

Chapter 12

Ground Conditions

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12. Ground Conditions

12.1 Introduction

- 12.1.1 The Draft ES has been produced to fulfil the Applicant's consultation duties and enable consultees to develop an informed view of the likely significant effects of the Project.
- 12.1.2 This chapter presents the assessment of the likely significant effects of the Project with respect to ground conditions, including land quality and potential impacts on human health and controlled waters, based on the information obtained to date. Following consultation, the assessment will be updated for the Final ES that will accompany the DCO application for the Project.
- 12.1.3 This chapter should be read in conjunction with the Project description provided in **Chapter 2: The Project** and with respect to relevant parts of the following chapters:
- **Chapter 7: Water Environment;** and
 - **Chapter 16: Major Accidents and Disasters.**
- 12.1.4 This chapter describes:
- The legislation, policy and technical guidance that has informed the assessment (**Section 12.2**);
 - Consultation and engagement that has been undertaken and how comments from consultees relating to ground conditions have been addressed (**Section 12.3**);
 - The methods used for baseline data gathering (**Section 12.4**);
 - Overall baseline, including existing and future baseline (**Section 12.5**);
 - Embedded environmental measures relevant to ground conditions (**Section 12.6**);
 - The scope of the assessment for ground conditions (**Section 12.7**);
 - The methodology applied for the assessment (**Section 12.8**);
 - The assessment of ground conditions effects (**Section 12.9**);
 - The assessment of cumulative (inter-project) effects (**Section 12.10**); and
 - A consideration of potential -combination Climate Change Impacts (ICCI) (**Section 12.11**); and
 - A summary of the significance conclusions (**Section 12.12**).
- 12.1.5 This chapter is supported by the following appendices:
- **Appendix 12A: Preliminary Risk Assessment (PRA).**
 - **Appendix 12B: Ground Investigation Factual Report.**

- **Appendix 12C: Draft Halite Risk Assessment.**
- **Appendix 12D: Geohazards Desk Study.**

Project overview

- 12.1.6 The Project includes the construction, operation and eventual decommissioning of approximately 100km of new pipeline to distribute hydrogen to industry in the North West. A number of Hydrogen Above Ground Installations (HAGIs), including Block Valve Installations (BVIs) are required to control the flow and pressure of hydrogen at key points along the proposed pipeline.
- 12.1.7 The Project connects the Hydrogen Production Plant (HPP) at the Stanlow site, as the source of hydrogen, for onward distribution to the network. The pipeline transports hydrogen to the Central Hub at the centre of the network, which then serves as the connection and onward distribution point to the North, East and South corridors, which would extend to St. Helens, Partington and Northwich respectively. Branching off from each main corridor would be pipeline spurs connecting hydrogen customers to the main pipeline. Infrastructure has also been included which supports the potential blending of hydrogen with methane in the existing gas network. The Project would also link to underground hydrogen storage facilities in Cheshire used to balance supply and demand through the network.
- 12.1.8 The presently anticipated maximum extent of land in which the Project may take place, which is assessed in this Draft ES, is defined by the 'Draft Order Limits', land within which is hereafter referred to as 'land within the Draft Order Limits'.
- 12.1.9 A proportionate degree of flexibility has been incorporated into the Project design so that unforeseen issues that may be encountered following consent can be sufficiently mitigated. For example, previously unidentified poor ground conditions may require a pipeline section to be re-routed slightly for geotechnical reasons. Therefore, to allow for this, new infrastructure would be constructed within specified Limits of Deviation (LoD) which identify a maximum distance or measurement of variation within which the works must be constructed; further detail is provided on LoD in **Chapter 2: The Project**.

Limitations and assumptions

- 12.1.10 To ensure transparency within the Environmental Impact Assessment (EIA) process, the following limitations have been identified:
- The work undertaken to provide the basis of this assessment comprised a study of the available documented information from a variety of sources and discussions with the relevant Local Planning Authorities (LPA) and the Environment Agency.
 - Any risks identified within this chapter are perceived risks based on the information reviewed. Actual risks can only be assessed following further surveys and intrusive investigations.
 - Although the work of third parties have been used to inform this chapter, WSP UK Ltd cannot warrant the work of third parties.

12.2 Relevant Legislation, Planning Policy and Technical Guidance

12.2.1 This section identifies the legislation, planning policy and technical guidance that has informed the assessment of effects with respect to ground conditions. Further information on policies relevant to the Project is provided in **Chapter 4: Legislation and policy overview**.

Legislation

12.2.2 A summary of the relevant legislation is given in **Table 12.1**.

Table 12.1 Legislation relevant to the ground conditions assessment

Legislation	Legislative context
The Environmental Protection Act 1990¹	Part 2 of the Environmental Protection Act 1990 makes provision for the improved control of pollution arising from certain industrial and other processes. Part 2A of this Act provides the regulatory basis for the identification, designation, and remediation of contaminated land.
Town and Country Planning Act 1990	The Town and Country Planning Act 1990 obliges LPAs to deal with contaminated land and gives powers to ensure that land that is contaminated is cleaned up so that it is suitable for its proposed use.
Water Resources Act 1991² as amended by the Water Act 2003³	The Water Resources Act 1991 states that it is an offence to cause or knowingly permit polluting, noxious, poisonous or any solid waste matter to enter controlled waters. The Water Resources Act 1991 was revised by the Water Act 2003, which provides the definition of and regulatory controls for the protection of water resources, including the quality standards expected for controlled waters.
European Union Groundwater Directive (2006/118/EC) 2006⁴	The aim of the European Union Groundwater Directive 2006 is to protect groundwater against pollution caused by dangerous substances. This Directive continues to have

¹ UK Government (1990). Environmental Protection Act 1990, (online). Available at: <https://www.legislation.gov.uk/ukpga/1990/43/contents> (Accessed July 2024).

² UK Government (1991). Water Resources Act 1991, (online). Available at: <https://www.legislation.gov.uk/ukpga/1991/57/contents> (Accessed July 2024).

³ UK Government (2003). Water Act 2003, (online). Available at: <https://www.legislation.gov.uk/ukpga/2003/37/contents> (Accessed July 2024).

⁴ UK Government (2006). Groundwater Directive 2006, (online) Available at: <https://www.legislation.gov.uk/eudr/2006/118> (Accessed July 2024).

Legislation	Legislative context
	effect in England following the end of the Brexit transition period.
Environmental Damage (Prevention and Remediation) (England) Regulations 2015⁵	The Environmental Damage Regulations 2015 implement the European Union (EU) directive on environmental liability setting out the principles for prevention and remedy of environmental damage.
Health and Safety at Work etc. Act 1974⁶	The Health and Safety at Work etc. Act and regulations made under this Act place responsibilities upon employers to carry out a risk assessment for every work activity and to document it. Besides carrying out a risk assessment, employers also need to: make arrangements for implementing the health and safety measures identified as necessary by the risk assessment; appoint competent people to help them implement the arrangements; set up emergency procedures; provide clear information and training to employees; and work together with other employers sharing the same workplace.
The Construction (Design and Management) Regulations 2015⁷	The Construction (Design and Management) Regulations 2015 (CDM) place specific duties on clients, designers, and contractors, so that health and safety is considered throughout the life of a construction project from its inception to its subsequent final demolition and removal. These regulations include the requirement to appoint a Principal Designer and Principal Contractor to co-ordinate health and safety aspects during construction. Under the CDM regulations, designers must avoid foreseeable risks so far as reasonably practicable by eliminating hazards from the construction, cleaning, maintenance, and proposed use and demolition of a structure; reducing risks from any remaining hazard; and giving collective safety measures priority over individual measures.

⁵ UK Government (2015). Environmental Damage (Prevention and Remediation) (England) Regulations 2015, (online). Available at <https://www.legislation.gov.uk/ukxi/2015/810/contents> (Accessed July 2024).

⁶ UK Government (1990). Health and Safety at Work etc. Act 1974 (online), Available at <https://www.legislation.gov.uk/ukpga/1974/37/contents> (Accessed July 2024)

⁷ UK Government (2015). The Construction (Design and Management) Regulations 2015, (online), Available at <https://www.legislation.gov.uk/ukxi/2015/51/contents/made> (Accessed July 2024)

Legislation	Legislative context
Cheshire Brine Pumping (Compensation for Subsidence) Act 1952	The Cheshire Brine Act 1952 sets up a single Compensation District and Compensation Board covering all areas of Cheshire where brine subsidence is considered a possibility. Areas potentially at risk from brine subsidence have been identified by the Board where the Local Planning Authority must consult with the Board regarding the erection of buildings in these areas.

Planning policy

- 12.2.3 The primary national planning policy documents relevant to the consideration of the Project are the Overarching National Policy Statement for Energy (EN-1) and the National Policy Statement for Natural Gas Supply Infrastructure and Gas and Oil pipelines (EN-4).
- 12.2.4 Other national and local policies may also provide additional guidance on this environmental topic and could be considered material to the consideration of this Project. Policy potentially relevant to the Project and to this environmental topic is summarised within **Table 12.2**.

Table 12.2 Planning policy relevant to the ground conditions assessment

Policy	Policy context
National planning policy	
Overarching National Policy Statement (NPS) for Energy EN-1 2024⁸	This Overarching National Policy Statement for Energy (EN-1) is part of a suite of NPS designated by the Secretary of State of DESNZ in January 2024. Paragraph 4.3.2 states that <i>“The Regulations specifically refer to effects on population, human health, biodiversity, land, soil, water, air, climate, the landscape, material assets and cultural heritage, and the interaction between them”</i>. Paragraph 5.11.3 states that <i>“Although the re-use of previously developed land for new development can make a major contribution to sustainable development by reducing the amount of countryside and undeveloped greenfield land</i>

⁸ Department of Energy Security and Net Zero. (2024). ‘Overarching National Policy Statement for Energy (EN-1)’. Available at: <https://www.gov.uk/government/collections/national-policy-statements-for-energy-infrastructure> (Accessed July 2024).

Policy**Policy context**

that needs to be used, it may not be possible for many forms of energy infrastructure”.

Paragraph 5.11.4 states that *“Development of land will affect soil resources, including physical loss of and damage to soil resources, through land contamination and structural damage. Indirect impacts may also arise from changes in the local water regime, organic matter content, soil biodiversity and soil process”.*

Paragraph 5.11.5 states that *“Where pre-existing land contamination is being considered within a development, the objective is to ensure that the site is suitable for its intended use. Risks would require consideration in accordance with the contaminated land statutory guidance as a minimum”.*

Paragraph 5.11.8 states that *“The ES should identify existing and proposed land uses near the project, any effects of replacing an existing development or use of the site with the proposed project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan. The assessment should be proportionate to the scale of the preferred scheme and its likely impacts on such receptors. For developments on previously developed land, the applicant should ensure that they have considered the risk posed by land contamination and how it is proposed to address this”.*

Paragraph 5.11.13 states that *“Applicants should also identify any effects and seek to minimise impacts on soil health and protect and improve soil quality taking into account any mitigation measures proposed”.*

Paragraph 5.11.14 states that *“Applicants are encouraged to develop and implement a Soil Management Plan which could help minimise potential land contamination. The sustainable reuse of soils needs to be carefully considered in line with good practice guidance where large quantities of soils are surplus to requirements or are affected by contamination”.*

Paragraph 5.11.15 states that *“Developments should contribute to and enhance the natural and local environment by preventing new and existing developments from contributing to, being put at unacceptable risk from, or being*

Policy	Policy context
	<i>adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability”.</i> Paragraph 5.11.16 states that <i>“Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans”.</i> Paragraph 5.11.17 states that <i>“Applicants should ensure that a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination”.</i> Paragraph 5.11.18 states that <i>“For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination, and where contamination is present, applicants should consider opportunities for remediation where possible. It is important to do this as early as possible as part of engagement with the relevant bodies before the official pre-application stage”.</i> Paragraph 5.11.19 states that <i>“Applicants should safeguard any mineral resources on the proposed site as far as possible, taking into account the long-term potential of the land use after any future decommissioning has taken place”.</i> Paragraph 5.11.23 states that <i>“Although in the case of most energy infrastructure there may be little that can be done to mitigate the direct effects of an energy project on the existing use of the proposed site (assuming that some of that use can still be retained post project construction) applicants should nevertheless seek to minimise these effects and the effects on existing or planned uses near the site by the application of good design principles, including the layout of the project and the protection of soils during construction”.</i> Paragraph 5.11.28 states that <i>“Where a proposed development has an impact upon a Mineral Safeguarding Area (MSA), the Secretary of State should ensure that appropriate mitigation measures have been put in place to safeguard mineral resources”.</i>
NPS for natural gas supply infrastructure	for natural gas supply infrastructure and gas and oil pipelines (EN-4) is part of a suite of NPS designated by the Secretary of State, DESNZ in January 2024. Although the document

Policy	Policy context
and gas and oil pipelines (EN-4) 2024⁹	is intended for hydrocarbon based gas and oils, the approach to decision making may be relevant to this project. In relation to the factors influencing the site selection for natural gas and oil pipelines Paragraph 2.21.7 states that <i>‘Applicants may need to remove or dispose of contaminated materials’</i>. Paragraph 2.21.37 states, <i>‘Constructing pipelines creates corridors of surface clearance and excavation that can potentially affect watercourses, aquifers, water abstraction and discharge points, areas prone to flooding and ecological receptors. Pipeline impacts could include... interference with groundwater flow pathways, mobilisation of contaminants already in the ground and the introduction of new pollutants.’</i>
National Planning Policy Framework (NPPF) 2023¹⁰	The NPPF sets out the Government’s planning policies for England and how these should be applied, with the following chapters relating to ground conditions and soils: Chapter 11: Making Effective Use of Land (paragraphs 119 to 120): <i>“Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or ‘brownfield’ land...Planning policies and decisions should...support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land”</i>. Chapter 15: Conserving and Enhancing the Natural Environment (paragraphs 174 to 185): <i>“Planning policies and decisions should contribute to and enhance the natural and local environment by:</i> <i>a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner</i>

⁹ Department of Energy Security and Net Zero. (2024). ‘National Policy Statement for natural gas supply infrastructure and gas and oil pipelines (EN-4)’. Available at: <https://www.gov.uk/government/collections/national-policy-statements-for-energy-infrastructure> (Accessed July 2024).

¹⁰ Department for Levelling Up, Housing and Communities. (2023). ‘National Planning Policy Framework’. Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2> (Accessed July 2024).

Policy**Policy context**

commensurate with their statutory status or identified quality in the development plan);...

d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate...

Planning policies and decisions should ensure that:

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation); b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and....

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments...

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development”.

Chapter 17: Facilitating the Sustainable Use of Minerals (paragraphs 210 to 216):

Policy	Policy context
	<i>"Planning policies should...Set out criteria or requirements to ensure that permitted and proposed operations do not have unacceptable adverse impacts on the natural and historic environment or human health, taking into account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality;...</i> <i>Minerals planning authorities should:...encourage underground gas and carbon storage and associated infrastructure if local geological circumstances indicate its feasibility... When determining planning applications, minerals planning authorities should ensure that the integrity and safety of underground storage facilities are appropriate, taking into account the maintenance of gas pressure, prevention of leakage of gas and the avoidance of pollution".</i>
Local planning policy	The adopted and emerging planning policies of the local and regional planning authorities that fall within the ground conditions study area have been reviewed and these all refer to implementation of the requirements of the NPPF in respect of the assessment of the effects on ground conditions receptors and hence have not all been listed individually in this table. It is noted that a number of the adopted plans still refer to the 2019 NPPF.

Technical guidance

12.2.5 A summary of the technical guidance for ground conditions is given in **Table 12.3**.

Table 12.3 Technical guidance relevant to the ground conditions assessment

Technical guidance document	Context
The Environmental Protection Act 1990: Part 2A Contaminated	Sets out how local authorities should implement the Part 2A regime, including how they should go about deciding whether land is contaminated land in the legal sense of the term. It also elaborates on the remediation provisions of Part 2A, such as the goals of remediation, and how regulators should ensure that remediation requirements are reasonable.

Technical guidance document	Context
Land Statutory Guidance¹¹	
The Environment Agency (2023) Land Contamination Risk Management (LCRM)¹²	Provides the technical framework for applying a risk management process when dealing with land affected by contamination.
Guidance for the Safe Development of Housing on Land Affected by Contamination Annex 4 (NHBC et al.) (2008)¹³:	Provides guidance on defining the likelihood definitions used in the ground conditions assessment methodology described in Section 12.7 .
The Contaminated Land: Applications in Real Environments (CL:AIRE) (2010) Framework for Assessing the Sustainability of Soil and Groundwater Remediation¹⁴	Provides a framework for assessing the sustainability of remediation and informing the decision-making process where remediation measures are required.
The CL:AIRE (2016) CAR-SOIL: Control of Asbestos Regulations	Provides interpretation and guidance to all involved in the management of asbestos in both soils and construction and

¹¹ Defra (2012) Environmental Protection Act 1990 Part 2A – Contaminated Land Statutory Guidance (online) Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/223705/pb13735cont-land-guidance.pdf (Accessed July 2024).

¹² Environment Agency, (2023). Land contamination risk management (LCRM). (online) Available at: <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm> (Accessed July 2024).

¹³ NHBC et al. (2008) Guidance for the Safe Development of Housing on Land Affected by Contamination Annex 4. Available at <https://www.nhbc.co.uk/binaries/content/assets/nhbc/products-and-services/tech-advice-and-guidance/guidance-for-the-safe-development-of-housing-on-land-affected-by-contamination.pdf> (Accessed July 2024).

¹⁴ CL:AIRE, (2010) Framework for Assessing the Sustainability of Soil and Groundwater Remediation. Available at: <https://www.claire.co.uk/component/phocadownload/category/16-surf-uk-bulletins?download=61:surf-uk-framework-final-march-2010> (Accessed July 2024).

Technical guidance document	Context
2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials¹⁵	demolition arisings in accordance with the Control of Asbestos Regulations 2012.
BS10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice	This British Standard sets out the process to be followed in the investigation of potentially contaminated sites. It identifies a phased approach beginning with desk-based study and, where appropriate, intrusive investigation. The British Standard describes the methodology to be followed for each phase of the investigation.
BS8576:2013 Guidance on investigations of ground gas – Permanent gases and volatile organic compounds (VOC)	Describes the process to be followed to assessing whether ground gases, including mine gas, may pose a risk to development.

12.3 Consultation and Engagement

Overview

- 12.3.1 The assessment has been informed by consultation responses and statutory and technical engagement. An overview of the approach to consultation is provided in **Chapter 3: Approach to preparing the Draft ES**.

Scoping Opinion

- 12.3.2 A Scoping Opinion was adopted by the Secretary of State, administered by the Planning Inspectorate, on 08 March 2022. A summary of the relevant responses received in the Scoping Opinion in relation to ground conditions and confirmation of how these have been addressed within the assessment is presented in **Table 12.4**.

¹⁵ CL:AIRE (2016) Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials. Available at: <https://www.claire.co.uk/component/phocadownload/category/36-asbestos-in-soil?download=545:jiwg-car-soil-guidance> (Accessed July 2024).

Table 12.4 Summary of EIA Scoping Opinion responses for ground conditions

Consultee	Consideration	How addressed in this Draft ES
Planning Inspectorate	The ES should confirm how the delivery of embedded measures is secured through the Construction Environmental Management Plan (CEMP) and Development Consent Order (DCO). Subject to this, the Inspectorate is satisfied that significant effects on construction/operation workers are not likely and that these matters can be scoped out from further assessment.	Table 12.7 summarises how the delivery of embedded measures will be secured. Effects on construction/operation workers have been scoped out from this Draft ES as agreed with PINS at the scoping stage.
	Excavated materials disposal. The Scoping Report does not explain how construction waste would be reused or disposed of. This must be addressed in the ES.	As noted in Table 12.7 the environmental measures include the development of a Materials Management Plan (MMP) and use of the CL:AIRE (2011) Definition of Waste Code of Practice (DoWCoP). Alongside compliance with the Waste Regulations (2015) this will ensure how soils excavated as part of the construction process will be managed. The Outline CEMP to be submitted with the draft DCO will outline details of how general construction waste will be managed during the construction phase.
	Ground stability. The pipeline passes through a known area of risk of subsidence due to salt and brine extraction. The ES should consider the potential for the proposed development to increase subsidence risk or be affected by ground instability. Any likely significant effects should be considered in the ES.	The basis of the structural design for the Project will be completed in general accordance with design standards to minimise the risk of structural or geotechnical instability. Accordingly, ground stability will be considered within the geotechnical

Consultee	Consideration	How addressed in this Draft ES
		design of the Project. However, information on brine subsidence is included in Appendix 12A for completeness. Potentially significant effects on land stability to other receptors as a result of the Project is considered in Chapter 16: Major Accidents and Disasters.
	Remediation. The ES should include a full description of any remediation that may be required and confirm how this is to be secured. The ES should consider any likely significant effects, e.g., traffic movements, waste handling, land contamination, that could occur.	An initial phase of ground investigation was undertaken in Autumn 2022 to inform the project design, and in particular, the design of trenchless crossings. Further ground investigation work is being undertaken in Autumn 24 and post consent. Environmental measures have been embedded by the Applicant so that the Project is suitable for the proposed use in respect of land contamination and that the Environment Agency's guidance (LCRM, 2023¹²) is followed when identifying whether any remediation is required and how that remediation would be carried out during the construction phase. Future ground investigation, prior to the commencement of development to inform this process will be secured as a DCO Requirement.
Canal & River Trust	Potential impact of contamination and pollution on waterway corridors. Canals to be considered as sensitive receptors and should be included in any conceptual model. Location of	Canals are considered as controlled water receptors within the land contamination assessment (and therefore the

Consultee	Consideration	How addressed in this Draft ES
	existing drainage within the development to be considered. The potential impact of works close to waterway infrastructure should be considered. The structural integrity of waterways must not be put at risk at any stage during the development.	conceptual model presented in Appendix 12A). Potentially significant effects on land stability to other receptors as a result of the project development are considered in Chapter 16: Major Accidents and Disasters.
	Where the route passes within 250m of a canal or navigable waterway, the Trust should be provided with relevant geo-environmental and geotechnical reports for review.	The Applicant has engaged with the Canal and River Trust to discuss the methods for crossing their assets and Protective Provisions will be secured to set out how the Applicant will protect these assets during construction. An initial phase of ground investigation was undertaken in Autumn 2022 to inform the project design, and in particular, the design of trenchless crossings. Further ground investigation work is being undertaken in Autumn 24 and post consent. The Factual Reports are contained in Appendix 12B. Detailed geo-environmental assessments of specific waterway crossings will be developed post DCO consent and discussed with consultees prior to construction. It is anticipated that future ground investigation will be secured as a DCO Requirement.

Consultee	Consideration	How addressed in this Draft ES
	The Scoping EIA omits reference discussion of geotechnical constraints. The southern options A and B pass through the Cheshire Brine Compensation District as well across other areas of mining. Provide assessment of potential for subsidence/ground collapse and possible risk to hydrogen pipeline and associated infrastructure.	The basis of the structural design for the Project will be completed in general accordance with design standards to minimise the risk of structural or geotechnical instability. Accordingly, ground stability will be considered within the geotechnical design of the Project. However, information on brine subsidence is included in Appendix 12A for completeness whilst a Halite Risk Assessment has been undertaken and is provided as Appendix 12C . Potentially significant effects on land stability to other receptors as a result of the Project will be considered in Chapter 16: Major Accidents and Disasters .
Cheshire East Council	The proposed methodology in Chapter 12 of the Scoping Report is acceptable. The Council is able to provide information on sites within the scoping boundary prioritised under Part 2A of the Environmental Protection Act 1990, known ground investigations, known private water supplies and possible foot and mouth burial pits. The Council is pleased to note that any future remedial options appraisal will be conducted within the SuRF Framework.	Relevant information provided by Cheshire East Council is contained with Appendix 12A .
Cheshire West & Cheshire Council	The Council is satisfied with the information relating to land contamination in the Scoping Report and agrees with the impacts and activities contained within Table 12.6	Noted. Information on former industrial uses is incorporated into the PRA within Appendix 12A .

Consultee	Consideration	How addressed in this Draft ES
	(of the Scoping Report). Land contamination is particularly important around Ellesmere Port. The area around Stanlow has a legacy of former industrial uses and is close to a historic landfill site.	
	Construction strategies that maximise the reuse of excavated material are to be implemented. Further details regarding the proposals for excavated materials should be provided to Cheshire West & Chester Council at the appropriate stage.	Table 12.7 details the proposed environmental measures including the development of a Materials Management Plan (MMP) and use of the CL:AIRE (2011) Definition of Waste Code of Practice (DoWCoP). Alongside compliance with the Waste Regulations (2015) this will provide for reuse of materials and details regarding excavated materials management, reuse and disposal.
	Ground instability considerations are particularly important in the Cheshire West & Chester area where ground instability and subsidence due to salt and brine extraction and natural erosion occur. Areas of risk should be identified and avoided. Ground instability and risk of subsidence should be included in the Environmental Statement.	The basis of the structural design for the Project will be completed in general accordance with design standards to minimise the risk of structural or geotechnical instability. An initial phase of ground investigation was undertaken in Autumn 2022 to inform the Project design, and in particular, the design of trenchless crossings. Further ground investigation work is being undertaken in Autumn 24 and post consent. The Factual Report is contained in Appendix 12B . Accordingly, ground stability will be considered within the geotechnical design of the Project.

Consultee	Consideration	How addressed in this Draft ES
		However, information on brine subsidence is included in the ES PRA for completeness (Appendix 12A). Potentially significant effects on land stability to other receptors as a result of the Project development will be considered in Chapter 16: Major Accidents and Disasters.
	Paragraph 12.4.10 of the Scoping Report identifies numerous historical and authorised landfills within the Study Area and notes that further information to assist with assessing risk from landfills will be obtained. However, there are other existing and proposed waste management facilities within the pipeline zones. These may be associated with hazard zones that could impact construction. It is important that the pipeline avoids existing and proposed waste management facilities including the nearby Gowry Landfill and does not impact on their future operation or access requirements. Sites of concern include the energy from waste and waste recycling facility at Protos, Ellesmere Port and underground storage of hazardous waste at Minosus, Winsford Rock Salt Mine.	The presence of existing landfills and other waste management facilities has been reviewed and these have been considered in the optioneering process and through design evolution. The environmental measures detailed in Table 12.7 include measures to avoid, where practicable, areas of historic landfill and other known areas of potential contamination and to manage unexpected land contamination.
The Coal Authority	The Scoping Report identifies that coal mining data sets will be used to inform the ground conditions baseline. The Coal Authority requested that once the extent of the pipeline/hubs is confirmed, due consideration is given to potential risks to the development from coal mining legacy features in the site.	The basis of the structural design for the Project will be completed in general accordance with design standards to minimise the risk of structural or geotechnical instability. An initial phase of ground investigation was undertaken in Autumn 2022 to inform the project

Consultee	Consideration	How addressed in this Draft ES
		design and in particular, the design of trenchless crossings. Further ground investigation work is being undertaken in Autumn 24 and post consent. Accordingly, ground stability will be considered within the geotechnical design of the Project. However, information on coal mining is included in the PRA (Appendix 12A) for completeness.
St Helen's Borough Council	The Council's Contaminated Land Officer agrees with the proposed risk-based assessment methodology for land contamination. The Officer requests a Phase 1 desk study report is provided as part of the application.	Noted. The Phase 1 PRA is included as Appendix 12A .
Trafford Council	Existing or former use of the area within the scoping boundary means that some of the land may be contaminated. The Council is satisfied that the criteria identified for use are satisfactory for assessing contaminated land.	Noted.
National Highways	Geotechnical risks. Reference to National Highways document <i>SES Guidance Notes for Horizontal Directional Drilling and other Trenchless Installations</i> . Notes need for an understanding and realistic ground model.	The basis of the structural design for the Project will be completed in general accordance with design standards to minimise the risk of structural or geotechnical instability. An initial phase of ground investigation was undertaken in Autumn 2022 to inform the project design, and in particular, the design of trenchless crossings. Further ground investigation work is being undertaken in Autumn 24 and post consent.

Consultee	Consideration	How addressed in this Draft ES
		Accordingly, ground stability will be considered within the geotechnical design of the Project and not as part of the ES.
West Lancashire Borough Council	No comments on ground conditions	N/A
Environment Agency	Land contamination risk management to be used for risks from land contamination to controlled waters.	Environmental measures have been embedded by the Applicant so that the Project is suitable for the proposed use in respect of land contamination and that the Environment Agency's guidance (LCRM 2023) is followed when identifying whether any remediation is required and how that remediation would be carried out during construction.
Knowsley Metropolitan Borough Council	Does not believe the development will have significant effects on ground conditions	Noted.
Warrington Borough Council	Identified historic and authorised landfill sites. Arpley impinges on the Hydrogen Above Ground Installation (HAGI) zone. Novelis is adjacent to an authorised landfill site and Penketh is adjacent to historic sites. The Scoping Report identifies latest contaminated land documents – desk studies to be undertaken including consultation with LPAs is encouraged but has not yet commenced.	Noted. Information on landfill sites is incorporated into the PRA (Appendix 12A).

Statutory Consultation

12.3.3 Stage 2 Statutory Consultation took place between 12 September and 10 November 2022 in accordance with the Planning Act 2008. Prescribed and non-prescribed consultees and members of the public were consulted. Various

methods of consultation and engagement were used in accordance with the Statement of Community Consultation (SoCC) including letters, website, public exhibitions, publicity and advertising in newspapers and webinar briefings.

- 12.3.4 The Applicant prepared a Preliminary Environmental Information Report (PEIR) which was publicised at this consultation stage. The Applicant sought feedback on the environmental information presented in that report. Feedback received during statutory consultation was considered by the Applicant and incorporated, where relevant into the design of the Project and its assessment and is presented in this Draft ES.
- 12.3.5 A summary of the relevant responses received in response to statutory consultation, together with any subsequent discussions held in relation to ground conditions and confirmation of how these have been considered within the assessment to date is presented in **Table 12.5**.
- 12.3.6 Technical engagement with consultees in relation to ground conditions is ongoing.

Table 12.5 Summary of Section 42 Consultation responses for ground conditions

Consultee	Consideration	How addressed in this Draft ES
Cheshire West and Chester Council	Ground stability associated with the Brine Subsidence should be considered, and the impacts from subsidence should be considered at an early stage as they may influence the route. In addition, the Brine Subsidence Compensation Board should be consulted.	Brine compensation report has been included within the PRA (Appendix 12A) and the design of the Project will appropriately consider the risks.
Cheshire West and Chester Council	Comprehensive ground investigations should be undertaken to ensure safety of residents.	Detailed ground investigation will be undertaken and secured via a DCO requirement.
Warrington Borough Council	Given the nature of the Project, at a minimum it is expected that a PRA (Desk Study) is submitted.	A PRA (Appendix 12A) has been produced to inform the baseline conditions within this Ground Conditions chapter.
Canal and River Trust	Landfills should be considered and assessed.	Landfills have been included and assessed within the PRA (Appendix 12A), which has been used to inform the baseline conditions within this Ground Conditions Chapter.
	The proximity, age and condition of the Trust's waterways and	The basis of the structural design for the Project will be completed in general accordance with design

Consultee	Consideration	How addressed in this Draft ES
	associated infrastructure should be considered.	standards to minimise the risk of structural or geotechnical instability. Accordingly, ground stability will be considered within the geotechnical design of the Project and is not considered within this Draft ES Engagement with CRT has been undertaken. The Applicant is seeking to agree Protective provisions with CRT to ensure that CRT infrastructure is adequately protected.
	We do note that the south corridor passes through Acton Dredging Tip (in between Acton Bridge and Dutton). This tip is Trust owned and operated and is still in use. This is not shown on figure 12.4 Historic and Authorised Landfills and it ought to be included, considered and assessed.	The presence of the Acton Dredging Tip has been discussed with CRT. The Project design has been amended in consultation with CRT to include an alternative HDD trenchless crossing which would pass at depth beneath the tip, exiting in the field to the north.
	The Trust requests access to future reports which concern their waterways to enable their comment.	All future reports to be produced as a requirement of the DCO will be provided to consultees.
Coal Authority	It does not appear that any of the pipeline or infrastructure that lies within the Warrington administrative area, falls within the Development High Risk Area (DHRA), as defined by the Coal Authority. Accordingly, there are no recorded coal mining features that could pose a risk to surface instability and / or public safety within your area.	Noted.
Environment Agency	We are in broad agreement that a majority of the proposed pipeline route (including corridor) will be in ground that has or is currently being used for non-industrial	Noted. The PRA (Appendix 12A) captures historical land uses within the Zone of Influence (ZoI) to incorporate this point. Risks to

Consultee	Consideration	How addressed in this Draft ES
	purposes (i.e. agricultural use). These areas are unlikely to be subject to adverse impact from ground contamination, however, it is important to carefully consider the proposed baseline ground conditions desk study as there is a possibility that areas may have been historically subject to industrial or classified land uses, such as, military bases and other associated infrastructure that are not necessarily evident from a contemporary perspective. Consideration should be made to ensure controlled water receptors are not impacted and their condition does not deteriorate as a result of contaminant mobilisation and migration.	Controlled Waters are also assessed within the PRA.
	The DCO Proposed Development may need regulatory and / or Environmental Permit requirements.	Noted. Environmental Permits will be sought for specific activities such as impounding watercourse, dewatering and discharge to surface or groundwater as required.
	Materials and chemicals likely to cause pollution should be stored in appropriate containers and adhere to guidance for the storage of drums and intermediate bulk containers.	An Outline CEMP is to be included in support of the DCO application which outlines appropriate procedures to adequately control and respond to any emergencies including the clean-up of spillages, to prevent environmental pollution from the site operations during construction.
	Development on, or within, 250 metres of known gassing or potentially gassing permitted landfill site. The proposed development could be located on or within 250 metres of a landfill site that could potentially be producing landfill gas.	Landfill gas is included as a potential source within the PRA (Appendix 12A) which informs the baseline of this Draft ES.

Consultee	Consideration	How addressed in this Draft ES
	The CL:AIRE Definition of Waste: Development Industry Code of Practice (version 2) provides operators with a framework for determining whether or not excavated material arising from site during remediation and/or land development works is waste or has ceased to be waste. Contaminated soil that is (or must be) disposed of is waste.	A Materials Management Plan will be produced to address how excavated material is dealt with and is included within this Draft ES as Embedded Mitigation.
	We recommend that developers should follow the risk management framework provided in Guidance on Land contamination risk management (LCRM), when dealing with land affected by contamination.	The PRA (Appendix 12A) is in accordance with LCRM guidance.
EA Comments (15 May 2023) on Applicant's Draft PRA		
	Weston Quarry landfill requires special consideration as the materials suspected and known to have been deposited at these locations were hazardous and likely toxic.	Weston Quarry landfills are now outside of the 500m ZoI and therefore are not considered within the assessment.
	The spur into the Runcorn Peninsula includes a corridor through the former Manchester Ship Canal dredging grounds as well as the area that extends into the Stanlow Manufacturing Complex.	Noted. These sources are contained within the PRA (Appendix 12A).
	Active and former landfills are present in the Warrington area, which include LeBlanc waste deposits.	Noted. These sources are contained within the PRA (Appendix 12A).
	Within the Partington area, the pipeline zone of influence includes the former Partington	Industrial processes as a potential source of contamination within this

Consultee	Consideration	How addressed in this Draft ES
	Gas Works and the Partington Liquid Natural Gas terminal. Both are known to have led to elevated concentrations of contamination being introduced to the ground.	area have been included within the PRA (Appendix 12A).
	Records available to the EA indicate that the area around Higher Walton HAGI to area around Northwich has been extensively used in connection with the chemical manufacturing industry and salt extraction.	The Draft Order Limits have been updated since this review. Information on the remaining salt extraction works has been included within the PRA (Appendix 12A).
	Advice and points of clarification on tables and graphics describing groundwater abstractions and groundwater source protection zones.	Clarifications on the number and type of groundwater abstractions present have been provided/updated within the relevant tables and graphics within the PRA (Appendix 12A).
	Queries relating to the consideration of potential pollutant linkages and corresponding significance of risk and likelihood of contamination being encountered.	The conceptual site model has been updated within the PRA (Appendix 12A) to address these queries.
	Having assessed the list of potential pollutants there is a noticeable absence of emerging contaminants of concern such as Per- and Polyfluoroalkyl Substances (PFAS).	PFAS has been included as a contaminant in relation to relevant current and former industrial land uses in the PRA (Appendix 12A).
	The Environment Agency agree in general that operational sites should be regulated under relevant existing legislation, it should be considered where the pipeline route encroaches onto, or passes close to these types of sites, that there is potential for pollution and	Noted. Consideration of current operational sites is included with the conceptual site model within the PRA (Appendix 12A).

Consultee	Consideration	How addressed in this Draft ES
	contamination to exist.	
	Where the pipeline / HAGI(s) are located within permitted / regulated sites, it will need to be demonstrated that the proposed scheme will not impact the operation of consented activities and / or compliance with the operators Environmental Permit.	The Draft Order Limits have been updated since this review and the pipeline/HAGIs are not located within permitted sites. The project design has also been amended in consultation with CRT to include an alternative HDD trenchless crossing which would pass at depth beneath the dredgings tip at Acton Bridge to ensure the Project will not impact this historical waste site.
	It is noted that the initial conceptual model and Preliminary Risk Assessment has not considered the pipeline itself as a potential pathway for the migration of contamination.	Consideration of the proposed pipeline as a potential preferential pathway is included within the PRA (Appendix 12A).

12.4 Data Gathering Methodology

Desk study

12.4.1 A summary of the organisations that have supplied data, together with the nature of that data is outlined in **Table 12.6**.

Table 12.6 Data sources used to inform the Ground Conditions assessment

Source	Date	Summary of Data Obtained from the Source
Groundsure	Website accessed July 2024	Environmental and GIS data including information on geohazards, 1:10,000 and 1:50,000 historical mapping ¹⁶

¹⁶ GroundSure EnviroGIS Report references GSIP-2021-12402-9275, GSIP-2021-12402-9276, GSIP-2021-12402-9281 and GSIP-2021-12402-9282, all dated 02 April 2022

Source	Date	Summary of Data Obtained from the Source
Ordnance Survey (OS)	Various	OS topographic maps 1:25,000 and 1:50,000 scale Identification of topography, watercourses, springs, lakes and other watercourses.
MAGIC map¹⁷	Website accessed July 2024	Designated sites, Aquifer designations, groundwater vulnerability designations, Source Protection Zones and Geological SSSI information
British Geological Survey¹⁸	Website accessed July 2024	On-line Geoindex 1:50,000 digital geology Borehole Record Viewer (offers access to the National Geoscience Data Centre collection of onshore scanned boreholes, shafts and well records) Minerals resource data
Environment Agency Catchment Data Explorer¹⁹	Website accessed July 2024	Water Framework Directive classification of surface water and groundwater bodies
Natural England²⁰	Website accessed July 2024	Geological SSSI citations
Coal Authority Interactive Map Viewer²¹	Website accessed July 2024	Location of coal mining areas including areas likely

¹⁷ Defra (2022). Magic maps (online) Available at: www.magic.gov.uk (Accessed July 2024).

¹⁸ British Geological Survey (2022). Geoindex onshore. (Online) Available at: <http://mapapps2.bgs.ac.uk/geoindex/home.html> (Accessed July 2024).

¹⁹ Environment Agency (2022). Explore Catchment Data (online) Available at: <https://environment.data.gov.uk/catchment-planning/> (Accessed July 2024).

²⁰ Natural England (2022). Designated Sites View (online) Available at: <https://designatedsites.naturalengland.org.uk/> (Accessed July 2024).

²¹ The Coal Authority (2022). Interactive Map (online). Available at: <http://mapapps2.bgs.ac.uk/coalauthority/home.html> (Accessed July 2024).

Source	Date	Summary of Data Obtained from the Source
		to be affected by shallow mining and locations of mine entries/shafts.
Public Health England ²²	Website accessed July 2024	Indicative maps of radon risk.
Cheshire Brine Subsidence Compensation Board	Website accessed July 2024	Map shows the Cheshire Brine Subsidence Compensation District and Consultation Areas
Google Earth Pro	Imagery date April 2021 Website accessed July 2024	Current and past aerial photography

Survey work

12.4.2 A site walkover survey was undertaken between 20 and 22 July 2022. The purpose of the site walkover was to inform the PRA by verifying information from the Desk Study at specific locations across the Draft Order Limits. Details of the specific locations visited and the observations made are contained in the PRA (**Appendix 12A**).

Data limitations

12.4.3 The following limitations apply:

- This ground conditions assessment is based available factual data covering the spatial scope of the assessment (the Study Area, as defined in **Section 12.7** and shown on **Figure 12.1**) obtained only from the published sources highlighted in **Table 12.6**. The information provided may not be exhaustive but represents the key sources used to prepare this Draft ES Chapter. Further sources of data will be considered and reviewed as the Project progresses and included within the Final ES.
- The accuracy of historical maps cannot be guaranteed, and it should be recognised that unrecorded conditions may have existed between and after the various surveys.
- An initial phase of ground investigation was undertaken in Autumn 2022 to inform the project design. Further ground investigation work is being undertaken in Autumn 24 and post consent. The summary of information

²² UK Health Security Agency (2022). UK Maps of Radon (online) Available at: <https://www.ukradon.org/information/ukmaps> (Accessed July 2024).

provided in **Section 12.5** is factual only to inform the ground condition geological baseline.

- The ground conditions assessment is written in the context of legislation and guidance available in July 2024. New information, revised guidance and changes in legislation may necessitate a reinterpretation of the data assessed in part or in whole after submission.

12.4.4 None of these data limitations affect the robustness of the assessment of this Draft ES.

12.5 Overall Baseline

Current baseline

History

- 12.5.1 A review of the available historical mapping reveals that much of the Study Area and its immediate surrounding area has remained in agricultural use since the mid-1800s. Localised industrial uses that could give rise to land contamination were identified where the Study Area impinges on the major towns of Warrington, Runcorn, St. Helens, Ellesmere Port, Stanlow, Northwich and Partington.
- 12.5.2 Principally, potentially contaminative land uses were identified along the North and West Corridors. Fewer instances were recorded along the East and South Corridors.
- 12.5.3 Notable historical land uses within the West Corridor that may give rise to land contamination include the following:
- HPP HAGI and corridor section to Rocksavage HAGI: Oil refinery located within the HAGI, brick fields, gasworks, gasometer, water works, electricity generating station, sewage works, telephone exchange, unspecified works, depots, glass manufacturing plant, reservoir, fire station, motorway services area, tanks, dredging disposal ground, railway infrastructure and roads.
 - Rocksavage HAGI and Runcorn HAGI (and adjoining spur): Various industrial works including bone and charcoal works, chemical works, a tube works, tanks and power stations, industrial estates, pumping stations, depots and unspecified works, gas pressure breakdown station, electricity substation, canal deposit tip and dredging disposal ground, lagoon and sludge lagoon, railway infrastructure and roads.
 - Corridor section to Central Hub: Rare clay pits, farms, smithies and roads scattered sparsely throughout the corridor.
- 12.5.4 Notable historical land uses within the North Corridor that may give rise to land contamination include the following:
- St Helens Spurs and Clock Face Spur: densely concentrated industrial works including glass and bottle works, pottery works, copper works, brick and tile works, lead works, boiler works, timber yards, foundries, sewage works, transport depots, landfills, collieries, clay pits, coal pits, coal shafts and smalt

works, magazines, garages, tanks, unspecified works and factories, power station, waste recycling centre, canals, railway infrastructure, roads and isolated farms.

- Clock Face HAGI and corridor section to Higher Walton HAGI: Predominantly agricultural with isolated residential development and sparse industrial use including a sewage farm, a septic tank, a tannery, canal turn bridge and ferry lock, hydraulic installation, sheep dip works, shipyard, unspecified works buildings, cannery, sandstone quarries and sand pits, , canals, railway infrastructure, roads and isolated farms.
- Warrington Spurs: Mixed residential and industrial uses, including unspecified works and depots, borate works, bitumen works, iron works, tube works, tanneries, industrial estates (Richmond Works, Palatine Works), tanks, canal deposit land, allotment gardens and roads.
- Higher Walton HAGI; Mixed agricultural and industrial uses, including Runcorn and Latchford Canal, Manchester Shipping Canal, railway lines and sidings, sewage disposal works, saw mills, timber yards, dredging deposit ground (Arpley Landfill), iron foundry, warehouses, depots, tanks and roads.
- Corridor section to Central Hub: Predominantly agricultural with isolated residential development and sparse industrial use including sewage works, farms and roads.

12.5.5 Notable historical land uses within the South Corridor that may give rise to land contamination include the following:

- Corridor section from Central Hub to the Hartford BVI located to the north of the A556 (Chester Road): Predominantly agricultural with isolated residential development and sparse industrial use, including a quay, refining works, creamery, gasometer, coal yard, sanatorium, caravan parks, nursery, sand/marl pits and unspecified pits, farms, railway infrastructure and roads.
- HSF HAGI and corridor section to the west: Predominantly agricultural with isolated residential development and sparse industrial use, including brick field, pumping station and water tower, salt works, caravan site, telephone exchange, sand pits, farms, smithies, railway infrastructure and roads.

12.5.6 Notable historical land uses within the East Corridor that may give rise to land contamination include the following:

- Partington HAGI: Densely concentrated industrial uses including gasworks, petrochemical works, associated tanks, gasholders, pipework, unspecified industrial works, paper manufacturing plant, warehouses, depots, tramways, railway infrastructure and roads.
- Corridor from Central Hub to the Sworton Heath BVI off the A50, west of High Legh: Predominantly agricultural with isolated residential development and sparse industrial use including clay and gravel pits, farms and roads.
- Corridor section from eastern BVI to Warburton HAGI (and corridor to Partington HAGI); Predominantly agricultural with isolated residential

development and sparse industrial use including brick field, depot, gas valve compound, farms, smithies, clay and gravel pits, railway infrastructure and roads.

- 12.5.7 Additionally, in the vicinity of the proposed location of the Central Hub HAGI use has historically been agricultural with isolated residential development and sparse industrial use, including a brick and tile works, depot, garage, dredging disposal ground, marl and gravel pits, farms and roads.

Geology

- 12.5.8 BGS 1:50,000 mapping shows that the distribution of superficial deposits across the Study Area is complex. Over much of the Study Area, glacial deposits of till (diamicton) and glaciofluvial deposits (sand and gravel) are recorded. Superficial deposits are shown to be thin or absent in several areas, principally in the vicinity of Runcorn (West Corridor). Tidal flat deposits (mud and/or sand) and glacio-fluvial sheet deposits (sand and gravel) are recorded on either side of the River Mersey (North Corridor) along with the Shirdley Hill Sand Formation (blown sand), which may include layers of peat. Extensive deposits of glaciofluvial sheet deposits are recorded in the vicinity of Partington and along the East Corridor.
- 12.5.9 BGS mapping at a scale of 1:50,000 does not record areas of artificial ground within the Study Area. However, 1:10,000 scale mapping records artificial ground in the area identified for the St Helens HAGI and spur and in the ZOI to the north.
- 12.5.10 BGS mapping at a scale of 1:50,000 shows that the western and central areas of the East Corridor impinge on two areas of peat. A separate peat assessment and assessment of effects associated with peat are addressed in **Chapter 13: Agriculture and Soil Resources**.
- 12.5.11 The bedrock geology beneath the superficial deposits over most of the Study Area consists mainly of mudstone or sandstones of Triassic age. In the Northwich area (South Corridor and southern part of North and East Corridors), the mapped geology consists of the Northwich Halite Member (halite with partings of mudstone). The Bollin Mudstone is present beneath most of the West Corridor, East Corridor and North Corridor. To the north of the M56, the strata consists largely of sandstone. The extreme northern part of the North Corridor and St Helens HAGI lie on the Pennine Middle Coal Measure.
- 12.5.12 With reference to Magic Map and Natural England mapping, no Sites of Special Scientific Interest (SSSI) cited for their geology were identified within the Study Area.
- 12.5.13 No Regionally Important Geological Sites (RIGS) or Locally Important Geological Sites (LIGS) have been identified within the ZOI to date.

Landfill

- 12.5.14 Numerous historical and authorised landfills are present within the Study Area, particularly in the North Corridor and West Corridor, along the River Mersey.

Coal Mining and Brine Extraction

12.5.15 The north-eastern part of South Corridor to the north-east of Northwich lies within a Cheshire Brine Subsidence Consultation Board Consultation Area and may be at risk from brine subsidence.

12.5.16 Coal Authority mapping shows that the following portions of the Project are located within the Coal Authority Mining Reporting Area:

- St Helens Spurs;
- Clock Face Spur; and
- Clock Face HAGI and corridor section to the River Mersey (northwest of Higher Walton HAGI.; and Northern extent of the Warrington Spurs.

12.5.17 Numerous historical mine entries are recorded in St Helens Spurs, Clock Face Spur and Clock Face HAGI, particularly to the north of the Rainhill to Lea Green railway line. Numerous BritPits (dataset collectively identifying to mines, quarries, oil wells, gas wells, ash and desulphogypsum plants) relating to collieries, coal and coal-related products are recorded between St Helens Spurs and the River Mersey.

Hydrogeology

12.5.18 The Environment Agency classifies the superficial deposits in the Study Area as Secondary A and Secondary (Undifferentiated) Aquifers.

- Alluvium, Glaciofluvial Deposits, Shirdley Hill Sand Formation, River Terrace Deposits – Secondary A aquifers (permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers).
- Glacial Till, Tidal Flat Deposits – Secondary (undifferentiated) Aquifer (generally lower permeability aquifers where it is not possible to apply either a Secondary A or Secondary B definition due to the variable characteristics of the rock type).

12.5.19 Bedrock aquifers present are classified as Secondary B Aquifers, Principal Aquifers or Unproductive Strata.

- Chester Formation - Principal aquifer (rock layers or superficial deposits of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale).
- Kinnerton Formation – Principal Aquifer;
- Tarporley Siltstone Formation – Secondary B Aquifer (rock layers or superficial deposits of lower permeability that may store and yield limited amounts of groundwater through localised features such as fissures, thin permeable horizons and weathering).
- Bollin Mudstone Member – Secondary B Aquifer.

- Northwich Halite Member – Unproductive Strata (rock layers or superficial deposits of low permeability that have negligible significance for water supply or river base flow).
- Sidmouth Mudstone Formation - Secondary B Aquifer.

12.5.20 The Environment Agency classifies groundwater vulnerability across the Study Area from low to high reflecting the distribution of low permeability till deposits (low vulnerability), higher permeability sand and gravel and areas where superficial deposits are thin or absent. The area around Northwich (South Corridor) is mapped as at risk from soluble rock.

12.5.21 Several parts of the Study Area lie within a Groundwater Source Protection Zone (SPZ):

- A portion of the corridor section from Higher Walton HAGI to the Central Hub is located within a SPZ 3 (Total Catchment) and a small portion of this adjacent to Higher Walton is just within a SPZ 2 (Outer Protection Area);
- The corridor section between St Helens Spurs and Clock Face HAGI lies partly within a SPZ 3 (Total Catchment);
- The corridor section between Clock Face HAGI and Higher Walton HAGI passes through a SPZ 3; and
- The Higher Walton HAGI, the Warrington Spurs and the corridor section from Higher Walton HAGI to the Central Hub are partly located in several linked SPZ 3s.

12.5.22 Much of the Study Area lies within a Nitrate Vulnerable Zone (NVZ).

Ground Gas

12.5.23 Given the presence of former underground coal mine workings in the Study Area to the north of the River Mersey, there is a potential for mine gas. In addition, the Study Area impinges on several landfill sites, which may be a source of landfill gas.

Unexploded Ordnance

12.5.24 The Zetica online UXO risk maps²³ indicate moderate UXO risks to be present in the Study Area at the following locations:

- St Helens Spurs and Clock Face Spur to Clock Face HAGI;
- Corridor section from south of the River Mersey to Higher Walton HAGI;
- Higher Walton HAGI and Warrington Spurs.

12.5.25 All other locations within the Draft Order Limits are recorded as being of low UXO risk, however it is noted that additional areas of moderate risk are located at Runcorn immediately adjacent to the west of the Study Area. Additionally, a

²³ Zetica UXO Risk Maps. (Online) Available at: <https://zeticauxo.com/guidance/risk-maps/> (Accessed July 2024)

number of potential Second World War (WW2) Luftwaffe targets are noted to be present across the extent of the site in areas of both moderate and low UXO risk.

Future baseline

- 12.5.26 In the absence of the Project, there is unlikely to be a change to baseline conditions with respect to ground conditions over the lifetime of the Project. This is because the ground conditions are unlikely to be altered over time without a significant change of land use.
- 12.5.27 With respect to management of land contamination, the relevant requirements are identified under Part 2A of the Environmental Protection Act 1990 and, for other future developments, the Town and Country Planning Act 1990. Part 2A of the Environmental Protection Act 1990 requires LPAs to identify potentially contaminated land in their area and ensure potential risks from historical contamination are assessed and mitigated accordingly.
- 12.5.28 For future developments which take place within the Study Area, the Town and Country Planning Act 1990 requires the consideration of the potential for contamination to be present. Where necessary a developer would be required to carry out remediation of contamination to ensure the development site is suitable for the proposed end use.
- 12.5.29 Therefore, it is reasonable to conclude that in the absence of the Project there would not be a detrimental change in ground conditions over time within the Study Area.

12.6 Embedded Environmental Measures

- 12.6.1 As part of the project design process, a number of embedded environmental measures are proposed to reduce the potential for impacts on Ground Conditions. These are broken down into measures that are incorporated into the overall design of the Project, and those that are to be implemented during its construction and operational phases. At the appropriate point in time a Decommissioning Plan will be developed by the Applicant. Whilst specific measures have not been identified for the decommissioning phase at this stage of the Project, it is anticipated that measures equivalent to those implemented during construction would also be effective in mitigating effects on Ground Conditions during decommissioning and would be incorporated into the Decommissioning Plan. **Table 12.7** outlines how these embedded measures will influence the Ground Conditions assessment.

Table 12.7 Summary of embedded environmental measures

Environmental measure	How the environmental measures will be secured
Where practical, sensitive sites will be avoided by the temporary and permanent project footprint including SSSIs,	Development Consent Order (DCO) works plans and order limits

Environmental measure	How the environmental measures will be secured
LIGS, RIGS, areas of historical and authorised landfills and other known areas of potential contamination.	
Potential risks to human health from any unexpected ground contamination will be avoided by the use of Personal Protective Equipment (PPE) and by adopting appropriate working practices.	Construction Environmental Management Plan (CEMP) secured via DCO requirement
Prior to construction, an unexpected contamination protocol will be developed in line with Environment Agency (2020) guidance (LCRM) to minimise the potential risks to human health and controlled waters from any unexpected ground contamination. The protocol will take into account the requirements for risk assessment, the use of Personal Protective Equipment (PPE) and adoption of best practice methods during construction.	CEMP secured via DCO requirement
All aspects of the construction work will be in accordance with the Construction (Design and Management) Regulations 2015.	CEMP and DCO and UK legislative requirement
A Detailed Unexploded Ordnance Threat Assessment will be produced prior to intrusive works within areas indicated to have a moderate risk of unexploded ordnance (St Helens Spurs, Higher Walton HAGI, North Corridor section south of the River Mersey, Warrington Spurs). A detailed study will also be produced for the Runcorn HAGI given its immediate proximity to an area of moderate risk. Mitigation measures from this assessment will be included within the final CEMP.	CEMP secured via DCO requirement
A CEMP will be produced prior to commencement of construction which would detail measures to be implemented to avoid or reduce impacts during the construction phase. The CEMP will minimise temporary disturbance to residential properties, recreational users, existing land users and provide details of measures to protect environmental receptors.	CEMP secured via DCO requirement
Construction strategies will be implemented that will seek to maximise the reuse of excavated clean materials from the pipeline construction corridor where practicable and feasible. A Materials Management Plan (MMP) will be developed by the Principal Contractor that outlines where excavated non-waste materials will be reused in line with the CL:AIRE (2011) Definition of Waste Code of Practice (DoWCoP). The	CEMP secured via DCO requirement

Environmental measure	How the environmental measures will be secured
MMP will include a declaration by a Qualified Person that the MMP has been completed in accordance with the DoWCoP and that best practice is being followed.	
The Applicant will ensure that the land used for the Project is suitable for the proposed use with respect to the potential for soil and groundwater contamination and, where necessary, risk-based remediation is undertaken in line with Environment Agency (2020) guidance (Land Contamination: Risk Management). The precise design of any remediation strategy will be confirmed in the detailed design after consent has been granted and will be informed by targeted ground investigation in line with the findings of the Phase 1 Desk Study.	DCO and UK legislative requirement
Prior to construction, an unexpected contamination protocol will be developed in accordance with Environment Agency (2023) guidance (LCRM) to minimise the potential risks to human health and controlled waters from any unexpected ground contamination. The protocol will take into account the requirements for risk assessment, the adoption of best practice methods during construction and use of PPE.	CEMP secured via DCO requirement
The basis of the structural design for permanent infrastructure will be completed in general accordance with design standards to minimise the risk of structural or geotechnical instability. The structural design will give due consideration to minimum design requirements for ambient design temperatures, wind pressures and snow loads, including climate change allowances where appropriate.	DCO and UK legislative requirement
In accordance with good practice, Pollution Prevention Plans (PPPs) will be developed to detail how ground and surface waters will be protected in construction and operation. These will include information on the use and storage of any fuels, oils and other chemicals and pollution incidence response planning. These will also include measures for the protection of licenced and private abstractions (for example monitoring regimes associated with critical or very near receptors).	CEMP secured via DCO requirement
If water being pumped from excavations is suspected to be contaminated, appropriate measures will be taken in accordance with relevant Environment Agency guidance to prevent uncontrolled or unauthorised releases of this water to ground or to the water environment.	CEMP secured via DCO requirement

Environmental measure	How the environmental measures will be secured
Any temporary onsite storage of excavated materials suspected or confirmed to be contaminated will be on impermeable sheeting, covered over and with adequate leachate/runoff drainage to prevent migration of contaminants from the stockpile. Materials will be segregated where possible to prevent cross-contamination occurring. Such materials will only be reused if they are confirmed as suitable for use in line with the requirements of the MMP.	CEMP secured via DCO requirement
In areas where there is a potential for hydrocarbon residues from run-off/isolated leakages, surface water drainage measures will be provided to capture hydrocarbons prior to discharge, such as hydrocarbon interceptors.	CEMP secured via DCO requirement
Plant and machinery used during the construction and operation phases will be maintained to minimise the risks of oils leaks or similar. Maintenance and refuelling of machinery will be undertaken within designated areas where spillages can be easily contained. In these designated areas contingency plans will be implemented to ensure that the risk of spillages is minimised. Placing a drip tray beneath a plant and machinery during refuelling and the availability of spill kits will contain small spillages.	CEMP secured via DCO requirement
Any tanks and associated pipe work used during construction containing oils, fuels and hazardous chemicals will be double skinned. Fuel storage will be in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001 and Pollution Prevention Guidelines (PPGs) and details of oils, fuels and hazardous chemicals bund capacity will be set out in the CEMP. All stores of fuel will be located at least 20m from any watercourses and away from areas at risk of flooding.	CEMP secured via DCO requirement
Environmentally hazardous drilling fluids, or those containing groundwater hazardous substances, will not be used during trenchless crossings (including HDD).	CEMP secured via DCO requirement
In the event that piling is required for installation of permanent infrastructure foundations, a detailed piling risk assessment will be developed. This will be submitted to the Environment Agency for approval at the detailed design stage, prior to the commencement of construction	CEMP secured via DCO requirement

Environmental measure	How the environmental measures will be secured
Where the pipeline passes through areas of known contamination identified from the ground investigation, or where areas of unexpected contamination are encountered during construction, measures will be in place to amend the design of the pipeline (for example through installation of an impermeable lining) to prevent the pipeline acting as a preferential pathway for contamination. The exact design of any measures will be based on the nature and extent of the contamination encountered alongside appropriate risk assessment in line with Environment Agency (2023) guidance (LCRM).	CEMP secured via DCO requirement
Where required, targeted Phase 2 ground investigations will be undertaken after consent has been granted in line with the findings of the Phase 1 Desk Study to characterise the ground conditions and refine the potential land contamination risks.	DCO and UK legislative requirement

12.7 Scope of the Assessment

12.7.1 The scope of the assessment has been refined as the Project design has evolved and responds to feedback received to date as set out in **Section 12.3**.

Spatial scope

12.7.2 The spatial scope of the ground conditions assessment is based on applying the following principles to give the wider of either:

- The Draft Order Limits within which the project infrastructure will be located, including the temporary and permanent construction and operational work areas and access routes.
- A Zone of Influence (ZoI) 250m from the Draft Order Limits along the pipeline corridors.
- A ZoI 500m from the Draft Order Limits around the outer extents of the permanent infrastructure (such as HAGIs).

12.7.3 These elements comprise the Study Area that forms the basis of this assessment.

12.7.4 The rationale for the ZoI used to define the Study Area is informed from the Competent Expert's professional judgement by considering:

- The spatial extent (taking account of contaminant degradation, dilution and dispersion in the environment) at which significant ground effects could be present through potentially active contaminant linkages.

- The spatial extent from which off-site sources of contamination have the potential to lead to significant effects on human health receptors within the Project.

Temporal scope

- 12.7.5 The temporal scope covers the period over which changes to the environment and the resultant effects are predicted to occur.
- 12.7.6 The construction phase is anticipated to last for two years, commencing in late Q1 2027 ready for commissioning in Q1 2030; the Project would be operational from Q2 2030. Construction of the HAGIs (the largest permanent above ground features of the Project) would take between six months and one year.
- 12.7.7 The design life of the pipeline and HAGIs is 40 years, however, the actual life of the pipeline would extend well beyond this period, with parts being replaced or refurbished during maintenance activities. Decommissioning would likely involve leaving the pipeline in situ with rail, road and watercourse crossings being filled with grout. HAGIs and BVIs would be removed, and the land would be restored to its former use.
- 12.7.8 The temporal scope of the assessment of ground conditions is consistent with whole life cycle of the Project and covers the construction, operation and maintenance, and decommissioning phases. This includes consideration of effects which may be temporary (i.e. related to a particular activity that will cease when that activity ceases, such as construction work for a HAGI) or permanent (i.e. which may remain even when the Project is complete, such as a preferential pathway created by installation of a pipeline).

Potential receptors

- 12.7.9 The principal ground condition receptors that have been identified as being potentially subject to effects are summarised in **Table 12.8**.

Table 12.8 Ground conditions receptors subject to potential effects

Receptor	Reason for consideration
Human Health	Potential for human health receptors (including users of the land required for the Project and adjacent users) to be impacted by pre-existing contamination within soils and groundwater.
Controlled Waters (including groundwater, surface water and canals)	Potential for controlled water bodies to be impacted by pre-existing contamination.
Property	Potential for existing and future property and infrastructure to be impacted by pre-existing contamination within soils and groundwater.

Likely significant effects

12.7.10 The effects on ground conditions receptors which have the potential to be significant and have been taken forward for detailed assessment are summarised in **Table 12.9**.

Table 12.9 Ground conditions receptors scoped in for further assessment

Receptor	Likely significant effects
Human Health	Mobilisation of contamination via pathways including groundwater, surface water, leaching from soil, migration of vapours and windblown dusts resulting in health effects. Build-up of gases in confined spaces in existing or newly constructed infrastructure on and adjacent to the land required for the Project resulting in health effects.
Controlled Waters (including groundwater, surface water and canals)	Accidental spillages and leaks resulting in ground contamination and resultant risks to controlled waters during construction and ongoing operation and maintenance activities (e.g. fuel spills from vehicles/plant/equipment). Potential mobilisation of contamination, either during construction or through creation of preferential pathways, which, if not properly managed, could impact upon the quality of controlled waters.
Property	Damage to existing and newly constructed infrastructure from land affected by contamination either through direct interaction or mobilisation of contamination. Build-up of gases in confined spaces in existing or newly constructed infrastructure on and adjacent to the land required for

Receptor	Likely significant effects
	the Project resulting in property damage (e.g. explosion of ground gases).

Elements scoped out of further assessment

12.7.11 The receptors/effects detailed in **Table 12.10** have been scoped out from the assessment because the potential effects are not considered likely to be significant.

Table 12.10 Summary of effects scoped out of the ground conditions assessment

Receptors/potential effects	Justification
Geodiversity	No geological SSSIs or RIGS/LIGS identified from baseline data within the Study Area.
Human Health (Construction/Operation Workers)	As agreed with the Planning Inspectorate in the Scoping Opinion, taking into account compliance with legal requirements (CDM Regulations and Health and Safety at Work etc. Act including regulations made under the Act) and implementing the embedded environmental measures, which include current best practice and actions to meet existing legislative requirements, significant effects on the health of workers are unlikely to arise as a result of the Project.

12.8 Assessment Methodology

Introduction

12.8.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 3: Approach to preparing the Draft ES**, and specifically in **Section 3.10**. However, whilst this has informed the approach that has been used in this ground conditions assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this ground conditions assessment.

12.8.2 The assessment methodology applied within this Draft ES chapter differs from that outlined at Scoping and used in the PEIR to bring the assessment in line with Design Manual for Roads and Bridges (DMRB) Sustainability & Environmental

Appraisal, LA 109 Geology and Soils guidance²⁴ and the assessment methodology outlined within **Chapter 3: Approach to preparing the Draft ES**. This is to simplify the overall assessment process.

Assessment criteria

12.8.3 Assessment of receptor value (sensitivity) for ground conditions follows the procedure described in **Table 12.11** which is set out in the DMRB Sustainability & Environmental Appraisal, LA 109 Geology and Soils (Table 3.11) (Highways England, 2019). Negligible value/sensitivity has been removed, as it is deemed irrelevant as no receptor (in terms of Ground Conditions) is classed as negligible. The attribute associated with geodiversity has also been removed as no geodiversity receptors have been identified within the Study Area.

12.8.4 Factors that may affect the sensitivity of the likely receptor include:

- Human receptors: age, weight, sex, exposure duration and distance from a potential source of contamination; and
- Controlled Waters receptors: distance from the potential source of contamination and resource potential.

Table 12.11 Classification of Value or Sensitivity

Value or Sensitivity	Attribute	Criteria	Typical Examples
Very High	Contamination	Human health: very high sensitivity land use.	Residential or allotments.
	Groundwater	Nationally significant attribute of high importance.	Principal aquifer providing a regionally important resource and / or supporting a site protected under: • European Commission (EC); and • UK legislation Ecology and Nature Conservation

²⁴ Highways England (2019), Design Manual for Roads and Bridges, LA 109 Geology and Soils Revision 0. Available at: <https://standardsforhighways.co.uk/search/adca4c7d-4037-4907-b633-76eaed30b9c0> (Accessed July 2024).

Value or Sensitivity	Attribute	Criteria	Typical Examples
			Groundwater locally supports Groundwater dependent terrestrial ecosystem (GWDTE) or Source Protection Zones (SPZ) 1
High	Contamination	Human Health: high sensitivity land use.	Construction and maintenance workers (where extensive earthworks, and demolition of buildings are proposed) Public Open Space.
	Groundwater	Locally significant attribute of high importance.	Principal aquifer providing locally important resource or supporting a river ecosystem Groundwater supports a GWDTE or SPZ2.
Medium	Contamination	Human Health: medium sensitivity land use.	Construction workers (where limited earthworks, are proposed) Commercial or Industrial.
	Groundwater	Of moderate quality and rarity	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.

Value or Sensitivity	Attribute	Criteria	Typical Examples
Low	Contamination	Low sensitivity land use	Construction and maintenance workers (Minimal disturbance of ground). Infrastructure (roads, bridges, railways, buildings).
	Groundwater	Lower quality	Unproductive strata.

12.8.5 The expected magnitude of change to each identified attribute and receptor has been assigned in accordance with the principles established in DMRB LA 109 (Table 3.12) and DMRB LA 104²⁵ (Table 3.4N), along with Competent Expert's professional judgement. In considering the magnitude of change, the following have been taken into account:

- The magnitude of the potential consequence (severity). It takes into account both the potential duration and severity of exposure to potential land contamination and the sensitivity of the receptor;
- The magnitude of probability (likelihood). It takes into account both the presence of potential land contamination and receptor and the potential for a pathway to be realised between them; and
- Embedded mitigation which, by design, reduces the severity or likelihood of exposure to potential land contamination.

12.8.6 The terms used to describe magnitude of change are defined in **Table 12.12**.

²⁵ Highways England (2020), Design Manual for Roads and Bridges, LA 104 - Environmental assessment and monitoring Revision 1. Available at: <https://www.standardsforhighways.co.uk/search/0f6e0b6a-d08e-4673-8691-cab564d4a60a> (Accessed July 2024).

Table 12.12 Classification of Magnitude of Change

Magnitude of Change		Definition
No Change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduce risk of negative impact occurring.
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements; short-term exposure to contaminants with chronic (long-term) toxicity.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Major	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements; exposure to acutely toxic contaminants.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.

Significance evaluation methodology

12.8.7 Once the sensitivity of the affected receptor / receiving environment to change and the magnitude of change have been established, the matrix presented in **Table 12.13**, will be used to determine the significance of effect ranging from 'negligible' to 'major'.

Table 12.13: Significance evaluation matrix

		Magnitude of change				
		Major	Moderate	Minor	Negligible	No Change
Sensitivity or value	Very High	Major (significant)	Major (significant)	Moderate (potentially significant)	Minor (not significant)	Negligible (not significant)
	High	Major (significant)	Moderate (potentially significant)	Minor (not significant)	Minor (not significant)	Negligible (not significant)
	Medium	Moderate (potentially significant)	Minor (not significant)	Minor (not significant)	Negligible (not significant)	Negligible (not significant)
	Low	Minor (not significant)	Minor (not significant)	Negligible (not significant)	Negligible (not significant)	Negligible (not significant)

12.8.9 The risk definitions used in assessing significance are presented in **Table 12.14**.

Table 12.14 Significance definitions

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

12.9 Assessment of Ground Conditions Effects

Receptor Sensitivities

12.9.1 The baseline data identifies a range of human health receptors within the Study Area including residential properties of major towns (in particular Warrington, Runcorn and St Helens) commercial and industrial sites (in particular around

Ellesmere Port, Stanlow, Northwich and Partington) and agricultural land/public open spaces.

- 12.9.2 Notable controlled waters receptors are present across the Study Area including groundwater aquifers which support drinking water abstractions (with the pipeline passing through their associated SPZs), major rivers (including the River Weaver and River Mersey) and canals/waterways (including the Manchester Ship Canal and the Weaver Navigation).
- 12.9.3 A range of infrastructure and property is present within the Study Area including major motorways and A-Roads, railway lines and bridges.
- 12.9.4 Given the complexity and range of receptors present within the study area, the following receptor sensitivities have been assigned for the ground conditions assessment in line with **Table 12.11**:
- Human Health Receptors – Very High, taking into account the presence of residential properties and occupants as the worst-case scenario.
 - Controlled Waters Receptors – Very High, taking into account the presence of the groundwater SPZs and major Rivers as a worst-case scenario.
 - Property Receptors – Low, taking into account the nature of the existing and proposed infrastructure.

Construction Phase Assessment

Potential Effects from the Presence of Existing Contamination

- 12.9.5 The baseline data identifies that there were two principal categories of land within the Study Area:
- Land that has been, and remains, in agricultural use since the mid-1800s or land on which potentially contaminative uses have not been identified; and,
 - Land on which a range of potentially contaminative land uses (including landfills, chemical works, salt works, gas works, collieries, sewage works, timber works, tanneries, tube works and various unspecified industrial works) were identified and which may give rise to various organic and inorganic contaminants.
- 12.9.6 Much of the Study Area is of the former category. In these areas there is not anticipated to be a significant risk from the presence of land contamination. Therefore, the potential for mobilisation of contamination to controlled waters, human health, and property receptors during the construction phase in these areas is considered to be unlikely. The embedded environmental measures include control measures for preventing the construction works themselves from causing pollution (such as from leaks and spills) and from encountering unexpected contamination.
- 12.9.7 In these parts of the Study Area, the magnitude of change would therefore be no change. For the very high sensitivity of human health and controlled waters receptors and the low sensitivity of property receptors, this equates to a negligible effect (**not significant**).

- 12.9.8 In the case of the latter category, the probability of encountering contamination during construction increases.
- 12.9.9 Excavation of potentially contaminated soils or Made Ground²⁶ could pose a health risk to those in the immediate vicinity of the Project including the potential for the inhalation of contaminated dusts and particulate matter or the potential for the build-up of ground gases in confined spaces associated with existing or newly constructed infrastructure (i.e. the HAGIs). There is also the potential to mobilise existing contamination within the ground or through leaching of stockpiled soils or Made Ground which could pose a risk to controlled waters receptors.
- 12.9.10 The potential risks to the identified receptors would be highly dependent on the type and nature of contamination, if present. However, the embedded environmental measures include ground investigation prior to construction to identify the nature and extent of potential contamination, appropriate remediation, where required, to ensure the land is suitable for the proposed use and control measures for management of potentially contaminated soils excavated during trenching to prevent generation of dusts and leaching of contamination.
- 12.9.11 Consequently, whilst the probability of encountering contamination may have increased, the likelihood that this would result in a land contamination pollutant linkage being realised is low and, at worst, would be temporary in nature.
- 12.9.12 In these parts of the Study Area, the magnitude of change would therefore be negligible, at worst. For the very high sensitivity of human health and controlled waters receptors this equates to a minor negative effect (**not significant**) and for property receptors with low sensitivity a negligible effect (**not significant**) effect.

Potential Effects from the Physical Construction Activities

- 12.9.13 Construction activities for the Project include the setup of temporary construction compounds and temporary construction works for the pipeline, BVIs and HAGIs. All these temporary construction activities, regardless of their location will require the storage of fuels including the refuelling of plant and machinery, which have the potential to cause fuel losses either as a result of loss of bulk containment or from minor leaks/spills.
- 12.9.14 In addition, the trenchless crossings will require the use of drilling fluids to be stored at the trenchless crossing site with the potential for a release from loss of bulk containment.
- 12.9.15 The embedded environmental measures include a number of measures to limit the potential for accidental spillages and leaks during construction, incorporating requirements for secondary containment of bulk fuel storage in line with best practice containment guidance, and measures to reduce the severity of a spillage should one occur, for example through citing of fuel storage on an impermeable surface, not storing hazardous materials within a SPZ or immediately adjacent to

²⁶ Made Ground is land where natural and undisturbed soils have largely been replaced by artificial deposits.

surface water receptors and development of incident response plans to promptly deal with incidents.

- 12.9.16 The drilling fluids used during trenchless crossings are not classified as environmentally hazardous and do not contain groundwater hazardous substances and, therefore, a loss of containment or breakout during trenchless crossing operations would be low.
- 12.9.17 In respect of property receptors, the embedded environmental measures include the design of infrastructure in general accordance with design standards and compliance with relevant legislation and guidance which would take into account the potential for geohazards including aggressive ground conditions and the effect on dewatering during temporary works. Therefore, the risk of construction activities causing damage to existing infrastructure from a land contamination perspective would also be low.
- 12.9.18 Consequently, the magnitude of change, which is noted would also be temporary in nature, is considered negligible, at worst. For the very high sensitivity of human health and controlled waters receptors this equates to a minor negative effect (**not significant**) and for property receptors with low sensitivity a negligible effect (**not significant**) effect.

Operational Phase Assessment

- 12.9.19 By the operational phase, potential risks associated with land contamination will have already been controlled by ensuring that land required for the Project is suitable for the proposed use in line with LCRM. This includes the implementation of remediation, where required, and measures to amend the design of the pipeline (for example through installation of an impermeable lining) to prevent the pipeline acting as a preferential pathway for contamination.
- 12.9.20 Furthermore, the embedded environmental measures during the construction phase include the use of a MMP for the reuse of soils and for dealing with potentially contaminated soils requiring disposal as opposed to reuse, both of which will ensure that inappropriate reuse of materials generating a build-up of ground gas or contaminant leachate or from aggressive ground conditions is not likely.
- 12.9.21 The pipeline network is being built to carry hydrogen, which is a naturally occurring gas and not a ground polluting substance. Consequently, there would not be a risk of pollution of soil and/or groundwater should there be a leak during the operational phase.
- 12.9.22 During the operation phase, maintenance activities at the newly installed BVIs or HAGIs could give rise to accidental spillages and leaks. However, it can reasonably be expected that both the likelihood of a spillage/leak and the impact of any individual spillage/leak will be significantly reduced from the construction phase owing the absence of large-scale construction vehicles and bulk storage of associated fuels/liquids. Taking into account adoption of standard and good practice operational controls, the potential for maintenance activities to result in contamination impacts is very low.

- 12.9.23 Maintenance procedures and adoption of standard good practice measures will ensure that pollution of soil and/or groundwater is avoided during the operational phase (for example from spills and leaks from vehicles or plant during maintenance visits to the HAGIs). Furthermore, it is noted that the likelihood of a spillage/leak will be significantly reduced owing the absence of large-scale construction vehicles/equipment and storage of associated fuels/liquids.
- 12.9.24 Consequently, the magnitude of change during the operational phase would therefore be no change. For the very high sensitivity of human health and controlled waters receptors and the low sensitivity of property receptors, this equates to a negligible effect (**not significant**).

Decommissioning Phase

- 12.9.25 Disassembly of equipment and demolition of structures would have greatest potential for soil or groundwater contamination and impacts to neighbouring people and property due to the presence of construction equipment and spills, leaks and waste generated.
- 12.9.26 Whilst the detail and scope of the decommissioning will be determined by the relevant legislation and guidance at the time, it is anticipated that the pipeline will be left in-situ to minimise effects associated with removal with the BVIs and HAGIs removed.
- 12.9.27 At the appropriate point in time a Decommissioning Plan will be developed by the Undertaker. It is anticipated that environmental measures equivalent to those implemented during construction would also be effective in mitigating effects on Ground Conditions during decommissioning and would be incorporated into the Decommissioning Plan.
- 12.9.28 As such, impacts no greater than those identified for the construction phase on land, outside of contamination sources are expected for the decommissioning phase, i.e. for the very high sensitivity of human health and controlled waters receptors and for property receptors with low sensitivity a negligible effect (**not significant**).

12.10 Assessment of Cumulative (Inter-Project) Effects

- 12.10.1 A cumulative effects assessment (CEA) has been undertaken for the Project which considers the combined impacts with other developments on the same single receptor or resource (inter-project effects). The detailed method followed in identifying and assessing potential cumulative effects is set out in **Chapter 3: Approach to preparing the Draft ES**, with a short list of other developments that may interact with the Project during their construction, operation or decommissioning so as to lead to a cumulative effect presented in **Appendix 3A: Cumulative Effects Assessment: Long List and Short List** of the Draft ES.
- 12.10.2 A number of other developments have been identified within the 500m ZoI.
- 12.10.3 Of these, some have already been approved with conditions requiring environmental ground conditions measures to be adopted prior to commencement of construction activities, such as submission of detailed land contamination

remediation plans and adoption of best practice construction mitigation to prevent pollution.

- 12.10.4 For the remaining development that have not yet been approved, UK legislation and planning policy requires all developments to be suitable for their proposed use in which risks to human health and controlled waters from land contamination have been appropriately managed.
- 12.10.5 Furthermore, it can reasonably be assumed that good and standard construction practices and actions that would be undertaken to meet existing legislative requirements under CDM Regulations (2015) and the Health and Safety at Work Act (1974) would be implemented by these developments such that the risk of pollution incidents would be low, and that unexpected contamination found during construction of the 'other developments' would be managed in line with the Environment Agency guidance LCRM.
- 12.10.6 Consequently, even where construction and operation of these other developments overlaps with the Project, none of the ground condition receptors identified for assessment are likely to experience a significant cumulative effect as a result of the Project.

12.11 In-combination Climate Change Impact (ICCI) assessment

- 12.11.1 The impact of future climate change has been considered throughout the assessment and in-combination climate change impacts (ICCI) have been identified. The ICCI assessment is reported in **Chapter 19: Intra-project effects**.

12.12 Significance Conclusions

- 12.12.1 A summary of the results of the ground conditions assessment is provided in **Table 12.15**.

Table 12.15 Summary of significance of effects

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale	LPA ⁴ and Chapter section reference
Construction Phase					
Human health and controlled waters receptors from construction activities located outside of potential sources of contamination	Very high	No change	Negligible (not significant)	Contaminated material unlikely to be encountered where no potential sources identified. Embedded environmental measures included for managing unexpected contamination.	All LPAs Section 12.9
Human health and controlled waters receptors from construction activities located on potential sources of contamination	Very high	Negligible	Minor negative (not significant)	Increased likelihood of encountering contamination. Embedded environmental measures include ground investigation prior to construction to identify the nature and extent of potential contamination, appropriate remediation, where required, to ensure the land is suitable for the proposed use measures to control excavation of contaminated materials.	All LPAs Section 12.9
Property receptors from construction activities located outside of potential sources of contamination	Low	No change	Negligible (not significant)	Contaminated material unlikely to be encountered where no potential sources identified. Embedded environmental measures included for managing unexpected contamination.	All LPAs Section 12.9

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale	LPA ⁴ and Chapter section reference
Property receptors from construction activities located on potential sources of contamination	Low	Negligible	Negligible (not significant)	Increased likelihood of encountering contamination. Embedded environmental measures include ground investigation prior to construction to identify the nature and extent of potential contamination, appropriate remediation, where required, to ensure the land is suitable for the proposed use measures to control excavation of contaminated materials.	All LPAs Section 12.9
Human health and controlled waters receptors from physical construction activities	Very high	Negligible	Minor negative (not significant)	Embedded environmental measures for management of construction activities including storage of fuels, use on non-hazardous drilling fluids and development of pollution response plans.	All LPAs Section 12.9
Property receptors from physical construction activities	Low	Negligible	Negligible (not significant)	Embedded environmental measures for design in accordance with design standards and compliance with relevant legislation and guidance during construction.	All LPAs Section 12.9
Operational Phase					

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale	LPA ⁴ and Chapter section reference
Human health and controlled waters receptors from operational activities	Very high	No change	Negligible (not significant)	Land contamination risks managed during construction to make land suitable for use including preventing preferential pathway creation. Pipeline doesn't carry polluting substances and operational maintenance subject to embedded environmental controls to prevent pollution.	All LPAs Section 12.9
Property receptors from operational activities	Low	No change	Negligible (not significant)	Land contamination risks managed during construction to make land suitable for use including preventing preferential pathway creation. Pipeline doesn't carry polluting substances and operational maintenance subject to embedded environmental controls to prevent pollution.	All LPAs Section 12.9
Decommissioning Phase					
Human health and controlled waters receptors from decommissioning activities	Very high	No change	Negligible (not significant)	Pipeline left in-situ to minimise effects associated with removal. Decommissioning Plan developed incorporating environmental measures equivalent to those implemented during construction.	All LPAs Section 12.9

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale	LPA ⁴ and Chapter section reference
Property receptors from decommissioning activities	Low	No change	Negligible (not significant)	Pipeline left in-situ to minimise effects associated with removal. Decommissioning Plan developed incorporating environmental measures equivalent to those implemented during construction.	All LPAs Section 12.9

1. The sensitivity/importance/value of a receptor is defined using the criteria set out in **Section 12.9** and is defined as low, medium, high and very high.
2. The magnitude of change on a receptor resulting from activities relating to the Project is defined using the criteria set out in **Section 12.9** and is defined as no change, negligible, minor, moderate and major. The magnitude of change takes into account the implementation of the embedded environmental measures set out in **Table 12.7**.
3. The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (potentially significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in **Section 12.9**.
4. Local Planning Authority: Cheshire West and Chester Council (CWACC); Cheshire East Council (CEC); Halton Borough Council (HBC); Warrington Borough Council (WBC); St. Helens Borough Council (SHBC); Trafford Council (TC).

HyNet North West Hydrogen Pipeline

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