12. Ground Conditions

12.1 Introduction

12.1.1 This chapter presents the preliminary ground conditions assessment of the likely significant effects of the Project with respect to land contamination and geodiversity. The preliminary assessment is based on information obtained to date. It 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 5: Biodiversity**.
- **Chapter 7: Water Environment.**
- **Chapter 13: Agriculture and Soil Resources.**
- **Chapter 16: Major Accidents and Disasters.**

12.1.2 This chapter describes:

- the legislation, policy and technical guidance that has informed the assessment (**Section 12.2**).
- consultation and engagement that has been undertaken to date and how comments from consultees relating to ground conditions have been addressed (**Section 12.3**).
- a description of the study area (**Section 12.4**).
- the methods used for baseline data gathering (**Section 12.5**).
- overall and future baseline (**Section 12.6**).
- embedded environmental measures relevant ground conditions (**Section 12.7**).
- the scope of the assessment for ground conditions (**Section 12.8**).
- the methodology applied for the assessment (**Section 12.9**).
- the preliminary assessment of ground conditions effects (**Section 12.10**).
- a summary of the preliminary significance conclusions (**Section 12.12**).
- an outline of further work to be undertaken for the Environmental Statement (ES) (**Section 12.13**).

Limitations and assumptions

12.1.3 The information provided in this Preliminary Environmental Information Report (PEIR) is preliminary. The final assessment of likely significant effects will be reported in the ES. The PEIR 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.

12.1.4 At time of writing, the site walkover to obtain a visual record of ground conditions had not yet been undertaken. This is scheduled for summer 2022 following the initial review of the baseline data obtained as part of this PEIR and before completion of the ES.

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 1990[1]	Part 2 of the Act makes provision for the improved control of pollution arising from certain industrial and other processes. Part 2A of the 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 Local Authorities 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 1991[2] as amended by the Water Act 2003[3]	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 Act 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.

[1] UK Government (1990). Environmental Protection Act 1990, (online). Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents (Accessed December 2021).
[2] UK Government (1991). Water Resources Act 1991, (online). Available at: https://www.legislation.gov.uk/ukpga/1991/57/contents (Accessed December 2021).
[3] UK Government (2003). Water Act 2003, (online). Available at: https://www.legislation.gov.uk/ukpga/2003/37/contents (Accessed December 2021).

Legislation	Legislative context
European Union Groundwater Directive (2006/118/EC) 2006[4]	The aim of the Directive is to protect groundwater against pollution caused by dangerous substances. The Directive continues to have effect in England following the end of the Brexit Transition Period.
Environmental Damage (Prevention and Remediation) (England) Regulations 2015[5]	Regulations implementing 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 1974[6]	The Health and Safety at Work etc. Act and regulations made under the 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 2015[7]	The Construction (Design and Management) Regulations (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.

[4] UK Government (2006). Groundwater Directive 2006, (online) Available at: https://www.legislation.gov.uk/eudr/2006/118 (Accessed December 2021).
[5] UK Government (2015). Environmental Damage (Prevention and Remediation) (England) Regulations 2015, (online). Available at https://www.legislation.gov.uk/uksi/2015/810/contents (Accessed December 2021).
[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 December 2021)
[7] UK Government (2015). The Construction (Design and Management) Regulations 2015, (online), Available at https://www.legislation.gov.uk/uksi/2015/51/contents/made (Accessed December 2021)

Legislation	Legislative context
	They 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.
Cheshire Brine Pumping (Compensation for Subsidence) Act 1952	The Act 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 A summary of the relevant national and local planning policy is given in **Table 12.2**.

Table 12.2 Planning policy relevant to the ground conditions assessment

Policy	Policy context
National planning policy	

Policy	Policy context
Overarching National Policy Statement (NPS) for Energy (EN-1) 2011[8] **Draft NPS EN-1 2021**[9]	NPS EN-1 includes guidance on what matters are to be considered in the assessment of renewable energy projects including the potential effects in relation to geological conservation. With regard to paragraphs 5.3.3 of the 2011 NPS (now paragraph 5.4.3 of the draft 2021 NPS), the ES will need to demonstrate that effects on internationally, nationally, and locally designated sites of geological conservation importance have been identified. With regard to paragraph 5.10.8 of the 2011 NPS (now paragraph 5.11.8 of the draft 2021 NPS), where development occurs on previously developed land, the ES will need to demonstrate consideration of the risk posed by land contamination.
National Planning Policy Framework (NPPF) 2021[10]	120. Planning policies and decisions should "*give substantial weight to the value of using suitable brownfield land…and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land*". 183. Planning policies and decisions "*ensure that a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination.*"
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

[8] Department of Energy and Climate Change (2011), online. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf. Accessed June 2022
[9] Department for Business, Energy and Industrial Strategy (2021), online. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015233/en-1-draft-for-consultation.pdf. Accessed June 2022
[10] Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework, online. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf. Accessed June 2022

Policy	Policy context
	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

12.2.4 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 Land Statutory Guidance[11]	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
The Environment Agency (2020) 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	Provides guidance on defining the likelihood definitions used in the ground conditions assessment methodology described in **Section 12.7**

[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 December 2021).
[12] Environment Agency, (2020). Land contamination risk management (LCRM). (online) Available at: https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm (Accessed December 2021).

Technical guidance document	Context
Contamination Annex 4 (NHBC et al.) (2008)[13]:	
The Contaminated Land: Applications in Real Environments (CL:AIRE) (2010) Framework for Assessing the Sustainability of Soil and Groundwater Remediation[14]	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 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials[15]	Provides interpretation and guidance to all involved in the management of asbestos in both soils and construction and demolition arisings in accordance with the Control of Asbestos Regulations 2012.
BS10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice	The 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.

[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 December 2021).
[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 December 2021).
[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 December 2021).

Technical guidance document	Context
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 ongoing statutory and technical engagement. An overview of the approach to consultation is provided in **Section 3.4** of **Chapter 3: Approach to preparing the PEIR**.

Scoping Opinion

12.3.2 A Scoping Opinion was adopted by the Secretary of State, administered by the Planning Inspectorate, on 8 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 to date is presented in **Table 12.4**.

12.3.3 The information provided in the PEIR is preliminary and not all the Scoping Opinion comments have been addressed at this stage although all comments will be addressed within the ES.

Table 12.4 Summary of EIA Scoping Opinion responses for ground conditions

Consultee	Consideration	How addressed in this PEIR
Planning Inspectorate	The ES should confirm how the delivery of embedded measures is secured through the Code of Construction Practice (CoCP) 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 12.6** summarises how the delivery of embedded measures will be secured. Effects on construction/operation workers have been scoped out from this PEIR 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 12.6** the environmental measures included 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 CoCP to be submitted with the 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 design of the Project. However, information on brine subsidence will be

Consultee	Consideration	How addressed in this PEIR
		included in the ES Desk Study for completeness. 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**.
	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.	At the ES stage, it will not be possible to identify specific remediation that may be required (if any). However, 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 Land Contamination Risk Management is followed when identifying whether any remediation is required and how that remediation would be carried out during construction.
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 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.	Canals are considered as controlled waters receptors within the land contamination assessment (and therefore the conceptual model). 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**.
	Where the route passes within 250m of a canal or navigable waterway, the Trust should be provided	An initial phase of ground investigation is being undertaken in Summer 2022 to inform the project design, and in particular, the design of trenchless

Consultee	Consideration	How addressed in this PEIR
	with relevant geo-environmental and geotechnical reports for review.	crossings. Detailed geo-environmental assessments of specific waterway crossings will be developed post DCO consent and discussed with consultees prior to construction.
	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 will be included in the ES Desk Study for completeness. 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**.
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.	Noted. Requests for data have been made to Cheshire East Council and responses will be incorporated into the ES Desk Study.

Consultee	Consideration	How addressed in this PEIR
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. 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.	Noted – information on former industrial uses will be incorporated into the Desk Study.
	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.	As noted in **Table 12.6** 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 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 is being undertaken in Summer 2022 to inform the Project design, and in particular, the design of trenchless crossings. Accordingly, ground stability will be considered within the geotechnical design of the Project. However, information on brine subsidence will be included in the ES Desk Study for completeness. Potentially significant effects on land stability to other receptors as a result of the Project

Consultee	Consideration	How addressed in this PEIR
		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 Gowy 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 noted and these have been considered in the optioneering process when considering evolution and refinement of the project location. The environmental measures detailed in **Table 12.6** 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 is being undertaken in Summer 2022 to inform the project design and in particular, the design of trenchless crossings. Accordingly, ground stability will be considered within the geotechnical design of the Project.

Consultee	Consideration	How addressed in this PEIR
		However, information on coal mining will be included in the Desk Study for completeness.
St Helen's Borough Council	The Council's Contaminated Land Officer agrees with the proposed risk-based assessment methodology for land contamination. Request for Phase 1 report.	A copy of the Phase 1 Desk Study will be issued for feedback following the PEIR (as noted in **Section 12.13** on further engagement) and included with the ES.
Trafford Council	Existing or former use of the area within the scoping boundary means that some of the land may be contaminated. 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 *SES Guidance Notes for Horizontal Directional Drilling and other Trenchless Installations*. 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 is being undertaken in Summer 2022 to inform the project design, and in particular, the design of trenchless crossings. Accordingly, ground stability will be considered within the geotechnical design of the Project.
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 Land

Consultee	Consideration	How addressed in this PEIR
		Contamination Risk Management 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 will be incorporated into the Desk Study. A copy of the Phase 1 Desk Study will be issued for feedback following the PEIR (as noted in **Section 12.13** on further engagement) and included with the ES.

Technical engagement

12.3.4 At the time of writing technical engagement has not been carried out beyond requests to local authorities and Cheshire Brine Subsidence Compensation Board for data relating to Part 2A contaminated land sites, geodiversity sites and information on brine subsidence. This represents the initial phase of data gathering to inform the baseline Desk Study, following which further engagement will be carried out as detailed in **Section 12.13**.

Planned future engagement

12.3.5 As the project details progress further, it is intended to agree, where possible, the details of the baseline, including the Phase 1 Desk Study described in **Section 12.4** with the Environment Agency and Environmental Health Officers within the Local Planning Authorities.

12.3.6 Following receipt of comments on the PEIR, consultation will also be held as necessary to ensure that consultee comments are fully addressed and incorporated for the ES.

12.4 Study Area

12.4.1 The Study Area is located within the counties of Cheshire, Merseyside and Greater Manchester, England. The approximate centre of the Central Hub Hydrogen Above Ground Installation (HAGI) is located 3.3 km northwest of the town of Barnton at approximate grid reference 360050, 377850 (approximate post code WA4 4HB).

12.4.2 The Project comprises the construction, commissioning, operation, maintenance and future decommissioning of up to 125km of new pipeline to distribute hydrogen to industry and blending of the gas with the existing gas distribution network. The Pipeline would connect to a newly constructed Hydrogen Production Plant at the Vertex Stanlow site as the source of hydrogen for onward distribution to the network. It would continue to the Central Hub HAGI at the centre of the network, which serves as the connection and onward distribution point to customers along three corridors identified as South, East and North. A number of customers are linked into the West Corridor as well.

12.4.3 The Project Preliminary Order Limits (**Figure 1.1**) includes several component parts including the pipeline corridor sections, the spurs and the HAGIs (including the currently identified HAGI options), which are illustrated in **Figure 1.2** in. As the Project progresses the pipeline corridor sections will be narrowed down to approximately 100m wide linear features, which will include the selected pipeline corridor, temporary construction compounds and temporary construction access routes.

Spatial Scope

12.4.4 The spatial scope of the ground conditions assessment (as shown on **Figure 12.1**) is based on applying the following principles to give the wider of either:

- The Preliminary 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 Preliminary Order Limits along the pipeline corridors.
- A ZoI 500m from the Preliminary Order Limits around the outer extents of the permanent infrastructure (such as HAGIs).

12.4.5 The rationale for the ZoI used to define the Study Area is informed from 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

12.4.6 The temporal scope covers the period over which changes to the environment and the resultant effects are predicted to occur, and are typically defined as being either temporary or permanent:

- Permanent – these are effects that will remain even when the Project is complete, although these effects may be caused by environmental changes that are permanent or temporary.
- Temporary – these are effects that are related to environmental change associated with a particular activity and that will cease when that activity ceases.

12.4.7 The construction phase is anticipated to last for two years, commencing in late 2024/2025 with commissioning in 2027, the Project would be fully operational from late 2027 to early 2028. Construction of the HAGIs (the largest permanent above ground features of the Project) will take between six months and one year.

12.4.8 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 would be removed, and the land would be restored to its former use.

12.4.9 The temporal scope of the assessment of ground conditions is consistent with whole life cycle of the Project.

12.5 Data gathering methodology

Desk study

12.5.1 A summary of the organisations that have supplied data, together with the nature of that data is outlined in **Table 12.5**.

Table 12.5 Data sources used to inform the ground conditions assessment

Source	Date	Summary
Groundsure	Website accessed June 2022	Environmental and GIS data including information on geohazards, 1:10,000 and 1:50,000 historical mapping[16]
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 map[17]	Website accessed June 2022	Designated sites Aquifer designations and groundwater vulnerability Source Protection Zones Geological SSSIs information
British Geological Survey[18]	Website accessed June 2022	On-line Geoindex 1:50,000 digital geology Borehole Record Viewer (offers access to the National Geoscience Data Centre collection of onshore scanned

[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
[17] Defra (2022). Magic maps (online) Available at: www.magic.gov.uk (Accessed August 2022).
[18] British Geological Survey (2022). Geoindex onshore. (Online) Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html (Accessed August 2022).

Source	Date	Summary
		boreholes, shafts and well records) Minerals resource data
Environment Agency Catchment Data Explorer[19]	Website accessed June 2022	Water Framework Directive classification of surface water and groundwater bodies
Natural England[20]	Website accessed June 2022	Geological SSSI citations
Coal Authority Interactive Map Viewer[21]	Website accessed June 2022	Location of coal mining areas including areas likely to be affected by shallow mining and locations of mine entries/shafts.
Public Health England[22]	Website accessed June 2022	Indicative maps of radon risk.
Cheshire Brine Subsidence Compensation Board	Website accessed June 2022	Map shows the Cheshire Brine Subsidence Compensation District and Consultation Areas
Google Earth Pro	Imagery date April 2021 Accessed June 2022	Current and past aerial photography

Survey work

12.5.2 No surveys have been carried out to date. The findings of a walkover to inform the Desk Study will be included in the ES. This is scheduled for summer 2022 following the initial review of the baseline data obtained as part of this PEIR.

[19] Environment Agency (2022). Explore Catchment Data (online) Available at: https://environment.data.gov.uk/catchment-planning/ (Accessed June 2022).
[20] Natural England (2022). Designated Sites View (online) Available at: https://designatedsites.naturalengland.org.uk/ (Accessed June 2022).
[21] The Coal Authority (2022). Interactive Map (online). Available at: http://mapapps2.bgs.ac.uk/coalauthority/home.html (Accessed June 2022).
[22] UK Health Security Agency (2022). UK Maps of Radon (online) Available at: https://www.ukradon.org/information/ukmaps (Accessed June 2022).

Data limitations

12.5.3 The following limitations apply:

- This ground conditions assessment is based available factual data for the Study Area obtained only from the published sources highlighted in **Table 12.5**. The information provided may not be exhaustive but represents the key sources used to prepare this PEIR. Further sources of data will be considered and reviewed as the project progresses and included within the 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.
- A walkover survey has not yet been carried out to verify the published information consulted. This is scheduled for Summer 2022 and will be used to inform the ES.
- No intrusive investigation has been carried out. An initial phase of ground investigation is being undertaken in Summer 2022 to inform the project design and will be reviewed to inform the ground condition geological baseline in the ES.
- The ground conditions assessment is written in the context of legislation and guidance available in June 2022. New information, revised guidance and changes in legislation may necessitate a reinterpretation of the data assessed in part or in whole after submission.

12.6 Overall baseline

Current Baseline

History

12.6.1 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.

12.6.2 Principally, potentially contaminative land uses were identified along the North and West Corridors. Fewer instances were recorded along the East and South Corridors.

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

- Bone and charcoal works, chemical works, tube works, canal deposit tip and dredging disposal ground, unspecified industrial estate, gas pressure regulating systems and electricity substation near the Rocksavage HAGI and corridor section to the east;

- Quarries and various industrial works including alkali and salt works, chemical works, tanks and power stations in the Runcorn/Rocksavage spur;
- Gasworks, electricity generating station, sewage works, telephone exchange, unspecified works, and an oil refinery in the western end of the corridor section.

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

- Plate glass/ bottle works and copper works near the locations identified for the St Helens HAGI and spur, and collieries in the HAGI, spur and adjacent corridor section;
- Industrial works (ultramarine and smalts), nursery, collieries, sewage works and garage near the Clock Face HAGI and spur, and RAF Burtonwood adjacent to the corridor section to the south;
- Penketh Tannery, Fiddler's Ferry Power Station, sheep dip works and shipyard, lagoons, unspecified industrial works and household waste recycling centre in the southern part of the corridor section;
- Hydraulic installation, gasworks, timber yard, sewage works, saw mills, dredging deposit grounds, warehouses and depots near the locations identified for the Higher Walton HAGI options;
- Borate works, iron works, tanneries, hide yards, tube works, laundry and various unspecified works in the Higher Walton spur.

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

- Salt works, industrial estate, sanatorium, waterworks, timber yard, electricity substation, telephone exchange and sewage works near the locations identified for the Hydrogen Storage Facility HAGI and corridor section to the west;

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

- Gas works (including former gas-holder sites), petrochemical works, iron and steel works, sewage works and associated tanks and railway infrastructure near the location identified for the Partington HAGI, spur and corridor section.
- Pumping house, brick works, depot and historical railway line/station in the Warburton HAGI and corridor section to the west.

12.6.7 Additionally, potentially contaminative land uses were identified in the vicinity of the proposed location of the Central Hub HAGI options. These include brine and salt works, brick works, cistern works, unspecified industrial works, associated tanks and railway infrastructure.

Geology

12.6.8 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. The superficial geology is shown on **Figure 12.2.**

12.6.9 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.

12.6.10 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 will be prepared and included in the Desk Study to accompany the ES and effects associated with peat are addressed in **Chapter 13: Agriculture and Soil Resources**.

12.6.11 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. The bedrock geology is shown on **Figure 12.3**.

12.6.12 With reference to Magic Map and Natural England mapping, no Sites of Special Scientific Interest cited for their geology were identified within the Study Area.

12.6.13 No Regionally Important Geological Sites (RIGS) or Locally Important Geological Sites (LIGS) have been identified within the ZoI to date.

Landfill

12.6.14 Numerous historical and authorised landfills are present within the Study Area, particularly in the North Corridor and West Corridor, along the River Mersey. Historical and authorised landfills in the Study Area are shown on **Figure 12.4**.

Coal Mining and Brine Extraction

12.6.15 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.

12.6.16 Coal Authority mapping shows that much of the Study Area to the north of the River Mersey, i.e. North Corridor, Clock Face HAGI and St Helens HAGI lie within a Coal Mining Reporting Area. There are several Development High Risk Areas associated with past or probable shallow mining within the North Corridor to the north of the M62 and within the area identified for the St Helens HAGI. There are several mine entries in the vicinity.

12.6.17 The northernmost part of the North Corridor and St Helens HAGI impinge on an area mapped by the Coal Authority as being subject to surface mining (past and current).

12.6.18 The North Corridor to the north of the M62 lies within a surface coal resource area.

Hydrogeology

12.6.19 The Environment Agency classifies the superficial deposits in the Study Area as Secondary A and Secondary (Undifferentiated) Aquifers. The Secondary A Aquifers correspond to areas of till while the Secondary A Aquifers correspond to glacio-fluvial deposits, river terrace deposits and blown sand. The bedrock is classified as a Principal Aquifer in the northern part of the Study Area (sandstone) and as a Secondary B Aquifer (mudstone) in the southern part of the Study Area. The Pennine Coal Measures rocks in the extreme north are classified as a Secondary A aquifer.

12.6.20 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.

12.6.21 Parts of the North Corridor pass through groundwater Source Protection Zones (SPZs). There are several drinking water abstractions indicated to be present in the Study Area the locations of which are surrounded by associated groundwater Source Protection Zones (SPZs). Much of the Study Area lies within a Nitrate Vulnerable Zone (NVZ). The locations of groundwater abstractions and SPZs are shown on **Figure 12.5.**

Ground Gas

12.6.22 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.

Radon

12.6.23 Parts of the northern part of the Study Area are located within a radon affected areas (1 – 3% radon potential).

Future baseline

12.6.24 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.

12.6.25 With respect to management of land contamination, the relevant requirements are identified under Part 2A of the Environmental Protection Act[23] and, for other future developments, the Town and Country Planning Act 1990[24]. Part 2A of the Environmental Protection Act requires local authorities to identify potentially contaminated land in their area and ensure potential risks from historical contamination are assessed and mitigated accordingly.

12.6.26 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.

12.6.27 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.

12.7 Embedded environmental measures

12.7.1 As part of the project design process, several embedded environmental measures are proposed to reduce the potential for impacts on ground conditions. **Table 12.6** outlines the embedded measures that will influence the ground conditions assessment.

Table 12.6 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, LIGS, RIGS, areas of historic landfill and other known areas of potential contamination.	Development Consent Order (DCO) works plans and order limits
Potential risks to human health from any unexpected ground contamination will be avoided by adopting appropriate working practices and using Personal Protective Equipment (PPE).	Code of Construction Practice (CoCP) secured via DCO requirement
Unexpected contamination, if found, will be subject to appropriate risk assessment and if necessary, either removed, treated and/or mitigated as part of the Project.	CoCP secured via DCO requirement

[23] UK Government (1990). Environmental Protection Act 1990. (online) Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents (Accessed December 2021).
[24] UK Government (1990). Town and Country Planning Act 1990. (online). Available at https://www.legislation.gov.uk/ukpga/1990/8/contents (Accessed December 2021).

Environmental measure	How the environmental measures will be secured
All aspects of the construction work will be in accordance with the Construction (Design and Management) Regulations 2015.	CoCP and DCO and UK legislative requirement
A CoCP would be produced prior to commencement of construction which would detail measures to be implemented (via a Construction Environmental Management Plan (CEMP)) 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.	CoCP 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 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.	CoCP secured via DCO requirement
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, that where necessary, risk-based remediation is undertaken in line with Environment Agency (2020) guidance (Land Contamination: Risk Management (LCRM). The precise design of any remediation strategy will be confirmed in the detailed design after consent has been granted.	DCO and UK legislative requirement
Prior to construction, an unexpected contamination protocol will be developed in accordance 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 adoption of best practice methods during construction and use of PPE.	CoCP secured via DCO 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	CoCP secured via DCO requirement

Environmental measure	How the environmental measures will be secured
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).	
If water being pumped from excavations is suspected to be contaminated, appropriate measures will be taken in accordance with Environment Agency guidance and the Environmental Permitting Regulations, to prevent uncontrolled or unauthorised releases of this water to ground or to the water environment.	CoCP secured via DCO requirement
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.	CoCP 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.	CoCP 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.	CoCP 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.	CoCP secured via DCO requirement

Environmental measure	How the environmental measures will be secured
Drilling fluids used during Horizontal Directional Drilling (HDD) will not be classified as environmentally hazardous or contain hazardous substances.	CoCP secured via DCO requirement

12.8 Scope of the assessment

Maximum design scenario

12.8.1 Assessing the use of a parameter-based design envelope approach means that the assessment considers a maximum design, or reasonable worst case, scenario whilst allowing the flexibility to make improvements in the future in ways that cannot be predicted at the time of submission of the DCO Application. The assessment of the worst-case scenario for each receptor establishes the maximum potential adverse impact and as a result impacts of greater adverse significance would not arise should any other development scenario (as described in **Chapter 2: The Project**) to that assessed within this chapter be taken forward in the final design of the Project.

12.8.2 The maximum assessment assumptions that have been identified to be relevant to ground conditions are outlined in **Table 12.7** below.

Table 12.7 Maximum assessment assumptions for impacts on ground conditions

Project phase and activity/impact	Maximum assessment assumptions	Justification
Construction activities	Construction compounds within the Preliminary Order Limits adjacent to HAGI sites. Pipeline corridor with a working construction width of between 22m and 36m. Single pipeline trench of varied depth and width but with a minimum reinstated cover of 1.2m to the top of the pipeline.	Construction corridor and potential temporary construction compounds represent the areas where construction works may result in ground condition effects, for example from spills or leaks from construction equipment, and provides for worst-case assessment to allow for micro siting within the Preliminary Order Limits. The design assumptions for construction activities such as volumes of potentially contaminating substances and frequency of refuelling activities are reasonable maximum assumptions from

Project phase and activity/impact	Maximum assessment assumptions	Justification
		which to assess the risk of soil or groundwater contamination
Operation and Maintenance	All pipeline elements will be below ground outside of the HAGI/Block Valve locations Ten HAGIs are proposed, each up to 2.0ha in area, giving a maximum total area of 20.0ha for the HAGI development area. Two Block Valves are proposed, each up to 0.5ha in area, giving a maximum total area of 1.0ha for the Block Valves development area. The total area of development which is effectively permanent is therefore approximately 21.0ha.	This area represents the permanent infrastructure that could result in ground condition effects during operation and maintenance, for example, from potential contamination due to spills or leaks from operational equipment or maintenance works.
Decommissioning	Pipeline left in-situ, sealed and buried. HAGIs/Block Valves fully decommissioned and returned to baseline conditions with assumptions as per construction phase	A Decommissioning Plan will be developed at the appropriate time, as secured through the DCO. The detail and scope of the decommissioning will be determined by the relevant legislation and guidance at the time. For the decommissioning phase the onsite disassembly of equipment and demolition of structures would have greatest potential for soil or groundwater contamination due to spills, leaks and waste generated. Given that the decommissioning phase will therefore primarily be focused on just the HAGIs/Block Valves, the potential ground

Project phase and activity/impact	Maximum assessment assumptions	Justification
		conditions impacts are likely to be less than those during the wider construction phase which considers broadly similar activities taking place. As such, for the purposes of a maximum design scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.

Potential receptors

12.8.3 The ground conditions receptors that have been identified as being potentially subject to effects are summarised in **Table 12.8**.

Table 12.8 Receptors requiring assessment for ground conditions

Receptor	Receptors included within group
Human Health	Occupiers of residential properties. Occupiers of commercial/industrial properties. Users of Public Open Space.
Property	Land and property (including land used for allotments, agriculture (crops and livestock), existing and future structures, utilities and infrastructure).
Controlled Waters	Groundwater resources in superficial deposits. Groundwater resources in bedrock. Surface waters (for example, reservoirs, streams, rivers, canals, lakes and ponds). Groundwater and surface water abstractions.

Likely significant effects

12.8.4 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 and likely significant effects

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.
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 the Project resulting in property damage (e.g. explosion of ground gases).
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 landfill leachate, which, if not properly managed, could impact upon the quality of controlled waters.

Elements scoped out of further assessment

12.8.5 The receptors/effects detailed in **Table 12.10** have been scoped out from being subject to further 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 ZoI.
Human Health (Construction/Operation Workers)	As agreed with PINS in the Scoping Opinion, taking into account compliance with legal requirements (CDM Regulations and Health and Safety at Work etc. 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.

12.9 Methodology for PEIR assessment

Introduction

12.9.1 The project-wide generic approach to assessment is set out in **Chapter 3: Approach to Preparing the PEIR**.

12.9.2 The assessment methodology for ground conditions for the PEIR is consistent with that provided in in the Scoping Report and no changes to the methodology have been made since the scoping phase.

12.9.3 The assessment and management of ground conditions is usually based on the risk presented by the presence of a hazard (for example, contamination) for a given circumstance, i.e. the probability and consequence of an event occurring. However, EIA seeks to identify the magnitude of a change in status from baseline (impact) caused by the Project and the consequences of those changes (effects).

12.9.4 Consequently, for the ground conditions assessment, the impact and its effect have been defined as a change in risk and the magnitude of the change in risk from baseline, through construction to post-development conditions.

Risk Assessment – Ground Conditions

12.9.5 The process of managing land contamination, as set out in the Environment Agency (2020) guidance LCRM, is based on risk assessment. The assessment of risks from contaminated land is based upon the identification and subsequent assessment of a contaminant linkage. A contaminant linkage requires the presence of:

- a source of contamination;
- a receptor capable of being adversely affected by the contamination; and
- an active pathway capable of exposing a receptor to the contaminant.

12.9.6 The risk assessment aims to assess the significance of each potential contaminant linkage. The key to the classification is that the designation of risk is based upon the consideration of both of the following:

- the magnitude of the potential consequence (severity). It takes into account both the potential severity of the hazard and the sensitivity of the receptor (**Table 12.11**)
- the magnitude of probability (likelihood). It takes into account both the presence of the hazard and receptor and the integrity of the pathway (**Table 12.12**).

12.9.7 The definitions for the qualitative risk assessment have been taken from *Guidance for the Safe Development of Housing on Land Affected by Contamination Annex 4* (NHBC et al., 2008) (**Table 12.13**).

Table 12.11 Classification of consequence

Classification	Human Health	Controlled Water	Geodiversity	Property/ Structures/ Crops and animals	Notes/Examples
Severe	Highly elevated concentration is likely to result in "significant harm" to human health as defined by the Environmental Protection Act (EPA) 1990, Part 2A, if exposure occurs.	Equivalent to Environment Agency Category 1 pollution incident[25] including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce.	Major damage to a geodiversity site, which is likely to result in a substantial adverse change in its functioning or harm to a site of special interest that endangers the long-term maintenance of the site.	Catastrophic damage to crops, buildings or property.	Significant harm to humans is defined in the Contaminated Land Statutory Guidance as death, life threatening diseases (for example, cancers), other diseases likely to have serious impacts on health, serious injury, birth defects, and impairment of reproductive functions. Major fish kill in surface water from large spillage of contaminants from site. Highly elevated concentrations of hazardous or priority substances present in groundwater close to small potable abstraction (high sensitivity). Explosion, causing building collapse (can also equate to

[25] Environment Agency (2017). Available at: https://www.ofwat.gov.uk/wp-content/uploads/2017/12/20171129-Incidents-and-their-classification-the-Common-Incident-Classification-Scheme-CICS-23.09.16.pdf (Accessed December 2021).

Classification	Human Health	Controlled Water	Geodiversity	Property/ Structures/ Crops and animals	Notes/Examples
					immediate human health risk if buildings are occupied).
Medium	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs.	Equivalent to Environment Agency Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce.	Significant damage to a geodiversity site, which may result in a substantial adverse change in its functioning or harm to a site of special interest that may endanger the long-term maintenance of the site.	Significant damage to crops, buildings or property.	Exposure could lead to acute or chronic health effects which are significant as defined in the Contaminated Land Statutory Guidance. Damage to building rendering it unsafe to occupy, for example, foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes.
Mild	Exposure to human health unlikely to lead to "significant harm".	Equivalent to Environment Agency Category 3 pollution incident including minimal or short-lived effect on water quality; marginal effect on amenity value, agriculture or commerce.	Minor or short-lived damage to a geodiversity site, which is unlikely to result in a substantial adverse change in its functioning or harm to a site of special interest that would	Minor damage to crops, buildings or property.	Exposure could lead to slight short-term effects (for example, mild skin rash). Surface spalling of concrete.

Classification	Human Health	Controlled Water	Geodiversity	Property/ Structures/ Crops and animals	Notes/Examples
			endanger the long-term maintenance of the site.		
Minor	No measurable effects on humans.	Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.	Equivalent to insubstantial pollution incident with no observed effect on a geodiversity site or site of special interest.	Repairable effects of damage to buildings, structures.	The loss of plants in a landscaping scheme. Discoloration of concrete.

12.9.8 The likelihood classifications for the contaminant linkages being realised is presented in **Table 12.12.**

Table 12.12 Likelihood classification of contaminant linkage being realised

Classification	Definition	Examples
High Likelihood	There is a contaminant linkage and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution	a) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m of ground where direct contact is possible. b) Ground/groundwater contamination could be present from chemical works, containing a number of Underground Storage Tanks (USTs).
Likely	There is a contaminant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.	a) Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m where direct contact is possible, or the top 0.5m of ground where direct contact is not possible. b) Ground/groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.
Low Likelihood	There is a contaminant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place and is less likely in the shorter term.	a) Elevated concentrations of toxic contaminants are present in soils at depths >1m where direct contact is possible, or 0.5-1.0m of ground where direct contact is not possible. b) Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.
Unlikely	There is a contaminant linkage, but circumstances are such that it is improbable that an event	a) Elevated concentrations of toxic contaminants are present below hardstanding.

Classification	Definition	Examples
	would occur even in the very long-term.	b) Light industrial unit <10 years old containing a double skinned UST with annual integrity testing results available.

12.9.9 The risk matrix which links the likelihood and consequence with respect to the EIA for the Project is shown in **Table 12.13**.

Table 12.13 Risk matrix

Likelihood / Potential Consequence	Unlikely	Low	Likely	High
Severe	Moderate/Low Risk	Moderate Risk	High Risk	Very High Risk
Medium	Low Risk	Moderate/Low Risk	Moderate Risk	High Risk
Mild	Very Low Risk	Low Risk	Moderate/Low Risk	Moderate Risk
Minor	Very Low Risk	Very Low Risk	Low Risk	Low Risk

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

Table 12.14 Risk definitions

Risk	Definition
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action or there is evidence that severe harm to a designated receptor is already occurring. Realisation of that risk is likely to present a substantial liability to the site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term.
High	Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action. Realisation of the risk is likely to present a substantial liability to the site owner or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short-term and are likely over the longer term.

Risk	Definition
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that the harm would be relatively mild. Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner or occupier. Some remediation works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst that this harm if realised would normally be mild. It is unlikely that the site owner or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.
Very Low	It is a low possibility that harm could arise to a designated receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.

Table 12.15 Ground conditions significance evaluation matrix

			Risk Post-development (including embedded environmental measures)					
			Very Low	**Low**	**Moderate / Low**	**Moderate**	**High**	**Very High**
Risk Pre-development	**Existing Receptors**	**Very High**	Major Positive (Significant)	Major Positive (Significant)	Moderate Positive (Potentially Significant)	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)
		High	Major Positive (Significant)	Moderate Positive (Potentially Significant)	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)
		Moderate	Moderate Positive (Potentially Significant)	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)
		Moderate / Low	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)
		Low	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)	Major Negative (Significant)
		Very Low	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)	Major Negative (Significant)	Major Negative (Significant)

			Risk Post-development (including embedded environmental measures)					
			Very Low	**Low**	**Moderate / Low**	**Moderate**	**High**	**Very High**
	No Receptor Present	**N/A**	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)	Major Negative (Significant)	Major Negative (Significant)	Major Negative (Significant)
	Risks that remain at moderate, high or very high post-development are unlikely to be considered acceptable and further environmental measures will be required to enable the development to proceed.							

Significance evaluation methodology

12.9.11 The evaluation of the significance of effects will be based on the change in risk from baseline conditions to those following construction and operation of the Project

12.9.12 In order to define the baseline risk the initial assessment and classification of risk is carried out for the Study Area in its pre-development state. A separate assessment of risk is then conducted for the site post-development (including environmental measures inherently embedded in the development) to enable an evaluation of the change in risk due to the Project.

12.9.13 **Table 12.15** uses the risk classification pre- and post-development as the basis for the significance evaluation matrix that will be used in the EIA.

12.10 Preliminary assessment of ground conditions effects

Construction phase

12.10.1 The baseline assessment identified that within the Preliminary Order Limits there were two principal categories of land which could be identified:

- 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.

12.10.2 Much of the Study Area and its immediate surrounding 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 and the consequences mild (in the case of controlled waters and human health receptors) or severe (in the case of property receptors). Therefore, there would be no change from the current baseline risk and the effect would be **negligible**, which is **Not Significant** in EIA terms.

12.10.3 In the case of the latter category, the primary areas of potentially contaminative land uses were identified around the major towns of Warrington, Runcorn, St. Helens, Ellesmere Port, Stanlow, Northwich and Partington.

12.10.4 For human health receptors, the baseline likelihood is assessed as unlikely and the worst-case outcome as severe which represents a moderate/low risk. In the case of controlled waters, the worst-case outcome is considered to be medium with a baseline likelihood of likely which represents a moderate risk. For property receptors, the baseline likelihood is low with a worst-case outcome of severe which represents a moderate risk.

12.10.5 The embedded environmental measures in **Table 12.6** include control measures for encountering unexpected contamination and for management of potentially contaminated soils excavated during trenching to prevent generation of dusts and leaching of contamination and migration of ground gases. This would include consideration of amendments to the design of the pipeline corridor, for example through installation of impermeable linings, should ground gas or contamination leachate be identified during construction.

12.10.6 Consequently, whilst the likelihood of encountering contamination in these areas during construction increases, for human health and controlled waters receptors they only do so by one order of likelihood (that is to a low likelihood in the case of human health receptors and to a high likelihood in the case of controlled waters). Therefore, the risks to controlled waters, human health receptors and property from the Project passing through potential sources of contamination during construction are considered to be moderate and the effect is **minor negative,** which is **Not Significant** in EIA terms.

12.10.7 For property receptors, the likelihood of the Project being inappropriately designed or creating a preferential pathway for ground gas migration to human health and property receptors is considered to remain low. Accordingly, the risk would be moderate and, therefore, the effect is **negligible,** which is **Not Significant** in EIA terms.

12.10.8 It is noted that there remains optionality in respect of the Western, Northern and Southern corridors and HAGI/Block Valve locations in some parts of the Project, as described in **Chapter 2**. However, in the context of the ground conditions assessment the choice of pipeline corridor option or HAGI/Block Valve location would not alter the conclusions of the preliminary assessment, given that the embedded environmental measures would still be adopted, and the preliminary assessment already considers a worst-case effect in which contamination is encountered during construction requiring mitigation to be undertaken (for example removal of contamination).

Operational phase

12.10.9 During the operational phase, potential risks associated with ground conditions will have already been controlled by ensuring that the ground conditions within the Project are suitable for the proposed use as part of the construction phase in line with LCRM. 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.

12.10.10 The pipeline network is being built to carry hydrogen. Consequently, there is unlikely to be a risk of pollution of soil and/or groundwater should there be a leak during the operational phase.

12.10.11 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 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 and storage of associated fuels/liquids.

12.10.12 Accordingly, the potential for land contamination risk to increase from the baseline during the operation and maintenance phase from inappropriate reuse of materials generating a build-up of ground gas or landfill leachate or from aggressive ground conditions is not likely. On this basis, the effects of the Project on controlled waters and human health receptors during the operation and maintenance phase are considered to be **negligible,** which is **Not Significant** in EIA terms.

Decommissioning phase

12.10.13 Onsite disassembly of equipment and demolition of structures would have greatest potential for soil or groundwater contamination due to spills, leaks and waste generated.

12.10.14 It is anticipated that the pipeline will be left in-situ with ends cut, sealed, and buried to minimise effects associated with removal.

12.10.15 The detail and scope of the decommissioning for the remaining permanent infrastructure (HAGIs and Block Valves) will be determined by the relevant legislation and guidance at the time.

12.10.16 As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase on land outside of contamination sources are expected for the decommissioning phase.

12.10.17 Accordingly, the effects during decommissioning are considered, at worse to be **negligible,** which is **Not Significant** in EIA terms.

12.11 Preliminary significance conclusions

12.11.1 A summary of the results of the preliminary ground conditions assessment is provided in **Table 12.16**.

Table 12.16 Preliminary summary of significance of effects

Receptor	Baseline Assessment			Assessment with the Project			Change in Risk (Significance)
	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	
Construction[26]							
Human health and controlled waters receptors from construction activities located outside of potential sources of contamination	Unlikely	Minor/Mild	Very low	Unlikely	Minor/Mild	Very low	Negligible (Not Significant)
Human health and controlled waters receptors from construction activities located on potential sources of contamination	Likely	Medium	Moderate	High	Medium	High	Minor Negative (Not significant)
Property receptors from construction activities located outside of potential sources of contamination	Unlikely	Severe	Moderate /Low	Unlikely	Severe	Moderate/ Low	Negligible (Not Significant)

[26] Based on the findings of the assessment presented in **Section 12.10**, the construction effects have been split in this table to separately summarise the assessment of effects from where the Project passes through potential sources of contamination to those from outside of potential sources of contamination.

Receptor	Baseline Assessment			Assessment with the Project			Change in Risk (Significance)
	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	
Property receptors from construction activities located on potential sources of contamination	Low	Severe	Moderate	Low	Severe	Moderate/ Low	Negligible (Not Significant)
Operation and maintenance[27]							
Human health and controlled waters receptors	Unlikely	Minor/Mild	Very Low	Unlikely	Minor/Mild	Very low	Negligible (Not Significant)
Property receptors	Unlikely	Minor/Mild	Very Low	Unlikely	Minor/Mild	Very low	Negligible (Not Significant)
Decommissioning[25]							
Human health and controlled waters receptors	Unlikely	Minor/Mild	Very low	Unlikely	Minor/Mild	Very low	Negligible (Not Significant)

[27] Based on the findings of the assessment presented in **Section 12.10**, the operation and maintenance and decommissioning effects are presented as a single assessment as it has been assumed that contamination, if encountered, will have been managed in line with LCRM during the construction phase.

Receptor	Baseline Assessment			Assessment with the Project			Change in Risk (Significance)
	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	
Property receptors	Unlikely	Severe	Moderate /Low	Unlikely	Severe	Moderate/ Low	Negligible (Not Significant)

12.12 Further work to be undertaken

12.12.1 The information provided in this PEIR is preliminary, the final assessment of likely significant effects will be reported in the ES. This section describes the further work to be undertaken to support the ground conditions assessment presented in the ES.

Baseline

12.12.2 A site walkover of the key areas of potential contamination will be undertaken to refine the ground conditions desk study. This includes incorporation of any information provided by the Cheshire Brine Subsidence Board in relation to brine extraction.

12.12.3 The ground conditions desk study will be finalised using the information from the site walkover and, following this PEIR, issued to consultees for feedback. The final desk study will be reported in the ES having been updated to reflect the final Project design to be taken forward for DCO submission and feedback from consultees.

12.12.4 An initial phase of ground investigation is being undertaken in Summer 2022 to inform the Project design and will be reviewed to inform the ground conditions geological baseline in the desk study.

Assessment

12.12.5 The preliminary assessment presented in this PEIR will be refined to reflect the final Project design to be taken forward for the ES and any updates to the desk study and baseline information.

12.12.6 A cumulative effects assessment (CEA) will be 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 **Section 3.9** of **Chapter 3: Approach to Preparing the PEIR.**

12.12.7 For ground conditions, a Zone of Influence (ZoI) will be applied for the CEA to ensure direct and indirect cumulative effects can be appropriately identified and assessed. Based on professional judgement, the maximum extent of the ZoI used to determine ground conditions effects from the Project alone is 500m (see **Section 12.4**). The ZoI for the ground conditions CEA will therefore be defined as an area 1km from the Order Limits. The larger CEA ZoI accounts for shared receptors which could experience an effect from both the Project and 'other developments' when considering the maximum extent of the ZoI used to determine ground condition effects from the Project alone (i.e. a receptor located 500m from the Project which in turn is 500m from the 'other development').

12.12.8 A long list and proposed short list of other developments that may interact with the Project ZoI during their construction, operation or decommissioning is presented in **Appendix 3B**. Only those developments currently identified in the long list that fall within the ground conditions ZoI have the potential to result in cumulative effects

with the Project either through introduction of a new contaminative source or sensitive receptor or through a combined impact on the same receptor. Therefore, all developments falling outside the ground conditions ZoI will be excluded from the CEA for ground conditions.

12.12.9 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 and risks of damage to geodiversity sites have been appropriately managed.

12.12.10 Planning policy takes into account how new development could affect existing developments by the potential mobilisation of contamination. Existing developments that may be affected by contamination with the potential to affect nearby developments fall within the remit of other regulatory regimes, e.g. Part 2A of the Environmental Protection Act or the Environmental Permitting (England and Wales) Regulations 2016.

12.12.11 The majority of 'other developments' will, therefore, have been approved, (or it has been assumed that they will be approved in line with UK legislation and planning policy), 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.

12.12.12 On this basis, it is considered that successful implementation of such conditions and any embedded and standard good industry practice measures would offset any potential significant effects identified as part of other developments. This will however be considered further in the ES.

Environmental measures

12.12.13 Environmental measures relating to ground conditions will be refined in line with feedback from consultees, further survey work and the final Project design and included in the ES.

Consultation and Engagement

12.12.14 Further consultation and engagement that will be undertaken to inform the ground conditions assessment and presented within the ES. This will include:

- Issue of desk study to seek agreement on ground conditions baseline.
- Review of feedback on PEIR assessment of effects with consultees.
- Review of feedback on environmental measures with consultees.

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