, manageable and compatible with the principles of sustainable development.

10.2.23. These three objectives underlie the 'suitable for use' approach to the assessment and remediation of 'land contamination'. This approach recognises that the risks presented by any given level of land contamination will vary greatly according to the use of the land and a wide range of other factors, such as the sensitivity of the underlying geology and the receptors which may be affected. The 'suitable for use' approach consists of three elements:

- Ensuring that land is suitable for its current use.
- Ensuring that land is made suitable for any new use.
- Limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land.

Land Contamination Risk Management, 2021

10.2.24. The objectives set out in the Contaminated Land Statutory Guidance 2012¹⁸ are applied in the Land Contamination Risk Management Guidance 2021 (LCRM)¹⁹. The guidance provides a technical approach for undertaking a tiered risk assessment to appraise the potential risks to the environment from potential contaminants in soil and groundwater. The tiered approach comprises:

- Preliminary Risk Assessment (PRA) to develop an initial conceptual site model (CSM) to establish whether there are any potentially unacceptable risks.
- Generic Quantitative Risk Assessment (GQRA) using generic assessment criteria and assumptions for an appropriate end-use scenario to refine the CSM and quantify the potential risk.
- Detailed Quantitative Risk Assessment (DQRA) using detailed site-specific information to refine the risk.

10.2.25. Each tier of assessment uses the following hierarchy:

- Identify the hazard.
- Assess the hazard.
- Estimate the risk.
- Evaluate the risk.

DEFRA's Safeguarding our Soils – A Strategy for England 2009

10.2.26. Safeguarding our Soils – A Strategy for England²⁰ states that by 2030, DEFRA's vision is that all of England's soils will be managed sustainably and degradation threats will be

¹⁸ Department for Environment, Farming and Rural Affairs, Contaminated Land Statutory Guidance, 2012

¹⁹ Environment Agency, Land Contamination Risk Management, 2022, <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

²⁰ Department for Environment, Farming and Rural Affairs, Safeguarding our Soils – A Strategy for England, 2009

tackled successfully. Chapter 6 of the strategy states objectives for effective soil protection during construction and development are to:

- Ensure soil ecosystem services are fully valued in the planning process.
- Ensure appropriate consideration is given to the protection of good quality agricultural soils from development.
- Encourage better management of soils through all stages of the construction process.

10.2.27. In addition to the documents referenced above, the following guidance documents have also been considered in the development of this chapter:

- British Standards (BS) BS8485+A1:2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
- BS5930+A1:2020 – Code of practice for ground investigations.
- BS10175:2011+A2:2017 – Code of Practice for Investigation of Potentially Contaminated Sites.
- Construction Industry Research and Information Association (CIRIA) C681 Unexploded Ordnance (UXO) – A Guide for the Construction Industry, 2009.
- CIRIA C733 Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks, 2014.
- CIRIA C682 The Volatile Organic Contaminants Handbook, 2009.
- CIRIA C552 Contaminated Land Risk Assessment – A Guide to Good Practice, 2001.
- CIRIA C665 Assessing Risks Posed by Hazardous Ground Gases to Buildings, 2007.
- Contaminated Land: Applications in Real Environments – The Definition of Waste: Development Industry Code of Practice (DoWCoP), 2011.
- DEFRA's Code of Practice for the Sustainable Use of Soils on Construction Sites, 2009.
- Department of the Environment (DoE) / Environment Agency, Industry Profiles for previously developed land, Environment Agency, 1995.
- Environment Agency Report R&D66, Guidance for the Safe Development of Housing on Land Affected by Contamination, 2008.
- Environment Agency, Guiding Principles for Land Contamination (GPLC), 2010.
- Institute of Environmental Management and Assessment, A New Perspective on Land and Soil in Environmental Impact Assessment, 2022.
- Natural England, Technical Information Note 049 Agricultural Land Classification: protecting the best and most versatile agricultural land (TIN049), 2012.

10.3. Methodology

Assessment methodology

General

10.3.1. The assessment methodology follows the requirements outlined within LA109 and comprises the following stages:

- Establishment of scope and objectives of the assessment.
- Identification of study area.
- Completion of a desk based baseline assessment using available published datasets and supplemented by site specific investigations and surveys, as required.
- Development of a CSM to identify the likely risk presented to humans, controlled waters, property and ecological receptors from identified potential land

contamination.

- Assignment of significance/value to agricultural land and land contamination receptors and assessment of the likely magnitude of potential impact to the identified receptors.
- Review of the likely potential impacts to identified agricultural land and land contamination receptors for baseline, construction and operation scenarios.

10.3.2. Identification of required embedded and additional mitigation, considering the outcome of the impact assessment. Further details on the assessment considerations specific to agricultural land and land contamination aspects are detailed in the following sections.

Agricultural land and soil

10.3.3. The assessment has been undertaken in accordance with the methodology set out in the DMRB guidance documents LA104 and LA109.

10.3.4. The information in Table 10-1 below is taken from Table 3.11 of LA109 and describes how value (sensitivity) has been assigned. Agricultural land is assigned a value based on its Agricultural Land Classification (ALC) Grade in the application of the Ministry of Agriculture, Fisheries and Food (MAFF) revised guidelines and criteria for grading the quality of agricultural land²¹. BMV agricultural land is land that has been assigned Grade 1, Grade 2 or Subgrade 3a in the ALC system.

10.3.5. Section 3.6.1 of LA109 states that a soil resource and/or ALC survey should be undertaken to inform the assessment where data is incomplete. ALC surveys were carried out in:

- December 2020 along the Link Road between the A4019 and B4634.
- October 2021 along the proposed flood storage area adjacent south-east of the M5 Junction 10.
- May 2022 consisting of three parcels of land adjacent to the north-west of the M5 Junction 10, and along the Link Road between the A4019 and B4634.

10.3.6. The ALC survey results are provided in Appendix 10.4, 10.5 and 10.6 (application document TR010063 – APP 6.15) and presented in Figure 10-3.

10.3.7. ALC surveys were planned for the area adjacent to the north of the A4019 between Uckington and the Piffs Elm Interchange. However, due to land access constraints, the surveys were unable to be completed. Further discussion on this is provided in paragraph reference 10.5.39.

10.3.8. DMRB guidance on assigning receptor value states soils which support areas of recognised environmental/ecological interest should also be considered. These receptors were scoped out at the previous stage of assessment²². Soils not within BMV agricultural land, nor within an area of recognised environmental/ecological interest, can be allocated a sensitivity value where particular agricultural practices contribute to the quality and character of the environment or local economy. The site visit carried out for the ALC survey confirmed that this exception is not applicable to the study area and has also been scoped out of the assessment.

Table 10-1 - Assigning receptor value (sensitivity) for agricultural land and soil

Receptor value (sensitivity)	Description
Very high	Land in ALC Grades 1 & 2.
High	ALC Subgrade 3a.
Medium	ALC Subgrade 3b.
Low	ALC Grades 4 & 5.

²¹ Ministry of Agriculture, Fisheries and Food, Revised guidelines and criteria for grading the quality of agricultural land. Agricultural Land Classification of England and Wales, 1988

²² Atkins, M5 J10 Scoping Report. Document number GCC M5J10-ATK-EGT-ZZ-FN-LM-000001, 2020

Receptor value (sensitivity)	Description
Negligible	Previously developed land formerly in hard uses with little potential to return to agriculture.

Table Source: DMRB LA109 – Geology and soils, Table 3.11.

10.3.9. Table 10-2 is a replication of Table 3.12 and Table E/2.1 of DMRB LA109 and describes how magnitude is assigned to impacts.

Table 10-2 - Magnitude of impact (sensitivity) for agricultural land and soil

Magnitude of impact	Typical description
Major	Physical removal or permanent sealing of soil resources or >20 ha of agricultural land.
Moderate	Physical removal or permanent sealing of 1 ha to 20 ha of agricultural land. Permanent loss/reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource.)
Minor	Temporary loss/reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource.)
Negligible	No discernible loss/reduction of soil function(s) that restrict current or approved future use or permanent sealing of <1 ha.
No change	No loss/reduction of soil function(s) that restrict current or approved future use.

Table Source: DMRB LA109 – Geology and soils, Table 3.12 and Table E/2.1.

10.3.10. The significance of the effect is determined using the significance matrix in DMRB LA104 (Table 3.8.1), which is displayed in Table 10-3. Due to the nature of impacts on agricultural land as described above, all effects identified (if not neutral) are adverse.

Table 10-3 - Assigning significance of effect for agricultural land and soil

Value/ sensitivity	Magnitude of impact (degree of change)				
	No change	Negligible	Minor	Moderate	Major
Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Table Source: DMRB LA 104 Environmental assessment and monitoring, Table 3.8.1

10.3.11. The following influential factors are considered in the agricultural land and soil assessment:

- The assessment of the significance of residual effects considers the implementation of plausible mitigation measures.
- In alignment with DMRB guidance, where two potential values of significance of effect are identified using the matrix in Table 10-3, professional judgement is used

to assign the value based on an understanding of details of both the magnitude of impact and value of the receptor. For example, where a minor impact is identified in relation to a receptor of high sensitivity, professional judgement is used to determine whether this results in a slight or moderate effect.

- In general, moderate to very large effects are considered significant in terms of the EIA regulations.

Land contamination

- 10.3.12. The land contamination assessment has been undertaken using the methodology below and has been informed by the Conceptual Site Model (CSM) developed for the Scheme. The CSM has been developed as part of the baseline assessment to identify the likely risk presented to humans, controlled waters, property and ecological receptors from identified potential sources of land contamination. The CSM has been derived in accordance with the approach presented in the Environment Agency LCRM guidance. The plausible potential contamination sources, receptors to that contamination and pathways between the two (defined as potential contaminant linkages (PCLs)) are individually considered and a risk rating applied to each PCL. The CSM, considering baseline, construction and operation scenarios, is presented in Appendix 10.2 (application document TR010063 – APP 6.15).
- 10.3.13. The risk rating determined from the CSM has been used to assess the potential impact through consideration of the receptor value/sensitivity and the anticipated magnitude of the potential impact. The assignment of sensitivity/value and magnitude is explained in the following sections. The impact assessment is presented in Appendix 10.3 (application document TR010063 – APP 6.15).
- 10.3.14. A sensitivity/value has been assigned to each receptor using the criteria detailed in Table 10-4. For human health receptors, DMRB guidance document LA 109 has been used to define the receptor value. To assess surface water and groundwater receptors, DMRB guidance document LA 113²³ for road drainage and the water environment has been applied.

Table 10-4 - Assigning receptor value (sensitivity) – Land contamination

Receptor value (Sensitivity)	Description
Human Health¹	
Very high	Very high sensitivity land use such as residential or allotments.
High	High sensitivity land use such as public open space.
Medium	Medium sensitivity land use such as commercial or industrial.
Low	Low sensitivity land use such as highways and rail.
Negligible	Undeveloped surplus land / no sensitive land use proposed.
Groundwater²	
Very high	Principal aquifer providing a regionally important resource and/or supporting a site protected under European Commission (EC) and UK legislation LA 108 ²⁴ . Groundwater locally supports Groundwater Dependent Terrestrial Ecosystem (GWDTE). Groundwater Source Protection Zone (SPZ), Zone 1.
High	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE.

²³ Department for Environment, Farming and Rural Affairs, Sustainability & Environment Appraisal - LA 113 - Road drainage and the water environment, 2020

²⁴ Department for Environment, Farming and Rural Affairs, Sustainability & Environment Appraisal - Biodiversity LA 108, 2020

Receptor value (Sensitivity)	Description
	SPZ, Zone2.
Medium	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ 3, Zone .
Low	Unproductive strata.
Negligible	N/A
Surface Water²	
Very high	Watercourse having a WFD classification shown in a RBMP and $Q95 \geq 1.0 \text{ m}^3/\text{s}$. Site protected/designated under EC or UK legislation (Special Areas of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), Ramsar site, salmonid water) / Species protected by EC legislation LA 108 ²⁴ .
High	Watercourse having a WFD classification shown in a RBMP and $Q95 < 1.0 \text{ m}^3/\text{s}$. Species protected under EC or UK legislation LA 108 ²⁴ .
Medium	Watercourses not having a WFD classification shown in a RBMP and $Q95 > 0.001 \text{ m}^3/\text{s}$.
Low	Watercourses not having a WFD classification shown in a RBMP and $Q95 \leq 0.001 \text{ m}^3/\text{s}$.
Negligible	N/A

Table Source:

¹ DMRB LA 106 Geology and Soils Table 3.11

² DMRB LA 113 Road drainage and the water environment Table 3.70

10.3.15. Following the determination of the value/sensitivity of the receptors, the magnitude of potential impacts has been determined. The criteria for the assessment of impact magnitude are set out in Table 10-5.

Table 10-5 - Assigning magnitude of impact – Land contamination

Magnitude of impact (change)	Description
Human health¹	
Major	Significant contamination was identified. Contamination levels significantly exceed background levels and relevant screening criteria with the potential for significant harm to human health. Contamination heavily restricts the future use of land.
Moderate	Contaminant concentrations exceed background levels and are in line with the limits of relevant screening criteria. Significant contamination can be present. Control/remediation measures are required to reduce risks to human health/make the land suitable for the intended use.
Minor	Contaminant concentrations are below relevant screening. Significant contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health.
Negligible	Contaminant concentrations substantially below levels outlined in relevant screening criteria. No requirement for control measures to reduce risks to human health/make the land suitable for intended use.

Magnitude of impact (change)	Description
No change	Reported contaminant concentrations below background levels.
Groundwater²	
Major adverse	<ul style="list-style-type: none"> • 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 or significant damage to major structures through subsidence or similar effects.
Moderate adverse	<ul style="list-style-type: none"> • 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 to groundwater from routine runoff - risk score 150-250. • Calculated risk of pollution from spillages ≥1% annually and <2% annually. • Partial loss of the integrity of GWDTE. • Contribution to a reduction in water body WFD classification. • Damage to major structures through subsidence or similar effects or loss of minor structures.
Minor adverse	<ul style="list-style-type: none"> • Potential low risk of pollution to groundwater from routine runoff - risk score <150. • The calculated risk of pollution from spillages ≥0.5% annually and <1% annually. • Minor effects on an aquifer, GWDTEs, abstractions and structures.
Negligible	<ul style="list-style-type: none"> • No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages <0.5%.
Minor beneficial	<ul style="list-style-type: none"> • 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.
Moderate beneficial	<ul style="list-style-type: none"> • 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.
Major beneficial	<ul style="list-style-type: none"> • Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. • Recharge of an aquifer.

Magnitude of impact (change)	Description
	<ul style="list-style-type: none"> Improvement in water body WFD classification.
No change	<ul style="list-style-type: none"> No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Surface water²	
Major adverse	<ul style="list-style-type: none"> Failure of both acute-soluble and chronic-sediment related pollutants in the Highways England Water Risk Assessment Tool (HEWRAT) and compliance failure with Environmental Quality Standards (EQS) values. The 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.
Moderate adverse	<ul style="list-style-type: none"> 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.
Minor adverse	<ul style="list-style-type: none"> 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.
Negligible	<ul style="list-style-type: none"> No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages $< 0.5\%$.
Minor beneficial	<ul style="list-style-type: none"> HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fair condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $< 1\%$ annually).
Moderate beneficial	<ul style="list-style-type: none"> HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fair condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk $> 1\%$ annually). Contribution to improvement in water body WFD classification.
Major beneficial	<ul style="list-style-type: none"> Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification.
No change	<ul style="list-style-type: none"> No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Table Source:

¹ DMRB LA 106 Geology and Soils Table 3.12

² DMRB LA 113 Road drainage and the water environment Table 3.71

10.3.16. The overall significance of land contamination effects is defined using the matrix presented in Table 10-6 as per LA 104, which describes the relationship between the value/sensitivity of the receptor and the magnitude (change) of the impact.

Table 10-6 - Assigning significance of effect – Land contamination

Value/ sensitivity	Magnitude of impact (degree of change)				
	No change	Negligible	Minor	Moderate	Major
Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Table Source: DMRB LA 104 Environmental assessment and monitoring Table 3.8.1

Table 10-7 - Significance categories and typical descriptions

Value	Typical descriptors
Very Large	Effects at this level are material in the decision-making process.
Large	Effects at this level are likely to be material in the decision-making process.
Moderate	Effects at this level can be considered to be material decision-making factors.
Slight	Effects at this level are not material in the decision-making process.
Negligible	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Table Source: DMRB LA 104 Environmental assessment and monitoring Table 3.7

10.3.17. In alignment with DMRB guidance, where two potential values of significance of effect are identified using the matrix in Table 10-6, professional judgement has been used to assign the value based on an understanding of details of both the magnitude of impact and value of the receptor. For example, where a minor impact is identified in relation to a receptor of high sensitivity, professional judgement has been used to determine whether this results in a slight or moderate effect.

10.3.18. Following the classification of an effect, a clear statement is made as to whether the effect is 'significant' or 'not significant'. As a general rule, moderate to very large effects are considered to be significant.

Limits of deviation

10.3.19. The assessment has been conducted within the Limits of Deviation (LoD) outlined within Chapter 2 - The Scheme (application document TR010063 – APP 6.2). The vertical and lateral LoD for the Scheme has been reviewed with respect to sensitive receptors identified within this ES chapter, and would not affect the conclusions of the assessment reported in this chapter.

10.4. Consultation

Agricultural land and soil

- 10.4.1. It is stated in the Scoping Report that consultation will be carried out in accordance with DMRB guidance and TIN049²⁵. However, the Scheme is classified as an NSIP and therefore, Natural England, as a consultation body, has been contacted by the Planning Inspectorate as part of the Application Scoping Request process. An informal consultation was undertaken with farmers in advance of the ALC surveys being completed to inform the agricultural assessment summarised in this chapter.

Land contamination

- 10.4.2. The Environmental Health officers and/or online contaminated land risk registers for Cheltenham Borough Council, Uckington Parish Council and Tewkesbury Borough Council were consulted in April 2022 regarding information on areas of potentially contaminated land identified from the baseline. No records of areas of potentially contaminated land were identified within the study area.
- 10.4.3. There is a historical landfill located, 30 m distant from the south-eastern extent of the Scheme at Gallagher Retail Park (Violet Villa). Licence records indicate that inert materials were placed in the landfill. However, no further information was able to be obtained for review. Further details are presented in Section 10.5.62.
- 10.4.4. Tewkesbury Borough Council was consulted in July 2020 and April 2022 with reference to the presence of local water abstraction data for consideration in the baseline. Cheltenham Borough Council was contacted for abstraction data in April 2022. No local abstraction licences are present within the study area.

Statutory consultation

- 10.4.5. In February 2022, statutory consultation was undertaken on the Preliminary Environmental Information Report (PEIR). Responses were received in relation to Geology and Soils comprising a joint response provided by Cheltenham Borough Council, Tewkesbury Brough Council and additional responses received from Uckington Town Council and residents.
- 10.4.6. Cheltenham and Tewkesbury Borough Councils and Uckington Town Council raised a comment that it would be expected to see the results of additional agricultural land surveys, and accompanying assessment, in relation to the attenuation basins, flood compensation areas and temporary works areas. Additionally, it was noted that the assessment of agricultural land could be improved related to the area to the north of the A4019, between the M5 in the west and Uckington in the east. These comments have been considered and additional surveys completed with detail provided in the agricultural assessment sections of this chapter.
- 10.4.7. The joint councils also requested that details of relevant historical investigation reports, local records and details of permitted and/or licenced processes be included within the baseline and considered in the assessments. A review of the preliminary baseline provided in the PEIR had been completed and details were updated to include this additional information where available and relevant to the Scheme.
- 10.4.8. The joint councils also stated that no evidence had been provided in the PEIR for site specific surveys regarding ground investigation information. Since the issue of the PEIR, a ground investigation has been completed within the Order limits of the Scheme comprising intrusive investigation and environmental analysis of soil, groundwater and surface water samples. A summary of the findings of this survey is provided in this chapter with further details included in Appendix 10.7 (Application document TR010063/APP/6.1). A review of the planning portal has also been completed and, where relevant information identified, information has been incorporated into the baseline and assessment.

²⁵ Natural England, Technical Information Note 049. Agricultural Land Classification: protecting the best and most versatile agricultural land. 2012

Targeted consultation

- 10.4.9. Targeted consultation has been undertaken from August to September 2022, December 2022 to February 2023, and May to June 2023, considering feedback received and covering changes in the design since the statutory consultation. No aspects related to Geology and Soils were raised during this consultation stage.

10.5. Baseline conditions

- 10.5.1. This section provides a summary of the baseline soil and geology characteristics for the Scheme.

Study area

Agricultural land and soil

- 10.5.2. The study area for the agricultural land and soil assessment is land that is likely to be required within the permanent and temporary footprint of the Scheme. This includes construction compounds, haul roads, storage areas, embankments, slip-roads, small areas (i.e., on new roundabouts), attenuation basins and the flood storage area where the land can no longer be utilised as a resource.

Land contamination

- 10.5.3. To consider the effects associated with land contamination, the study area includes the Scheme and land immediately beyond it to a distance of 500 m (study area). This is considered appropriate for identifying historical and current potentially contaminative land uses, which may have resulted in contamination within the Scheme, and the location of sensitive off-site receptors, which may be affected by the Scheme.

Baseline sources

- 10.5.4. Baseline data has been obtained from the following sources of information:
- Agricultural Land Classification survey, completed November 2021, Appendix 10.4 (Application document TR010063/APP/6.15).
 - Agricultural Land Classification: J10 M5 Flood Storage Area, completed October 2021, Appendix 10.5 (Application document TR010063/APP/6.15)²⁶.
 - Agricultural Land Classification: J10 M5 Gloucestershire, completed May 2022, Appendix 10.6 (Application document TR010063/APP/6.15)²⁷.
 - M5 Junction 10 Ground Investigation Interpretative Report (GIR), February 2022, Appendix 10.7, (Application document TR010063/APP/6.15)²⁹.
 - British Geological Survey (BGS) GeoIndex Onshore, <https://mapapps2.bgs.ac.uk/geoindex/home.html>.
 - DEFRA MAGIC mapping database, <https://magic.defra.gov.uk/>³⁵.
 - Landmark Information Group, Envirocheck reports, M5 Junction 10 Improvement, Cheltenham, Gloucestershire, 2019²⁸.
 - Zetica, Unexploded Ordnance (UXO) risk maps⁴⁰.

Historical development

- 10.5.5. The historical development of the study area has been determined using historical ordnance survey maps obtained as part of the Envirocheck reports for the Scheme²⁸.
- 10.5.6. In 1884 the study area was predominantly undeveloped agricultural land with several farms. Several roads are mapped within the study area including the current Withybridge Lane within the west of the study area and the current B4634 road is within the Scheme in the south of the study area. The current A4019 road is located within the Scheme and

²⁶ Askew Land and Soil, Agricultural Land Classification: J10 M5 Flood Compensation Area, Ref: C831, 2021

²⁷ Askew Land and Soil, Agricultural Land Classification: J10 M5 Flood Compensation Area, Ref: C884, 2022

²⁸ Landmark Information Group, Envirocheck, M5 Junction 10 Improvement, Cheltenham, Gloucestershire, 2019

passes through the village of Uckington towards Cheltenham located within the east of the study area. A corn mill is shown approximately 190 m west of the Scheme at Withy Bridge.

- 10.5.7. The River Chelt crosses the Scheme approximately 280 m west of Withybridge Lane. Leigh Brook crosses the Scheme approximately 460 m to the north of the current M5 Junction 10.
- 10.5.8. In 1885 a smithy is shown approximately 250 m east of the Scheme, to the north of Arle. A sewage farm (Cheltenham Corporation) is shown on 1903 mapping within the north-west of the study area located to the west of Barn Farm, approximately 260 m west of the Scheme.
- 10.5.9. In 1954 mapping engineering works were constructed approximately 250 m north east of the Scheme to the north of Arle. By 1968 the engineering works had expanded and further residential development within Cheltenham located within the south-east of the study area has taken place.
- 10.5.10. By 1973 the current M5 has been constructed within the Order limits. In 1975 mapping, a works building is located approximately 265 m south-east of the Scheme in Cheltenham. Allotment gardens are shown within the south-east of the study area located approximately 400 m south-east of the current B4634 in Cheltenham. By 1991 further residential development and allotments are shown in the south-east of the study area in Cheltenham.
- 10.5.11. In 2000 the Gallagher Retail Park was shown within the south-east of the study area in Cheltenham. The Gallagher Retail Park is located adjacent to the north of the Scheme.

Geology

- 10.5.12. The BGS GeoIndex²⁹ indicates that there are two areas of mapped artificial ground present within the study area. The artificial ground is located in the north of the study area, approximately 200 m north of the Scheme adjacent to the M5 associated with the historical Colman Farm landfill. An area of worked ground (void) associated with an unspecified man-made excavation is also present in the east of the study area adjacent to the north of the A4019 (underlying the Gallagher Retail Park), approximately 30 m north-east of the Scheme.
- 10.5.13. Although not indicated on published maps, Made Ground is also likely to be present surrounding the existing road networks, associated with its construction and operation.
- 10.5.14. Superficial deposits of Cheltenham Sand and Gravel and Alluvium are present along the alignment of the existing watercourses, sections of the M5 and the A4019 between the M5 Junction 10 and Cheltenham.
- 10.5.15. Charmouth Mudstone bedrock underlies the Scheme across the majority of the study area with the Rugby Limestone Member present in the south-west of the study area.
- 10.5.16. A plan summarising the geology present within the study area is provided in Figure 10-1.

Figure 10-1 - Geology of the study area

Figure provided in Appendix 10.8 (application document TR010063 - APP 6.15).

Ground investigation

Geology

- 10.5.17. A ground investigation was completed for the Scheme by Geotechnical Engineering under the supervision of Atkins between June and September 2021, covering the M5 Junction 10, A4019, proposed Link Road and associated features (e.g. drainage, flood compensation area). A detailed appraisal of the ground investigation, including a geotechnical and land contamination assessment, is presented in the_Ground

²⁹ British Geological Survey, Geoindex Onshore, <https://mapapps2.bgs.ac.uk/geoindex/home.html>, accessed 2021

Investigation Report (GIR) report³⁰, included as Appendix 10.7 (Application document TR010063/APP/6.15). A summary of the identified ground conditions is provided in the following sections. A ground investigation location plan is provided in Figure 10-2. Note that the GIR report was completed in 2022 and the Order limit presented on the included drawings may not reflect the current Scheme design.

- 10.5.18. The results of the ground investigation generally confirmed the anticipated geological succession identified from published mapping data and presented above. The strata encountered during the ground investigation comprised superficial deposits of Alluvium and Cheltenham Sands and Gravels overlying the bedrock of the Charmouth Mudstone Formation. Made Ground was recorded in the vicinity of existing roads, embankments and structures. Topsoil was present in areas where Made Ground was absent.
- 10.5.19. Made Ground was recorded as silty clay with angular to rounded fine to coarse gravel of limestone and sandstone with a thickness between 0.5 metres (m) to 12 m.
- 10.5.20. Topsoil was recorded as sandy silty clay with rootlets up to 1.9 m in thickness.
- 10.5.21. Where present, Alluvium, comprising brown silty fine to coarse sand or firm sandy silt, and Cheltenham Sands and Gravels were encountered at depths of 0.2 m to 2.7 m below ground level (bgl), overlying the Charmouth Mudstone Formation. The superficial strata were found to be present in the vicinity of the River Chelt and Leigh Brook and were recorded at an approximate maximum thickness of 2.7 m. Superficial strata were absent across the remainder of the site.
- 10.5.22. Weathered Charmouth Mudstone Formation, comprising firm to stiff laminated clay, was present across the site and generally encountered at shallow depths from 1.5 m bgl. Unweathered strata, comprising weak laminated mudstone, were encountered from 4.0 to 13 m bgl. The base of the stratum was not proven.
- 10.5.23. Details on environmental soil and groundwater analysis undertaken as part of the investigation, are provided in the section on Contaminated Land later in this document.

Figure 10-2 - Ground investigation location plan

Figure provided in Appendix 10.8 (application document TR010063 - APP 6.15).

Mining activity and quarrying

- 10.5.24. The study area is not located within an area affected by coal mining.
- 10.5.25. Two areas licenced for mineral extraction are recorded adjacent to the A4019 approximately 100 m and 220 m north-east of the Scheme. The closest feature, 100 m from the Scheme, is identified as likely to be worked ground (void), as indicated by BGS mapping²⁹. These areas are considered historical workings and unlikely to be viable future mineral sites. The site 100 m north-east of the Scheme relates to the Violet Villa historical landfill and has been infilled and developed for the Gallagher Retail Park. Further detail on this feature is provided in Section 10.5.62.

Soil data

- 10.5.26. The only published soil map for the study area is the 1:250,000 scale National Soil Map of England and Wales, Sheet 5, South West England³¹, which illustrates the soil associations present in the region.
- 10.5.27. The map displays soils of the Badsey 2 association present on the Cheltenham Sand and Gravel Deposit, consisting of mainly well drained loamy soils. Soils on the Alluvium of the River Chelt are mapped as poorly drained, clayey soils of the Fladbury 1 association. The

³⁰ Atkins, M5 Junction 10 Improvements Scheme. Ground Investigation Report (GIR), 2022

³¹ Soils of England and Wales, Sheet 5 South West England, 1983

soils of the Charmouth Mudstone Formation are mapped as the Evesham 2 association of slowly permeable and seasonally waterlogged calcareous clay soils.

- 10.5.28. The profiles encountered in December 2020, October 2021 and May 2022 ALC survey (see Appendix 10.4, 10.5 and 10.6 (Application document TR010063/APP/6.15)) reflect the published soil map. The Badsey series, slightly calcareous sandy clay loams with little gleying encountered above 40cm, was present in the northern extent of the ALC survey area. Progressing south, from the Cheltenham Sand and Gravel Deposit and onto the River Chelt Alluvium, the profiles were stoneless, non-calcareous, gleyed clay soils of the Fladbury series. Due to restricted land access, the extent of the Fladbury series could not be confirmed. On the southern extent of the survey study area, the Evesham series of stoneless, slightly calcareous, gleyed clay soils was encountered.

Agricultural Land Classification

- 10.5.29. As summarised in the section above on Agricultural land and soil, the quality of agricultural land is assessed using the MAFF guidance on ALC³². The grading system ranges from Grades 1-5 (1 being the highest quality), with Grade 3 being divided into Subgrades 3a and 3b. ALC Grades 1 and 2 and Subgrade 3a are BMV agricultural land. Figure 10-3 displays the ALC grades assigned to land within the vicinity. The ALC grades and the sources of information are described below.
- 10.5.30. The findings of the December 2020, October 2021 and May 2022 ALC surveys confirm the predictions made in the Scoping Report. Land provisionally assigned Grade 3 on the 1:250,000 Provisional ALC Map³³ which overlays the Cheltenham Sand and Gravel Deposit is of BMV agricultural land (Subgrade 3a), whilst land directly on Alluvium or Charmouth Mudstone Formation is non BMV agricultural land (Subgrade 3b).
- 10.5.31. For land parcels within the extent of the proposed West Cheltenham Link Road, and to the north of the A4019, where access was not permitted during the three ALC surveys mentioned above, the ALC grades have been determined using a combination of the available published and survey information and observations made during the surveys.
- 10.5.32. For land adjacent to the west of the M5, there is existing published post-1988 survey data which has been used to inform the ALC. The post-1988 data does not cover sections of land north-west of the M5 and north of the A4019; an ALC survey was undertaken in May 2022 to survey this area within the extent of the Scheme in the vicinity of Barn Farm.
- 10.5.33. Approximately 15 ha of Subgrade 3a (BMV) land was identified, as adjacent to the south-west of Junction 10. The profiles of the survey points within this area described the absence of gleying, therefore it is expected to be an area of better drainage.
- 10.5.34. Elsewhere, to the west of the M5, on the Alluvium of the River Chelt and the Charmouth Mudstone, the land is mostly Subgrade 3b (ADAS, 1994). The survey of the land to the north-west, in the vicinity of Barn Farm, identified land as subgrade 3b.

Land adjacent to the east of the M5

- 10.5.35. An ALC survey was completed in October 2021 within the proposed flood storage area, located adjacent to the south-east of the M5 Junction 10. The survey classified the north-east and south-west quadrant of the area as Subgrade 3a (BMV) whilst the central, north-west and south-east quadrants of the area were surveyed as Subgrade 3b.
- 10.5.36. An ALC survey was undertaken in May 2022 to survey two land parcels proposed for an attenuation basin and flood compensation located alongside the Link Road between the A4019 and B4634. The attenuation basin, located at the southern-west end of the Link Road adjacent to the B4634 is surveyed as Subgrade 3b. The flood compensation area to the north-east of the Link Road was surveyed as Subgrade 3b.

³² Ministry of Agriculture, Fisheries and Food, Revised guidelines and criteria for grading the quality of agricultural land. Agricultural Land Classification of England and Wales, 1988

³³ Natural England, Agricultural Land Classification Map South West Region (ALC006), 2018

Land to the north of the A4019

- 10.5.37. An ALC survey was completed in 2009 to inform the EIA for the proposed North-west Cheltenham Development Area, north of the A40109 between Uckington in the west and Gallagher’s Retail Park in the east. Information has been obtained from this 2009 survey³⁴ to inform ALC grades on land at the north-eastern extent of the Scheme. The survey mapped agricultural land north of the A4019 as Subgrade 3a BMV land. Land-take requirements within this section are anticipated to be low comprising widening of the A4019 and road access to the Scheme.
- 10.5.38. The area to the north of the A4019 between the M5 in the west and Uckington in the east was unable to be completely surveyed due to land access issues. A small area of land was surveyed in October 2020 in the location of the proposed junction between the A4019 and the Link Road which was assessed as Grade 3a (BMV). The Natural England Agricultural Land Classification Map South West Region (ALC006) covers this area but it is noted that the scale of mapping is not sufficiently accurate for use in assessing individual site areas and also does not sub-divide Grade 3.
- 10.5.39. The ALC006 map shows the majority of this area as Grade 3 (undivided) with the land adjacent to the north of the A4019 as Grade 1. The results of the October 2020 ALC survey and the survey for the North-west Cheltenham Development Area, adjacent to the north of the A4019, identify subgrade 3a land to be present. On this basis, it is considered that the unsurveyed land areas directly to the north of the A4019 in the north-west of the Scheme are likely to be BMV agricultural land Subgrade 3a. The permanent land take requirements within this section are anticipated to comprise a narrow, approximately 25 m wide, strip adjacent to the north of the A4019 and east of the M5 to allow for a proposed access track to existing properties alongside the proposed widened carriageway of the A4019. This land take will cover an approximate area of 5.6 ha over a length of approximately 1.6 km.

Summary

- 10.5.40. A summary of the approximate agricultural land take anticipated for each area is provided in Table 10-8. The majority of the agricultural land impacted by the Scheme is dominated by Subgrade 3a (BMV land that has a high receptor value/sensitivity) and Subgrade 3b (non-BMV land with a medium receptor value/sensitivity).

Table 10-8 - Approximate agricultural land take

Location	Subgrade 3a (high sensitivity) permanent land take	Subgrade 3a (high sensitivity) temporary land take	Subgrade 3b (medium sensitivity) permanent land take	Subgrade 3b (medium sensitivity) temporary land take
Land adjacent to the west of the M5	4.61 ha	11.45 ha	3.71 ha	16.34 ha
Land adjacent to the east of the M5	19.52 ha	16.50 ha	18.85 ha	22.76 ha
Land to the north of the A4019	7.43 ha	13.78 ha	None	None
Total	31.56 ha	41.73 ha	22.56 ha	39.11 ha

Figure 10-3 - Agricultural land classification grading within the Scheme

Figure provided in Appendix 10.8 (Application document TR010063/APP/6.15).

³⁴ White Peak Planning, Environmental Statement for 16/02000/OUT, 2012, <https://www.tewkesbury.gov.uk/planning>

Designated sites

- 10.5.41. There are no EU-designated sites, UK-designated sites (e.g. SPA, SSSI, Ramsar) or non-statutory designated sites (e.g. Local or Regionally Important Geological Sites, Local Geological Sites (LGS), Geological Conservation sites (GCR) and Local Nature Reserves) present within the study area, where sensitive soils could be directly affected and have therefore been scoped out of the assessment.
- 10.5.42. Areas of Deciduous Woodland are present around Junction 10 which are designated as Priority Habitats/National Forest Inventory sites. However, the soils within these areas are not considered to be significantly or uniquely important to support these habitats and have been scoped out from the geology and soil assessment. The impact on the Deciduous Woodland areas from a biodiversity perspective is described in Chapter 7 - Biodiversity (Application document TR010063/APP/6.5).
- 10.5.43. The DEFRA MAGIC map application³⁵ indicates that there are no statutory environmental designations within the study area. However, the Scheme is located within the non-statutory Gloucestershire Green Belt (Tewkesbury district)¹⁵

Hydrogeology

- 10.5.44. The superficial Alluvium and Cheltenham Sand and Gravel strata are classified as high vulnerability, secondary A aquifers. The bedrock Charmouth Mudstone Formation is classified as a medium vulnerability secondary undifferentiated aquifer and the Rugby Limestone Member as a high vulnerability secondary A aquifer.
- 10.5.45. The study area is not located within a SPZ. There are no licenced groundwater abstractions within the study area. Tewkesbury District Council and Cheltenham Borough Council were contacted to determine if private water abstractions, where less than 20 m³ is abstracted per day, are present within the study area. The council responded to confirm that, according to their records, no private local groundwater abstractions are located in the study area.

Hydrology

- 10.5.46. Two main rivers intersect the study area, the River Chelt to the south of M5 Junction 10 and Leigh Brook to the north. Both rivers flow in a westerly direction joining the River Severn approximately 5.3 km west of the study area. There are no licensed surface water abstractions within the Scheme or study area. Tewkesbury Borough Council and Cheltenham Borough Council have confirmed that they have no records of private low-volume unlicensed surface water abstractions in the study area at the time of enquiry in April 2022.

Flood risk

- 10.5.47. The study area has been identified as being at high risk from flooding activities, with the area to the south of M5 Junction 10 surrounding the River Chelt known to be a historical flood plain of the River Severn with recorded flood events.
- 10.5.48. Environment Agency mapping³⁶ indicates the study area to be at risk of flooding by rivers or sea with the land surrounding the River Chelt designated as a Flood Zone 2 (0.1-1% chance of flooding within any given year) and Flood Zone 3 (>1% chance of flooding within any given year) areas. Further information on surface water flooding is described in Chapter 8 - Road Drainage and the Water Environment (Application document TR010063/APP/6.6).
- 10.5.49. BGS flood risk data indicates that the fields on either side of the M5 and A4019 carriageways, and the northern half of the Link Road, are liable to potential flooding from high groundwater levels.

³⁵ Department for Environment, Farming and Rural Affairs, Multi Agency Geographic Information for the Countryside (MAGIC), <https://magic.defra.gov.uk/>, accessed 2021

³⁶ Environment Agency, Long term flood risk maps, <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>, accessed 2021

Contaminated land

Ground investigation

- 10.5.50. As summarised in Section 10.5.17, a ground investigation has been completed for the Scheme³⁷. Olfactory evidence of contamination, comprising hydrocarbon odours, was recorded in three locations. The odours were recorded at 0.3 m to 3.0 m bgl in M5_BH025 and M5_BH027, located on the northbound M5 carriageway beneath the existing Piffs Elm Interchange bridge, and A4019_BH006, located on the south side of the A4019 near to Rose Cottage. No olfactory evidence was recorded across the remainder of the site. No visual indicators of contamination were recorded in any of the locations progressed during the investigation.
- 10.5.51. As part of the ground investigation, soil samples and groundwater samples were collected from across the site and analysed for a suite of inorganic, organic and metal contaminants relevant to the current and historical use of the site. The analytical results were used to complete a generic quantitative risk assessment (GQRA) to assess the potential risk from contamination in soil and groundwater to human and controlled water receptors. Details of the assessment are provided within the GIR report, provided in Appendix 10.7 (Application document TR010063/APP/6.15). A summary of the results of the GQRA from the GIR is presented in the following sections.
- 10.5.52. Soil chemical testing data was assessed against generic assessment criteria (GAC) protective of an open space (residential) land use for the M5 and A4019 and an open space (parkland) land use for the Link Road. These scenarios take into account the potential exposure risks of current and future site users making use of the roads, pavements and adjacent residential or landscaping areas.

Human health assessment

- 10.5.53. A total of 70 samples were recovered from the M5 Junction area, collected from a range of strata from depths of between ground level to 5.9 m bgl. Benzo(a)pyrene was identified above the GAC in samples collected from five locations within the existing M5 carriageway footprint.
- 10.5.54. A total of 23 samples were recovered from the A4019 area from depths of between 0.05 and 0.6 m bgl and a total of 51 samples were recovered from the Link Road area from depths of between 0.05 m and 2.9 m bgl. No soil samples from the A4019 or the Link Road exceeded the GAC.
- 10.5.55. A total of 157 soil samples across all three areas were visually screened for potential asbestos fibres and asbestos containing materials (ACM) within the soil matrix. No asbestos was visually identified in any of the samples analysed.
- 10.5.56. The GQRA concluded that considering the isolated exceedances, which are encapsulated beneath hardstanding, it was unlikely that there was an unacceptable risk to human health from soils across the M5, A4019 and the Link Road areas.

Controlled waters assessment

- 10.5.57. Soil leachate samples and groundwater samples were assessed against Water Quality Standards (WQS) comprising Environmental Quality Standards for inland freshwater (EQS)³⁸ protective of aquatic life in surface water and Drinking Water Standards (DWS) protective of a potential future potable abstraction resource from the underlying secondary A (Alluvium / Cheltenham Sands and Gravels) and secondary undifferentiated (Charmouth Mudstone Formation) aquifers³⁹.
- 10.5.58. Concentrations of ammoniacal nitrogen, nitrate, sulphate, metals and organics were identified to exceed the EQS and DWS in soil leachate.

³⁷ Atkins, M5 Junction 10 Improvements Scheme. Ground Investigation Report (GIR), 2022

³⁸ United Kingdom Government, The Water Framework Directive (Standards and Classification) Directions (England and Wales), 2015

³⁹ United Kingdom Government, Statutory Instruments: 2016 No.614. Water, England and Wales. The Water Supply (Water Quality) Regulations, 2016

- 10.5.59. In groundwater, concentrations of chloride, sulphate, metals and organics were identified to exceed the EQS and DWS. No organic contaminants were identified to exceed the WQS.
- 10.5.60. Samples were obtained from the surface water of the River Chelt and no concentrations of analysed contaminants exceeded the EQS.
- 10.5.61. The GQRA concluded that there was unlikely to be an unacceptable risk to controlled waters receptors considering that the identified exceedances of metals and inorganics were marginally above the assessment criteria and generally widespread across the Scheme. The concentrations were considered likely to be indicative of natural background concentrations associated with farming and naturally high sulphate associated with the underlying Charmouth Mudstone bedrock. In addition, direct comparison of soil leachate results with WQS, does not take into account the dilution and attenuation of contaminants that may occur along the pathway between the source and the nearest surface water receptors and no exceedances of the screening criteria were reported in surface water samples.

Landfills and waste management sites

- 10.5.62. There are two historical landfill sites located within the study area at the following locations:
- Approximately 200 m north of the Scheme adjacent to the M5 northbound carriageway (Colman's Farm landfill). The site was licensed between 31 July 1970 and 2 September 1972 and accepted household waste. The landfill also accepted excavated natural material, soil and sub-soil waste from 1st May 1992. No end date for this record is provided; however, the licence is listed as 'known to be surrendered'. Colemans Farm Borrow Pit at the same location was licensed between 30 June 1992 to 31 December 1992 and accepted inert, industrial, commercial and household waste.
 - Approximately 30 m north-east of the Scheme adjacent to the A4019 (Violet Villa, likely to be the worked ground (void) indicated by BGS mapping). The licence details for the site indicate that the landfill accepted inert waste and sludge from 30 September 1967 with no closure date provided. No further information on the ground conditions is known to be available for review for this feature.
- 10.5.63. Elicot Ltd located 340 m north-west of the A4019 (west of the M5 Junction 10) at Piffs Elm, holds licenced records as a waste management facility for household, commercial and industrial waste transfer, as well as being a registered waste incineration disposal site. It is understood that this site is no longer in operation.
- 10.5.64. Anecdotal evidence is available, from a review of aerial photographs, to suggest ground disturbance has taken place approximately 85 m north of the Piffs Elm Interchange Bridge, adjacent to the east of the M5 southbound carriageway, and adjacent to an informal traveller site. The extent, depth and nature of the ground disturbance associated with this feature is unknown. A review of aerial photographs suggests that excavations may have taken place from 2013 and potentially continued to the present day.

Fuel stations

- 10.5.65. There are two fuel stations located within the study area. The Sainsburys petrol station is located 200 m north of the Scheme in the Gallagher Retail Park and the Cheltenham Filling Station (currently Applegreen Cheltenham) is located 360 m south-east of the Scheme, adjacent to the A4019.

Pollution incidents

- 10.5.66. There have been nine recorded pollution incidents to controlled waters within the study area. A summary of these incidents is provided below:
- An incident was recorded in 1995 at a dairy cattle farm located adjacent to the west of the M5 carriageway related to a Category 3 minor incident for the release of cattle slurry into an unknown water course.

- In 1995, a Category 3 minor incident was recorded east of the M5 carriageway, located off Withybridge lane for the spillage of oils.
- A Category 3 minor incident located 95 m north-east of the A4019 was recorded in 1995 relating to the spillage of oils into an unknown water body.
- In 1996, a Category 3 minor incident was recorded adjacent to Homecroft Drive, 320 m south of the A4019 related to an 'unknown' pollutant affecting the River Chelt.
- In 1998, a Category 3 minor release of oils was recorded on the carriageway of the A4019 at Uckington.
- A Category 3 minor incident was recorded in 1998 relating to the presence of two drums (possibly oil) in the River Chelt, 320 m south of the A4019 near Appleyard Close.
- In 1998 a Category 3 minor incident was recorded 345 m east of Withybridge for the accidental spillage of sewage sludge into the River Chelt.
- A Category 3 minor incident was recorded in 1998 relating to the spillage of heavy-duty heat oil into the Wymans Brook, 463 m north-east of the A4019 within the Kingsditch trading estate.
- An incident was recorded near Mill House, Boddington in 1999, 445 m east of the M5 carriageway related to a Category 3 minor incident for the release of laundry type discharge into the River Chelt.

Unexploded ordnance

- 10.5.67. The Zetica online map⁴⁰ indicates that the study area has a low risk of encountering unexploded ordnance (UXO). A low risk is defined by Zetica as having '1 bomb impacts per acre or less'. It should be noted that this online map is a guide to the likely risk which may be present and is not a site specific risk assessment. A more detailed UXO assessment would be required to be undertaken prior to the construction of the Scheme as detailed within the Environmental Management Plan (EMP) (Application document TR010063/APP/7.3).

Future baseline

- 10.5.68. On completion of the Scheme, it is anticipated that the baseline will generally be similar to that summarised for the current baseline conditions. Identified land contamination receptors will remain largely unchanged. The future users of the Scheme and users of future developments within the study area have been considered within the baseline assessment. The area of remaining agricultural land will be reduced due to the permanent land take required for the Link Road and widening of the A4019 to the east of the Piffs Elm Interchange.

Conceptual Site Model

- 10.5.69. A CSM has been prepared for the Scheme. The CSM 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 potential contaminant linkage (PCL).
- 10.5.70. A summary of potential contamination sources is provided in Table 10-9. Potential pathways and receptors including receptor value identified is provided in Table 10-10. Definitions for the classification of probability and consequence in relation to contamination are provided in Appendix 10.1 (Application document TR010063/APP/6.15). The CSM and risk assessment are provided in Appendix 10.2 (Application document TR010063/APP/ 6.15), based on guidance in CIRIA C552 Contaminated land risk assessment: a guide to good practice (CIRIA, 2001).
- 10.5.71. The CSM, included in Appendix 10.2 has been used to inform the impact assessment provided in Appendix 10.3 - (Application document TR010063/APP/6.15).

⁴⁰ Zetica, Unexploded Ordnance Risk Maps, <https://zeticauxo.com/downloads-and-resources/risk-maps/>, accessed 2021

Potential sources of contamination

Table 10-9 - Potential contamination sources

Potential source of contamination	Contaminants of concern	Location
Made Ground associated with the construction of existing (M5, A4019 and B4634) and proposed carriageways and activities associated with their operation.	A range of inorganic and organic contaminants within Made Ground including asbestos. Fuels and oils attributed to spills from vehicles on the roads included within the Order limits, plus exhaust particulates.	Within the Order limits (on-site)
Agricultural activities.	Contamination risk from herbicides, pesticides, silage, effluent, and fuel oils. Risk of inorganic and organic contamination including ammonia, nitrates, metals and hydrocarbons, polychlorinated biphenyls (PCBs), asbestos, etc.	On-site
Made Ground associated with the construction and operation of adjacent roads.	A range of inorganic and organic contaminants including heavy metals, hydrocarbons and polyaromatic hydrocarbons (PAHs) and the potential for asbestos. Fuels and oils attributed to spills from vehicles on the roads, plus exhaust particulates.	Within the Study Area (off-site)
Historical sewage works/farm (Cheltenham Corporation). 260 m west.	Potential contamination may comprise metals, inorganic contaminants, fuels and oils, PCBs, treatment chemicals, and potential for hazard gas generation from sludges (as well as sanitary waste).	Off-site
Allotments and agricultural activities within the surrounding area.	Contamination risk from herbicides, pesticides, silage, effluent, and fuel oils. Risk of inorganic and organic contamination including metals hydrocarbons and asbestos.	Off-site
Unauthorised landfill, 85 m north of Piffs Elm Interchange bridge	Range of inorganic and organic contaminants including metals, hydrocarbons, PAHs, PCBs and asbestos. Potential ground gas.	Off-site
Historical corn mill 190 m west.	Range of inorganic and organic contaminants including metals and hydrocarbons.	Off-site
Historical smithy 250 m east.	Range of inorganic and organic contaminants including metals and hydrocarbons.	Off-site
Historical engineering works 260 m south-east.	Range of inorganic and organic contaminants including metals, petroleum, petrol additives, diesel, oils and lubricants.	Off-site
Sainsbury's petrol station 200 m north and the Cheltenham Filling Station 360 m south-east.	A range of contaminants including heavy metals, hydrocarbons and PAHs.	Off-site
Violet Villa historical landfill 30 m north-east (Gallagher Retail Park)	Range of inorganic and organic contaminants including metals,	Off-site

Potential source of contamination	Contaminants of concern	Location
and Colman Farm historical landfill 200 m north.	hydrocarbons, PAHs, PCBs, asbestos and ground gases.	
Waste management facility 340 m north-west of the A4019.	Range of inorganic and organic contaminants including metals, hydrocarbons, PAHs, PCBs, and asbestos.	Off-site

Potential Receptors and Pathways

Table 10-10 - Potential receptors, receptor value and exposure pathways

Receptor group	Receptor	Receptor value (sensitivity)	Principal contaminant migration pathways
Human Health (on-site)	Construction and maintenance workers of current roads	Medium (commercial/industrial use with potential for contact with soils)	Dermal contact with and ingestion of contaminants in soils, soil-derived dusts, and water; and Inhalation of soil-derived dust, fibres, gas, and vapours.
	Pedestrians accessing existing roads, footpaths, and public rights of way	Low (transient users unlikely to contact soils due to hardstanding)	
	Current road users	Low (transient users unlikely to contact soils due to hardstanding)	
	Users of the new road Scheme	Low (transient users unlikely to contact soils due to hardstanding)	
	Farmers and workers on agricultural land	Medium (commercial/industrial use with potential for contact with soils)	
Human Health (off-site)	Residents in adjacent properties	Very high (residential users in close to the Scheme with potential for long-term dust inhalation)	Dermal contact with and ingestion of contaminants in soil-derived dusts and water that may have migrated off-site; and Inhalation of soil-derived dust, fibres, gas, and vapours which may have migrated off-site.
	Users of adjacent commercial/industrial premises	Medium (commercial/industrial users with short duration exposure)	

Receptor group	Receptor	Receptor value (sensitivity)	Principal contaminant migration pathways
	Pedestrians accessing surrounding roads, footpaths, and public rights of way	Low (short term transient use)	
	Farmers and workers on agricultural land	Medium (commercial/industrial users with short duration exposure)	
Controlled Waters: Groundwater (on-site and off-site)	Groundwater in Secondary A superficial aquifers (Alluvium and Cheltenham Sand and Gravel)	Medium (moderate productivity aquifer)	Leaching of contaminants in soil to groundwater in underlying aquifers; and Migration of contaminated water through preferential pathways such as underground services, pipes, and granular material to groundwater in underlying aquifers.
	Groundwater in Secondary A bedrock aquifer (Rugby Limestone Formation)	Medium (moderate productivity aquifer)	
	Groundwater in Secondary bedrock undifferentiated aquifer (Charmouth Mudstone Formation)	Low (low productivity strata)	
Controlled Waters: Surface waters (on-site)	River Chelt, Leigh Brook and surface water drains	High (WFD watercourse with a Q95 <1.0 m ³ /s)	Lateral migration of contaminated groundwater with discharge to surface watercourses; and Discharge of contaminants entrained in groundwater and, or surface water run-off followed by overland flow and discharge.
Controlled Waters: Surface waters (off-site)	River Chelt, Leigh Brook and surface water drains	High (WFD watercourse with a Q95 <1.0 m ³ /s)	Lateral migration of contaminated groundwater with discharge to surface watercourses as base flow; and Discharge of contaminants entrained in groundwater and/or surface water run-off followed by overland flow and discharge.

10.6. Potential impacts

Construction

Agricultural land and soil

- 10.6.1. The potential impacts of the Scheme on agricultural land during construction are considered to be:
- The physical removal of agricultural land where land is permanently required for the road and the flood storage area (major magnitude of impact).
 - The temporary loss of 1.13 ha of Subgrade 3b agricultural land is to be returned to agricultural use but with a potential reduction in ALC classification due to a reduction in levels for flood compensation (moderate magnitude of impact), located to the east of the Link Road.
 - The temporary loss or the restriction to current agricultural land, due to land temporarily acquired during construction, to be returned to agricultural use (minor magnitude of impact).
- 10.6.2. The likely extent of potential impacts relating to land take have been determined using the Order limits of the Scheme and the approximate total land take in agricultural area is presented in Table 10-11. It is noted that urban areas and areas within the current highway boundary are not included in this total as they are not currently in agricultural use.

Table 10-11 - Potential impacts to agricultural land and soil

Subgrade sensitivity	Approximate Permanent land-take (major impact)	Approximate Temporary land take (reduced quality) (moderate impact)	Approximate Temporary land take (minor impact)
Subgrade 3a (high sensitivity) - BMV agricultural land	31.56 ha	None	41.74 ha
Subgrade 3b (medium sensitivity)	22.56 ha	1.13 ha	37.98 ha
Total	54.12 ha	1.13 ha	79.72 ha

Land contamination

- 10.6.3. The land contamination assessment has been completed based on the relationship between the value/sensitivity of the receptor and the magnitude of the impact in accordance with DMRB guidance documents LA109 and LA113. The CSMs are included in Appendix 10.2 (Application document TR010063/APP/6.15) and have been used to inform the potential magnitude of the impact.
- 10.6.4. Construction activities could potentially introduce new sources of contamination (i.e. from spillages and leaks) and disturb and mobilise existing sources of contamination, which may pose a risk to human health and controlled water receptors.
- 10.6.5. Construction activities, such as earthworks, piling, installation of drainage and other below ground services may introduce new pathways for migration of existing contamination and exposure of contaminated soil, remobilisation of contaminants through soil disturbance and the creation of preferential pathways for surface water run-off and ground gas migration. The construction work activities could potentially generate contaminated dust and vapours.

Operation

Agricultural land and soil

- 10.6.6. It is assumed that there will be no potential impacts/no further loss of agricultural land when the Scheme is operational and so impacts are confined to the construction phase.
- 10.6.7. There is the potential for soil erosion to occur through off-site migration of surface water from the new carriageway. Engineered drainage will be incorporated into the design to minimise this effect.

Land contamination

- 10.6.8. Environmental impacts are likely to be greatest during construction, with reduced impacts likely during operation.
- 10.6.9. The operation of the Scheme may potentially introduce new sources of contamination i.e. spillages and leaks from vehicles and below ground services could create additional potential pathways for the migration of potential contamination which were not present at baseline. There may also be migration of contaminants in road spray and airborne contaminants from road traffic to soils adjacent to the carriageway. However, it is assumed that the Scheme will be operated in accordance with the relevant regulations and best practice guidance in applying Best Available Techniques and pollution prevention.

10.7. Mitigation measures

Construction

Agricultural land and soil

- 10.7.1. The design of the Scheme has considered the reduction in the required land taken where possible as embedded mitigation. BMV classified soils are located across the study area and therefore cannot be avoided. The route of the Scheme is required to expand and provide a link between existing infrastructure routes and the design has taken into account the most direct routes, minimising land take as far as is possible.
- 10.7.2. There is no construction mitigation which can be implemented for the permanent loss of agricultural land. Surplus soils from agricultural land, generated from the footprint of the Scheme will be reused sustainably where possible, such as in the construction of embankments. Further detail is presented in Chapter 12 - Materials and Waste (Application document TR010063/APP/6.10).
- 10.7.3. The land occupied or disturbed during the construction process that is not permanently acquired for engineering and landscaping, such as that utilised for construction compounds, will be restored to a condition equivalent to its original ALC classification. It will be subject to an aftercare period (duration to be agreed), during which time problems with settlement, drainage and weed infestation will be rectified.
- 10.7.4. A Soil Handling Management Plan (SHMP) will be produced prior to any construction to ensure that the quality of soil in areas within the temporary footprint of the Scheme is maintained, in accordance with the Code of Practice for the Sustainable Use of Soils on Construction Sites, 2009⁴¹. The SHMP will include requirements to protect topsoil and subsoils as a valuable and finite resource such as minimising mishandling which may result in a reduction in fertility and permeability:
- Identification of areas where topsoil and subsoil are to be removed and the methodology to do so to avoid damage.
 - Identification of stockpile areas and how topsoil and subsoil will be segregated to maintain quality, such as avoidance of compaction and erosion.

⁴¹ Department for Environment, Farming and Rural Affairs, Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, 2009

- Records of volumes of each soil material excavated and stored.
 - The expected use for each soil type excavated, is either retained and reused or removed from the site.
 - Identification of responsible persons for supervising and monitoring of these activities.
- 10.7.5. These requirements will be implemented through the EMP (Application document TR010063/APP/7.3) and the Register of Environmental Actions and Commitments (REAC) (Application document TR010063/APP/7.4) for the Scheme.
- 10.7.6. Although soils supporting other land uses have been scoped out of this assessment, a Materials Management Plan (MMP) will be implemented through the EMP (Application document TR010063/APP/7.3) in accordance with the CL:AIRE Definition of Waste Code of Practice (DoWCoP)⁴². The MMP will consider the sustainable reuse of all surplus soils generated from the Scheme, such as roadside woodlands, hedgerows and gardens (subject to contamination testing and suitable for use criteria) in the effort to reduce waste and to meet carbon targets. In addition, best practice construction methods will be included in the EMP.

Land contamination

Environmental design

- 10.7.7. The embedded mitigation measures that have been incorporated into the design of the Scheme in relation to soils and geology include:
- Ground investigation information, collected between October and December 2021, has been used to inform the Scheme design and confirm the ground conditions and contamination status of the Scheme.
 - Remediation of soil and groundwater will be undertaken prior to construction if investigation and risk assessments are deemed necessary as outlined within the EMP.

Construction phase

- 10.7.8. Construction mitigation measures will be implemented through the EMP and include:
- Health and safety risk assessments, method statements (RAMS) and appropriate Personal Protective Equipment (PPE) for the protection of construction workers in accordance with the Control of Substances Hazardous to Health (COSHH) Regulations⁴³.
 - Implementation of appropriate dust suppression measures to prevent migration of contaminated dust and fibres as appropriate, as set out in Chapter 5 - Air Quality (Application document TR010063/APP/6.3).
 - Preparation of piling risk assessments as required in accordance with Environment Agency guidance to assess and manage risks to controlled waters.
 - Working methods during construction to manage groundwater and surface water appropriately and ensure that there is no run-off from the works, any material/waste stockpiles, and storage containers into adjacent surface watercourses in accordance with DEFRA and Environment Agency's guidance.
 - Stockpile management (such as water spraying and avoiding overstockpiling to reduce compaction of soil and loss of integrity) and timely removal of stockpiled soil to prevent windblown dust and surface water run-off.
 - Implementation of an appropriate MMP and Site Waste Management Plan (SWMP) to manage materials during the construction works. Further information can be found in Chapter 12 - Materials and Waste (Application document TR010063/APP/6.10).
 - Limiting the area of earthworks at any one time to reduce temporary effects on

⁴² CL:AIRE, The Definition of Waste: Code of Practice, 2011

⁴³ Health and Safety Executive, Control of Substances Hazardous to Health, <https://www.hse.gov.uk/coshh/>, accessed 2021

topography, soil compaction and erosion.

- Limiting the duration of soil exposure and timely reinstatement of vegetation or hardstanding to prevent soil erosion.
- Implementing appropriate pollution incident control e.g. plant drip trays and spill kits.
- Implementing appropriate and safe storage of fuel, oils and equipment during construction.
- If unexpected contamination is encountered during the proposed earthworks, further assessment will be required. Following assessment further mitigation measures such as remediation or removal of contamination may be required.

10.7.9. It has been assumed that hardstanding will be placed across the majority of the proposed works associated with the carriageway, except for soft landscaping along embankments and cuttings, which will minimise the generation of dust, direct contact and ingestion pathways and minimise infiltration during the operational phase. If soil contamination is identified, laying a clean capping layer may be required in areas of proposed soft landscaping.

10.7.10. Drainage design will consider the risks from any residual contamination and designers may be required to use lined drainage systems in areas of contamination that may be left in situ. If soil and/or groundwater contamination is identified during the ground investigation which poses a risk to sensitive receptors, appropriate remediation will be undertaken.

10.7.11. The design of the road and the selection of construction materials will be in accordance with DMRB standards, British Standards and best practice guidance at the time of the design. The design will be required to take into account the ground conditions including the potential for ground gas and ground aggressivity.

Operation

Agricultural land and soil

10.7.12. No mitigation measures are applicable during operation. The implementation of engineered drainage will also minimise the potential for soil erosion of adjacent verges and embankments, where present, from off-site migration of surface water.

Land contamination

10.7.13. It is assumed that the Scheme will be operated in accordance with the relevant regulations and best practice guidance in applying Best Available Techniques and pollution prevention.

10.7.14. Furthermore, pollution prevention measures incorporated within drainage design will mitigate the risk of contamination to controlled waters. The principles of drainage design for the Scheme are summarised in Chapter 8 - Road Drainage and the Water Environment (Application document TR010063/APP/6.6).

10.7.15. There may be an element of migration of contaminants in road spray and airborne contaminants from road traffic. This is likely to be irregular and of short term duration during rain storm events. No reasonable mitigation measures can be implemented to control these effects over the implementation of engineered drainage mentioned above.

10.8. Residual effects

10.8.1. Residual effects relate to those impacts which remain following the implementation of primary / embedded mitigation measures.

Construction

Agricultural land and soil

- 10.8.2. Land returning to agriculture after temporary use is expected to be of the same quality as baseline (see section 10.5), after treatment to be detailed within the SHMP. With reference to Table 10-11 of this ES, land returning to agriculture, at an equivalent ALC grade to the existing condition, is anticipated to have a slight adverse temporary effect, with no residual effects. This is considered not significant.
- 10.8.3. The flood compensation area (assuming it returns to agricultural use) will be one or two ALC grades poorer than the ALC grade assigned to the land prior to construction and no longer of BMV. This is due to increasing the frequency and duration of flood events, decreased drainage capability and degraded soil structure where subsoil is removed to lower the ground level. With reference to Table 10-11 of this ES, under the current design, this impact is anticipated to have a moderate adverse residual effect. This is considered a significant effect.
- 10.8.4. With regards to the permanent land taken for the new road layout, flood storage area and attenuation basins, moderate to very large adverse residual effects are anticipated as summarised below.
- 10.8.5. Effects to Subgrade 3a, BMV agricultural land during construction are considered to be very large adverse and significant for permanent land take and slight and not significant for temporary land take.
- 10.8.6. Effects on Subgrade 3b agricultural land during construction are considered to be moderately adverse and significant for permanent land take, moderately adverse and significant for temporary (reduced quality) land take and slight and not significant for temporary land take.

Land Contamination

- 10.8.7. With the implementation of mitigation measures through design and through the construction phase, potential land contamination effects during construction have been assessed as neutral to slight which are classed as not significant. The land contamination impact assessment is presented in Appendix 10.3 (Application document TR010063/APP/6.15). Consequently, there are anticipated to be no residual effects.
- 10.8.8. A summary of the construction phase contamination effects from land contamination is provided in Table 10-12. A more detailed assessment of operational risk and impact assessment is provided in Appendix 10.2 and 10.3 (Application document TR010063/APP/6.15).

Table 10-12 - Construction phase effects from land contamination

Receptor	Value/Sensitivity	Construction Risk	Magnitude of Impact	Classification of Effect
Human health: On-site	Low to Medium	Low	Minor adverse	neutral to slight (Not Significant)
Human health: Off-site	Very High to Low	Low	Negligible to Minor adverse	neutral to slight (Not Significant)
Controlled Waters: groundwater	Low to Medium	Low	Minor adverse	neutral to slight (Not Significant)
Controlled Waters: Surface waters (on-site)	High	Low	Minor adverse	neutral to slight (Not Significant)
Controlled Waters: Surface waters (off-site)	High	Low	Minor adverse	slight (Not Significant)

Operation

Agricultural land and soil

10.8.9. No residual effects are anticipated during the operation of the Scheme.

Land Contamination

10.8.10. With the implementation of embedded mitigation measures neutral to slight effects are anticipated during operation which are classed as not significant. Consequently, there are anticipated to be no residual effects.

10.8.11. A summary of the operational phase contamination effects from land contamination is provided in Table 10-13. A more detailed assessment of operational risk and impact assessment is provided in Appendix 10.2 and 10.3 (Application document TR010063/APP/6.15).

Table 10-13 - Operational phase effects from land contamination

Receptor	Value/Sensitivity	Operational Risk	Magnitude of Impact	Classification of Effect
Human health: On-site	Low to Medium	Low	Negligible	neutral to slight (Not Significant)
Human health: Off-site	Very High to Low	Low	Negligible	neutral to slight (Not Significant)
Controlled Waters: groundwater	Low to Medium	Low	Negligible	neutral to slight (Not Significant)
Controlled Waters: Surface waters (on-site)	High	Low	Negligible	neutral to slight (Not Significant)
Controlled Waters: Surface waters (off-site)	High	Low	Negligible	slight (Not Significant)

10.9. Cumulative effects

Intra-Scheme in-combination cumulative effects (single project impacts) within topic

10.9.1. The focus of the intra-Scheme Cumulative Effects Assessment (CEA) is understanding how receptors may experience a number of different types of impacts from the Scheme at the same time. Within the topic assessments, the geology and soils assessment methodology requires impacts to be reported individually on the basis of different categories, separate from other aspects. As a result of this approach, different receptors may be noted as experiencing impacts of more than one type within this chapter. The list below draws together these findings to indicate which receptors have been identified as likely to experience more than one type of impact related to Geology and Soils and are therefore considered relevant to the intra-Scheme assessment:

- River Chelt, Leigh Brook and surface water drains – potential receptors to both soil and groundwater contamination.
- Groundwater in Secondary A superficial and bedrock Aquifer – potential receptor to both soil and groundwater contamination.

10.9.2. The combined effect of soil and groundwater contamination on the receptors has been considered within the ground investigation interpretative report provided in Appendix 10.7 (Application reference TR010063/App/6.15). Negligible cumulative effects are anticipated, which are classified as not significant. No additional mitigation is anticipated.

10.9.3. There are anticipated to be intra-Scheme effects between geology and land quality, soils and agriculture, ecology, heritage and the water environment in relation to potential

receptors which could be impacted by ground contamination during the construction of the Scheme.

10.9.4. Potential impacts would include the contamination of sensitive/high-value receptors such as SSSIs, listed buildings, principal aquifers, surface water in ponds and rivers and groundwater source protection zones (SPZs) during construction works. Construction activities may introduce new sources of contamination, new pathways for migration of contamination and disturb and mobilise existing sources of contamination.

10.9.5. However, given the embedded and additional mitigation measures proposed in relation to these disciplines as outlined within each chapter, it is not expected that the combined impact of these effects would be greater than those effects predicted for the geology and land quality assessment as presented within this chapter. Further details are provided in Chapter 8 - Road Drainage and the Water Environment (Application document TR010063/APP/6.6) and Chapter 11 - Cultural Heritage (Application document TR010063/APP/6.9). Minor adverse residual cumulative intra-Scheme effects are anticipated, which are classified as not significant.

Inter-project cumulative effects assessment (different project impacts) within topic

10.9.6. To complete the cumulative effects assessment inter-project 'within topic' element, the geology and soils assessment has been completed with reference to the list of RFFPs that has been developed for the Scheme. The list is based on a review of all developments known to the planning system using the methodology described in Chapter 4 – Environmental Assessment Methodology of the ES (Application document TR010063/APP/6.2).

10.9.7. The RFFP long list has been screened to identify projects that are considered to have a realistic prospect of interacting with the Scheme in relation to Geology and Soils. The screening criteria used were as follows:

- within 500 m of the Scheme; and
- have been identified as likely to have effects that will combine with those identified for the scheme, such as loss of BMV land, contamination impacts and physical effects.

10.9.8. The RFFPs shortlisted and considered likely to interact with the Scheme in the context of the Geology and Soils assessment are provided in Table 10-14.

Table 10-14 - Summary of RFFP considered relevant to the Geology and Soils cumulative effects assessment

Application	Distance from Scheme	Potential impact
16/02000/OUT (Elms Park) Development of up to 4115 homes Relating to land allocated under Policy A4, North-west Cheltenham Development Area	Partly within and adjacent to Order limits, north of A4019	Loss of BMV land Potential mobilisation of contaminants which may be present in soils
20/00759/FUL (Swindon Farm) Demolition of a residential property and the erection of 266 homes Relating to part of the land allocated under Policy A4, North-west Cheltenham Development Area	258 m from Order limits, north of A4019	Loss of BMV land Potential mobilisation of contaminants which may be present in soils
Safeguarded land to the north-west of Cheltenham (Policy SD5)	Partly within and adjacent to Order limits, north of A4019	Loss of BMV land Potential mobilisation of contaminants which may be

Development for residential development for up to 2000 homes		present in soils
Gallagher Retail Park, Ref: 17/00827/FUL and 17/01459/FUL Construction of retail unit and car park	Partly within and adjacent to Order limits, north of A4019	Potential mobilisation of contaminants from current Commercial / Industrial land use
Land North West of Manor Road, Ref: 19/01260/OUT Construction of light industrial units	470m from Order limits, north of A4019	Potential mobilisation of contaminants from current Commercial / Industrial land use
Gallagher Retail Park, Ref: 21/02120/FUL Erection a restaurant unit	73 m from Order limits, north of A4019	Potential mobilisation of contaminants from current Commercial / Industrial land use
22/01817/OUT / 22/01107/OUT (same application made to TBC and CBC) Mixed use residential led development (1100 homes, 450 sqm convenience store, 250 sqm of café space and 300 sqm of community hub elements Relating to part of the land allocated under Policy A7, West Cheltenham Development Area	Partly within and adjacent to Order limits, south of B4634	Loss of BMV land Potential mobilisation of contaminants which may be present in soils
21/00872/REM Affordable housing scheme for 85 dwellings Relating to part of the land allocated under Site HD8 – land north of B4634 Allocated in Cheltenham Plan for construction of 175 homes	Allocation is partly within and adjacent to Order limits, south of A4019 corridor The application site is 311m from Order Limits	Loss of horticultural nursery and allotments Loss of BMV land Potential mobilisation of contaminants which may be present in soils

Construction

10.9.9. Table 15-3 of Chapter 15 – Cumulative Effects Assessment (application document TR010063 – APP 6.13) provides the assumptions about the progression of each RFFP relative to the construction of the Scheme, which has been used for the CEA. The construction of the developments identified in Table 10-14 may be concurrent with the construction of the Scheme and due to their location close to the Scheme, may cause construction cumulative impacts.

10.9.10. The following cumulative impacts may be present during the construction phase:

- An increase in soil erosion and the amount of dust and surface water runoff generated through a larger construction area affecting controlled waters (groundwater and surface water), human health and property receptors.
- An increase in the mobilisation of contaminants in the air, ground and groundwater through the disturbance of a larger area of potentially contaminated ground mobilising contaminants causing the exposure of human health, controlled waters (groundwater and surface water) and property receptors to potential contaminants.
- An increase in the area of BMV land lost to development.

10.9.11. Mitigation measures will be implemented as part of the construction of the Scheme as outlined in Section 10.8 of this chapter. The RFFPs themselves will also be subject to the

NPPF and will require mitigation and control measures to be adopted during the construction through management plans to reduce impacts on the environment including dust generation and potential mobilisation of contaminants. Therefore, it is not expected that the combined impact of these cumulative effects will be greater than those effects predicted for geology and soils as outlined in this chapter. Only negligible to minor adverse cumulative effects are anticipated in relation to contaminated land, which are classified as not significant. No additional mitigation is anticipated.

- 10.9.12. There will be a loss of BMV agricultural land required for the RFFPs as identified below:
- 16/02000/OUT (Elms Park), relating to part of the North-west Cheltenham Development Area (Policy A4);
 - 20/00759/FUL (Swindon Farm), relating to part of the North-west Cheltenham Development Area (Policy A4);
 - Safeguarded land to the north-west of Cheltenham (Policy SD5);
 - 22/01817/OUT Mixed use residential lead development, relating to the West Cheltenham Development Area (Policy A7); and
 - 20/00872/REM – land north of B4634, relating to land allocated under Policy HD8 of the Cheltenham Local Plan.
- 10.9.13. The RFFPs would be required to demonstrate that they have looked to limit the loss of land as far as is practicable within the design of their respective development proposals as part of the consenting process. However, there will be a combined cumulative effect of loss of agricultural land within the Scheme and other developments. Therefore, moderate to very large adverse cumulative effects are anticipated which is classed as significant. No additional mitigation is available for the loss of agricultural land. This is a matter of compensation and falls outside of the EIA process.

Operation

- 10.9.14. During the operation of the Scheme, cumulative effects relating to geology and soils may arise in combination with the operation of the RFFPs listed above.
- 10.9.15. The following cumulative impacts may be present during operation of the Scheme:
- An increase in the amount of dust generated due to maintenance works at the Scheme and operation of the other developments affecting human health receptors.
 - The potential introduction of new sources of contamination from the new operational areas causing the exposure of human health, controlled waters (groundwater and surface water), property and ecological receptors to potential contaminants.
- 10.9.16. The CEA assumes that the Scheme and RFFPs will be operated in accordance with granted consents and the relevant regulations, permits and best practice guidance and pollution prevention. Therefore, it is not expected that the combined impact of these cumulative effects will be greater than those effects predicted for geology and soils during the operation of the Scheme as outlined in this chapter. Only negligible to minor adverse cumulative effects are anticipated, which are classified as not significant. No additional mitigation is anticipated.

10.10. Assumptions and limitations

- 10.10.1. A realistic assumption on ground conditions and impacts has been made, based on the data available at the time of reporting including an Envirocheck report, publicly available desk based/website data and site specific information obtained from a ground investigation completed for the Scheme in October 2021.
- 10.10.2. As detailed design will not be finalised until post consent, the likely 'reasonably likely worse case' impact from the Scheme has been assumed in the assessment and is sought to be mitigated.

- 10.10.3. For the assessment of effects associated with ground conditions and land contamination, the following assumptions have been made:
- Contamination is assumed to be present at all locations where potential sources have been identified in the study area.
 - Ground disturbance during the construction phase could occur anywhere within the Order limits of the Scheme.
 - The assessment provides an initial indication of chronic long-term risks to construction and maintenance workers. Control measures to mitigate the risk of adverse health impacts to construction workers will be identified by risk assessments and will be incorporated into the EMP.
 - There will be areas used for the storage of materials, waste and containers during the construction and operational phase. Where storage/stockpiling of materials occurs, the material will stay within the Order limits of the Scheme.

10.11. Chapter summary

- 10.11.1. A total of 31.56 ha of subgrade 3a BMV agricultural land is anticipated to be lost resulting in a very large adverse effect which is significant. A total of 22.56 ha of subgrade 3b agricultural land is also anticipated to be lost resulting in a moderate adverse effect which is significant. A further 1.13 ha of Subgrade 3b agricultural land is anticipated to have a permanent reduction in ALC classification to Grade 4, due to the ground level being reduced to create a flood compensation area (located to the east of the Link Road). The land will be returned to agriculture, but its use may be restricted to grass production. This results in a moderate effect which is significant.
- 10.11.2. Land returning to agriculture after temporary use is expected to be of the same quality as a baseline and is anticipated to have a slight adverse temporary effect, which is not significant, with no residual effects.
- 10.11.3. With respect to land contamination, potential land contamination effects during construction have been assessed as neutral to slight which are classed as not significant.
- 10.11.4. With the implementation of embedded mitigation measures neutral to slight effects are anticipated in relation to land contamination during operation. No residual effects are anticipated.
- 10.11.5. The construction of the nearby RFFP developments, as summarised in Table 10-4, may cause construction and operational cumulative effects due to their location close to the Scheme. There will be a combined cumulative effect of loss of agricultural land within the Scheme and other developments (RFFPs). Therefore, moderate to very large adverse cumulative effects are anticipated which are significant. No additional mitigation is available for the loss of agricultural land. For land contamination aspects, it is not expected that the combined impact of these cumulative effects will be greater than those effects predicted for the Scheme as outlined in this chapter. Therefore, negligible to minor adverse cumulative effects are anticipated which are not significant.

Appendices



Appendix 10.1 – Definitions of Probability and Consequence

Appendix 10.1 – Definitions of Probability and Consequence is provided as a separate document (application document TR010063 – APP 6.15).

Appendix 10.2 – Conceptual Site Models

Appendix 10.2 – Preliminary Conceptual Site Models is provided as a separate document (application document TR010063 – APP 6.15).

Appendix 10.3 – Land Contamination Impact Assessment Tables

Appendix 10.3 – Land Contamination Impact Assessment Tables is provided as a separate document (application document TR010063 – APP 6.15).

Appendix 10.4 – Agricultural Land Survey Report – Link Road

Appendix 10.4 – Agricultural Land Survey Report is provided as a separate document (application document TR010063 – APP 6.15).

Appendix 10.5 – Agricultural Land Survey Report – Flood Storage Area

Appendix 10.5 – Agricultural Land Survey Report is provided as a separate document (application document TR010063 – APP 6.15).

Appendix 10.6 – Agricultural Land Survey Report – Additional areas

Appendix 10.6 – Agricultural Land Survey Report is provided as a separate document (application document TR010063 – APP 6.15).

Appendix 10.7 – Ground Investigation Report

Appendix 10.7 Ground Investigation Report is provided as a separate document (application document TR010063 – APP 6.15).

Appendix 10.8 – Geology and Soils

Chapter Figures

Appendix 10.8 Geology and Soils Chapter Figures is provided as a separate document (application document TR010063 – APP 6.15).

AtkinsRéalis

5th Floor, Block 5
Shire Hall
Bearland
Gloucester
GL1 2TH

Tel: +44 (0) 8000 514 514