A358 Taunton to Southfields Dualling Scheme

Preliminary Environmental Information Report - Chapter 9
Geology and Soils

HE551508-ARP-EGT-ZZ-RP-LE-000003

27/09/21

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9.1 Introduction

9.1.1 This chapter assesses the potential effects on geology and soils from the construction and operation of the proposed A358 Taunton to Southfields Dualling Scheme, following the methodology set out in *Design Manual for Roads and Bridges* (DMRB) LA 109 *Geology and soils* [1]. The scope of the assessment and the abbreviations and terms of reference used in this chapter, are as described in DMRB LA 109 *Geology and soils*.

9.1.2 This chapter provides an overview of the regulatory and policy framework related to geology and soils, both nationally and locally, details the methodology followed for the preliminary assessment and current assumptions and limitations. The existing environment and development history of the area through which the proposed scheme passes and surrounding locality, is described with respect to geology and soils. This provides the basis on which the proposed design, mitigation and opportunities for enhancement are identified and discussed, allowing for the subsequent assessment of likely residual significant effects of the proposed scheme.

9.1.3 The impacts on the existing environment in the area surrounding the proposed scheme is considered with regard to:

- bedrock geology and superficial deposits, including geological designations and sensitive / valuable non-designated features
- quantity and quality of agricultural land that would be affected, both temporarily and permanently
- soil resources
- land contamination on human health, surface water and groundwater receptors

9.1.4 In accordance with current contaminated land guidance [2] this chapter presents the baseline conditions with respect to potential soil and groundwater contamination and identifies potential contaminant linkages (PCLs) which could be formed due to the construction and/or operational phases of the proposed scheme. This forms the basis for the assessment of potential effects from land contamination.

9.1.5 Although designated sites exist within the region, there are no geological features of scientific interest and importance (e.g. Geological site of special scientific interest (SSSI) or Local Geological/Geomorphological Sites (LGS)) within the Geology and soils study area, therefore this aspect has been scoped out of further assessment.

9.1.6 Effects from land contamination are considered for soil, surface water and groundwater. Chapter 13 Road Drainage and the Water Environment details potential effects of the proposed scheme on surface and groundwaters from drainage and discharge, in terms of the potential effects on hydrogeology.

9.1.7 The potential effects of dewatering during construction works on paleoenvironmental and archaeological deposits are addressed in Chapter 6 Cultural Heritage.

9.1.8 The effects on mineral deposits as a resource and the suitability for reuse of soils are described in Chapter 10 Material Assets and Waste.

9.1.9 Chapter 7 Landscape considers the potential effects on geomorphology in relation to landforms.

9.2 Legislative and policy framework

Legislation

9.2.1 Geological sites of national importance are principally afforded protection under the *Wildlife and Countryside Act 1981* [3] (as amended) or the *National Parks and Access to the Countryside Act 1949* [4] by designation as SSSI or National Nature Reserve (NNR). In addition, the Joint Nature Conservation Committee (JNCC) has carried out a Geological Conservation Review (GCR) and Earth Science Conservation Review (ESCR) to identify the best and most representative earth science sites in Great Britain, with a view to their long-term conservation. Although GCR/ESCR identification does not itself give any statutory protection, many GCR/ESCR sites have been notified as SSSIs.

9.2.2 Environmental legislation and regulation provide drivers to manage contamination. The main drivers for managing risks to human health and the environment from land contamination are:

- *Part IIA of the Environmental Protection Act (1990) (c. 43)* [5]
- *The Contaminated Land Regulations (2006) (SI 2006/1380)* [6]
- *Contaminated Land (England) Amendment Regulations (2012) (SI 2012/263)* [7]
- *Environment Act (1995) (c.25)* [8] *and*
- *The Environmental Permitting (England and Wales) Regulations 2016 (SI 2016/1154)* [9]

9.2.3 Under Part IIA of the Environmental Protection Act, sites are identified as 'contaminated land' if they are causing, or if there is a significant possibility of them causing significant harm to human health or significant pollution of controlled waters, as defined by Section 104 of *the Water Resources Act 1991* (c.57) [10]. In general terms, the legislation advocates the use of a risk based assessment approach for the assessment of contamination and remedial requirements.

9.2.4 The *Town and Country Planning (Development Management Procedure) (England) Order 2015 (SI 2015/595)* [11] sets out the statutory consultation procedures whereby Natural England must consider development proposals which are not in accordance with a development plan and individually or cumulatively involve the loss of more than 20 hectares (ha) of best and most versatile agricultural land.

9.2.5 Additional key legislation/regulations considered within the assessment relating to contamination include:

- *The Water Act 2003 (Commencement No. 11) Order 2012 (SI 2012/264)* [12]
- *Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 (SI 2009.3104)* [13]
- *The Water Framework Directive (Standards and Classification) Directions (England and Wales) (2015)* [14]

- *The Environmental Damage (Prevention and Remediation) Regulations 2015 (SI 2015/810)* [15]
- *The Town and Country Planning (Development Management Procedure) (England) Order 2015 (SI 2015/595)* [11]

National and regional planning policy

9.2.6 As discussed in Chapter 1 Introduction, the primary basis for deciding whether or not to grant a Development Consent Order (DCO) for the proposed project is the *National Policy Statement for National Networks* (NPSNN) [16], which sets out policies to guide how DCO applications will be decided and how the effects of national networks infrastructure should be considered. Table 9-1 identifies the NPSNN policies relevant to geology and soils, and then specifies where in the preliminary environmental information (PEI) report chapter information is provided to address the policy.

Table 9-1 Relevant NPSNN policies for geology and soils assessment

Relevant NPSNN paragraph reference	Requirement of the NPSNN	Where addressed in this chapter
5.22	*Where the project is subject to EIA 'the applicant should consider likely significant effects on internationally, nationally and locally designated sites of ...geological conservation importance*	Section 9.7 Baseline conditions
5.23	*The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests*	Section 9.7 Baseline conditions – no sites of geological conservation importance have been identified within the study area.
5.25	*as a general principle, and subject to the specific policies below, development should avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives'*	Section 9.7 Baseline conditions have identified no sites of geological conservation importance within the study area and therefore no mitigation required.
5.168	*for developments on previously developed land 'applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this*	Section 9.7 Baseline conditions, identifies potential land contamination sites Section 9.8 Potential impacts - describes how potential contaminant sources could impact identified receptors. Embedded and additional mitigation to address these impacts are described in Section 9.9.

Relevant NPSNN paragraph reference	Requirement of the NPSNN	Where addressed in this chapter
5.168	*where significant development of agricultural land is necessary applicants should seek to use areas of poorer quality land in preference to that of a higher quality. Applicants should consider the economic and other benefits of the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification). Applicants should also identify any effects, and seek to minimise impacts, on soil quality, taking into account any mitigation measures proposed*	Section 9.7 Baseline conditions, identifies Agricultural Land Classification (ALC) grades of the area directly intersected by the proposed scheme and proposed scheme redline boundary. Section 9.8 Potential impacts – identifies how land is impacted both temporarily and permanently and the area of each ALC grade impacted. Section 9.9 Design, mitigation and enhancement measures describes best practice mitigation measures for the protection of soil.
5.179	*states 'applicants can minimise the direct effects of the project on existing uses of the proposed site or proposed uses near the site by the application of good design principles, including the layout of the project and the protection of soils during construction'*	Section 9.9 Design, mitigation and enhancement measures describes best practice mitigation measures for the protection of soil.

9.2.7 In addition to the NPSNN, this PEI Report also considers the *National Planning Policy Framework* (NPPF) [17] and relevant *Planning Practice Guidance* (PPG) including that for land contamination [18], which emphasises the need for sustainable development in terms of the resources used, the maintenance of the environment, the economic use of land and societal considerations within the general area. The importance of the restoration of derelict and contaminated land is stated.

9.2.8 In relation to conserving and enhancing the natural environment, the NPPF states that impacts on geodiversity should be reduced by preventing harm to geological conservation interests. In the UK, geological sites are afforded consideration at a local level by designation, including:

- Geological Conservation Review (GCR) sites (England, Scotland, Wales)
- Geoparks
- Regionally Important Geological and Geomorphological Sites (RIGS)
- Local Geological/Geomorphological Sites (LGS)
- Sites of Importance for Nature Conservation (SINC)

9.2.9 Regarding development on land affected by contamination, the NPPF emphasises the requirement to understand the ground risks, and the development of appropriate remediation to make ground hazards material considerations during the planning process.

9.2.10 It also states that planning policies and decisions should ensure that a site is suitable for its proposed use taking account of ground conditions. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation).

9.2.11 With regards to agricultural land, the NPPF states that: “where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality”. The protection and enhancement of soils is also considered an important element of the conservation of the natural environment.

9.2.12 The NPPF states that planning policies and decisions should contribute to and enhance the natural and local environment by preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of land instability.

9.2.13 It should be noted that the direct environmental impacts of land instability are excluded from this chapter in accordance with DMRB LA 109 *Geology and soils* [1], which states; “*Risks associated with geotechnical hazards and land stability are assessed in accordance with CD622, Managing geotechnical risk*.” [19]

9.2.14 Indirect impacts associated with land stability mitigation, such as damage to the landscape or ecological receptors have been considered within their respective chapters.

Local planning policy

Taunton Deane Borough Council Adopted Core Strategy (TDBC) 2011-2028 [20]

9.2.15 This strategy sets out the vision for future development of the Taunton Deane borough with objectives and policies developed to control and direct development.

9.2.16 The strategy includes environmental objectives and policies:

- Strategic objective 8 – ‘*maintain and enhance biodiversity, the natural and man-made environment, minimising the need to travel, waste, pollution and the use of non-renewable resources and to promote good design and materials which respect and enhance local distinctiveness*.’

9.2.17 This strategic objective is to be delivered via core policies specifically core policy CP8, Environment, which aims to enhance and protect the natural and historic environment including geological sites.

9.2.18 The TDBC strategy is to be replaced by the *Somerset West and Taunton Local Plan 2040* once adopted [21].

West Somerset Local Plan to 2032 (adopted 2016) [22]

9.2.19 The Local Plan for West Somerset aims to help make West Somerset a better place to live, work and study in. The Local Plan sets out a vision for the sustainable development of the communities in West Somerset over the next 20 years and provides the means of achieving it through the application of strategic planning policies.

9.2.20 Policy NH9; Pollution, Land Contamination and Land Instability requires that;

‘All development proposals on or in proximity to land known to be, or which may be, contaminated will include measures designed to prevent an unacceptable risk to public health and the environment.’

9.2.21 The purpose of the policy is to prevent new development being adversely affected by land contamination and protect users of the new development.

South Somerset Local Plan 2006-2028 [23]

9.2.22 Contaminated land is covered in policy EQ7 Pollution control, and in line with the NPPF, this policy aims to ensure new developments do not harm existing residents, future residents, or the natural environment. The policy states that '*Development that, on its own or cumulatively, would result in air, light, noise, water quality or other environmental pollution or harm to amenity, health or safety will only be permitted if the potential adverse effects would be mitigated to an acceptable level by other environmental controls, or by measures included in the proposals. This may be achieved by the imposition of planning conditions or through a planning obligation*.'

9.2.23 Sites of geological importance are considered in policy EQ4 Biodiversity, stating that all proposals for development, including those which would affect sites of regional and local biodiversity, nationally and internationally protected sites and sites of geological interest, should be designed to protect, enhance and conserve these protected areas. '*Development will not be allowed to proceed unless it can be demonstrated that it will not result in any adverse impact on the integrity of national and international wildlife and landscape designations, including features outside the site boundaries that ecologically support the conservation of the designated site'*.

Standards and guidance

9.2.24 This PEI Report refers to the following guidance:

- *Geotechnics, General Information, Managing Geotechnical Risk, CD 622, (formerly DMRB Volume 4, Section 1, Part 2 HD 22/08)* [19]
- *DMRB LA 104 Environmental assessment and monitoring* [24]
- *DMRB LA 109 Geology and Soils* [1]
- *DMRB LA 113 Road drainage and the water environment* [25]
- *Contaminated Land Statutory Guidance, Department for Environment, Food and Rural Affairs (Defra), 2012* [26]
- *Environment Agency (2020) Land Contamination: Risk Management,* [27]
- *BS 5930:2015 + A1 2020: Code of Practice for Site Investigations* [28]
- *BS 10175:2011 + A2 2017: Code of Practice for Investigation of Potentially Contaminated Sites* [29]
- *Environment Agency (2010) Guiding Principles for Land Contamination* [30]
- *Environment Agency (2018) The Environment Agency's approach to groundwater protection* [31]
- *CIRIA C552: Contaminated Land Risk Assessment, A guide to good practice* [32]
- *CIRIA C681: Unexploded ordnance (UXO) A guide for the construction industry* [33]
- *Defra: Soil Strategy for England – Safeguarding Our Soils, 2009* [34]
- *Defra: The Natural Choice: securing the value of nature, 2011* [35]
- *Defra: Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, 2009* [36].

9.3 Assessment methodology

9.3.1 This section outlines the methodology employed for assessing the likely significant effects on geology and soils from the construction and operation of the proposed scheme. The assessment methodology is based on LA104.

9.3.2 An overview of the methodology is provided below and comprises the following steps:

- Establish outline study area and baseline conditions.
- Undertake a desk-based review of study area to include; physical conditions, historical information and current regulatory data on potentially contaminative activities.
- Establish the potential for significant effects based on the scoping in DMRB LA 109 *Geology and soils*.
- Where likely significant effects are identified, complete a detailed baseline assessment which is representative of current conditions without implementation of the project.
- Finalise study area based on proposed scheme design and baseline scenarios.
- Establish design and mitigation measures.
- Undertake assessment of likely significant effects.
- Recommend monitoring where significant effects are reported.

Identification of baseline conditions

9.3.3 The scope of the baseline studies for specific topic areas is listed in 9.4.5. The identification of baseline conditions for geology and soils is primarily based on desk study information included within the Preliminary Sources Study Reports (PSSR) [37] and the Contamination Preliminary Risk Assessment (PRA) report [38].

9.3.4 The PSSRs were completed prior to adoption of preferred route option, 'pink modified route'. The options assessment process is set out in Chapter 3 of this PEI Report: Assessment of Alternatives. The PRA [38] was completed after preferred route announcement in June 2019.

9.3.5 Baseline data have been abstracted from the following sources:

- The options selection stage PSSR (HE551508-MMSJV-HGT-000RP-CE-0001) [37] was based on the following main primary sources:
  - previous reports available from the Highways Agency Geotechnical Data Management Systems (HAGDMS) website
  - a review of previous site investigations (SI)
  - Landmark Envirocheck Reports obtained between 2016 and 2018
  - Benham, A J et al. 2005. Mineral Resource Information in Support of National, Regional and Local Planning: Somerset (comprising Somerset, North Somerset, Bath and North East Somerset, the City of Bristol, and part of Exmoor National Park). British Geological Survey Commissioned Report, CR/04/214N
  - Multi Agency Geographic Information for the Countryside (MAGIC) website
  - findings of site walkovers completed between April and May 2017.
- The options selection stage Environmental Scoping Report (ESR) (HE551508-MMSJV-EGN-000-RP-LP-0006) [39].
- The options selection stage Environmental Assessment Report (EAR) (HE551508-MMSJV-EGN-000-RP-LP-0001) [40].
- The options selection stage Preliminary Sources Study Addendum (PSSR); (HE551508-MMSJV-HGT-0000-RP-CE-0006) [41].

- The options selection stage Environmental Assessment Report Addendum (EAR) (HE551508-MMSJV-EGN-000-RP-LP-0030) [42].
- Agricultural Development Advisory Service (ADAS) (1995), Taunton Deane Local Plan (MAFF ref. ALCB00895 [43]).
- Cranfield University (2001), The National Soil Map of England and Wales 1:250,000 scale, Cranfield University: National Soil Resources Institute [44].
- Soil Survey of England and Wales (1984), Soils and Their Use in South West England, Harpenden [45].
- MAGIC interactive mapping [46].
- Natural England's Regional ALC Maps [47].
- The Environmental Constraints Plan.
- Stage 3 Contamination Preliminary Risk Assessment (PRA), 2021 [38], which was based on the following additional sources:
  - Groundsure Geographic Information System (GIS) dataset (2021)
  - Groundsure Insight reports (2021)
  - British Geological Survey (BGS) Geoindex
  - Aerial photographs
  - Local Authority contaminated land searches

9.3.6 For land contamination, the collation and assessment of the baseline data has been undertaken in line with current guidance, Land Contamination: Risk Management [2].

9.3.7 A Tier 1 preliminary risk assessment of potentially contaminated land sites has been completed in accordance with LCRM [2]. This is reported in the PRA [38] as individual conceptual site models (CSMs) for each site. Appendix 9.2 summarises the CSMs from the PRA. The risk assessments have been completed in accordance with current guidance and detail of the methodology is presented in Appendix 9.3 Detailed Assessment Methodology for Contaminated Land.

Assessment Methodology

9.3.8 The environmental impact assessment methodology outlined below applies to both construction and operational phases of the propose scheme.

9.3.9 The assessment was undertaken in accordance with the following:

- DMRB LA 104 *Environmental assessment and monitoring* [24]
- DMRB LA 109 *Geology and soils* [1]

9.3.10 The key steps to the assessment are outlined below:

- Step 1: assess the value (sensitivity) of receptors, shown in Table 9-2, in accordance with Table 3.11, DMRB LA 109 *Geology and soils.*
- Step 2: assess the magnitude of impact on receptors, shown in Table 9-3, Table 3.12 in DMRB LA 109 *Geology and soils.*
- Step 3: derive impact significance from receptor value and magnitude of impacts, shown in Table 9-4 and in accordance with Table 3.8.1 in DMRB LA 104 Environmental assessment and monitoring. The significance of effect is determined by comparison of the identified value (sensitivity) of the receptors with the magnitude of the effect. For the purpose of this assessment, values of moderate adverse and above have been defined as significant effects.

Table 9-2 Environmental value (sensitivity) of receptors in the study area

Value/ sensitivity	Aspect	Description	Examples within the study area
Very High	Geology	International designated sites of geological value (e.g. United Nations Educational Scientific and Cultural Organization (UNESCO) World Heritage Sites).	None identified within the study area.
	Agricultural land and soil	ALC Grades 1 and 2[1]. Soils directly supporting an EC designated site (e.g. Special Area of Conservation (SAC) or Special Protection Area (SPA))[2].	Detailed post 1988 data shows areas of land in ALC Grade 2 to the north of the study area. An area of land in Grade 2 is also predicted to be found south-west of Thornfalcon.
	Human health	Very sensitive land use such as residential, allotments, schools.	Residential properties scattered along the route and settlements including; Henlade, Rushton, Thornfalcon, Haydon, West Hatch, Hatch Beauchamp and Ashill with other residential properties. Also Somerset Progressive School adjacent the route at West Hatch, Ashill Primary School.
	Groundwater	Principal aquifer[3], providing a regionally important resource and/or supporting a site protected under EC and UK legislation. Groundwater that locally supports a groundwater dependent terrestrial ecosystem (GWDTE). Inner source protection zone (SPZ1).	No source protection zones within the vicinity of the route and study area. No Principal aquifer within the study area.
	Surface water	Watercourse having a Water Framework Directive (WFD) classification shown in a River Basin Management Plan (RBMP) and a Q95≥1.0m^3/s.[3] Species or site protected/ designated under EC or UK legislation e.g. site of special scientific interest (SSSI), SPA.	No watercourses of this sensitivity were identified in the study area.
High	Geology	Regionally Important Geological Sites with limited potential for replacement (e.g. RIGS). Geology meeting regional designation citation criteria which is not designated as such.	None identified in the study area.
	Agricultural land and Soil	ALC Subgrade 3a Soils supporting a UK designated site (e.g. SSSI).	Detailed post-1988 data show areas of land in ALC Subgrade 3a at the western end of the proposed scheme at the M5 Junction 25. A large part of the study area north of West Hatch, and a small area south of

Value/ sensitivity	Aspect	Description	Examples within the study area
			Capland is also predicted to be in Subgrade 3a.
	Human health	High sensitivity land use such as public open space, recreational grounds, public rights of way (PRoW).	Users of parks/recreation grounds, PRoW, such as recreational ground at Ashill.
	Groundwater	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports GWDTE, SPZ2.	Secondary aquifers (undifferentiated)/Secondary A aquifers
	Surface water	Watercourse having a Water Framework Directive (WFD) classification shown in RBMP and a Q95<1.0m^3/s. Species protected under EC or UK legislation.	Broughton Brook, River Isle
Medium	Geology	Regionally Important Geological Sites (RIGS) with limited potential for replacement. Geology meeting regional designation citation criteria which is not designated as such.	None identified in the study area.
	Agricultural land and Soil	ALC Subgrade 3b Soils supporting non-statutory designated sites (e.g. LNR).	Detailed post-1988 data shows large area of land in ALC Subgrade 3b at the western end of the proposed scheme at the M5 Junction 25. The majority of the agricultural land in the study area south of West Hatch is predicted to be ALC Subgrade 3b.
	Human health	Medium sensitivity land use such as commercial or industrial.	Users of commercial properties and industrial areas located throughout the study area, for example: depot, petrol filling station (PFS), farm workers.
	Groundwater	Secondary B aquifer / aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3	Secondary B aquifers in Mercia Mudstone Group and Branscombe Formation
	Surface water	Watercourse not having a WFD classification shown in RBMP and a Q_{95}>0.001m^3/s.	Black Brook Tributaries (1 to 6), Venner's Water, Cad Brook.
Low	Geology	Geology of local importance / interest with potential for replacement (e.g. non designated geological exposures, former quarries / mining sites).	Local Geological / Geomorphological Site, identified 950m east (beyond study area). Historical mineral extraction sites.

Value/ sensitivity	Aspect	Description	Examples within the study area
	Agricultural land and Soil	ALC Grades 4 and 5. Soils supporting non-designated notable or priority habitats.	Some local areas of ALC Grade 4 and 5 land could be present in the land currently predicted to be Subgrade 3b.
	Human health	Low sensitivity land use such as highways and rail.	Local road network.
	Groundwater	Unproductive strata.	Charmouth Mudstone Formation including the Belemnite Member at the eastern end of the route
	Surface water	Watercourse not having a WFD classification shown in RBMP and a $Q_{95} \leq 0.001 m^3/s$.	Fivehead River Tributaries 1, 3, 4 & 5
Negligible	Geology	No geological exposures, little / no local interest.	None within the study area.
	Agricultural land and Soil	Previously developed land formerly in 'hard uses' with little potential return to agriculture.	A number of areas within the study area have been previously developed.
	Human health	Undeveloped surplus land / no sensitive land use proposed.	Undeveloped field.
	Groundwater	Not included in Table 3.70 of LA 113	Not applicable.
	Surface water	Not included in Table 3.70 of LA 113	Not applicable.
Notes: [1] Refer to Section 9.6.15 for definition of ALC [2] Refer to Chapter 18 Glossary for definition of environmental designations [3] Refer to Chapter 13 Road drainage and the water environment for description of controlled water designations.			

Table 9-3 Magnitude of impact and typical description

Magnitude of impact (change)	Receptor type	Typical description
Major	Geology	Loss of geological feature/designation and/or quality and integrity, severe damage to key characteristics, features or elements.
	Soils	Physical removal or permanent sealing of soil resource or agricultural land (>20ha).
	Contamination	1) human health: significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels, refer to Appendix 9.3) with potential for significant harm to human health. Contamination heavily restricts future use of land. 2) surface water: significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria e.g. environmental quality standards (EQS)/UK drinking water standards (DWS). Contamination causes significant chemical/biological degradation of water, reduction in WFD Classification/loss of regionally important public water supply. 3) groundwater: significant contamination identified.

Magnitude of impact (change)	Receptor type	Typical description
		Contamination levels significantly exceed background levels and relevant screening criteria e.g. EQS/ DWS Contamination causes reduction in water body WFD classification, loss of regionally important public water supply, loss of or extensive change to GWDTE.
Moderate	Geology	Partial loss of geological feature/designation, potentially adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	Soils	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.), Including: 1) physical removal or permanent sealing of 1ha-20ha of agricultural land; or 2) 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).
	Contamination	1) human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category 4 screening levels). Significant contamination can be present. Control/remediation measures are required to reduce risks to human health/make land suitable for intended use. 2) surface water: contamination exceed background levels and are in-line with screening criteria e.g. EQS/DWS. Control/remediation measures are required to improve water quality, degradation of regionally important public water supply, contribution to reduction in water body classification. 3) groundwater: contamination exceed background levels and are in-line with screening criteria e.g. EQS/DWS. Control/remediation measures are required to improve water quality, contribution to reduction in water body classification, degradation of regionally important public water supply, partial loss of the integrity of GWDTE.
Minor	Geology	Minor measurable change in geological feature/designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Soils	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.)
	Contamination	1) human health: contaminant concentrations are below relevant screening criteria (e.g. category 4 screening levels). Significant contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health. 2) surface water: contaminant concentrations are below relevant screening criteria (e.g. EQS/DWS). Minor effects on water supplies. 3) groundwater: contaminant concentrations are below relevant screening criteria (e.g. EQS/DWS). Minor effects on an aquifer, GWDTEs, abstractions.
Negligible	Geology	Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature/designation. Overall integrity of resource not affected.

Magnitude of impact (change)	Receptor type	Typical description
	Soils	No discernible loss/reduction of soil function(s) that restrict current or approved future use.
	Contamination	1) human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. category 4 screening levels). No requirement for control measures to reduce risks to human health/make land suitable for intended use. 2) surface water: contaminant concentrations substantially below screening criteria (e.g. EQS/DWS). 3) groundwater: contaminant concentrations substantially below screening criteria (e.g. EQS/DWS). No measurable impact on aquifer.

Table 9-4 Significance matrix

		Magnitude of impact (degree of change)				
		No change	Negligible	Minor	Moderate	Major
Environmental value (sensitivity)	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

Consultation/Engagement

9.3.11 Engagement has taken place with key stakeholders since 2018 including:

- A technical working group (TWG) was established for the options selection stage of the proposed scheme and a workshop held on the 8 May 2018. A number of statutory environmental bodies attended with representatives from the National Trust, Natural England, South Somerset District Council (SSDC), Blackdown Hills Area of Outstanding Natural Beauty, Taunton Deane Borough Council and West Somerset Council.
- Consultation with the Environment Agency, regarding records of historical landfills within the study area.
- Consultation with Somerset West and Taunton Council (SWTC) and SSDC to obtain information on historical landfills, potentially contaminated land and private water abstractions.

9.3.12 Recent enquiries have been made with Somerset County Council (SCC) with regard to information on historical landfills and to consult on the study area. The relevant Petroleum Licensing Officers (PLO) have been contacted for copies of their records for the fuel sites within the study area.

9.3.13 Engagement is currently on-going and specific further consultation with the Environment Agency will be necessary to discuss the effect of the proposed scheme on the landfill sites identified and vice versa.

9.3.14 Public consultation has been undertaken for previous stages and a community engagement has been completed at the end of March on the preferred route alignment with further dates planned.

9.4 Assessment assumptions and limitations

9.4.1 The assessment undertaken for geology and soils has been based on the collation and evaluation of available documentation listed in Section 9.3.5.

9.4.2 The proposed assessment methodology is, therefore, largely dependent on information obtained from third party sources the quality of which has not been independently verified. Some additional information may be available for future drafts, from the proposed SI and monitoring programmes.

9.4.3 The approach which was adopted for the assessment of contamination at the site is based on current best practice guidance.

9.4.4 In areas of land that would be temporarily acquired for construction, soils would be managed in accordance with Defra (2009) *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites* [36] and restored to the reasonable satisfaction of the owners of the land.

9.4.5 It is assumed that prior to completion of construction, the areas adjacent to the proposed scheme used for access, egress and other associated construction works would be restored to the reasonable satisfaction of the owners of the land.

9.4.6 It is assumed that potential effects on human health (e.g. for construction and maintenance workers) would be mitigated through adherence to relevant legislation and best practice with respect to health and safety management, including the *Construction (Design and Management) Regulations* (CDM) 2015 (SI 2015 No. 51) [48].

9.4.7 The following limitations have been encountered:

- Currently only provisional ALC data is available for the majority of the study area and as such the potential impact on soil and agricultural land cannot be fully assessed at this stage. A detailed soil survey will be undertaken to inform further stages of assessment.
- A SI is being scoped at the time of writing. In the absence of investigation data, potential impacts to current land users, groundwater and surface water from land contamination cannot be fully assessed at this stage.
- The SI is programmed to be completed and data made available in time to inform the assessment. However, if some of the SI data are unavailable at the time of drafting the Environmental Statement, a qualitative land contamination risk assessment will be completed.

9.4.8 It is proposed to undertake additional technical consultation with various statutory and non-statutory bodies and external sources to obtain the latest information on baseline conditions. However, the information held by these sources may in some cases be limited and may be delayed. Where there is a lack of third-party data, professional judgement will be used in interpreting available desk study information.

9.5 Study area

9.5.1 DMRB LA 109 *Geology and Soils* [1] does not set a defined study area but states that it should be 'identified on a project by project basis' taking account of the following:

- Construction footprint including compounds and temporary land take.
- Potential and actual land contamination inside and outside the construction footprint which could affect receptors.
- Location of off-site sensitive receptors (such as controlled waters, land users and neighbours) that can be affected by the project.

9.5.2 The study area for this PEI report has therefore taken into account the above, the physical conditions of the site and surrounding area. The following define the study area, with buffers measured from the centre line:

- The limits of the land to be used either temporarily or permanently for the construction and operation of the proposed scheme for soils and agricultural land and designated geological sites.
- 250m for potential land contamination sites and past pollution incidents.
- 500m for landfills/waste management sites (historical and current).

9.5.3 The extent of these zones has been developed using professional judgement on the basis that contamination migration beyond this distance is likely to be minimal or could be mitigated. As the design of the proposed scheme progresses additional areas may be incorporated into the assessment which will be reported in the Environmental Statement. The study area is shown on Figure 9.1 Study Area.

9.5.4 The following sections describe the baseline geology and soil conditions and identify receptors and potential impacts within the study area as defined above.

9.6 Baseline conditions

9.6.1 Baseline conditions are described in detail in the PSSRs previously prepared [37] [41] and the PRA [38], a summary of conditions is provided in the following sections.

Topography

9.6.2 The route joins the M5 at junction 25 where the motorway gyratory is above the main carriageway with a maximum elevation of approximately 20m above ordnance datum (AOD). The Broughton Brook watercourse is located beneath the existing slip road to the M5, which is at an elevation of approximately 10m AOD. Heading south-east towards the proposed Henlade Interchange, the topography passes through a valley and elevation remains relatively flat before gradually rising to a maximum of 16m AOD at the location of the proposed Henlade Interchange.

9.6.3 The alignment then descends into a wide valley containing Greenway bridge (approximately 21m AOD) before rising again to Mattock's Tree Hill at an existing height of approximately 60m AOD. There is then very little relief in terrain until Cad Road junction, ranging between 45-55m AOD as the route passes the hilltop village of Ashill. There is then a gentle decrease in existing ground levels until the alignment reaches the A303 at Southfields roundabout at an approximate

elevation of 35m AOD. The topography of the area is presented on Figure 9.2 Topography.

Geological setting

Artificial ground

9.6.4 Artificial ground is a term used by the British Geological Survey (BGS) for those areas where the ground surface has been significantly modified by human activity and includes areas of made ground, worked ground, landscaped and infilled ground. No areas of artificial ground are recorded on published sources beneath the route or within the proposed scheme boundary, however these are anticipated within the study area associated with historical land uses, such as; a dismantled railway which intersects the existing A358 and the proposed route at West Hatch Lane junction, and an inert landfill at Ashill junction adjacent to the existing A358.

Superficial deposits

9.6.5 The superficial geology where present beneath the route, comprises Quaternary age deposits of Head (gravel, sand and clay), Colluvium (Diamicton) and Valley Head or Alluvium (clay, silt and sand overlying gravel). An interdigitated succession of alluvium and colluvium is prevalent in the floodplain of the River Isle (at the eastern end of the proposed scheme). The location of superficial deposits is shown on Figure 9.3 Published Geology – Superficial Deposits.

Bedrock geology

9.6.6 A summary of the bedrock geology underlying the study area is described below and is shown on Figure 9.4 Published Geology - Bedrock:

- Mercia Mudstone, comprising Mudstone and Halite-stone at the M5 junction to Haydon.
- Branscombe Formation, consisting of reddish brown, weakly calcareous mudstones approximately 180m thick, of the Mercia Mudstone Group to south of Henlade.
- Blue Lias Formation underlies the route from just north of Griffin Lane to Folly Drove, comprising interbedded grey mudstones and limestones, with a thickness of 45m.
- From Folly Drove to Southfields the route is underlain by Charmouth Mudstone comprising dark grey laminated shales and dark, pale and bluish grey mudstone, approximately 95m thick, which dips to the south-east.
- At Ashill the Belemnite Marl Member is recorded either side of the current A358 beneath the proposed link roads, comprising dark grey interbedded calcareous mudstones with abundant belemnites, 25m thick and dipping to the south-east.

9.6.7 The route is crossed by two normal faults; north of Griffin Lane trending north-west to south-east and north of Horton Cross Farm, trending north east to south-west.

9.6.8 Further detail of the geology and existing borehole records can be found within the PSSRs. Additional SI will be completed to confirm the geochemical, geological and hydrogeological conditions within the study area not covered by previous investigations.

9.6.9 No landslips are recorded on the route, although two are recorded within 300m of it; Stoke Wood Landslip to the south and Island Copse landslip to the north. The potential for slope instability associated with Colluvium and Valley Head deposits and the underlying mudstone is noted, see the PSSR for further details.

Mining, quarrying and mineral resources

9.6.10 BGS Mineral Resource Information has been referenced in the options selection stage Scoping Report and EAR, no recorded mineral sites have been identified in close proximity to the route, although the Blue Lias Formation (limestone) is recorded as a resource which intersects the route.

9.6.11 Superficial deposits are not identified as a mineral resource in the BGS onshore mineral resources database, however, there is evidence for historical quarrying in the area, see following paragraphs. Further detail and assessment are presented in Chapter 10 Material assets and Waste.

Historical mineral extraction sites (potentially infilled)

9.6.12 Two areas of historical quarrying have been identified within the study area based on historical mapping:

- A quarry is indicated on-route near Home Farm.
- A gravel pit just north of the proposed Jordan's Bridleway.

9.6.13 The presence or composition of any backfilled material is unknown.

Geological designated sites

9.6.14 A local geological/geomorphological site (LGS) is recorded, south east of Hatch Beauchamp approximately 950m east of the route, identified as the Hatch Beauchamp Cutting designation noted as 'Exposure of Rhaetic clays and limestone in former railway cutting near Hatch Fault'. According to the options selection stage reports, no other designated geological sites of local, regional, national or international importance have been identified along the route or within the study area.

Soils and agricultural land

9.6.15 The quality of agricultural land in England and Wales is graded from 1 to 5 under the post-1988 ALC system, dependent on the extent to which physical or chemical characteristics of the soil impose long-term limitations on the agricultural use of the land. Grade 1 land is excellent quality agricultural land with either no or very minor limitations to its agricultural use. Grade 5 is very poor quality land, with severe limitations due to adverse soil, relief, climate or a combination of these factors. Grade 3 land is subdivided into Subgrade 3a (good quality land) and Subgrade 3b (moderate quality land).

9.6.16 Best Most Versatile (BMV) agricultural land is defined as Grades 1, 2 and Subgrade 3a of the ALC system. BMV land is the most flexible land in terms of the range of crops that can be grown, gives the highest yield, produces the most consistent yield, and requires fewer inputs.

Desk studies

9.6.17 As it has not been possible to carry out a detailed soil survey prior to the publication of this PEI Report, baseline soils and agricultural land conditions have

been determined using existing published information. Detailed surveys will be carried out in the summer of 2021 to inform the Environmental Statement.

9.6.18 The publicly available information considered includes Natural England's 1:250 000 scale *Regional ALC Map* [47], which is intended by Natural England for strategic use only and is not intended for use in assessment of individual sites. It should also be noted that the map shows the provisional Grades 1-5, but Grade 3 is not subdivided. Where detailed ALC mapping is available, the grade of agricultural land within the study area has been described.

9.6.19 Provisional ALC data for the study area show the area to be dominated by undifferentiated Grade 3 land. When soil and climate data is also taken into consideration, it is anticipated that this land would be a broadly even mix of BMV land in Subgrade 3a and lower quality land in Subgrade 3b. There are two small areas provisionally mapped as Grade 4 at the eastern portion of the A358 associated with alluvial soils adjacent to Venner's Water and a tributary leading to Cad Brook.

9.6.20 Available soil mapping shows the route to traverse nine soil associations which can be roughly grouped into four soil types:

- Imperfectly drained fine loamy or silty over clay, or clayey, of the Worcester, Whimple 3, Wickham 2 and Oxpasture associations.
- Poorly drained stoneless clay soils developed in river alluvium, of the Compton and Fladbury 1 associations.
- Imperfectly drained calcareous clays of the Evesham 1 and Evesham 3 associations.
- Well drained coarse loamy soils over gravel, of the Newnham association.

9.6.21 Climate, which can place a limitation on agricultural land quality, is warmest and driest in the north of the study area, becoming cooler and wetter in the south. The number of Field Capacity Days (FCD), when the soil moisture deficit is zero, is larger than is typical for lowland England which generally constrains agricultural cultivation and soil handling for relatively long periods over winter.

9.6.22 The first three grouped soil types identified in Paragraph 9.7.19 above are likely to be subject to similar wetness and workability limitations whilst the Newnham soils are more likely to be limited by droughtiness. It should be noted that the Newnham and Oxpasture associations are mapped to a very limited extent at the northern and southern edges of the study area respectively.

Published ALC data

9.6.23 Published detailed post-1988 ALC data is available at the northern end of the study area between the M5 Junction 25 and east of Henlade. The extent of the published data is shown on Figure 9.5 Published Detailed ALC Data.

9.6.24 The survey, carried out by ADAS in 1994, included 161 soil profiles of which 49 are within the study area. A majority of the surveyed land within the study area is classified as Subgrade 3b, with smaller areas of Grade 2 and Subgrade 3a.

9.6.25 The majority of the land classified by ADAS as Grade 2 is located on gently sloping land away from the watercourses and is mainly affected by a minor wetness and workability limitation (few profiles outside the study area are affected by droughtiness). Most of the profiles are described as having medium clay loam topsoils over heavy clay loam and clay subsoils. The profiles are slowly

permeable at depth and are assessed as Wetness Class (WC) II. Occasional profiles of WC I with heavy clay loam topsoil were identified and are also limited to Grade 2.

9.6.26 Land of Subgrade 3a quality has a moderate wetness limitation. The topsoil is medium clay loam or heavy clay loam and the subsoil is red clay. The profiles are gleyed below 40cm and slowly permeable at depth, assessed as WC II or III. To the south of Rose Farm is a minor soil variant in which the red clay subsoil is porous and the profile is WC I, however the topsoil is clay, resulting in a workability limitation to Subgrade 3a.

9.6.27 The most common soil type identified includes heavy clay loam or clay topsoil over red clay subsoil. All profiles are slowly permeable in the subsoil and are of WC II, III or IV depending upon the depth of the slowly permeable layer. With heavy topsoils, there is a wetness and workability limitation to Subgrade 3b.

Predicted ALC grades

9.6.28 Provisional ALC information, soil mapping, climate data and aerial photography have all been used to predict the likely agricultural land quality where detailed ALC survey information is unavailable. The various predicted ALC grades are shown on Figure 9.6 Probable Predominant Agricultural Land Quality.

9.6.29 Consideration of the mapped soil associations indicates that the areas of Grade 2 identified in the north and south of the study area are likely to be the most significant areas. Land south of Thornfalcon in the mapped Whimple 3 association may include land of Grade 2 quality, if found to be of WC II with medium loamy topsoil.

9.6.30 It is not considered likely that substantial areas of additional Grade 2 will be identified through detailed survey as most of the mapped soil associations are typically of WC III with clay loam topsoil. As seen in the detailed data available, where the topsoil is medium clay loam, or the profiles are slightly better draining, there is a wetness limitation to Subgrade 3a. Soils of the Worcester association, mapped broadly between Henlade and West Hatch, are likely to fall into this category and are predicted to be mainly of Subgrade 3a. A small additional area between Capland and Stewley is also predicted to be of Subgrade 3a, based on satellite images of the area.

9.6.31 The Wickham 2 association is generally of WC III or IV, resulting in a higher prevalence of Subgrade 3b south of Ashill.

9.6.32 The Evesham 1 and Evesham 2 associations mapped between West Hatch and Bickenhall Lane, and from north of Green Drove to north of Folly Drove, are also typically of WC III. With clay topsoils these profiles will all be limited to Subgrade 3b.

9.6.33 The alluvial soils mapped in the centre of the site, west of Hatch Green where two unnamed watercourses converge, and in the south of the study area along a tributary of Cad Brook, are clayey and affected by groundwater and/or flooding which ordinarily puts them in WC IV, resulting in a wetness limitation to Subgrade 3b. The areas of published and predicted ALC grades within the study area are shown in Table 9-5 below, with the distribution of these grades shown on Figures 9.5 Published Detailed ALC Data and 9.6 Probable Predominant Agricultural Land Quality.

Table 9-5 Baseline agricultural land within the study area

Agricultural land quality	Area (ha) (detailed survey)	Area (ha) (predicted)	Total area (ha)
Grade 1	0.0	0.0	0.0
Grade 2	6.5	14.7	21.2
Subgrade 3a	16.4	66.8	83.2
BMV subtotal	22.9	81.5	104.4
Subgrade 3b	41.8	205.0	246.8
Grade 4	0.0	0.0	0.0
Grade 5	0.0	0.0	0.0
Non-agricultural	19.2	89.9	109.1
Total agricultural land	64.7	286.5	351.2

Walkover surveys

9.6.34 A walkover survey of selected potential land contamination sites was completed on 22 June 2021 (Appendix 9.1 Site Walkover Notes).

Environmental setting

Site history

9.6.35 Historical Ordnance Survey (OS) maps dating from 1888 to current and Google Earth imagery have been reviewed to provide an understanding of the development history across the proposed scheme. This review has also assisted in identifying potentially contaminated sites within 250m of the proposed scheme, see Section 9.7.32.

9.6.36 The proposed scheme predominately passes through land which has a long history of agricultural usage, largely dairy farming with small settlements. The surrounding settlements of Henlade, West Hatch, Hatch Beauchamp, Hatch Green, Stewley, Ashill, and Cad Green have steadily developed to their current extents.

9.6.37 The proposed scheme to West Hatch comprised predominantly fields, crossed by several watercourses and numerous tracks, which have largely remained unchanged. The Great Western Railway (GWR) railway line was also present from earliest available maps from 1888 until noted as disused on the 1968 OS map. The line of the former GWR intersects the proposed scheme boundary at Thornfalcon and West Hatch, crossing the existing and proposed A358 alignment. The M5 was noted from OS map dated 1977 linking to the existing A358.

9.6.38 The route follows the line of the existing A358 at West Hatch to the A303 at Southfields roundabout. The original line of the A358 is shown on the maps from the 1880s. It diverted from the current alignment north of West Hatch, swinging to the east to Hatch Beauchamp, then passing south though Hatch Green to Capland and through Ashill before turning to the east to Rapps then heading south to Horton Cross. The current A358 was first indicated on OS plans dated 1989 and was generally developed along previously undeveloped farmland, following the original course of the road between Capland and Ashill.

9.6.39 Former and existing on-site and off-site land uses within 500m of the centre line include farmyards, filling stations, bulk fuel storage, a builders' yard, garden building factory, gravel pits, a sewage works and the former GWR railway line. Historical landfills have also been identified within 500m; these are further discussed in Section 9.7.32.

Unexploded ordnance

9.6.40 An unexploded ordnance (UXO) pre-desk study assessment completed in 2017 by Zetica identified the site to be at low UXO hazard level [37]. The options selection stage report [37] indicated that no further UXO investigation is required. A further UXO report produced by Fellows [49] was obtained for the section of route from the M5 junction to Henlade, which was not covered by the options selection stage PSSR due to modifications to the proposed route. This report concluded a low to medium risk for this section of the route. The medium risk is from 'fall to earth' anti-aircraft munitions due to the placement of British anti-air defensive munitions (a heavy anti-aircraft (HAA) battery approximately 360m south east and five light anti-aircraft (LAA) batteries) in the study area (5km from the route). The report includes mitigation recommendations.

Hydrogeology and hydrology

9.6.41 The hydrological and hydrogeological baseline conditions are described in full in Chapter 13 Road drainage and the water environment. A summary is provided in this chapter and in the PRA [38] and PSSRs [37], [41].

9.6.42 The area covered by the proposed route is underlain by formations of the Mercia Mudstone Group and Lias Group which are designated by the Environment Agency as Secondary B (Branscombe Mudstone), Secondary A (Blue Lias Formation) and Secondary undifferentiated (Charmouth Mudstone) aquifers.

9.6.43 In areas where superficial deposits are present the Colluvium and Head Deposits are classed as Secondary A aquifers, Alluvium is designated as a Secondary (undifferentiated) aquifer.

9.6.44 The proposed scheme boundary does not intersect any groundwater source protection zones (SPZ).

9.6.45 A groundwater abstraction has been identified within 250m of the proposed scheme, this is a private domestic water supply used for general farming and domestic purposes, located to Ashe Farm at Mattock's Tree Green. At this stage, it is not known if this water supply is officially designated as potable, or if it is used for drinking water supply. Additional data on this will be provided in the ES.

9.6.46 The groundwater vulnerability across the proposed alignment varies between high to medium indicating some to no protection to the underlying aquifers from pollution.

9.6.47 Five WFD water bodies fall within the study area and or cross the proposed scheme including; Broughton Brook, West Sedgemoor Main Drain, Fivehead River, River Ding and River Isle. The Proposed scheme is also crossed by numerous smaller watercourses and tributaries to these water bodies. All watercourses flow to the east/ northeast.

9.6.48 Construction works, if not carefully managed, may lead to downward migration or the creation of preferential overland or sub-surface pollution pathways for

contamination which could impact on groundwater and surface water. Information on surface water and groundwater receptors is covered in Chapter 13, road drainage and the water environment.

9.6.49 Surface water and groundwater will be monitored, as part of the proposed SI works, to enable assessment of the potential impact of the proposed scheme on groundwater and surface water.

9.6.50 Any potential effects from dewatering during construction works on paleoenvironmental and archaeological deposits are included in Chapter 6 Cultural Heritage.

Environmental designations

9.6.51 Most environmental designations are in excess of 1.5km from the proposed scheme. These include; Sites of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Special Protection Area (SPA) and Ramsar Site.

9.6.52 There are no geological features of scientific interest and importance (e.g. Geological Site of Special Scientific Interest (SSSI) or Local Geological/Geomorphological Sites (LGS)) within the study area.

9.6.53 The only environmental designations which fall within the study area are areas of ancient woodland:

- Henlade, approximately 435m south west (Stoke Wood)
- Mattock's Tree Hill, approximately 94m south west (Huish Coppice)
- West Hatch, approximately 475m east (Line Wood)
- Bickenhall Lane junction, adjacent to Red line 0m west (Bickenhall Wood)
- Ashill, adjacent to red line 0m east (Ashill Wood/Everyse Copse)

Regulatory data

9.6.54 Regulatory data pertaining to environmental permitting, abstraction and discharge consents, pollution incidents and waste management have been obtained for the study area [38]. The following records are of note:

- Three discharge consents to groundwater are recorded within the study area which relate to discharge of sewage effluent to a soakaway/infiltration system.
- Six discharge consents to surface water are noted, most relate to discharge of treated effluent (non-sewage works), however one is recorded to Ashill Sewage Treatment works for treated effluent to be discharged to Venner's Water and one formerly operated by Butler's Fuel for discharge of contaminated surface water.
- Two Part B environmental permits were identified, for unloading of petrol into storage tanks and are held by the Texaco and Horton Cross PFS, Texaco also hold a Part B permit for burning of waste oil.
- Four waste exemptions have been identified, two for use of waste in construction, one for burning waste in the open and one for storage of sludges.
- Eleven pollution incidents have been recorded between 2001 and 2004, all caused no impact or minor impact and involved pollutants such as oils and fuels, sewage materials, slurry and inert materials/commercial waste.
- No active landfill sites are recorded within the study area, however there are a number of historical landfills, further details of which are provided below.

9.6.55 The pollution incidents and discharge consents could have had a detrimental impact on soils and groundwater and surface water quality.

Landfills

9.6.56 Five records of historical landfills have been identified within the study area; Near Dairy House Farm Landfill, Thornfalcon refuse tip, Ashill Bypass Site A, Land East of Bow Bridge and Sawmills. Two are noted to intersect the proposed scheme. These are:

- Thornfalcon Refuse Tip at Mattock's Tree Green Junction off-slip embankment of the east bound carriageway. This site historically accepted commercial, industrial and biodegradable domestic waste, with last input in 1973, located in the former Great Western Rail (GWR) railway cutting.
- Ashill Bypass Site A Landfill at the crest of cutting, intersected by the proposed carriageway, Stewley link road and east-bound off-slip. The facility accepted inert waste and was operated under a waste management licence.

9.6.57 Further detail of these landfills and others within the study area are presented in PSSR [37].

9.6.58 Several of the landfill sites are former historical features including old gravel pits and railway cuttings, e.g. at West Hatch Lane, a quarry near Home Farm and a gravel pit just north of the proposed Jordan's Bridleway. Some former landfills are not in evidence on the historical Ordnance Survey (OS) maps reviewed. Further detail on these features is available in the PSSR [37].

Potential sources of contamination (based on historical and current land use)

9.6.59 The study area is located in a predominately rural setting however a number of potentially contaminative land uses have been identified including; historical landfills, an infilled railway cutting, a sewage works, commercial activities and fuel storage sites and there is evidence of made ground of unknown quality. The following potential land contamination sites have been identified:

On-site (direct interaction with proposed scheme alignment):

- Former Thornfalcon Refuse Tip/Thornfalcon Tip, the proposed slip embankment to Ashe Farm Road passes through the landfill and a proposed farm access track
- GWR infilled cutting at Home Farm and West Hatch intersected by both the existing and proposed scheme route
- Former inert Ashill Bypass Site A Landfill, located directly on the proposed scheme alignment and new link road

Off-site (within 250m of proposed scheme centreline)

- Near Dairy Farm landfill
- Texaco PFS and motorhome dealer at Mattock's Tree Hill
- Foresters Garden Buildings, north west of West Hatch Lane, manufacturers of timber products
- Hatch Green Garage and PFS at Hatch Green
- Former Ashill PFS (Stewley Cross)
- Former Butlers Fuel Depot, Kenny Lane, Ashill
- Ashill Sewage Treatment Works

- Land east of Bow Bridge and Sawmills
- Shell PFS, Horton Cross

9.6.60 Other areas of potential land contamination have also been identified, within the study area (*within 250m from centre of the proposed scheme*):

- Depot at Greenway Lane
- Farmyards (potential contamination sources include fuel tanks and slurry pits)
- Builders' yard at Hatch Beauchamp
- Former Horlick's site former dairy and cattle breeding centre
- Presence of made ground associated with existing road construction and the immediate environment of the route corridor, infilled disused quarries and former gravel pits

9.6.61 Priority sites of potential land contamination are shown on Figure 9.7 Potential Land Contamination Sites, these have been subject to a Tier 1 preliminary (qualitative) risk assessment (PRA) and are to be further investigated as part of the proposed SI for the proposed scheme.

Conceptual site model (CSM)

9.6.62 Conceptual site models (CSMs) have been produced for each of the potential contaminated land sites as these are most likely to interact with the proposed scheme and/or associated construction works. The potential sources of contamination, pathways and receptors are described in detail in Appendix F of the PRA [38], each potential contaminant linkage (PCL) identified has been assigned a level of risk. The CSMs from the PRA have been summarised and are presented in Appendix 9.2. The PCLs with a moderate or high risk assigned to them have been taken forward for the environmental assessment of potential significant effects and are addressed in Section 9.10.

Site investigation

9.6.63 A programme of intrusive investigation is to be undertaken across the current proposed scheme to provide information on the ground conditions and to inform the design. The PRA [38] identified priority sites which are included in the scope for the geo-environmental element of the investigation. The scope includes requirements for soil and groundwater sampling and a period of environmental monitoring to further investigate the priority sites and also provide scheme wide baseline monitoring data. These will be used in the next stages of assessment for geology and soils, refer to Appendix 9.3 for further detail on the methodology. Proposed exploratory hole locations are indicated on Figure 9.8 Proposed Ground Investigation – Indicative Location Plan.

Future baseline - 2028

<u>Geology</u>

9.6.64 No significant changes are anticipated.

<u>Soils and agricultural land</u>

9.6.65 The current soil baseline conditions for soils and agricultural land are expected to remain unchanged for the foreseeable future. However, in the longer term it is expected that climate change will affect the quality of the land within the study

area, although potential effects on the ALC will be complex and will vary between soil types. Therefore, the current conditions are considered to provide the most reasonable basis for assessment.

Contamination

9.6.66 Any future land use changes, for example a new bulk fuel storage premises (petrol station) developed in the study area, would potentially impact baseline soil conditions, groundwater and surface water quality in the area. Existing ground conditions would generally improve (particularly groundwater and surface water quality) in areas where existing / historical land contamination sources identified along the route are remediated for example, the former Ashill PFS at Stewley Cross .

9.6.67 It should be noted that a new business park, “Nexus 25” is currently being developed at the M5 junction 25 which could introduce new potential sources of contamination. The Nexus site will be considered during the ES.

9.6.68 The owners of the former Butler’s fuel depot, at Ashill, have applied for permission to redevelop the land for a residential use which would potentially require remediation of soil and /or groundwater contamination and also introduce new sensitive receptors. The application has been granted permission in principle.

9.6.69 An application to redevelop the former post office adjacent the former Ashill petrol fuel station for 10 residential units, is currently under consideration, this would also introduce new sensitive receptors and potentially require remediation of soil/groundwater contamination.

9.6.70 The former Ashill PFS itself is currently being developed for residential land use, outline planning permission 13/00101/OUT includes conditions pursuant to potential contamination, (numbers 14 to 17). Information on the SSDC planning portal indicates that the site has been subject to a Desk Study and SI with planned remediation works to remove the underground fuel tanks and provide a verification report. The planning conditions pursuant to desk study, SI and remediation have been discharged with an outstanding condition awaiting confirmation of validation works to verify that the site has been remediated to current standards.

9.6.71 Planning for a mixed use residential and commercial development at B3168 Station Road Ilminster south of the Southfields roundabout, on the former Horlicks factory is underway and these developments, if planning is granted, could introduce new sensitive receptors and potential sources of contamination dependent on the activities located on the commercial development. The works should also address potential contamination linkages related to the historical use of the site.

9.6.72 Additional residential developments within the study area which will introduce new highly sensitive human receptors include:

- proposed development of 25 dwellings, Windmill Hill Lane, Ashill
- minor development of two dwellings south of Stewley Cross, at Wood Road, Ashill

9.7 Potential Impacts

9.7.1 Mitigation measures incorporated in the design and construction of the proposed scheme are reported as embedded mitigation in Chapter 2.

Construction

Soils and agricultural land

9.7.2 Soils and agricultural land would potentially be affected during construction by way of:

- Damage to soils during stripping, handling and storage, through mechanisms such as compaction and smearing, and the temporary loss of agricultural land.
- Permanent removal of soils or permanent sealing of agricultural land.

Contamination

Human health

9.7.3 Made ground, infill materials, and natural soils underlying the proposed scheme may have been contaminated by historical and current land use activities including historical landfill sites, infilled mineral extraction pits, fuel storage, PFS, industrial areas and farmyards. Disturbance of potentially contaminated soils may cause an increase in leaching and mobilising of contaminants, along new or existing surface or sub-surface pollution pathways. These could create new pathways to receptors.

9.7.4 Ground gases/vapours may be associated with the existing historical landfills at Thornfalcon refuse tip and Ashill Bypass Site A, which could migrate to a small number of commercial/residential properties in close proximity to the proposed scheme. In the current scheme design there would be limited interaction with the landfills, however this may have to be reassessed once project control framework (PCF) stage 3 is adopted. Vapours could also be associated with former fuel sites where there is residual contamination which could also migrate to adjacent properties.

9.7.5 SI soil chemical data was not available at the time of writing, therefore, screening of the soil chemical analysis data against soil guideline values for human health risk assessment has not been undertaken. However, the impact on human health from exposure to contaminants exposed during the construction phase is considered likely to be minor based on information available from the PSSR. There is a short-term human health risk of exposure to potentially harmful contaminants at the landfill sites, infilled railway cutting, and other commercial sites such as bulk fuel storage sites, PFS and timber product site.

Groundwater and surface water

9.7.6 Several potentially contaminated land sites have been identified along the proposed scheme:

- Historical landfills
- Former or existing fuel sites
- Timber products manufactory
- Diffuse pollutants from agricultural land

9.7.7 Disturbance of potentially contaminated soils from these sites could be caused due to earthworks and/ or use of piled foundations for structures. This may cause an increase in leaching of contaminants in soils and mobilising of contaminants along new or existing surface or sub-surface pollution pathways. This in turn may lead to the quality of surface waters and groundwater aquifers being impacted through runoff, infiltration and vertical and horizontal movement of contaminated groundwater and leachate. In the absence of site-specific SI data and baseline groundwater monitoring data, the predicted significance of effects on Controlled Waters is likely to be moderate, prior to mitigation.

Operation

Soils and agricultural land

9.7.8 No additional impacts are predicted on soils or agricultural land during the operational phase. The permanent loss of agricultural land occurring during construction would continue into operation but is not considered as an additional effect. Temporary effects arising during construction on soil quality in relation to degradation during handling may extend into operation but should not be persistent assuming that the best practice mitigation measures are applied and a soil restoration plan is followed. Operational effects on soils and agricultural land are therefore scoped out of further assessment.

Contamination

Human health

9.7.9 The proposed scheme will predominately comprise hardstanding which will remove potential contaminant linkages to human health receptors. Contamination identified as having the potential to cause significant effect to human health would likely be removed or treated, during construction. This would reduce the potential for contact with contaminated soil/waste/leachate during the operational phase. The impact to future site users would be reduced to negligible for human health.

9.7.10 Appropriate site-specific risk assessments and method statements would be produced to control any likely future exposure to maintenance workers. However, human health for maintenance workers and occupants of residential properties are assessed where the alignment interacts with, or properties are near, landfill sites or fuel storage sites due to the possibility of them being affected by ground gas/vapours during the operational phase.

Groundwater and surface water

9.7.11 Potential land contamination linkages will be addressed during construction, i.e. contamination source removal or treatment, or breaking of potential contaminant linkages. If required, monitoring of groundwater, leachate and surface water will continue from the construction phase into the operational phase to confirm there are no additional impacts predicted, in relation to water receptors. Operational impacts on surface water and groundwater from land contamination are therefore scoped out of the operational assessment.

9.7.12 During operation there is the potential for leakage of various chemicals and fuels from vehicle using the road which could impact controlled waters due to surface run-off from the road. The potential impacts on water receptors are addressed in Chapter 13.

9.8 Design, mitigation and enhancement measures

9.8.1 The proposed scheme has been designed, to avoid and prevent adverse environmental effects on Geology and soils, through the process of design development and consideration of good design principles.

Construction

9.8.2 The following mitigation measures would be put in place for the receptors that have been identified as being potentially impacted by the proposed scheme or sites which would potentially impact the proposed scheme. Mitigation measures would include both embedded mitigation and additional mitigation measures.

Soils and agricultural land

9.8.3 Impacts on agricultural land would be reduced by minimising the use of agricultural land required permanently by the proposed scheme. In addition, agricultural land used temporarily would be restored to a condition suitable for a return to its existing land use.

9.8.4 The primary measures to mitigate the effects on soil resources would be set out in a Soil Resource and Management Plan (SRMP) which will identify the existing soil resources that will be affected by the proposed scheme, based on detailed soil surveys information.

9.8.5 The SRMP, which would be developed during the pre-construction phase and implemented by the Principal Contractor, would be prepared to reflect the intention of the proposed scheme to appropriately re-use soils within its design. Furthermore, it would confirm the different soil types and the proposed methods for handling, storing and replacing soils on-site.

9.8.6 The quality of soils retained on-site and exported off-site (if required) would be maintained by following good practice guidance on soil handling and storage, in accordance with Defra's Code of Construction Practice for the Sustainable Use of Soils on Construction *Sites (2009)* [36]. In particular, it would be necessary to avoid compaction and biodegradation of soils that are to be retained on-site in storage. In this respect, topsoil must be stockpiled separately to subsoil.

9.8.7 With the adoption of appropriate mitigation for soil handling and restoration, soils that are re-used on or off-site would be able to continue their various ecosystem functions, principally as a medium for producing food and biomass; for storing and cycling water and carbon; and for supporting habitats; biodiversity and landscape planting.

Contamination

9.8.8 Risks during construction would typically be mitigated by applying best practice, to be set out in an Environmental Management Plan (EMP) or Health and Safety Plan.

9.8.9 Embedded mitigation would include design measures which may include the use of:

- Promotion of sustainable reuse of excavated made ground and natural soils either within the proposed scheme or at a receiver or hub site; a Materials Management Plan (MMP) will be prepared by the Contractor in advance of

construction works in accordance with *CL:AIRE Definition of Waste Code of Practice (2011) (v.2)* [50], see Chapter 10 Material assets and waste.
- Adoption of waste hierarchy principles to be used at every stage of the project, as appropriate, to identify opportunities for reuse of soils within the proposed scheme.
- Completion of SI - to better define contaminated land and groundwater).
- Provision of risk assessments and method statements to be completed as part of the construction process and for future maintenance activities.
- Production of a draft EMP to be prepared prior to construction commencing
- The EMP to be further developed by the appointed contractor prior to the start of construction works.

9.8.10 Additional mitigation measures may also be developed to address specific identified impacts. At this stage, the requirement for specific mitigation measures in respect of soils and geology could include, for example:

- Remedial works where risk from land contamination to human health or controlled waters is assessed as high or moderate e.g.: associated with landfill sites (such as mobilisation of contamination to groundwater due to creation of new pathways and /or off-site migration of landfill gas) or sites identified following the SI which may identify areas of existing contamination.
- Control measures to mitigate potential impacts from gas migration, dust and vapour generation.

9.8.11 The requirement for remedial works is usually informed by SIs and detailed risk assessment. Remedial options and associated costs would be likely to be more complex and costly if the route is aligned through the existing landfill boundaries. The design should avoid these areas if possible, to reduce costs/impacts to construction programme.

Enhancement

9.8.12 Remediation of the legacy land contamination sites would be of environmental benefit.

Operation

9.8.13 No operational effects are identified.

9.9 Assessment of likely significant effects

9.9.1 This section presents the preliminary assessment of likely significant effects on geology, soils and land contamination resulting from the construction and operation of the proposed scheme.

9.9.2 The potential effects (set out in Section 9.8) that are considered to be non-significant have been reported in Appendix 9.4. Non-significant effects would be addressed by appropriate environmental management measures to be recorded and implemented within the draft EMP for submission.

Soils and agricultural land

9.9.3 During the construction phase, the areas of agricultural land within the study area which would be temporarily and permanently required is shown in Table 9-6 below.

Table 9-6 Agricultural land required temporarily and permanently

Agricultural land quality	Area required temporarily (ha)	Area to be restored (ha)	Area required permanently (ha)
Grade 1	0.0	0.0	0.0
Grade 2	21.2	8.6	12.6
Subgrade 3a	83.2	30.4	52.8
BMV subtotal	104.4	39.0	65.4
Subgrade 3b	246.8	77.6	169.2
Grade 4	0.0	0.0	0.0
Grade 5	0.0	0.0	0.0
Total agricultural land	351.2	116.6	234.6

9.9.4 The proposed scheme would result in the temporary loss of approximately 351ha agricultural land, of which approximately 104ha are classified as BMV land in Grade 2 and Subgrade 3a. According to Table 9-2, agricultural land in Grade 2 is a resource of *very high sensitivity*, with land in Subgrade 3a being a resource of *high sensitivity*.

9.9.5 Using the criteria in Table 9-3, the construction of the proposed scheme would require the physical removal of more than 20ha of agricultural land and would therefore be an impact of major magnitude. Therefore, the proposed scheme would result in a direct, temporary *very large adverse* effect on BMV agricultural land. This is considered a significant effect.

9.9.6 Within the land required temporarily for construction, approximately 116ha of agricultural land including 39ha of BMV land would be reinstated to agricultural use. This would leave a permanent loss of approximately 235ha of agricultural land, including 65ha of BMV land.

9.9.7 As the area of agricultural land which will be sealed or otherwise permanently required will be greater than 20ha (*major magnitude*), the proposed scheme would result in a direct, permanent *very large adverse* effect on BMV agricultural land, which is significant.

9.9.8 Furthermore, the temporary and permanent loss of more than 20ha of land in Subgrade 3b (*medium sensitivity* receptor) would result in a *large adverse* effect, which is significant.

9.9.9 The sensitivity of soils, other than as reflected in their ALC grade, is also determined by their support for habitats and biodiversity. As the majority of soils within the study area are used for agricultural production, they are considered *low sensitivity* in these terms.

9.9.10 The construction of the proposed scheme would result in the temporary loss of soil functions including food production and flood alleviation on land within the study area, such that the magnitude of change on the soil resource will be *moderate adverse*. This would give rise to a direct, temporary *slight adverse effect* on agricultural soils, which would not be significant.

9.9.11 Assuming mitigation measures outlined above in Section 9.8 are fully implemented, the majority of the soils would be restored or appropriately re-used off-site continuing to fulfil their various ecosystem functions. As such the

proposed scheme would have a permanent *neutral effect* on agricultural soils, which would not be significant.

Contamination

9.9.12 The potential for impacts from contamination on human health, surface water and groundwater are reported in the PRA [38] and summarised in Appendix 9.2 Contamination Preliminary Risk Assessment for Priority Sites of this PEI Report.

9.9.13 Potential contaminant linkages (PCLs) deemed to pose a 'moderate' risk or greater, in accordance with best practice guidelines in CIRIA C552, have been identified for further investigation and included in the scope of the proposed SI. Once the soil and groundwater data are available, further risk assessment in the form of a Tier 2 Generic Quantitative Risk Assessment (GQRA) will be completed. In this assessment, soil and groundwater contamination data will be screened against published guideline values based on the relevant receptors considered in the CSMs. Detail of the assessment methodology for all stages is present in Appendix 9.3 Detailed Assessment Methodology for Priority Sites.

9.9.14 The following PCLs were considered:

- Construction workers encountering potentially contaminated soils/materials/groundwater, primarily through the inhalation of soil dusts and direct dermal contact.
- Proposed scheme neighbours (e.g. residents, adjacent site workers, members of the public) being exposed to potentially contaminated materials via inhalation and dermal contact with soils or dust during construction works.
- Leaching of contaminants into the groundwater during the construction phases through rainwater infiltration.
- Runoff of contaminants to surface water receptors, during the construction phase.
- Driving of contaminated soils/groundwater/leachate downward during construction e.g. during piling works.
- Future maintenance workers coming to contact with potentially contaminated soils/materials/groundwater.

9.9.15 A current lack of site-specific SI and ground gas/ groundwater monitoring means that it is not feasible to identify likely significant or residual effects with respect to contamination, at this stage. However, the incorporation of the mitigation measures outlined in Section 9.9 has been considered, allowing a preliminary assessment to be made, as described in the following paragraphs.

9.9.16 During the construction phase, disturbance of landfills may create ground gas and vapour pathways, which could affect nearby residential and commercial properties. The magnitude of impact has been assessed as minor and therefore this has been assessed as a moderate adverse temporary effect, which could continue post construction, see Table 9-7. SI and risk assessment will identify the requirement for remedial/mitigation measures, which will be applied where the risk is significant.

Table 9-7 Summary of significant effects

Potential impact	Receptor	Receptor sensitivity	Magnitude of impact	Significance of effect
Exposure to contaminated soil / groundwater / leachate / ground gas/ vapours	Off-site users - residential	Very high	Minor	Moderate

9.9.17 If required, the design of the proposed scheme would include measures to protect off site residential receptors by mitigating against the ingress and accumulation of ground gas and vapours into confined spaces/service ducts/drains which may act as a secondary pathway to off-site receptors. This could include remediation activities at the landfills such as, placement of an engineered cover system within which service ducts/drains are placed, and /or installation of a gas pathway/venting layer across the top of the landfill waste, linked to vent trenches to passively vent gases/vapours to the atmosphere. Any old services / utilities identified should be identified and treated to prevent preferential pathways being created.

9.9.18 All construction activities would be undertaken in line with current best practice and guidance and to be detailed in the EMP which would also mitigate contamination risks with respect to controlled waters during construction (i.e. management of construction related waters and environmental monitoring). This also includes consideration of appropriate dust suppression measures which would reduce the impacts to construction workers and adjacent scheme neighbours.

9.9.19 The adoption of mitigation measures such as health and safety training and the provision and use of appropriate personal protective equipment (PPE) is considered to be sufficient in mitigating the identified risks posed to construction personnel. The health and safety management systems would incorporate appropriate mitigation measures and therefore the works would have a minor adverse impact, with a temporary slight adverse effect, which is not significant.

9.9.20 Assuming appropriate good working practices are undertaken during construction and monitoring of groundwater/surface water is continued post construction (if required), the predicted significance of effects is generally likely to be low.

9.9.21 Based on the desk study review and PRA, including information on the historical and current land uses, some remedial works may be required and some localised areas of unexpected contamination may be present within the proposed scheme area. These may pose a risk to construction workers (low sensitivity of receptor) and controlled waters (low to high sensitivity of receptors). This would be mitigated by the EMP and an action plan and procedures on how to manage and assess unexpected contamination that will be presented in the Environmental Statement. On account of these mitigation measures the potential impact would be negligible resulting in a temporary slight adverse and therefore not significant effect.

9.9.22 To promote sustainable reuse of excavated made ground and natural soils either within the proposed scheme or at a receiver or hub site, an assessment of the suitability for reuse of these materials would be required to confirm no significant risk to human health or controlled waters.

9.9.23 A Materials Management Plan (MMP) will be prepared in advance of construction works in accordance with *CL:AIRE Definition of Waste Code of Practice (2011) (v.2)* [50], see Chapter 10 Material assets and waste for further details. This will

include measures to establish acceptable reuse criteria (both chemical and geotechnical) and procedures, to ensure the suitability of material for reuse, can be demonstrated and verified.

9.9.24 A Site Waste Management Plan (SWMP) should also be prepared in advance of construction for the removal, transportation and disposal of all waste materials resulting from excavations. Recycling potential of materials arising from construction of the proposed scheme should be maximised.

9.9.25 The reuse of made ground, site won materials and material imported from off-site sources would also meet guidance in the Specification for Highway Works, Series 600 Earthworks and as a result, only material that is demonstrated to be suitable for reuse would be used along the proposed scheme.

9.9.26 Adherence to guidance described above would ensure that post completion of the works, there is unlikely to be a negligible impact above the current baseline scenario with respect to contamination with a *permanent slight adverse and not significant effect*.

9.10 Monitoring

9.10.1 A significant effect has been identified associated with land contamination. Further SIs and specific risk assessments would be required to confirm the risks and inform the design of appropriate remediation measures and monitoring required.

9.10.2 Restored soils would require monitoring for a period of five years following their reinstatement to confirm they are suitable for their intended use and function, as restored agricultural land or a basis for habitat creation or landscape planting.

9.11 Summary

Preliminary construction assessment

Soils and agricultural land

9.11.1 The construction of the proposed scheme would result in a direct, temporary and permanent, very large adverse effect on BMV agricultural land, and a large adverse effect of Subgrade 3b agricultural land, both of which are significant. All agricultural land temporarily required would be restored to ensure it could continue to fulfil its primary agricultural use.

9.11.2 The proposed scheme would result in a direct temporary slight adverse effect on agricultural soils, which is not considered to be significant. Appropriate mitigation would ensure that the permanent effect on agricultural soils would be *neutral*.

Contamination

9.11.3 With appropriate mitigation measures in place, a potential significant effect related to contamination from historical landfills and off-site residential site users has been identified which is considered likely during the construction of the proposed scheme and would produce a moderate adverse temporary effect. SI and risk assessment would identify the requirement for remedial / mitigation measures, further assessment to be undertaken on completion of the planned SI.

9.11.4 For all other PCLs no significant effects have been identified, once mitigation measures are in place.

Preliminary operational assessment

9.11.5 No operational effects are identified as mitigation measures in the construction phase, as previously described, would ensure that contamination is minimised during the operational phase. Where historical landfills are remediated, there may be a requirement for longer term gas, ground and surface water monitoring to continue, into the operational phase.

Further work

9.11.6 Information gained from the planned intrusive SI and period of environmental monitoring would be used in the assessment for geology and soils and reported on in the Environmental Statement. Data will be gathered on the chemical quality of soil and groundwater which will be used to inform further stages of assessment.

9.11.7 A land contamination risk assessment will be undertaken in accordance with the online guidance Land Contamination Risk Management (LC:RM) [2]. A Tier 1 risk assessment has been completed and CSMs have been developed as part of the initial desk-based assessment of the proposed scheme. The model will be refined or revised as more information becomes available (for example SI data).

9.11.8 Data gathered from the proposed SI and environmental monitoring will be assessed and the CSM and preliminary risk assessment will be updated on completion of the Tier 2 GQRA. Potential risks to human health will be assessed by screening soil contaminant concentrations against relevant soil screening criteria (e.g. category 4 screening levels) recommended in DMRB LA 109 *Geology and soils* [1] for assessment of risk to human health from land contamination. Similarly, potential risks to controlled waters will be assessed by screening monitoring data against relevant guideline screening values. Where exceedances of screening levels are established, further risk assessment and/or additional mitigation works will be recommended and incorporated into the design.

9.11.9 Additional technical consultation with various statutory and non-statutory bodies and external sources will be undertaken to obtain the latest information on baseline conditions, particularly landfills and the petrol filling sites.

9.11.10 Monitoring of watercourses likely to be impacted by the proposed scheme (see Chapter 13 for details of watercourses) is being undertaken prior to the start of construction works. This will be detailed in the Environmental Statement (ES) and EMP. The purpose of the monitoring would be to provide data under differing flow conditions which would be used to assess the impact, if any, of the proposed scheme development on surface water quality during and post construction works.

Abbreviations List

Please refer to PEI Report Chapter 17 Abbreviations.

Glossary

Please refer to PEI Report Chapter 18 Glossary.

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