Cambois Connection Onshore Scheme

Environmental Statement Volume 2

Chapter 10 Geology and Soils

sse Renewables

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Basis of Report

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Acronyms

Acronym	Description
ALC	Agricultural Land Classification
aOD	above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
BGS	British Geological Survey
CEA	Cumulative Effects Assessment
CEMP	Construction Environmental Management Plan
CMRA	Coal Mining Risk Assessment
COC	Contaminants of Concern
DEFRA	Department for Environment Food and Rural Affairs
DTM	Digital Terrain Model
EA	Environment Agency
EIA	Environmental Impact Assessment
ES	Environmental Statement
GCR	Geological Conservation Review
HDD	Horizontal Directional Drilling
HVDC	High Voltage Direct Current
HVAC	High Voltage Alternating Current
IEMA	Institute of Environmental Management and Assessment
Km	Kilometre
LoGS	Local Geological Sites
m	Metre
Ma	Million years ago
MAGIC	Multi-Agency Geographic Information for the Countryside
MLWS	Mean Low Water Springs
MSA	Mineral Safeguarding Area
NCC	Northumberland County Council
NPPF	National Policy Planning Framework
NTS	Non Technical Summary

Acronym	Description
OS	Ordinance Survey
PERA	Preliminary Environmental Risk Assessment
PFA	Pulverised Fuel Ash
PCB	polychlorinated biphenyls
PDE	Project Design Envelope
RIGS	Regionally Important Geological Sites
SAC	Special Area of Conservation
SHLAA	Strategic Housing Land Availability Assessment
SLA	Special Landscape Area
SMP	Soil Management Plan
SPA	Special Protection Area
SMI	Safeguarded Minerals Infrastructure
SSSI	Special Site of Scientific Interest
SWMP	Site Waste Management Plan
UNESCO	United Nations Educational, Scientific and Cultural Organization
UXO	Unexploded Ordnance

10. Geology and Soils

10.1. Introduction

1. This Chapter presents the assessment of the likely significant effects (as per the 'Environmental Impact Assessment (EIA) Regulations'[1]) on the environment arising from the Cambois Connection Onshore Scheme on geology and soils. Specifically, this Chapter considers the potential impact of the Onshore Scheme landward of Mean Low Water Springs (MLWS) for a defined geology and soils study area ('the Study Area') during the construction, operation and maintenance, and decommissioning phases.

2. This Chapter also assesses the likely significant effects of the Onshore Scheme on onshore receptors (landward of MLWS) during the construction, operation and maintenance, and decommissioning phases.

3. This assessment is informed by the following technical appendices:

    - Technical Appendix 10.1: Preliminary Environmental Assessment (PERA); and
    - Technical Appendix 10.2: Coal Mining Risk Assessment (CMRA).

10.2. Purpose of this Chapter

4. This Chapter:

    - Presents the existing environmental baseline established from desk studies, site-specific surveys and feedback obtained during technical engagement with stakeholders;
    - Identifies any assumptions and limitations encountered in compiling the environmental information;
    - Presents the potential environmental impacts on geology and soil receptors arising from the Onshore Scheme, and reaches a conclusion on the likely significant effects based on the information gathered and the analysis and assessments undertaken; and
    - Highlights any necessary monitoring and/or mitigation measures recommended to prevent, minimise, reduce or offset the likely significant adverse environmental effects of the Onshore Scheme on geological and soil receptors.

10.3. Study Area

5. The Onshore Scheme is located at Cambois, Blyth, south of the River Wansbeck and north of the River Blyth and encompasses around 188 ha of land.

6. The red line boundary for this area (hereafter referred to as 'the Site') is shown on Figure 1.2 and the Indicative Zones of Infrastructure are shown on Figure 5.1 (Volume 4).

[1] For the Onshore Scheme, these are Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended). For the Marine Scheme, this includes: The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2007 (as amended), The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, and The Marine Works (EIA) Regulations 2017.

7. The Site is located immediately north of the River Blyth Estuary along an area of open shoreline associated with the North Sea. Sleek Burn is present along the south-western boundary discharging into the Blyth Estuary.

8. The Site comprises of predominantly greenfield grassland and woodland with areas Site boundary overlapping into the estuarine areas of Sleek Burn. A large part of the Site includes former British Volt battery plant site land which is partially developed, comprising of large hardstanding areas and associated drainage arrangements. The Site boundary also encompasses the existing marina on the River Blyth and development to the south of Brock Lane: the Phase 1 Development of Northumberland Energy Park.

9. Topographic data of the Study Area suggests that overall slope falls towards the south towards Sleek Burn and River Blyth and east towards the North Sea. The highest land within the Study Area is however found within a bund bound by the Maw Burn in the north-east of the Site, elevated to 22.5 m above Ordnance Datum (aOD). Ground levels in the north-west of the Study Area fall from 14.8 m aOD to -2.2 m aOD around the Blyth Marina in the south-east. Ground levels also fall to -1 m aOD on the mapped area of tidal mud flats associated with the Sleek Burn at the estuary.

10. The Study Area encompasses all of the land being considered within the Site boundary, including the Blyth National Grid connection point, plus a 250 m buffer. The boundary for the Study Area is shown on Figure 10.1 (Volume 4).

11. The 250 m buffer was chosen as construction includes relatively shallow excavations for the onshore export cable, with no disturbance outside the onshore export cable and reinstatement of current land use following construction. It is considered beyond these distances geographic separation between development and the receptor results in the absence of an effect to geology and soils.

12. For agricultural land classification (ALC) and soils, the Study Area encompasses all of the land being considered within the Site boundary. The rationale for this is that agricultural land quality is impacted by the direct deterioration and loss of the resource itself. This predominately occurs by direct actions on soil quality via construction related activities.

10.3.1. Intertidal Area

13. The geology and soils Study Area for the Onshore Scheme includes the intertidal area. This intertidal area overlaps with the Marine Scheme topic of Physical Environment and Seabed Conditions (Volume 2, Chapter 7 of the Marine ES). An overall summary of likely significant effects associated with the intertidal area is also provided within the Non-Technical Summary (NTS) for both the Onshore Scheme and Marine Scheme. This Chapter addresses any potential impacts on the geological and soil receptors arising from the Onshore Scheme (including where those impacts arise in the intertidal area). Chapter 7 and Appendix 3.5 of the Marine Scheme address potential impacts on the beach and intertidal physical environment and seabed conditions features arising from the Marine Scheme.

14. As detailed within this document, the Applicant's commitment to trenchless technology at the Landfall means that there is no potential for any direct interaction with the intertidal area for both the Marine Scheme and Onshore Scheme. The trenchless technology ducts will pass beneath the intertidal area from a point at least 250 m seawards of MLWS to a location onshore landwards of the dune system, and there is no above ground infrastructure located within the intertidal area, thereby limiting the likelihood of significant effects on geological and soil receptors in the intertidal area.

10.4. Policy and Legislative Context

15. Policy and legislation in relation to geology and soils, is set out in detail in Volume 3, Chapter 2 of this ES. A summary of the policy and legislative provisions relevant to geology and soils are provided in Table 10-1 and Table 10-2.

Table 10-1 Summary of policy relevant to Geology and Soils

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
The Overarching National Policy Statement for Energy (EN-1)[2,3]	Paragraph 5.4.3: *'Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of… geological conservation importance'.* The Draft Overarching National Policy Statement for Energy (EN-1) (Department for Energy Security & Net Zero, DESNZ 2023) Paragraph 5.4.19 states 'The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests'	The existing environment is discussed in section 10.7.1. A review of geologically designated sites has been undertaken as part of the preparation of this Chapter. The review identified that there were not any nationally or locally geological designated sites located within the Onshore Scheme or the 250 m buffer zone.
	Paragraph 5.3.4: '*The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.'* The Draft Overarching National Policy Statement for Energy (EN-1) (DESNZ, 2023) paragraph 5.4.21 expands on this further by referencing Biodiversity Net Gain and how the applicant should consider biodiversity enhancements which can lead to wider environmental gains.	A review of geologically designated sites has been undertaken as part of the preparation of this Chapter. The review identified that there were not any nationally or locally geological designated sites located within the Site or the 250 m buffer zone. As there are no geological designated sites located within the Site, or within 250 m, an assessment of the potential impacts to these features has not been undertaken.

[2] Whilst it is acknowledged that the Onshore Scheme does not comprise or form part of an NSIP (please see Volume 2, Chapter 2: Policy and Legislative Context), NPSs are however a statement of government intention relating, in this case, to renewable energy projects, therefore can be taken into consideration during the preparation of the Onshore Scheme ES.

[3] A suite of draft revised Energy NPSs were published and consulted on by the UK Government in March 2023, and consultation closed on 23rd June. The consultation responses will be subject to consideration and the draft revised NPSs may now be revised before the NPSs are formally adopted. There is currently no date for the next stage of the review process and therefore this ES presents the extant adopted NPSs which have been considered during the preparation of this ES. It is however noted by the Applicant that the new draft NPSs state that they may be material considerations in other applications which are not considered under the Planning Act (2008), this includes the Marine Scheme. Further detail on the consideration of the draft NPSs in this ES is provided in Volume 2, Chapter 2 Policy and Legislation.

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
	Paragraph 5.3.7: *'As a general principle, and subject to the specific policies below, development should, in line with the mitigation hierarchy, aim to avoid significant harm to biodiversity and geological conservation interests, including through consideration of reasonable alternatives. Where significant harm cannot be avoided, impacts should be mitigated and as a last resort, appropriate compensation measures should be sought.'* This is also outlined in Paragraph 5.4.42 of the Draft Overarching National Policy Statement for Energy (EN-1) (DESNZ, 2023)	A review of geologically designated sites has been undertaken as part of the preparation of this Chapter. The review identified that there were not any nationally or locally geological designated sites located within the Site or the 250 m buffer zone. As there are no geological designated sites located within the Site, or within 250 m, an assessment of the potential impacts to these features has not been undertaken.
	Paragraph 5.10.8: '*Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the ALC) and preferably use land in areas of poorer quality (grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.'* The Draft Overarching National Policy Statement for Energy (EN-1) (DESNZ, 2023) has extended and separated Paragraph 5.10.8 into a number of paragraphs set out below: Paragraph 5.11.12: *'Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the ALC) and preferably use land in areas of poorer quality (grades 3b, 4 and 5).'* Paragraph 5.11.13: *'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: *'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: '*Developments should contribute to and enhance the natural and local environment by preventing new and existing developments from contributing to, being put at*	Risks posed by potential land contamination has been identified and assessed as part of a Preliminary Environmental Risk Assessment (PERA) (Technical Appendix 10.1). Potential impacts associated with contamination to identified receptors are discussed in section 10.7.1.7.

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
	unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability'. Paragraph 5.11.16*: '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.'* Paragraph 5.11.17: *'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.'* Paragraph 5.11.18: *'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.'*	
	Paragraph 5.10.9: *'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.'*	The identification of potential mining resources is presented in section 10.7.1.5. As there are no safeguarded mineral resources located within the Site, or within 250 m, an assessment of the potential impacts to these features has not been undertaken. An assessment of the effect of the Onshore Scheme on the mineral resource within the Study Area is provided in section 10.11.
National Policy Statement EN-5 (DECC, 2011)	Paragraph 2.8.9 sets out the considerations of the IPC (now, PINS and the Secretary of State) when granting development consent of underground cables in favour of overhead alternatives. In relation to geology and soils the following bullet point applies: • *'the environmental and archaeological consequences (undergrounding a 400kV line may mean disturbing a swathe of ground up to 40 metres across, which can disturb sensitive habitats, have an impact on soils and geology, and damage heritage assets, in many cases more than an overhead line would).'* Draft National Policy Statement EN-5 (DESNZ, 2023) paragraph 2.9.25 sets out the considerations of the Secretary of State when granting development consent of underground	The existing environment is discussed in section 10.7. Potential impacts are set out in section 10.11.

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
	cables in favour of overhead alternatives. In relation to geology and soils the following bullet points apply: • *'the potentially very disruptive effects of undergrounding on local communities, habitats, archaeological and heritage sites, soil, geology, and, for a substantial time after construction, landscape and visual amenity. (Undergrounding an overhead line will mean digging a trench along the length of the route, and so such works will often be disruptive – albeit temporarily – to the receptors listed above than would an overhead line of equivalent rating);*' and • *'the applicant's commitment, as set out in their ES, to mitigate the potential detrimental effects of undergrounding works on any relevant agricultural land and soils, particularly regarding Best and Most Versatile land. Such a commitment must guarantee appropriate handling of soil, backfilling, and return of the land to the baseline ALC, thus ensuring no loss or degradation of agricultural land. Such a commitment should be based on soil and ALC surveys in line with the 1988 ALC criteria and due consideration of the Defra construction Code.'*	
National Planning Policy Framework (NPPF, 2021)	Paragraph 174*: 'Planning policies and decisions should contribute to and enhance the natural and local environment by: a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan); b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland; c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate; 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'.*	The identification of designated sites of geological conservation, and potential contamination is presented in section 10.7.1.7.

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
	Paragraph 183: '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)'.	The existing environment is discussed in section 10.7. A CMRA has been carried out and is presented in Technical Appendix 10.1 (Volume 3). Potential impacts are set out in section10.11.1.26.
	Paragraph 210: Planning Policies should: *'c) safeguard mineral resources by defining Mineral Safeguarding Areas (MSA) and Mineral Consultation Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked); d) set out policies to encourage the prior extraction of minerals, where practical and environmentally feasible, if it is necessary for non-mineral development to take place;'*	The identification of potential mineral resources is presented in section 10.7. As there are no safeguarded mineral resources located within the Site, or within 250 m, an assessment of the potential impacts to these features has not been undertaken.
Northumberl and Local Plan 2016-2036 (Adopted March 2022)	Policy MIN 4: Safeguarding mineral resources. A number of criteria are used to develop Mineral Safeguarding Areas (MSA) that highlight areas of geology and locations of deposits that are, or may in the future, constitute an economically viable resource. The policy sets out the requirements for non-minerals developments proposed within MSAs. It also sets out that non-minerals developments will be not supported unless they can demonstrate certain criteria.	The identification of potential mineral resources is presented in section 10.7. An assessment of the effect of the Onshore Scheme on the mineral resource within the Study Area is provided in section 10.11.
	Policy MIN 5: Safeguarding mineral resources. Applications for non-mineral development in a MSA are required to consider the possibility of prior extraction ahead of the proposed non-mineral development being implemented.	An assessment of the effect of the Onshore Scheme on the mineral resource within the Study Area is provided in section 10.11 and additional mitigation and consultation with Northumberland Minerals and Waste Planning Authority is proposed.
	Policy MIN 6: Safeguarding Minerals Related Infrastructure. This policy sets out the requirements for non-minerals developments proposed within the vicinity of safeguarded mineral infrastructure. It also sets out that non-minerals developments will be not supported unless they can demonstrate certain criteria.	The identification of mineral infrastructure is presented in section 10.7.

Relevant Policy	Summary of Relevant Policy Framework	How and Where Considered in the ES
	Policy POL 1: Unstable and contaminated land The policy requires that the identification and assessment is undertaken to demonstrate that unacceptable risks from instability and contamination will be prevented and where required remedial measures are proposed.	Risks posed by potential land contamination have been identified and assessed as part of a PERA (Technical Appendix 10.1, Volume 3) and section 10.7.1.7. Potential impacts associated with contamination to identified receptors are discussed in section 10.11.
	Policy POL 2: Pollution and air, soil and water quality The policy sets out that developments that may cause an unacceptable risk, or harm from pollution, and where they cannot provided mitigation to acceptable levels will not be supported. Developments are required to maintain and protect the standard and quality of water, air and soils.	The existing environment is discussed in section 10.7. Potential impacts are set out in section 10.11.
	Policy POL 3: Best and most versatile agricultural land 1. *'Regard will be had, to the wider economic and other benefits of the best and most versatile agricultural land when considering any irreversible loss in accordance with national policy. Where significant development of such land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of higher quality.* 2. *Temporary or reversible development on best and most versatile agricultural land will be supported where the land would be reinstated to its pre-development quality.'*	The existing environment is discussed in section 10.7. Potential impacts are set out in section 10.11.
	Policy ENV 2: Biodiversity and Geodiversity The policy sets out the importance of protecting and enhancing biodiversity and geodiversity. It requires development proposals minimise thetheir impact and avoid significant harm, and maximise opportunities for enhancing biodiversity.	The existing environment is discussed in section 10.7. Potential impacts are set out in section 10.11.
The Coal Authority (2012)	Policy for Building Over or Within The Influencing Distance of a Mine Entry	Risks posed by historical mining have been identified and assessed as part of a CMRA Technical Appendix 10.1, Volume 3). Potential impacts associated with coal mining to identified receptors are discussed in section 10.11.

Table 10-2 Summary of legislation relevant to Geology and Soils

Relevant Legislation	Summary of Relevant Legislative Framework	How and Where Considered in the ES
The Environmental Permitting (England and Wales) Regulations 2016	Manages environmental permitting for activities which have potential to cause harm to human health or the environment, including pollution prevention and control, landfill, waste incarceration, the operation of large combustion plants, water discharge consents, groundwater authorisations, radioactive substances and mining waste and batteries	The identification of hazards is presented in section 10.7.1. Potential impacts associated with potential receptors are discussed in section 10.11.
The Environment Act 1995	Makes provision for the identification and remediation of contaminated land and abandoned mines in Part 2 of the Act.	The identification of potential contamination is presented in section 10.7.1.7. and historic mining hazards are presented in section 10.7.1.5.
Construction (Design & Management) Regulations 2015 (CDM Regulations)	A Health and Safety file is required by Part 3 of the CDM Regulations for projects involving more than one contractor and should include information on 'any hazards that have not been eliminated through the design and construction processes, and how they have been addressed (e.g., surveys or other information concerning asbestos or contaminated land);	The identification of hazards is presented in section 10.7.1. Potential impacts associated with potential receptors are discussed in section 10.11.
Infrastructure Planning (Environmental Impact Assessment (EIA) Regulations 2017	The EIA must identify, describe and assess, the direct and indirect significant effects of the proposed development on (a) population and human health; (b) biodiversity (c) land, soil, water, air and climate; (d) material assets, cultural heritage and the landscape; (e) and the interaction between all factors from points (a) to (e)	The identification of soils and geology is presented in section 10.7.1. Potential impacts associated with potential receptors are discussed in section 10.11.
Environmental Protection Act (EPA), 1990. Part 2A – Contaminated Land Statutory Guidance	The legislation should manage the identification of contamination sources, pathways and receptors which are 'likely' to represent an 'unacceptable' risk either to human health or the surrounding environment; The legislation in relation to contaminated land thus enables central government to protect and improve environmental quality of historical contamination and in pursuing policies to re-use and redevelop sites ensures developers and local authorities are aware of potential contamination issues.	The identification of potential contamination is presented in section 10.7.1.7.

10.5. Consultation and Technical Engagement

16. A summary of the key issues raised during consultation and technical engagement activities undertaken to date specific to geology and soils is presented in Table 10-3 below, together with how these issues have been considered in the production of this Chapter. Further detail is presented within Volume 2, Chapter 6 of the ES.

Table 10-3 Summary of key consultation and technical engagement undertaken for the Onshore Scheme relevant to Geology and Soils

Date	Consultee and Type of Consultation	Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
Pre-Application Consultation Advice (NCC)			
4th April 2023	Formal Pre-Application Planning Consultation Response from Environmental Protection Team	Land contamination, Coal Authority Mining Reporting Area, Radon, Mineral safe-guarding.	Land contamination – section 10.7.1.7, section 10.11.1 and section 10.11.2. Coal mining – section 10.7.1.1, section 10.7.1.3, section 10.7.1.5, section 10.11.1 and section 10.11.2 Radon – section 10.7.1.8. Mineral Safe-guarding – section 10.11.1
Consultation on the Onshore Scheme: Scoping Opinion			
December 2022 / January 2023	Scoping Opinion (NCC Reference: 22/04118/SCOPE)	No issues relating to geology or soils were raised in the Scoping Opinion	N/A

10.6. Methodology to Inform Baseline

17. There are no published guidelines or criteria for setting out the baseline for geology and soils within the context of an EIA. Baseline data with respect to geology and ground conditions has been collected from publicly available information and open-source data from a range of sources.

18. A desk-based review of soil and geological maps, Ordnance Survey (OS) mapping and Digital Terrain Model (DTM) mapping has been undertaken. Third party data from bodies such as NCC, the Environment Agency (EA) and The Department for Environment Food and Rural Affairs (DEFRA)'s MAGIC website has been used to characterise the geological features and identify any geological designated areas. The data reviewed by those sources are shown in Table 5.5.

19. The PERA (Technical Appendix 10.1) provides an assessment of geology and soils and has followed a phased risk-based approach including consideration of potential sources, pathways and receptors to identify potential pollutant linkages that may result in unacceptable risks to receptors from ground contamination.

10.6.1. Desktop Study

20. Information on geology and soils within the Study Area was collected through a detailed desktop review of existing studies and datasets. These are summarised in

21. Table 10-4.

Table 10-4 Summary of key desktop studies & datasets

Title	Source	Year	Author
Various datasets	Find open data - data.gov.uk	2023	NCC
	https://northumberland.maps.arcgis.com /apps/webappviewer	2023	
Soil Type and Character	UK Soil Observatory: http://www.ukso.org/static-maps/soils-of-england-and-wales.html and Cranfield Soil and Agrifood Institute Soilscapes map viewer	2023	UK Soil Observatory:
Geology & Minerals	British Geological Survey (BGS) Onshore Geoindex; https://www.bgs.ac.uk/map-viewers/geoindex-onshore/	2023	BGS
Groundwater Source Protection Zones (SPZ)			
Mining and quarries			
Coal Authority Map	The Coal Authority website interactive mapping https://mapapps2.bgs.ac.uk/coalauthority/home.html	2023	Coal Authority
Historic Active Landfills and Waste Management Sites	EA and Lincolnshire County Council & Groundsure Enviro Data Viewer https://www.groundsure.io/#	2023	EA
Radon	Public Health England: UK Radon Map	2023	Public Health England
Unexploded Ordnance (UXO)	Zetica UXO: Risk Maps	2023	Zetica
Land use	Google Earth aerial photography	2023	Google
Statutory and Non-Statutory Environmental Designations	DEFRA Multi-Agency Geographic Information for the Countryside (MAGIC) https://magic.defra.gov.uk/magicmap.aspx	2023	DEFRA
Brownfield Register	ArcGIS Web Application Northumberland Brownfield Land Register (2020 update) - data.gov.uk	2023	UK Government, NCC

10.6.2. Site-specific Surveys

22. Site-specific surveys were undertaken to inform this Chapter. A summary of the surveys undertaken are outlined in Table 10-5.

Table 10-5 Summary of site-specific survey data

Title	Extent of Survey	Overview of Survey	Survey Contractor	Date	Reference to Further Information
Geological walkover	Geology and Soils Study Area	Walk over of the Site to confirm observations made from the desktop study	SLR Consulting Ltd.	March 2023	PERA (Technical Appendix 10.1)

10.7. Baseline Environment

10.7.1. Overview of Baseline Environment

10.7.1.1. LAND USE

23. Available historical information and baseline reporting indicate the majority of the Site has experienced some degree of development, including a power station, coal storage and processing and associated industries e.g., rail, brick works, iron foundry etc. In addition, other developments on the Site include the construction of the A189 road bordering the western edge of the Site and the railway line to the east, which has been present since approximately 1898.

24. The earliest map dated from 1865, shows the Site was largely undeveloped consisting of agricultural fields and coastal dunes. During the Second World War (WWII) it appears a series of pill boxes and an air raid shelter were located on and directly behind the coastal dunes in the east of the Site.

25. A large proportion of land in the south of the Site, directly to the south of Harbour View Road was occupied by Blyth Power Station from 1974 until 2001 when it was decommissioned. The disused land in the north of the Site (which extends outwith the Site boundary) has experienced development since 1966 including a mineral railway, maintenance facility, bulk storage – coal and Pulverised Fuel Ash (PFA) – as well as settling ponds, conveyors and extensive drainage.

26. The BritishVolt Geotechnical and Geo-environmental Report (summarised within the Cathie report (Cathie, 2022)) explains this area was historically used as a coal stocking yard associated with the former Power Station until the 1990s. Coal supplies were transported via overhead conveyors to the power station site to the south. Coal stocking yards with drainage channels, PFA mounds, ash lagoons, associated facilities buildings and a Thermalite factory have all been present within this area.

27. Cambois Colliery was located to the north of the Site from 1898 and operated until 1968. Associated colliery housing is still present to the north of the Site. During 1978 Battleship wharf, to the south, in the Port of Blyth was used as a landfill for construction waste.

28. A business park and more recently a sewage works, are located northwest of the Site. Other land use in the surrounding area historically has been predominantly agricultural. The Port of Blyth and a Ferry Terminal is located to the southeast of the Site.

10.7.1.2. SUPERFICIAL GEOLOGY

29. Available published information from the BGS Onshore GeoIndex has been reviewed to produce the following summary of superficial geology present within the Study Area (illustrated on Figure 11.2, Volume 4). There are no artificial deposits shown on information provided by the BGS.

30. The superficial geology covering most of the Study Area is indicated to be Diamicton Till formed up to 12,000 years ago during the Late Pleistocene epoch which consists of unsorted and unstratified heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape. They are formed by glacial and inter-glacial processes and can comprise many different geomorphological features. Available borehole data has proven that this stratum is approximately 15 to 30 m thick across the Study Area.

31. Along the southern boundary of the Study Area to the south of East Sleekburn (within the High Voltage Alternating Current (HVAC) Zone), a very thin area is indicated to comprise Alluvium deposits (illustrated on Figure 11.2, Volume 3). Alluvium is a variable unconsolidated material deposited by fluvial processes and can consist of clay, silt, sand and gravel. These are likely to be associated with the River Sleekburn.

32. The coastal Landfall High Voltage Direct Current (HVDC) Zone comprises Blown Sand, which is formed by aeolian (wind) processes, creating beds and lenses of fine-grained sand that over time can form sand dunes. These deposits originated during the Quaternary period, up to 2.6 Ma, and continue to accumulate to the present day. Additionally, the area includes marine beach deposits that formed from 12,000 years ago up to the present. Marine beach deposits form coastal beaches dominated by shallow marine processes and comprises sand and gravel.

Table 10-6 Summary of Regional Stratigraphy

Formation	Description
Superficial Geology	
Marine Beach Deposits	Shingle, sand, silt and clay; may be bedded or chaotic; beach deposits such as dunes, sheets or banks; associated with the marine environment.
Blown Sand	Well sorted sand that has been transported via aeolian processes / wind.
Alluvium	Variable unconsolidated material deposited by fluvial processes and can consist of clay, silt, sand and gravel.
Glacial Till (Diamicton)	Unsorted and unstratified heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape.
Bedrock Geology	
Mull Dyke-Swarm	Complex of fine to medium grained mafic igneous rocks.
Pennine Middle Coal Formations	Interbedded mudstone, siltstone and pale grey sandstone with coal seams.

10.7.1.3. BEDROCK GEOLOGY

33. Available published information from the British Geological Survey (BGS) Onshore GeoIndex[4] has been reviewed to produce the following summary of bedrock geology present within the Study Area (Illustrated on Figure 11.1, Volume 4).

[4] BGS. (2023). GeoIndex Onshore. Available at: https://www.bgs.ac.uk/mapviewers/geoindex-onshore/ [Accessed on 11 May 2023].

34. The bedrock geology of the Study Area predominantly comprises the Pennine Middle Coal Measures Formation. This formation is a sedimentary sequence that includes interbedded sandstone, siltstone, mudstone and coal seams. They were formed in the Carboniferous period between 310 to 318 million years ago (Ma) in fluvial, palustrine (wetland) and shallow-marine depositional environments.

35. The Mull Dyke-Swarm present in the north-east of the Study Area is a complex of mafic igneous rocks that cut through the bedrock as narrow linear intrusions in a north-west to south-east orientation. They were formed in the Palaeogene period between 23 to 66 Ma.

10.7.1.4. SOILS

36. Available published information from the UK Soil Observatory[5] map viewer interactive map and have been reviewed to produce the following summary.

37. The UK Soil Observatory Soilscapes map indicates that the Study Area is mapped as 'unsurveyed / urban'. The Cranfield Soil and Agrifood Institute's interactive mapping indicates that the soils along the coast are mapped as sand dune soils, while soils located across the majority of the Site are classified as base-rich loamy and clayey soils. This soil type is indicated to have impeded drainage which increases the likelihood of waterlogged soil in periods of heavy rain. This soil type has moderate fertility and is best suited to grass or cereal production. The soil type associated risks are the potential of overland flow which can carry and transport contamination from organic slurry, fertiliser, and pathogens.

38. A review of the 'Peat Coverage' map provided by the UK Soil Observatory (as derived from the BGS geology surface dataset) confirms that carbon-rich, deep-peat and priority peatland habitat is not present within the Study Area. Furthermore, a review of the BGS trial pit log data for the Study Area further indicates the absence of peat.

39. The Natural England Provisional ALC[6] maps have been used to classify the soils across the Study Area. Land has been categorised within this section into one of the following grades:

- Grade 1: excellent quality agricultural land;
- Grade 2: good quality agricultural land;
- Grade 3a: good to moderate quality agricultural land;
- Grade 3b: moderate quality agricultural land;
- Grade 4: poor quality agricultural land;
- Grade 5: very poor quality agricultural land; and
- Urban.

40. The land within the Study Area is categorised as Urban.

[5] BGS. (2023). UK Soil Observatory. Available at: https://mapapps2.bgs.ac.uk/ukso/home.html [Accessed on 11 May 2023].
[6] Natural England Open Data Publication. (2019). Agricultural Land Classification. Available at: https://naturalengland-defra.opendata.arcgis.com/datasets/5d2477d8d04b41d4bbc9a8742f858f4d_0/explore?location=52.776796%2C-2.141583%2C7.80 [Accessed on 18 May 2023].

10.7.1.5. MINERAL SAFEGUARDING

41. ‘Safeguarding’ is the process used in the planning system to ensure the protection of mineral resources from the risk of sterilisation from non-mineral development. Northumberland County Council have used a number of criteria to identify to develop Mineral Safeguarding Areas (MSA’s) within the Northumberland Local Plan that highlight areas of geology that could constitute an economically viable resource.

42. The MSA’s ‘cover then whole of the resource area, include known mineral resources beneath existing settlements and overlap with other planning and environmental designations. The MSAs also extend beyond the boundary of the resource to create a buffer thereby protecting the potential extraction of the mineral from development near the resource’.[7]

43. The Study Area overlies areas defined as being safeguarded for coal, and sand and gravel and is therefore subject to Policy MIN4 of the Northumberland Local Plan. The Study Area lies entirely within an MSA for coal; the sand and gravel safeguarded area stretches along the coast and approximately 500 m inland.

44. The Northumberland Development Plan Policies Map[8] indicates that the rail link to Port of Blyth and Battleship Wharf, Cambois are Safeguarded Minerals Infrastructure under Policy MIN6 in the Northumberland Local Plan.

45. There are no site allocations within the plan for sand and gravel or crushed rock within the Area.

10.7.1.6. HISTORIC MINING

46. The Blyth area has a long industrial heritage predominantly associated with coal mining and shipbuilding. The Coal Authority Interactive Map Viewer[9] shows the extent of historic coal mining: there are several recorded mine entries near Cambois and East Sleekburn, and the west of the Study Area from Bedlington to West Sleekburn is identified as a Development High Risk Area, illustrated on Figure 10.1, Volume 4 (defined as ‘*where recorded coal mining risks are present at the surface or shallow depth and are likely to affect new development*’) with known coal outcrops and shallow coal mine workings. The Coal Authority[10] requires that new developments within these defined areas need to demonstrate that the proposals will be safe and stable taking full account of former coal mining activities. The requirement to undertake a CMRA also arises under POL1 of the Northumberland Local Development Plan[7].

47. The Development High Risk Area within the Study Area is associated with a coal seam (Moorland) and probable shallow coal mining workings. Probable shallow underground workings are

[7] Northumberland Local Plan (2022). https://www.northumberland.gov.uk/NorthumberlandCountyCouncil/media/Planning-and-Building/planning%20policy/Local%20Plan/Northumberland-Local-Plan-Adopted-March-2022.pdf [Accessed on 7 September 2023].
[8] NCC (2022). Northumberland Local Plan 2016 to 2036 (Adopted 31 March 2022). Available at: https://northumberland.maps.arcgis.com/apps/webappviewer/index.html?id=18c3c674270f406591cb5b0ea7bec4b3. [Accessed on 18 May 2023].
[9] BGS (2023). The Coal Authority – Interactive Map Viewer. Available at: https://mapapps2.bgs.ac.uk/coalauthority/home.html [Accessed on 11 May 2023].
[10] Coal Authority (2014). Planning applications and Coal Mining Risk Assessments. Available at: https://www.gov.uk/guidance/planning-applications-coal-mining-risk-assessments#:~:text=Low%20Risk%20Area.-,If%20your%20site%20is%20in%20the%20Development%20High%20Risk%20Area,and%20the%20risks%20these%20pose [Accessed on 18 May 2023].

areas/extents where no recorded plan exists, but where it is likely that workable coal at shallow depths has been mined before records were kept. A CMRA has been undertaken and is presented in Technical Appendix 10.1.

48. The CMRA indicates that there is no active deep or opencast coal mining within the Study Area. There are no mine shafts located within the study area. The CMRA indicates that the Moorland (possible shallow mine workings) may have been present in the north-west of the Onshore Converter Station area.

49. Available published BGS mining and quarry data and historic maps have been reviewed to produce the following summary. There are no current or historic mines or quarries indicated to be present within the Study Area. The Northumberland Development Plan Policies Map[11] indicates that the existing railway that runs adjacent to the coastline is classified as 'Safeguarded Minerals Infrastructure - Policy MIN6' in the Northumberland Local Plan 2016 to 2036.

10.7.1.7. POTENTIAL SOURCES OF CONTAMINATION

50. A PERA (Technical Appendix 10.1) has been prepared based on the desk-based information and the findings of the site walkover, potential sources of contamination across the Site have been identified.

51. The Study Area has been subjected to former industrial activities including a power station, underground mine workings, mineral railway, bulk storage of coal and PFA and utilisation during WWII for construction of pill boxes, an air raid shelter and pipe mines.

52. These may be associated with a very wide range of contaminants including hydrocarbons (fuels, oils and lubricants) and other organic compounds like polychlorinated biphenyls (PCBs).

53. The Groundsure Enviro Data Viewer[12] and desk PERA indicates the presence of a historic landfill in the north-east of the Study Area within the Landfall HVDC Zone, centred approximately at British National Grid Reference NZ 30176 84208 illustrated on Figure 10.2, Volume 4. The historic landfill occupies land to the east of Blyth Power Station which was decommissioned between 1991 to 2001 and demolished in 2003. The historic landfill is linked to Blyth Power Station, operated by Innogy Plc and the licence was issued in November 1992. The contents of the landfill are unknown however a site walkover identified this area to be relatively flat and could comprise an area infilled with made ground associated with the power station or associated railway.

54. Till is indicated to be covered by artificial deposits of made ground across eastern and northern parts of the study area. Some of the made ground is associated with coal industry activity. A previous site investigation identified the presence of PFA mounds located approximately NZ 30094 83886. PFA and made ground has the potential to present contamination of soils and to produce elevated concentrations of hazardous ground gas.

55. A sewage outfall is located to the north of the Landfall HVDC Zone (NZ 30839 84320). There is the potential for contaminated nearshore surface sediments where the outfall is located.

[11] NCC. (2022). Northumberland Local Plan 2016 to 2036 (Adopted 31 March 2022). Available at: https://northumberland.maps.arcgis.com/apps/webappviewer/index.html?id=18c3c674270f406591cb5b0ea7bec4b3 [Accessed on 18 May 2023].
[12] Groundsure (2023). Groundsure Enviro Data Viewer. Available at: https://www.groundsure.io/ [Accessed on 11 May 2023].

56. The Northumberland Brownfield Land Register outlines how much previously developed 'brownfield' land NCC has identified as being potentially suitable for future housing development. The latest Brownfield Land Register was published in December 2022. NCC defines brownfield sites as *'having a previous potentially contaminative use, such as foundries and gas works site'.*

57. A review of the NCC Brownfield Land Register[13] and the online interactive mapping indicates two brownfield sites present within the Study Area. The land parcels are within the Landfall HVDC Zone. The first is 2.64 hectares (ha) in size, listed as '*land adjacent to Cambois First School'*, located between North Cambois and North Blyth (NCC Brownfield Register Site Reference: 5083). Historic mapping from the National Library of Scotland[14] indicates the land parcel comprised terraced housing that was demolished in the 1950s. The second land parcel is located in the north-east of the Study Area, (NZ 30436 84164). It is 0.26 ha in size, listed as '*land at Debdon House'* (Site Reference: 5121). Historic mapping indicates this land parcel comprised the Cowpen Colliery Railway Cambois Pit Branch.

58. The NCC Strategic Housing Land Availability Assessment (SHLAA)[15] online mapping classifies a number of other land parcels within the Study Area as *'not suitable'* and some areas as *'suitable in part'* for housing development; these are not recorded brownfield sites on the NCC brownfield register.

10.7.1.8. GROUND GAS

59. Radon gas risk is classified by the percentage of homes per 1 km grid that may have radon concentration potential at or above the action level of 200 Bq m^{-3}, defined by the UK Health Security Agency. Interactive UK maps of radon[16] indicates that the Study Area is classified as having less than 1% of homes at or above the action level in the west which presents a negligible risk, and the east of the Study Area is classified as having 1 – 3 % of homes at or above the action level.

60. In terms of land gases generated from natural sources, it has been noted that the Study Area is near areas identified as historically infilled water areas (ponds) which may have contained organic deposits with the potential to generate carbon dioxide and methane. The desk study indicates the general risk from ground gas within the Study Area to be low although elevated ground gas concentrations may be present associated with local features.

10.7.1.9. ENGINEERING HAZARDS

61. The superficial deposits present in the Study Area are classified by the BGS as having a medium risk of shrink and/or swelling clay; the Landfall HVDC Zone is classified as a very low risk area.

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[13] NCC. (2022). Northumberland Brownfield Land Register (December 2022). Available at: https://www.northumberland.gov.uk/NorthumberlandCountyCouncil/media/Planning-and-Building/planning%20policy/Studies%20and%20Evidence%20Reports/Housing%20Studies/7.%20Brownfield/Northumberland_Brownfield_Land_Register_2022-pdf.pdf [Accessed on 27 July 2023].
[14] National Library of Scotland. (2023). Side by Side Viewer. Available at: https://maps.nls.uk/geo/explore/side-by-side/ [Accessed on 11 May 2023].
[15] NCC. (2022). Strategic Housing Land Availability Assessment (SHLAA) (July 2022). Available at: https://northumberland.maps.arcgis.com/apps/webappviewer/index.html?id=b7ecb0e93d404b1bacbb9a6223433575[Accessed on 11 May 2023].
[16] UK Health Security Agency. (2023). UK maps of radon. Available at: https://www.ukradon.org/information/ukmaps [Accessed on 11 May 2023].

62. A narrow area on the southern edge of the Study Area immediately adjacent to Port Blyth within the HVAC Zone is indicated by the BGS as having 'significant potential' for problems regarding compressible deposits. Compressible deposits may contain layers of very soft materials like clay. These may compress if loaded by overlying structures or if groundwater level changes, this may result in depression of the ground. This same area as well as the coastal beach front is mapped as having running sands as 'probably' present. Some geological units can contain loosely packed, sandy layers that can become fluidised by water flowing through them. Such sands can 'run', removing support from overlying buildings and causing potential damage.

10.7.1.10. UNEXPLODED ORDNANCE (UXO)

63. Zetica, a UXO specialist company, has undertaken an initial desk study for the Onshore Scheme scoping area to further assess the potential for UXO risk. Whilst the risk from unexploded bombs is low, a potential hazard from pipe mines to the east of East Sleekburn within the Study Area has been identified, illustrated on Figure 10.2 in Volume 4.

64. The main findings of the report are summarised below:

- No records of bombing or military activity within the Study Area during World War One (WWI) have been found.
- During WWII the main strategic targets in the vicinity of the Study Area included Blyth Docks, industries important to the war effort, transport infrastructure and public utilities.
- During WWII several Anti-Aircraft and anti-invasion defences were established within the Study Area, including Blythe 'A' Heavy AA battery.
- Records have been found indicating that during WWII 13 High Explosive bombs fell on and adjacent to the Study Area over the course of several minor raids. These are all recorded as having exploded.
- No records of military activity within the Study Area post-WWII have been found.

10.7.1.11. DESIGNATED SITES

65. There are two designated sites related to geological features within the Study Area, the Northumberland Shore Site of Special Scientific Interested (SSSI) and the Coquet to St Marys Marine Conservation Zone (MCZ). These sites are described below and within Volume 2, Chapter 9: Terrestrial Ecology and Ornithology.

66. DEFRA's MAGIC interactive map[17] indicates that the coast is associated with the Northumberland Shore SSSI, which protects the estuarine areas of the River Blyth and the intertidal zone along the North Sea coast in the eastern site. This SSSI area covers approximately 1883 ha and is designed for its biological interest.

67. The Northumberland Shore SSSI is designated for biological interest, which is supported by the landscape that the coastline consists of. The Northumberland shore consists *'largely of sandy bays*

[17] DEFRA. (2023). Multi-Agency Geographic Information for the Countryside (MAGIC). Available at: https://magic.defra.gov.uk/magicmap.aspx [Accessed on 18 May 2023[.

separated by rocky headlands with wave-cut platforms, backed by dunes or soft and hard cliffs. Discrete areas of estuarine intertidal mudflats and saltmarsh are also included."[18]

68. Natural England's 'Views on Management'[19] summarises that the key principle for rocky shores is to allow the natural dynamic processes, such as erosion and collapse of cliffs, to proceed freely.

69. The Site is also adjacent to the Coquet to St Marys Marine Conservation Zone. This site covers 192 km² of intertidal and offshore waters from near Whitley Bay in the south to near Alnwick in the north. It also supports a range of intertidal habitats, which are above water at low tide and underwater at high tide. Protected features along this zone are typically geological, corresponding to rock formations and sediment types.

10.7.2. Future Baseline Scenario

70. This section discusses the likely future evolution of the existing baseline environment according to known trends in the base condition without implementation of the Onshore Scheme.

71. With regards to the geological and soil environment, the main changes from the current baseline scenario would relate to climate change. It is widely accepted that the UK climate is likely to become move variable with projected increases in peak rainfall allowances, sea level rise, wind speed and wave height.

72. No major changes to the geology underlying the study area in relation to climate change and natural trends are anticipated to occur over the lifetime of the Onshore Scheme.

73. Climate change is expected to result in wetter winters and drier summers, which has the potential to mobilise pre-existing sources of contamination either through increased rates of infiltration due to heavier rainfalls or dust generation through drier summers. These changes have the potential to increase the exposure risks of receptors to pre-existing sources. Natural degradation of contaminants over time may result in a general improvement in ground conditions.

10.7.3. Data Assumptions and Limitations

74. The desk-based PERA (Technical Appendix 10.1) is based on a range of publicly available information. No ground investigation data from within the Study Area has been used to inform the PERA or the impact assessment presented in this Chapter. The assessment therefore adopts a precautionary approach i.e., if a potential pollutant linkage has been identified it is assumed to be present until further site-specific information is available to confirm the linkage does not exist..

75. The direct assessments and judgements given in this report are therefore limited in this regard, but they do provide an adequate and robust basis for the assessment, whilst also identifying areas of known contamination that may require further confirmatory investigation at detailed design phase, as well as identifying the general level of contamination that may be expected in the various Indicative Zones of Infrastructure (Volume 4, Figure 5.1).

[18] Natural England (2023), The Northumberland Shore SSSI. Available at: https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S2000134&SiteName=Northumberland%20Shore&countyCode=&responsiblePerson=&SeaArea=&IFCAArea= [Accessed on 18 May 2023].
[19] SSSI detail (naturalengland.org.uk) [Accessed July 2023]

10.8. Key Parameters for Assessment

10.8.1. Maximum Design Scenario (MDS)

76. The maximum design scenario(s) summarised here have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in the Chapter 5 of this ES: Project Description. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (PDE) (e.g., different infrastructure layout), to that assessed here, be taken forward in the final design scheme.

77. Given that the maximum design scenario is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be held that development of any alternative options within the design parameters will give rise to no worse effects than assessed in this impact assessment.

78. The geology and soils assessment for construction and operational phases has been based on the maximum Onshore Scheme footprint and areas of temporary infrastructure detailed in Chapter 5: Project Description, along with a construction programme of 60 months, considering impacts on geology, soils, contaminated land, land use, mining and UXO. This represents the maximum potential footprint / area of ground disturbance covered by the operational infrastructure.

79. For decommissioning it has been assumed that, at the end of the operational lifetime of the Onshore Scheme, the operator of the Onshore Scheme will develop and agree a solution for the onward handling of the onshore infrastructure with the regulator. This decision will be based on the advice from the regulator at the time and informed by the prevailing environmental regulatory requirements at that time, and relevant best practice. For the purposes of a realistic worst-case assessment while the approach to decommissioning is developed by the Applicant, it has been assumed for the purposes of this assessment that the cables would be pulled through the ducts and removed, with the ducts themselves left in situ. With regards to the Onshore Converter Station, it would be gradually dismantled with certain infrastructure removed for recycling or reuse. Following this, the area is likely to be remediated and restored. This represents a realistic worst-case scenario at decommissioning, while the approach to decommissioning is developed by the applicant.

10.8.2. Impacts Scoped Out of the Assessment

80. Impacts scoped out of the assessment were agreed with key stakeholders through consultation following receipt of the Scoping Opinion from NCC in December 2022/January 2023 reference: 22/04118/SCOPE. These, together with a justification, are presented in Table 10-7.

Table 10-7 Impacts scoped out of the assessment for Geology and Soils

Potential Impact	Phase[20]			Justification
	C	O	D	
Impact on ground conditions		X		Localised heating impacts arising from the buried cable has the potential to impact ground conditions through localised drying of soils over time. However, the burial depth of the cable and backfill material used will reduce localised heating of soils. The backfill material chosen will be one with low thermal conductivity and moderate increases in cable temperature will be incorporated into the cable design and this impact pathway can therefore be scoped out.

10.9. Methodology for Assessment of Effects

10.9.1. Overview

81. The assessment of effects on geological and soil receptors has followed the methodology set out in Chapter 3: EIA Methodology. The following topic-specific following guidance documents have also been considered:

- Control of Water Pollution from Construction Sites (C532), Construction Industry Research and Information Association, (CIRIA) 2001;
- Environmental Good Practice on Site (C741), CIRIA 2015;
- Control of Water Pollution from Linear Construction Projects (C648), CIRIA 2006;
- The EA's Approach to Groundwater Protection, version 1.2, February 2018;
- BS5930: 1999 (The Code of Practice for Site Investigations);
- BS10175:2001 (Investigation of Potentially Contaminated Sites);
- The EA's Land Contamination Risk Management (LCRM) Framework (last updated in 2023);
- The Coal Authority – Guidance for Developers: Risk Based Approach to Development Management;
- DEFRA Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (2009);
- Institute of Environmental Management and Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022);
- Standards for Highways, Sustainability & Environment Appraisal. LA 109 Geology and Soils, Rev 0' (2019); and
- Northumberland Local Plan 2016-2026 (2022).

82. The CIRIA guidance provides help on environmental good practice for the control of water pollution arising from construction activities. It focuses on the potential sources of water pollution from within construction sites and the effective methods of preventing its occurrence.

83. The EA's Land Contamination Risk Management Framework 2021 provides an update to the former EA Model Procedures for the Management of Land Contamination, Contaminated Land Report 11

[20] C = Construction, O = Operational and maintenance, D = Decommissioning

(CLR11). The guidance aims to help those assessing potentially contaminated site to identify and assess the risks posed to sensitive receptors from potentially contaminated sites, make appropriate decisions in relation to the outcome of the assessment and identify the required actions necessary, e.g., implement remediation if deemed necessary.

84. In addition, the assessment has considered the legislative framework as defined by:

- The Environmental Permitting (England and Wales) Regulations (EPR) (2016);
- The Environment Act (1995);
- Construction (Design & Management) Regulations 2015 (CDM Regulations);
- Town and Country Planning (Environmental Impact Assessment (EIA) Regulations 2017; and
- Environmental Protection Act (EPA) 1990. Part 2A – Contaminated Land Statutory Guidance.

10.9.2. Impact Assessment Criteria

85. The criteria for the assessment of impacts on geological and soils receptors follows those set out in Chapter 3: EIA Methodology, which details the general impact assessment method.

86. There are no published guidelines or criteria for assessing and evaluating effects on ground conditions and land use within the context of an EIA. In the absence of this, the assessment is based on a methodology derived from the IEMA guidance (2022), and the Standards for Highways (2019).

87. The assessment is a two stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts on those receptors. Professional judgement and a qualitative risk assessment methodology have been used to assess the findings to give an assessment of significance for each potential impact. Once the degree of impact and sensitivity have been assessed these are then combined to determine the likelihood of each significant effect occurring.

88. This approach provides a mechanism for identifying the areas where site specific mitigation measures will be required, in addition to embedded mitigation, and for identifying mitigation measures appropriate to the risk presented by the development proposals. This approach also allows effort to be focused on reducing risk where the greatest benefit may result.

89. The criteria for defining magnitude in this Chapter are outlined in Table 10-8.

Table 10-8 Definition of terms relating to the magnitude of an impact

Magnitude of Impact	Definition
High	Fundamental loss (long term or permanent) or change to baseline of resource and/or quality and integrity of resource; likely to cause exceedance of statutory objectives and/or breaches of legislation; severe damage to key characteristics, features or elements. **Geology and soils:** permanent loss of designated geological feature; loss over an area of more than 20 ha of soil-related features; complete sterilisation of mineral resource; **Contamination and human health:** • significant contamination identified, contamination heavily restricts future use of land; • permanent or major change to existing risk exposure; and • unacceptable risks/ severe harm to one of more receptors over the long-term or permanently.
Medium	Loss of resource but not adversely affecting the overall integrity; partial loss of/damage to key characteristics, features or elements with/without exceedance of statutory objectives or with/without breaches of legislation. **Geology and soils:** • partial loss of designated geological feature; • loss over an area of between 5 and 20 ha of soil-related features; • medium-term or local scale loss of mineral resources; **Contamination and human health:** • control / remediation measures are required to reduce risks to human health/make land suitable for intended use; • medium-term or moderate change to existing risk of exposure; or • unacceptable risks to one or more of the receptors over the medium-term.
Low	Some measurable change in attributes, quality or vulnerability; reversible or minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. **Geology and soils:** • temporary change in designated geological feature; • permanent, irreversible loss over less than 5ha or a temporary, reversible loss of one or more soil functions or soil Volumes; • short-term or very localised effects on mineral resources **Contamination and human health:** • significant contamination is unlikely with a low risk to receptors – • standard industry practice measures can be implemented to minimise risks; • short-term temporary or minor change to existing risk exposure; or • unacceptable risks to one or more receptors over the short-term.
Negligible	Very minor or no loss or detrimental alteration to one or more characteristics, features or elements; impact of insufficient magnitude to affect the use / integrity. **Geology and soils:** • no change in status of designated geological site ; • no discernible loss or reduction or improvement of soil functions or soil Volumes; • very minor impact on mineral resources; **Contamination and human health:** • no risks identified, no requirement for control measures to reduce risks to receptors or to make land suitable for intended use; • negligible change to existing risk of exposure; or • activity is unlikely to result in unacceptable risks to receptors.

90. The criteria for defining sensitivity in this Chapter are outlined in Table 10-9.

Table 10-9 Definition of terms relating to the sensitivity of the receptor

Value (Sensitivity of the Receptor)	Description
High	**Geology and soils:** • Receptor is internationally or nationally important / rare with limited potential for offsetting / compensation (e.g. United Nations Educational, Scientific and Cultural Organization (UNESCO) Geoparks, SSSI or Geological Conservation Review (GCR) sites with internationally or nationally important geomorphological or geological features); • Soils supporting protected features within a European site and/ or UK designated site (e.g. UNESCO Geoparks, Special Protection Area (SPA), Special Area of Conservation (SAC), SSSI or Areas of Outstanding Natural Beauty (AONB), Special Landscape Area, and GCR); • ALC Classes 1, 2 and 3a- Excellent to Good Quality agricultural land; and/or; • Important surface mineral reserves that would be sterilised (i.e. without future access). **Contamination:** • Presence of regulatory determined contaminated land (Part 2A EPA designated); • construction workers; and/or • offsite human receptors at distances <50 m.
Medium	**Geology and soils:** • receptor is regionally important / rare with limited potential for offsetting / compensation (e.g. Regionally Important Geological Site (RIGS); • soils supporting protected or valued non-statutory designated sites; • ALC Classes 3b Moderate Land capable of producing a moderate range of crops; and/or • surface mineral reserves that would remain accessible for extraction. **Contamination:** • areas of potential concern identified by Local Authority under their statutory investigation of contaminated land (under Part 2A; EPA 1990); • offsite human receptors at distances >50 m but <150 m.
Low	**Geology and soils:** • receptor is locally important / rare (e.g. Local Geological Sites (LoGS); • soils supporting valued features within non-designated notable or priority habitats/landscapes. Agricultural soils; • ALC Classes 4 and 5 Poor to Very Poor Quality– Improved grassland and rough grazing; and/or • surface mineral reserves that would remain accessible for extraction. **Contamination:** • areas of previously developed land with no areas of potential concern relating to contaminated land identified; and/or • offsite human receptors at distances >150 m but <250 m.
Negligible	**Geology and soils:** • receptor is not considered to be particularly important / rare; • urban soils; and/or • no economically viable minerals. **Contamination:** • no areas of previously developed land with no areas of potential • concern relating to contaminated land identified. • offsite human receptors >250 m.

91. The significance of the effect upon geological and soil receptors is determined by correlating the magnitude of the impact and the sensitivity of the receptor, as outlined in Table 10-10.

Table 10-10 Matrix used for the assessment of the significance of the effect

		Magnitude of Impact				
		No Change	**Negligible**	**Low**	**Medium**	**High**
Sensitivity of Receptor	**Negligible**	Negligible	Negligible	Negligible	Minor	Minor
	Low	Negligible	Negligible	Minor	Minor	Moderate
	Medium	Negligible	Minor	Minor	Moderate	Major
	High	Negligible	Minor	Moderate	Major	Major

10.10. Measures Adopted as Part of the Onshore Scheme

92. As part of the project design process, a number of measures have been proposed to reduce the potential for impacts on geology and soils (see Table 10-11)

93. These include measures which have been incorporated as part of the Onshore Scheme's design (referred to as 'designed in measures') and measures which will be implemented regardless of the impact assessment (referred to as 'tertiary mitigation'). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Onshore Scheme and have therefore been considered in the assessment presented in section 10.11 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry for this type of development.

94. There are some design details related to the Onshore Scheme that are still to be finalised due to further ground investigations required, ongoing engineering design work and the procurement of cable and converter station suppliers. These details will inform the final specification. The Site boundary has been chosen to allow flexibility to accommodate these design details which will be subject to future application(s) for approval of Reserved Matters.

Table 10-11 Measures adopted as part of the Onshore Scheme (designed in measures & tertiary mitigation)

Mitigation Measure	Justification
Route Selection and Avoidance	The Project has undergone a site selection process which has involved incorporating environmental considerations in collaboration with the engineering design requirements. Careful routing of the onshore infrastructure including commitment to trenchless techniques at Landfall to avoid key areas of sensitivity. Further detail on this is provided in Volume 2, Chapter 4: Site Selection and Consideration of Alternatives.
Micro-siting within the Onshore Scheme	Micro-siting within the Onshore Scheme will be carried out to help avoid or minimise interactions with localised engineering and environmental constraints identified during pre-construction surveys.
Soil Management	All construction work will be undertaken in accordance with DEFRA Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (2009). Following construction, land not required through the operation phase will be reinstated to allowfor the land to return to it's pre-development use, where applicable and where no permenant project infrastructure is required. The land take for the Onshore Scheme will be kept to the minimum necessary for safe construction and operation of the works. • A Soil Management Plan (SMP) will be developed and will be produced in advance of construction. The SMP will provide further details of mitigation measures and standard industry practice handling techniques during stripping, handling and reinstatement to safeguard soil resources by allowing for their protection, conservation and appropriate reinstatement following the construction of the onshore works.
Standard Industry Practice	All construction work will be undertaken in accordance with the CEMP which will be drafted having consideration of good practice guidance including, but not limited to: • Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors CIRIA (C532) (CIRIA 2001); • CIRIA – SuDS Manual (C753) (CIRIA, 2015); and • The Environment Agency's approach to groundwater protection, version 1.2, February 2018
Pollution Prevention	Relevant Pollution Prevention Guidelines and CIRIA guidance, would be followed to reduce any potential risks of ground pollution. Further details are set out in the outline CEMP, provided as part of this application.

Mitigation Measure	Justification
Contaminative Material	Standard industry practice and mitigation measures, comprising relevant contaminated land guidelines would be followed to reduce any potential risks from contaminated land. Standard industry practice and mitigation measures, comprising relevant contaminated land guidelines would be followed to reduce any potential risks from contaminated land. A Site Waste Management Plan (SWMP) will be developed to monitor waste arising and ensure adherence to duty of care and waste legislation. All works will be carried out in accordance with Land Contamination Risk Management (LCRM) guidance; BS5930: 1999 (The Code of Practice for Site Investigations) and BS10175:2001 (Investigation of Potentially Contaminated Sites); Hazardous Waste (England and Wales) Regulations 2005.

10.11. Assessment of Likely Significant Effects

95. The potential impacts arising from the construction, operational and maintenance and decommissioning phases of the Onshore Scheme are listed in Table 10-7 along with the MDS against which each impact has been assessed.

96. An assessment of the likely significance of the effects of the Onshore Scheme on geological and soil receptors caused by each identified impact is given below.

10.11.1. Potential Effects During Construction

IMPACT ON GEOLOGY – THE ONSHORE CONVERTER STATION, CABLE ROUTE AND LANDFALL WILL CUT ACROSS GEOLOGY, SURFACE SEDIMENTS, DUNES, QUATERNARY GLACIAL SEDIMENTS AND SOILS

10.11.1.1. INTRODUCTION OF IMPACT

97. Trenching and cabling techniques used in the construction of the HVDC and HVAC cable routes as well as the construction of access roads will disturb the in-situ geology within the Onshore Scheme. This has the potential to interact with natural deposits to create slope instabilities.

98. The sediment movements on the beach are likely in response to local tidal and wave processes. Thus, in terms of beach processes and beach form, any excavations on the beach would not be expected to impact large scale coastal processes and sediment transport along the shore. South of the immediate Landfall location, at Blyth south beach, the dunes have generally demonstrated a long-term trend of stability. A site visit carried out in December 2022 demonstrated a wide shallow profile beach and summarised that coastal frontage along the proposed Landfall location is relatively stable (BBWFL, 2023).

99. The Applicant's commitment to trenchless technology at the Landfall means that there is no potential for any direct interaction with the intertidal area for both the Marine Scheme and Onshore Scheme. The trenchless technology ducts will pass beneath the intertidal area from a point at least 250 m seawards of MLWS to a location onshore landwards of the dune system, and there is no above ground infrastructure located within the intertidal area, thereby limiting the likelihood of significant effects on geological and soil receptors in the intertidal area.

100. Trenchless techniques such as Horizontal Directional Drilling (HDD) will be used at Landfall for cabling through the beach and coastal area to an area to the west of the Unity Terrace road. Damage to the coastal landforms is unlikely because trenchless methods, such as HDD, would follow a close to parabolic profile under the beach and generally be up to 15 m below the surface with risk of erosion exposure unlikely.

101. The majority of the HVDC and the HVAC route cables will be installed using Open Cut Trenching (OCT) technique. However, at certain locations where there is a requirement to cross existing infrastructure i.e., roads or railway lines, or other sensitive features i.e. watercourses and areas of woodland it may be necessary to use trenchless techniques such as HDD.

102. Detailed site investigation will be carried out to inform the final detailed design, prior to construction. This will confirm the ground conditions within the areas of construction (i.e., Onshore Converter Station buildings, construction compounds etc.) are adequate to support intended loadings and inform the foundation type. Detailed construction plans will be required in areas where the cable route passes through areas of potential instability or high sensitivity and appropriate pollution

management controls (as described in the embedded mitigation: Table 10-11) will be required to maintain the integrity of these areas. Design burial depths will be adjusted where necessary in areas of loose sand with erosion potential or in areas where shallower burial is appropriate due to outcropping rock. Standard industry practice construction design management will minimise potential risks on site, which will be part of the CEMP.

103. As described in section 10.7.1.5 there are a number of MSAs, and SMI (Safeguarded Minerals Infrastructure) located within the Site. Construction activities and installation of cables within these areas would prevent the extraction of coal or sands and gravels.

104. The installation of the cable infrastructure as part of the construction, has the potential to sterilise the sand and gravel resources potentially present within the route of the cable corridor within the HVDC Zone and Landfall zone during construction. The installation of the infrastructure as part of the construction, has the potential to sterilise the coal resources potentially present within the Landfall Zone, HVDC and HVAC Zone and Onshore Converter Station Zone during construction. In all cases, where the permanent onshore infrastructure intersects a MSA or SMI, only part of each area would be impacted and not the whole protected area.

105. The footprint required for construction works will be greater than that required for permanent infrastructure during the operational phase. Therefore, the potential impacts during the construction phase will temporarily sterilise a larger area than that which would be permanently sterilised during operation. The total area of MSAs impacted during the construction phase of the Onshore Scheme will be quantified following route refinement.

10.11.1.2. MAGNITUDE OF IMPACT

106. The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility (occurring only during the works). It is predicted that the impact will affect the receptor directly where open cut trenching techniques are used for cable installation and indirectly where trenchless drilling methods are used for cable installation. The magnitude is therefore considered to be negligible.

107. The Onshore Scheme will not prevent mineral extraction across the entire Site as it will utilise a relatively narrow underground corridor, which will be determined at the final design stage, at a relatively shallow depth. Equally, the area proposed for that corridor and the Onshore Converter Station is not of sufficient scale to viably extract the minerals pre-development. Following completion of construction works, infrastructure associated with temporary haul roads, construction compounds etc., that have temporarily sterilised mineral resources present in MSAs or SMI will be removed. This would then allow for mineral resources to be available for extraction should they be present. Therefore, the magnitude of impact during construction is considered to be Low.

10.11.1.3. SENSITIVITY OF THE RECEPTOR

108. The designated sites related to geological features of note within the Study Area are the Northumberland Shore SSSI and Coquet to St Mary's Marine Conservation Zone. The protected sites are designated for geomorphological, geological, and sedimentary features of the coast, intertidal zone or seabed. The changes to coastal geology and properties identified are localised and composed of native material which may be deposited through sedimentation and erosion. Therefore, the designated sites are deemed to be of low vulnerability, medium recoverability and medium value. The features designated are protected under national and international legislation therefore the sensitivity of the receptor is therefore, considered to be High.

109. The underlying superficial and bedrock geology of the inland area is not deemed to be particularly unusual in terms of the regional environment. Similarly, the quaternary landscape features are not of significance in terms of their geo-conservation and geo-diversity value. The Diamicton (clay) deposits are limited in their value as a natural resource, and in this area have not seen a history of extraction either in terms of significant winning and working, or local use from borrow pits. The inland geology is deemed to be of low vulnerability, medium recoverability, and low value. The sensitivity of the inland geology as a receptor is therefore considered to be Low.

110. MSAs and SMI are considered to be of regional importance and therefore the sensitivity of the receptor is considered to be Medium.

10.11.1.4. SIGNIFICANCE OF THE EFFECT

111. Overall, the magnitude of the impact is deemed to be Negligible, and the sensitivity of the designated sites for geology is considered to be High. The effect will therefore be of **minor adverse** significance, which is **not significant** in EIA terms.

112. Overall, the magnitude of the impact is deemed to be Negligible, and the sensitivity of the coastal and intertidal geology is considered to be Low. The effect will therefore be of **negligible adverse** significance, which is **not significant** in EIA terms.

113. Overall, the magnitude of the impact on safeguarded minerals and infrastructure is deemed to be low, and the sensitivity is considered to be medium. The effect will therefore be of **minor adverse** significance, which is **not significant** in EIA terms.

10.11.1.5. SECONDARY MITIGATION AND RESIDUAL EFFECT

114. No secondary mitigation is considered necessary for designated sites and geology because the likely effect in the absence of secondary mitigation is not significant in EIA terms. The effect will therefore remain as **negligible adverse significance**, which is **not significant** in EIA terms.

115. Although the significance of effect on mineral resources is minor adverse, and therefore not considered significant in EIA terms, additional mitigation may be required post consent to determine the quality and viability of potential resources. This mitigation would include consultation with Northumberland Minerals and Waste Planning Authority regarding the potential presence of any mineral resources and the practicality and viability of extraction of any mineral resource present within the works footprint in accordance with the requirements of Policy MIN 5 of the Northumberland Local Plan.

116. The effect will remain as **minor adverse significance**, which is **not significant** in EIA terms.

IMPACT ON SOILS – DISTURBANCE OF DEPOSITS FROM TRENCHING WORKS RESULTING IN MODIFICATIONS TO NATURAL DRAINAGE PATTERNS AND POTENTIAL INCREASE IN FLOOD RISK

10.11.1.6. INTRODUCTION OF IMPACT

117. Trenching, cabling and drilling techniques used in the construction of the HVDC and HVAC cable routes and Onshore Converter Station will disturb the in-situ deposits within the Site, which has the potential to interact with natural drainage patterns and potentially increase flood risk.

118. Due to the history of construction and mining activities within the Study Area, made ground is known to be present across large areas. It is likely that natural drainage patterns have been affected by past

activities on the Study Area. Furthermore, due to the nature of the underlying geology (clay), there will be no shallow water table and therefore interaction would not be possible. Water may be present in permeable areas of the diamicton (clay); however, these are likely confined and not continuous across the strata. Therefore, interaction with the water table is not considered an impact for the construction compounds, or inland areas of the cable route, which are underlain by diamicton geology.

119. The Study Area is located adjacent to an area of open coast, and therefore, regional groundwater levels, particularly at a site level, will fluctuate with the incoming tidal level. At Landfall areas (more permeable geology) the groundwater is hydrologically connected to the sea. Changes to the drainage regime in this location would be unlikely due to the dominance of the tide impacting water levels. There would therefore be no implication on groundwater flood risk and any cabling installed through the development will be designed in consideration of water resilience.

120. During trenching and excavation works, the natural deposits will be disturbed, and natural drainage patterns may be temporarily disrupted. Temporary drainage solutions will be designed and implemented to ensure drainage patterns and water flows are maintained during construction. This would not, therefore, result in an impact on flood risk.

121. The embedded construction methodology is designed such that the direct impacts on soils resulting from excavation will be limited spatially to the HVDC and HVAC cables and temporally to a one-off process of excavation, storage and replacement. Soils and superficial deposits will be replaced to the pre-development state where practicable, and predevelopment drainage patterns will recommence.

122. More information regarding the local drainage system is provided in Chapter 11: Hydrology and Hydrogeology. Flood Risk Assessments (FRA) for the Onshore Converter Station and the cable route have been provided (Technical Appendix 11.1 and 11.2, Volume 4) a surface water drainage strategy (Technical Appendix 11.3. Volume 4) has also been prepared for the Onshore Converter Station to support the planning application for the Onshore Scheme.

10.11.1.7. MAGNITUDE OF IMPACT

123. The impacts are predicted to be of local spatial extent (localised to the work areas), of short-term duration, of intermittent occurrence and high reversibility (occurring only during the works). The magnitude of impact is therefore considered to be Low.

10.11.1.8. SENSITIVITY OF THE RECEPTOR

124. The soils within the Study Area are classed as urban or base-rich loamy and clayey soils that are not considered to generally exhibit characteristics which indicate they have a high susceptibility to damage or degradation. The soils are classified as urban soils under the Natural England ALC Scheme.

125. The soil is deemed to be of low vulnerability, high recoverability, and negligible value. The sensitivity of the receptor is therefore, considered to be Negligible.

10.11.1.9. SIGNIFICANCE OF THE EFFECT

126. Overall, the magnitude of the impact is deemed to be Low, and the sensitivity of the receptor is considered to be Negligible. The effect will, therefore, be of **negligible significance**, which is **not significant** in EIA terms.

10.11.1.10. SECONDARY MITIGATION AND RESIDUAL EFFECT

127. No secondary mitigation is considered necessary because the likely effect in the absence of secondary mitigation is not significant in EIA terms.

IMPACT ON SOILS – DISTURBANCE OF DEPOSITS IN THE ONSHORE SCHEME FROM TRENCHING WORKS RESULTING IN CHANGES TO SOIL QUALITY, COMPACTION AND EROSION

10.11.1.11. INTRODUCTION OF IMPACT

128. Trenching, cabling and drilling techniques used in the construction of the HVDC and HVAC cable routes and Onshore Converter Station will disturb the in-situ deposits within the Study area, which has the potential to result in changes to soil quality, compaction and erosion. Potential impacts identified include:

- Over compaction of soils caused by the use of heavy machinery;
- Over compaction of agricultural and amenity soils caused by storage of construction equipment;
- Structural deterioration of soil materials during excavation, soil handling, storage and replacement;
- Erosion and loss of soils during soil handling, storage and replacement; and
- Homogenisation and loss of characteristic horizons during excavation, storage and replacement.

129. The site clearance and preparation work for the installation of the HVDC and HVAC cables and cable Joint Bays will cover a working corridor of land up to 110 m in width for HVDC and up to 200 m for HVAC . The construction of the Onshore Scheme will involve the temporary stripping and storage of topsoil and subsoil to excavate trenches to the required width and depth to install cable circuits. Whilst there will be a short term, temporary impact of disturbance to soils during the construction phase, the reinstatement of land above the buried cables will allow regeneration and pre-development activities to re-commence once the cables have been installed.

130. Drilling, trenching and excavation techniques used within the construction phase of the cable route could result in erosion and mobilisation of sediment, however the land is generally low and flat lying land reducing the risk of mobilisation.

131. The construction methodology chosen will ensure that the direct impacts on soil resulting from excavation will be limited spatially to the H and temporally to a one-off process of excavation, storage and replacement. Standard industry practice soil handling measures will be implemented in order to preserve soil, structure, texture and avoid compaction. Mitigation measures to ensure soils are protected during the construction phase will be secured through the CEMP and SMP.

132. The principles that will be adopted to manage potential impacts upon soil during construction within the Onshore Scheme will be set out in a Soil Management Plan SMP as discussed in Table 10-11.

133. The SMP will set out the principles and procedures for general good practice mitigation for soil handling to be used for the onshore construction works associated with the Onshore Scheme to minimise the adverse impacts on the nature and quality of the soil resource. The soil handling operations include stripping, handling, storage and reinstatement, the SMP will also address soil management with respect to the re-use of site soils (topsoil and subsoil).

134. The SMP provides details of mitigation measures and standard industry practice handling techniques to safeguard soil resources by providing for their protection, conservation and appropriate reinstatement during the construction of the onshore works.

135. Embedded mitigation measures outlined in section 10.10 include the implementation of pollution prevention procedures which will be secured as part of the CEMP. These measures, alongside appropriate soil management and handling measures tailored to pollution mitigation (i.e., settlement ponds, silt traps) will minimise the potential for deterioration in soil quality associated with spills or leaks of stored fuels / chemicals. Containment of spillages and the cessation of works and relocation of sensitive infrastructure during flooding or extreme heavy rainfall is therefore critical in preventing impacts arising from spillages.

10.11.1.12. MAGNITUDE OF IMPACT

136. Given the features affected, i.e., urban soils and made ground, in addition to the limited and temporary nature of the works and mitigation measures proposed, there will not be considerable, permanent / irreversible changes over the soils. It is therefore that the potential for long-term impacts on soil resulting from the construction works is assessed as Low.

10.11.1.13. SENSITIVITY OF THE RECEPTOR

137. The soils within the Onshore Scheme, are classified as Urban soils under the ALC Scheme that are not considered to generally exhibit characteristics which indicate they have a high susceptibility to damage or degradation.

138. The soil is deemed to be of low vulnerability, medium recoverability, and negligible value. The sensitivity of the receptor is therefore, considered to be Negligible.

10.11.1.14. SIGNIFICANCE OF THE EFFECT

139. Overall, the magnitude of the impact is deemed to be Low, and the sensitivity of the receptor is considered to be Negligible. The effect will, therefore, be of **negligible significance**, which is **not significant** in EIA terms.

10.11.1.15. SECONDARY MITIGATION AND RESIDUAL EFFECT

140. No secondary mitigation is considered necessary because the likely effect in the absence of secondary mitigation is not significant in EIA terms. The effect will, therefore, remain as **negligible significance**, which is **not significant** in EIA terms.

IMPACT ON CONTAMINATED LAND: DISTURBANCE OF HISTORIC CONTAMINATION IN THE SITE FROM TRENCHING WORKS WHICH HAVE THE POTENTIAL TO EXPOSE CONTAMINANTS THAT MAY BE BOUND IN SOILS AND SUPERFICIAL DEPOSITS RESULTING IN CONTAMINATION OF NON-CONTAMINATED AREAS

10.11.1.16. INTRODUCTION OF IMPACT

141. The desk-based assessment of land quality (Technical Appendix 10.1) shows that there is a history of potential contaminative land uses within the Study Area. Potential sources of contamination have been identified within the Site and within potential migration pathways (>250 m) including: the former

coal yard associated buildings and railway, the former Blyth Power Station site, infilled ground, historic landfill and underground mining.

142. The PERA has identified potential contaminants of concern that could be present in the Study Area and could represent a risk of transfer to uncontaminated areas as well as presenting a risk to construction workers, land owners, land users and neighbouring land users if exposed during construction activities.

143. The excavation of the cable trench and earthworks for the Onshore Scheme construction, movement and stockpiling of soils have the potential to mobilise existing ground contamination (where present), which could result in the disturbance of potential contamination could result in pollution of non-contaminated areas. In addition, the disturbance of ground could result in impacts on human health through dermal contact, inhalation and ingestion.

144. The risk associated with soil contamination sources to human health could be altered by a change in the migration pathways by construction activities. It is possible that future construction workers may have viable exposure pathways if residual contamination is present in the soils, in particular within the former railway and maintenance facility in the Landfall / HVDC zone.

145. There is potential for residual asbestos containing materials to be present within the made ground beneath the Landfall/HVDC and HVAC zone and may become a risk to site workers, and/or adjacent site users of the public open space, if respirable fibres are generated by future construction works.

146. The Onshore Scheme has undertaken a PERA and developed a conceptual site model and qualitative risk assessment. Future secondary stage ground investigation will comprise targeted risk based intrusive surveys in specific areas where potential risk has been identified and laboratory analysis will highlight if any risks to construction materials are present (such as elevated sulphate levels in soil or groundwater) which will potentially require mitigation. Any ground investigations that may be required would be undertaken prior to construction. Following the completion of targeted ground investigations, a quantitative risk assessment would be undertaken with recommendations included for further works should they be deemed necessary.

147. It is considered that should any issues arise as a consequence of encountering contaminated land, the management of the ground conditions and land quality would be addressed as part of standard industry practice and the mitigation measures included within the designed-in CEMP.

10.11.1.17. MAGNITUDE OF IMPACT

148. The impacts are predicted to be of local spatial extent (localised to the work areas and areas where contamination may be present), of short-term duration, of intermittent occurrence and high reversibility (occurring only during the works). The assessed magnitude of the various identified impacts of the Onshore Scheme from contaminated land is Medium.

10.11.1.18. SENSITIVITY OF THE RECEPTOR

149. The soils within the Onshore Scheme, are classified as Urban soils under the ALC Scheme that are not considered to generally exhibit characteristics which indicate they have a high susceptibility to damage or degradation. The land within the Study Area is known to have a history of construction and mining activities on the Site and made ground is known to be present across large areas.

150. The receptor is deemed to be of low vulnerability, medium recoverability, and low value. The sensitivity of the receptor is therefore, considered to be Low.

10.11.1.19. SIGNIFICANCE OF THE EFFECT

151. Through the implementation of mitigation measures, including those specified in a CEMP, it is considered that the likely overall effect of the Onshore Scheme on ground conditions and land quality throughout the construction, operation and decommissioning of the Onshore Scheme will not be significant.

152. Overall, the magnitude of the impact is deemed to be Low, and the sensitivity of the receptor is considered to be Low. The effect will, therefore, be of **minor adverse significance**, which is **not significan**t in EIA terms.

10.11.1.20. SECONDARY MITIGATION AND RESIDUAL EFFECT

153. No secondary mitigation is considered necessary because the likely effect in the absence of secondary mitigation is not significant in EIA terms. The effect will, therefore, remain as **minor adverse significance**, which is **not significan**t in EIA terms.

IMPACT ON LAND USE – CONSTRUCTION WORKS MAY IMPACT ON LOCALISED LAND USE VIA DIRECT LOSS OF AGRICULTURAL LAND, INDIRECT CHANGES TO SOIL QUALITY, CHANGES TO AGRICULTURAL DRAINAGE, POTENTIAL INTERFERENCE WITH AGRICULTURAL OPERATIONS, AND CHANGES TO ACCESS

10.11.1.21. INTRODUCTION OF IMPACT

154. The Natural England ALC mapping indicates that the Study Area is classified as Urban land, indicating it is not productive for agriculture. Walkover surveys confirm that the land within the ALC study area is not currently used for agriculture or grazing. The majority of the land within the study area is grassland of open mosaic habitat on previously developed land.

155. Considering that there is no agriculture within the study area there is no potential to reduce the total agricultural yield in areas affected by construction activities.

156. Construction will involve the temporary stripping and storage of topsoil and subsoil to excavate trenches to the required width and depth to install cable circuits. Following completion of the cable works, the working width above the HVAC and HDVC and areas of temporary construction compounds will be reinstated as near as practicably possible to its former condition in accordance with the SMP.

157. There will be permanent land take associated with Onshore Converter Station, the TJBs and Joint Bays, where access is needed to link boxes. There may be an increase in impermeable surfacing associated with the onshore cable route arising from permanent access routes required for inspection and maintenance of the TJBs at Landfall and Joint Bays along route.

158. Designed in measures including the provision and implementation of an SMP to provide for standard industry practice soil handling will be implemented during the pre-construction and construction phases. As part of the SMP a pre-construction soil survey would be undertaken by a competent soil science contractor to record details of soil condition. This would be part of the designed-in SMP.

159. The SMP will include construction method statements for soil handling, and will be produced by a competent soil science contractor and agreed with the relevant regulator, in advance of the works in order to avoid any material change to the soil resource.

160. Land above the would be reinstated to its pre-construction condition as soon as reasonably possible following construction. The mitigation measures would be dependent upon the field-by-field characteristics of soils, weather conditions, existing drainage arrangements.

10.11.1.22. MAGNITUDE OF IMPACT

161. The impacts are predicted to be of local spatial extent (localised to the work areas), of short-term duration, of intermittent occurrence and high reversibility (occurring only during the works). Assuming the standard industry practice measures are adopted as set out in the SMP, the magnitude of impact of the Onshore Scheme on land use is expected to be Negligible.

10.11.1.23. SENSITIVITY OF THE RECEPTOR

162. The land use is deemed to be of low vulnerability, high recoverability, and low value. The sensitivity of the receptor is therefore, considered to be Negligible overall.

10.11.1.24. SIGNIFICANCE OF THE EFFECT

163. Overall, the magnitude of the impact is deemed to be Negligible, and the sensitivity of the receptor is considered to be Negligible. The effect will, therefore, be of **negligible significance**, which is **not significant** in EIA terms.

10.11.1.25. SECONDARY MITIGATION AND RESIDUAL EFFECT

164. No secondary mitigation is considered necessary because the likely effect in the absence of secondary mitigation is not significant in EIA terms. The effect will, therefore, remain as **negligible significance**, which is **not significant** in EIA terms.

IMPACT ON MINING – POTENTIAL FOR HISTORIC MINING ACTIVITIES TO PRESENT RISK TO DEVELOPMENT

10.11.1.26. INTRODUCTION OF IMPACT

165. The Blyth area has a long industrial heritage predominantly associated with coal mining and shipbuilding. The CMRA indicates that the Moorland (possible shallow mine workings) may have been present in the north-west of the Onshore Converter Station area, which is currently covered by woodland and is designated as a Development High Risk Area.

166. The trenching, cabling and earthworks in the Onshore Converter Station Zone have the potential to encounter shallow unrecorded workings or mine entries, locally broken / fissured ground or mine gas associated with historical mining activities. There is potential for the ground beneath the structures to become unstable from previous mining activities and earthworks.

167. The CMRA concludes that there is a low risk of significant impacts related to historic coal mining: ‘provided that adequate investigation in the areas where shallow coal workings may be present, should the proposed Onshore Converter Station be planned for one of these areas of the site. Cable routes to and from a Onshore Converter Station have much relatively lower sensitivity to identified potential mining related risks than the Onshore Converter Station structures.’

168. The probability of the risk of encountering mine workings within the Landfall/HVDC and HVAC Zones are considered to be negligible.

169. A targeted ground investigation will be undertaken prior to construction as standard industry practice in areas where mine workings are anticipated, which will inform the foundation design and any remediation required.

170. If evidence of workings is encountered during ground investigation or construction, works should temporarily cease, and the Coal Authority be informed with subsequent investigation and any required mitigation carried out in accordance with guidance such as CIRIA C758.

10.11.1.27. MAGNITUDE OF IMPACT

171. The impacts are predicted to be of local spatial extent (localised to the work areas), of short-term duration, of intermittent occurrence and high reversibility (occurring only during the works). The magnitude of impact of the Onshore Scheme on mining is expected to be Low.

10.11.1.28. SENSITIVITY OF THE RECEPTOR

172. The sensitivity of the receptor is considered to be high as these effects from coal mining can lead to loss of, or damage to plant and risk to construction workers.

173. The receptor is deemed to be of high vulnerability, medium recoverability, and high value. The sensitivity of the receptor is therefore, considered to be High.

10.11.1.29. SIGNIFICANCE OF THE EFFECT

174. Overall, the magnitude of the impact is deemed to be Low, and the sensitivity of the receptor is considered to be High. The effect will, therefore, be of **moderate adverse significance**, which is **significant** in EIA terms.

10.11.1.30. SECONDARY MITIGATION AND RESIDUAL EFFECT

175. Based on the CMRA, it is recommended that the targeted ground investigation referred to above will include the assessment of hazardous gases associated with mine workings to identify any risks to receptors and, where required, relevant mitigation measures which will be based on standard industry practice. The location of any features identified will need to be considered when undertaking detailed design of the layout of the development.

176. Overall, following mitigation, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be High. The effect will, therefore, be of **minor adverse significance**, which is **not significant** in EIA terms.

IMPACT ON UXO – POTENTIAL RISK FROM IDENTIFIED PIPE MINES ON THE DEVELOPMENT.

10.11.1.31. INTRODUCTION OF IMPACT

177. Zetica, a UXO specialist company, has undertaken a pre-desk study for the Onshore Scheme Landfall area to further assess the potential for UXO risk. Whilst the risk of unexploded bombs and other UXO across the majority of the Site is low, a moderate risk from pipe mines to the east of East Sleekburn has been identified, in the HVAC Zone.

178. Whilst pipe mines were typically cleared at the end of WWII, no records have been found to confirm their removal from the Study Area.

179. The prospective UXO threats in this instance must be considered in light of the proposed cable installation operations, as well as the impact on key receptors such as personnel and construction machinery, together with any other high-value or sensitive receptors in close proximity e.g., third party buildings, equipment, the local environment.

180. Trenching, cabling and drilling techniques used in the construction of the HVAC could disturb the in-situ deposits within the Site, which has the potential to result in contact with the potential hazard. Contact with the potential hazard could result in uncontrolled explosion.

10.11.1.32. MAGNITUDE OF IMPACT

181. The impact is predicted to be of local spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be High.

10.11.1.33. SENSITIVITY OF THE RECEPTOR

182. There are various potential receptors identified above. Construction workers are considered to be the most sensitive receptors as the activities they are engaged in constitute more direct exposure routes over longer periods of time. Therefore, the sensitivity is based on the most sensitive receptor.

183. The receptor is deemed to be of high vulnerability, low recoverability, and high value. The sensitivity of the receptor is therefore, considered to be High.

10.11.1.34. SIGNIFICANCE OF THE EFFECT

184. The probability of encountering pipe mines is unlikely, however the result of encountering them during construction without mitigation would be significant. Overall, without mitigation the magnitude of the impact is deemed to be High, and the sensitivity of the receptor is considered to be High. The effect will, therefore, be of **major adverse significance**, which is **significant** in EIA terms.

10.11.1.35. SECONDARY MITIGATION AND RESIDUAL EFFECT

185. Based upon the findings, Zetica recommend a non-intrusive UXO detection survey is undertaken in the areas of potential pipe mines, in advance of intrusive works, in order to detect pipe mine features. The non-intrusive survey will determine whether any pipe mines or other UXO are present in the moderate risk areas. This also determines whether further investigation is required. Further investigation would involve an intrusive target investigation and disposal.

186. If no potential pipe mine features are detected construction works can proceed. However, it is recommended that UXO awareness briefings should be provided to those involved in the construction.

187. Overall, following mitigation, the magnitude of the impact is deemed to be Negligible, and the sensitivity of the receptor is considered to be High. The effect will, therefore, be of **minor adverse significance**, which is **not significant** in EIA terms.

10.11.2. Potential Effects During Operation and Maintenance

IMPACT ON GROUND CONDITIONS – LOCALISED HEATING IMPACTS ARISING FROM THE BURIED CABLE HAS THE POTENTIAL TO IMPACT GROUND CONDITIONS THROUGH LOCALISED DRYING OF SOILS OVER TIME

10.11.2.1. INTRODUCTION OF IMPACT

188. Localised heating of buried cables during operation has the potential to impact ground conditions, which could result in drying of soils over time. The heat energy from cables that are buried below the surface have the potential to be retained within surrounding sediments. These heating and drying effects on soils could result in the reduction of soil quality. The heating of the ground from the cables also presents a theoretical risk to the potential presence of combustible materials within the shallow soils (e.g., coal content within colliery spoil).

189. The trench depth of the cables installed using the open cut trenching method will be up to 2.2 m below ground and backfill material used will reduce localised heating of soils. The backfill material chosen will be one with low thermal conductivity and moderate increases in cable temperature will be incorporated into the cable design. The cables installed by trenchless method will be up to 15 m in depth.

190. The cables will be installed within ducts and the ducts will be installed in a stabilised backfill material, Cement Bound Sand (CBS) which is a weak cement sand mix. The remainder of the trench is then backfilled with the excavated native material, where suitable. The cables are installed and the trenches backfilled, the stored topsoil will be replaced and the land reinstated back to its previous use. The cables would not be in direct contact with the ground with the exception of the Joint Bays and at these locations the cables or joints will be installed in sand or CBS and therefore will not be in contact with the ground directly.

191. The layer of CBS is a stabilised backfill material that ensures a consistent structural and thermal environment for the cables. Cement bound sand has a low thermal resistance to conduct the heat produced during electricity transmission from high voltage cables. It is often a weak cement mix which allows it to be relatively easy to remove should maintenance or removal of the cables be required. Compliant cement bound sand ensures that the thermal conductivity around the cables is of a known value and will remain consistent for the length of the cable being installed.

192. The temperatures will be highest at the core or the conductor with temperature reducing outwards from the centre of the cable. At the edge or the CBS surround the temperature is unlikely to be largely above ambient ground temperature. The cables are intermittent in their loading rather than continuous and it is further unlikely any level of heat would be provided to combust the ground materials.

193. The use of standard industry practice for construction of buried cables ensures that the risk of localised heating impacts are unlikely.

194. A targeted ground investigation will be undertaken prior to construction as standard industry practice in areas where contaminants may be present due to historical land uses. The investigation will inform the detailed design and any remediation required for the cable installation. Consideration should be given to the presence of coal within the backfill materials and if present, whether alternative backfill materials should be used to reduce the risk of localised heating.

10.11.2.2. MAGNITUDE OF IMPACT

195. The impact is predicted to be of local spatial extent, medium term duration, continuous and medium reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore considered to be Negligible.

10.11.2.3. SENSITIVITY OF THE RECEPTOR

196. The buried cables are not cited in locations of high-quality soils or areas of important geological interest, however colliery spoil may be present within the shallow soils. Therefore, soil is deemed to be of medium vulnerability, medium recoverability, and low value. The sensitivity of soils as a receptor is therefore, considered to be Low.

10.11.2.4. SIGNIFICANCE OF THE EFFECT

197. Overall, the magnitude of the impact is deemed to be Negligible, and the sensitivity of the receptor is considered to be Low. The effect will, therefore, be of **negligible significance**, which is **not significant** in EIA terms.

10.11.2.5. SECONDARY MITIGATION AND RESIDUAL EFFECT

198. No secondary mitigation is considered necessary because the likely effect in the absence of secondary mitigation is not significant in EIA terms. The effect will, therefore, remain as **negligible significance**, which is **not significant** in EIA terms.

IMPACT ON SOILS – POLLUTION OR CONTAMINATION OF SOILS FROM CHEMICAL SPILLS, EROSION AND POTENTIAL MOBILISATION OF HISTORIC CONTAMINATION DUE TO MAINTENANCE ACTIVITIES

10.11.2.6. INTRODUCTION OF IMPACT

199. Significant ground disturbance is considered unlikely during the operation and maintenance phase. Contractors appointed to carry out repair and/or maintenance activities would use existing access infrastructure. Contractors would be required to adopt appropriate working methods and control measures such as mitigation and standard industry practice measures.

200. Any possible impacts will be kept to a minimum. The effects on geological and soil receptors due to maintenance and repairs within the Site are not considered to be significant.

201. The detailed design of the Onshore Scheme will consider contaminated land and the layout will be designed to avoid any areas of potential contamination, where contamination cannot be avoided mitigation measures as part of the CEMP will mitigate the potential risk. The design will also take into account required measures to ensure loss of contaminants is contained avoiding release to ground.

202. Potential sources of contamination that have been identified by the PERA will be referenced during the detailed design phase, identifying selection of appropriate materials that provide adequate protection from contaminated soils and/or groundwater.

203. The Onshore Converter Station would contain potential pollutants which could include cooling oils, lubricants, fuels, greases, etc that could affect soil quality if released during operation.

204. The design, maintenance and routine inspection of the Onshore Converter Station would prevent or contain leaks of cooling oil etc., thereby mitigating against the potential for release of these possible

contaminants into the surrounding soils and geology. Any such maintenance would follow standard industry practice in line with the prevailing future guidance and legislation (as mentioned in Table 10-2), which would include specific measures to minimise the risk of a pollution event.

10.11.2.7. MAGNITUDE OF IMPACT

205. Through the adoption of standard industry practice the magnitude of impact is predicted to be of local spatial extent, short term duration (only during maintenance activities), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be Low.

10.11.2.8. SENSITIVITY OF THE RECEPTOR

206. As set out in section 10.7.1 the soil at the Onshore Converter Station is classed as having negligible sensitivity. The land use is deemed to be of low vulnerability, high recoverability, and low value. The sensitivity of the receptor is therefore, considered to be Negligible.

10.11.2.9. SIGNIFICANCE OF THE EFFECT

207. Overall, the magnitude of the impact is deemed to be Low, and the sensitivity of the receptor is considered to be Negligible. The effect will, therefore, be of **negligible significance**, which is **not significant** in EIA terms.

10.11.2.10. SECONDARY MITIGATION AND RESIDUAL EFFECT

208. No secondary mitigation is considered necessary because the likely effect in the absence of secondary mitigation is not significant in EIA terms. The effect will, therefore, remain as **negligible significance**, which is **not significant** in EIA terms.

IMPACT ON LAND USE: OPERATION AND MAINTENANCE WORKS MAY IMPACT ON LOCALISED LAND USE VIA DIRECT LOSS OF AGRICULTURAL LAND, INDIRECT CHANGES TO SOIL QUALITY, INTERFERENCE WITH AGRICULTURE ACTIVITIES AND CHANGES TO ACCESS

10.11.2.11. INTRODUCTION OF IMPACT

209. The following section considers the potential impact of a reduction in available soil resource for agriculture through the presence of the infrastructure within the Landfall, HVDC, HVAC and Onshore Converter Station zones during operation. Walkover surveys confirm that the land within the ALC study area is not currently used for agriculture or grazing.

210. Considering that there is no agriculture within the Study Area there is no potential for direct loss of agricultural land or interference with agriculture activities or changes to access from the operation and maintenance works.

211. The physical above-ground presence that the Onshore Scheme would have onshore during the operation and maintenance phase is limited to the Onshore Converter Station, link box and Joint Bays. There will be no permanent land take associated with the operational buried cables with the exception of the man-hole covers associated with the Joint Bays, where access is needed to link boxes as described above. There may be an increase in impermeable surfacing associated with the onshore cable routes arising from permanent access roads and man-holes required for inspection and maintenance.

212. Onshore Converter Station Zone soils will be removed and used for landscaping from the foundation footprint and therefore the soils will be subject to change over the whole feature. The Onshore Converter Station will be located within the Onshore Converter Station Zone. At this stage the permanent footprint of the Onshore Converter Station platform is proposed to be about 9.0 ha in size. The total area of land within the Onshore Scheme is 188 ha and the Onshore Converter Station Zone is 9.0 ha. The footprint of the Onshore Converter Station represents 4.74% of the overall Site area. There would be a localised impact restricted to the above ground onshore infrastructure, which includes the footprint of the Onshore Converter Station and the smaller footprints of the Joint Bays along the cable routes.

213. During construction, the onshore cables would be buried underground. The construction phase would include restoration of the land above the cable to its former land use. Standard industry practice and soil handling principles for reinstatement will be set out within the SMP secured as part of the CEMP.

214. Activity during operation and maintenance will be limited to periodic inspection and maintenance activity of infrastructure within the onshore cable. Any repair activity would be of a similar nature to the construction phase (albeit at a much-reduced scale).

10.11.2.12. MAGNITUDE OF IMPACT

215. Whilst there may be loss of Urban soil on a local scale, due to the small area of the permanent operational infrastructure in the context of the overall development, the impact of operation on soil / land quality is considered to be of low magnitude.

216. The impact is predicted to be of local spatial extent, medium to long term duration, continuous and low reversibility. It is predicted that will affect the receptor directly. The magnitude of impact the impact on agricultural land is therefore considered to be low.

10.11.2.13. SENSITIVITY OF THE RECEPTOR

217. The soil resource being affected is classified as Urban soils under ALC. Therefore, soil is deemed to be of low vulnerability, high recoverability, and low value. The sensitivity of the receptor is therefore, considered to be Negligible.

10.11.2.14. SIGNIFICANCE OF THE EFFECT

218. Overall, the magnitude of the impact is deemed to be Low, and the sensitivity of the receptor is considered to be Negligible. The effect will, therefore, be of **negligible significance**, which is **not significant** in EIA terms.

10.11.2.15. SECONDARY MITIGATION AND RESIDUAL EFFECT

219. No secondary mitigation is considered necessary because the likely effect in the absence of secondary mitigation is not significant in EIA terms. The effect will, therefore, remain as **negligible significance**, which is **not significant** in EIA terms.

10.11.3. Potential Effects During Decommissioning

220. No decision has been made regarding the final decommissioning plan for the Onshore Scheme, as it is recognised that industry standard practice, rules and legislation change over time. The detailed activities and methodology would be determined and agreed with the relevant planning authority later within the lifetime of the Onshore Scheme.

221. During the decommissioning phase, the impacts on geology and soils will be similar or equivalent to those assessed for the construction phase.

222. The decommissioning works of the Onshore Converter Station may involve removal of some or all of the impermeable hard standing and restoration of greenfield land present prior to construction. The action would result in ground being return to its pre-development state. Specific decommissioning requirements and potential concerns with regards to geology and soils would be discussed with the relevant statutory consultees at the time.

223. At the end of the operation and maintenance phase of the Onshore Scheme, the options for decommissioning works will be assessed, taking into consideration constraints (e.g., safety and liability) and the potential environmental impacts associated with decommissioning works.

224. The principal options for decommissioning of the HVDC and HVAC cables include:

- Leaving the cabled in-situ, trenched;
- Leaving the cabled in-situ and providing additional protection; and
- Remove sections of the cables.

225. For the purposes of a realistic worst-case assessment while the approach to decommissioning is developed by the applicant, it has been assumed for the purposes of this assessment that the cables would be pulled through the ducts and removed, with the ducts themselves left in situ. With regards to the Onshore Converter Station, it would be gradually dismantled with certain infrastructure removed for recycling or reuse. Following this, the area is likely to be remediated and restored.

226. Should complete removal of the HVDC and HVAC cables be required, the significance of effect is considered to result in similar impacts to those assessment as part of the construction phase of the Onshore Scheme. Complete removal of infrastructure represents the most significant adverse effects, and therefore if the other decommissioning options were to be progressed, they would have no more significant adverse effects.

10.12. Proposed Monitoring

227. No monitoring is considered necessary to test the predictions made within the assessment of likely significant effects on geological soil receptors.

10.13. Cumulative Effects Assessment

10.13.1. Methodology

228. The Cumulative Effects Assessment (CEA) takes into account the impact associated with the Onshore Scheme together with other relevant plans, developments and activities. Cumulative effects are therefore the complete set of effects arising from the Onshore Scheme together with the effects from a number of different developments, on the same receptor or resource. Please see Volume 2, Chapter 3 of this ES for detail on CEA methodology.

229. The developments selected as relevant to the CEA presented within this Chapter are based upon the results of a screening exercise and the development of a ‘long list’ of cumulative developments relevant to the Onshore Scheme (see Volume 3, Technical Appendix 3.1). Each development has been considered on a case by case basis for screening in or out of this Chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved, to create the ‘short list’ as summarised in Table 10-12. This approach was agreed during the EIA scoping

process and further consultation and technical engagement undertaken with consultees, as detailed in Table 10-3 and in ES Chapter 6: Stakeholder Engagement and Consultation.

230. The greatest potential for cumulative effects arises when the construction phase of another development overlaps with the construction phase of the Onshore Scheme. Cumulative effects are considered to have a likely significant effect only where such an overlap may exist, as activities that could be potentially detrimental to the ground conditions and land use environment are greatly reduced during the operational phase of developments.

231. Therefore, it is considered that geographic separation between developments, results in the absence of a cumulative effect to geology and the soils environment. Potential cumulative effects to geology and the soils environment between the Onshore Scheme and other proposed or consented developments are considered plausible only where the development footprint of both developments overlap.

232. Based on geographic separation between the Onshore Scheme and other proposed or consented developments located within a 250 m radius, the majority of other projects have been scoped out of the cumulative assessment.

233. It is appropriate to consider the Landfall area in further detail in the context of the Cambois Connection Marine Scheme. Based on the MDS for the Marine Scheme, a trenchless technique, such as HDD, will be deployed to bring the Offshore Export Cables ashore via ducts that will be installed from a point landward of MHWS to an exit point at least 250 m seaward of MLWS, thus completely bypassing the intertidal area. All construction works and infrastructure associated with the Onshore Scheme will be above MHWS, and landward of the dune system on Cambois beach, and therefore there is no potential for any direct interaction with the intertidal area. Given there will be no construction works associated with the Onshore Scheme within the intertidal area, there is no potential for any direct effects on geological and soil receptors. Therefore, the Marine Scheme is not considered further within this CEA. Further detail on the Marine Scheme is provided in Volume 2, Chapter 5: Project Description. The specific projects scoped into the CEA for geology and soils are outlined in Table 10-12.

Table 10-12 List of other developments considered within the CEA for Geology and Soils

Development / Plan	Status	Distance from Study Area (km)	Description of Development / Plan	Dates of Construction	Dates of Operation	Overlap with the Onshore Scheme
Land At Former Power Station Site on Northern Side of Cambois. 21/00818/FULES	Consented	0 km (adjacent to boundary)	Erection of battery manufacturing plant with ancillary offices, together with associated development and infrastructure works (including site preparation works, ground modelling, drainage, landscaping, vehicular assess, cycle and pedestrian access, parking provision, substation and other associated works).	Not yet known	2023 (full operation by 2028)	Large-scale development with potential for direct overlap. Construction likely to overlap.
Land North of Blyth Power Station Substation, East Sleekburn 22/00879/FUL	Consented	0 km (adjacent to boundary)	Erection of building for manufacturing of subsea cables, with ancillary offices and outdoor cable storage, together with associated development and infrastructure works including vehicular accesses off Brock Lane, landscaping and vehicular parking.	Not yet known	Not yet known	Large-scale development with potential for direct overlap. Construction likely to overlap.
Land East of Sleekburn Business Centre, West Sleekburn 21/02506/HAZARD	Consented	0 km (adjacent to boundary)	Hazardous Substance Consent for the storage and use of: Cathode Active Material (Cobalt Lithium Manganese Nickel Oxide) (Powder) and Electrolyte (no more than 20% Lithium Hexaflourophosphate) (Liquid). Quantities: 1830 tonnes of Cathode Active Material and 3162 tonnes of Electrolyte.	Under construction	2027	Large-scale development with potential for direct overlap.

10.13.2. Cumulative Effects Assessment

234. An assessment of the likely significance of the cumulative effects of the Onshore Scheme with other projects, plans and developments upon geological and soil receptors arising from each identified impact is given below.

10.13.2.1. POTENTIAL EFFECTS DURING CONSTRUCTION

235. Table 10-12 summarises those projects that have been considered for the cumulative effects assessment due to their temporal or spatial overlap with the likely significant effects arising from the Onshore Scheme. Where the impacts of these projects have the potential for cumulative likely significant effects on geology and soils the rationale column of the Table 10-13 identifies these.

Table 10-13 Potential cumulative impacts

Potential Impact	Potential for Cumulative Impact	Justification
Impact on geology	Yes	Impacts may be exacerbated by other projects.
Impact on soils	Yes	
Impact on contaminated land	Yes	
Impact on land use	Yes	
Impacts on mining	Yes	
Impacts on UXO	Yes	

236. Construction impacts on geology and soils would potentially be increased should the developments listed in Table 10-12 and overlap spatially and temporally with the Onshore Scheme, which could lead to a larger land take and increased disturbance.

237. In addition, given the industry requirements to control adverse likely significant effects of any development on geology and soils, appropriate mitigation would be in place for these schemes to secure approval. It is anticipated that the other identified projects would be constructed in accordance with a Code of Construction Practice during construction and, if appropriate, an Environmental Permit or CEMP.

238. It is therefore considered unlikely that there would be any cumulative effects during construction on geology and soils associated with the listed projects as any potential impacts will be minimised by adoption of the mitigation measures described in this Chapter.

10.14. Inter-Related Effects

239. Inter-related effects are the potential effects of multiple impacts, effecting one receptor or a group of receptors. Inter-related effects include interactions between the impacts of the different stages of the Onshore Scheme (i.e., interaction of impacts across construction, operation and maintenance and decommissioning), as well as the interaction between impacts on a receptor within a stage.

240. The potential of the onshore geological and soil effects to have secondary effects on other receptors and these are fully considered in the topic specific Chapters. These are:

- Hydrological and hydrogeological receptors (Volume 2, Chapter 11) e.g., changes to the sediment transport regime resulting in impacts on hydrological and riverine morphology,

particularly at Landfall, and the interaction between the surface water discharge point on the sleek burn and riverine morphology; and

- Archaeological and cultural heritage receptors (Volume 2, Chapter 8) e.g., changes to the soil by the location of the Onshore Converter Station outfall in the location of cropmark remains.

241. The assessment of effects on geological and soil receptors, as presented in section 10.11 has already taken into account the potential for multiple impacts from the Onshore Scheme affecting particular receptors. Significant effects on geological and soil receptors resulting from the interaction of impacts across the construction, operation and maintenance and decommissioning phases are unlikely since changes would likely only occur for the construction phase, the potential for significant effects during operation and maintenance is low, and the decommissioning phase is far enough in the future for there to be no cross-phase impacts.

242. There are not anticipated to be any potential inter-related receptor led effects beyond those effects already assessed in section 10.11.

243. As such, inter-related effects are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phases. Therefore, these inter-related effects would not be significant in EIA terms.

10.15. Summary of Impacts, Mitigation Measures, Likely Significant Effects and Monitoring

244. Information on geology and soils within the Study Area was collected through desktop review, site surveys and consultation. Table 10-14 presents a summary of the potential impacts, mitigation measures and the conclusion of likely significant effects in EIA terms in respect to geology and soils. The impacts assessed include:

- Impact on geology;
- Impact on soils;
- Impact on contaminated land;
- Impact on land use;
- Impacts on mining; and
- Impacts on UXO.

245. Overall, it is concluded that there will be no likely significant effects arising from the Onshore Scheme during the construction, operation and maintenance or decommissioning phases.

246. Overall, it is concluded that there will be no likely significant cumulative effects from the Onshore Scheme alongside other developments / plans.

Table 10-14 Summary of potential likely significant environmental effects, mitigation and monitoring

Description of Impact	Phase C O D	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Secondary Mitigation	Residual Effect	Proposed Monitoring
Construction and decommissioning impact on geology: the Onshore Converter Station, onshore cable route and Landfall will cut across geology, surface sediments, dunes, Quaternary glacial sediments and soils	✓ × ✓	Negligible to Low	Designated sites – High Geology – Low Mineral resource – Medium	Designated sites – minor adverse Geology – Negligible Mineral resource – minor adverse	Consultation with Northumberland Minerals and Waste Planning Authority regarding the potential presence of any mineral resources.	Designated sites – minor adverse Geology – negligible Mineral resource – minor adverse	None
Construction and decommissioning impact on soils: disturbance of deposits in the Onshore Scheme from trenching works resulting in modifications to natural drainage patterns and potential increase in flood risk.	✓ × ✓	Low	Negligible	Negligible	n/a	Negligible to minor adverse	None
Construction and decommissioning impact on soils: disturbance of deposits in the Onshore Scheme from trenching works resulting in changes to soil quality, compaction and erosion	✓ × ✓	Low	Negligible	Negligible	n/a	Negligible to minor adverse	None
Construction and decommissioning impact on contaminated land: disturbance of historic contamination in the onshore scoping area from trenching works which have the potential to expose contaminants that may be bound in soils and superficial	✓ × ✓	Medium	Low	Minor adverse	n/a	Minor to moderate adverse	None

Description of Impact	Phase C O D	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Secondary Mitigation	Residual Effect	Proposed Monitoring
deposits resulting in contamination of non-contaminated areas.							
Construction and decommissioning impact on land use: construction works may impact on localised land use via direct loss of agricultural land, indirect changes to soil quality, changes to agricultural drainage, potential interference with agricultural operations, and changes to access.	✓ × ✓	Negligible	Low	Negligible	n/a	Negligible	None
Construction and decommissioning impacts on mining: potential for historic mining activities to present risk to development.	✓ × ✓	Low	High	Moderate adverse	Assessment of hazardous gases associated with mine workings to identify any risks to receptors and, where required, relevant mitigation measures.	Minor adverse	None
Construction and decommissioning impact on UXO: potential risk from identified pipe mines on the development.	✓ × ✓	High	High	Major adverse	A non-intrusive UXO detection survey recommended to be undertaken in the areas of potential pipe mines, in advance of intrusive works, in order to detect pipe mine features. The non-intrusive survey will determine whether any pipe mines or other UXO are present in the moderate risk areas. This also	Minor adverse	None

Description of Impact	Phase C O D	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Secondary Mitigation	Residual Effect	Proposed Monitoring
					determines whether further investigation is required.		
Operational impact on ground conditions: localised heating impacts arising from the buried cable has the potential to impact ground conditions through localised drying of soils over time.	× ✓ ×	Negligible	Low	Negligible	n/a	Negligible to minor adverse	None
Operational impact on soils: pollution or contamination of soils from chemical spills, erosion and potential mobilisation of historic contamination due to maintenance activities	× ✓ ×	Low	Negligible	Negligible	n/a	Negligible	None
Operational impact on land use: operation and maintenance works may impact on localised land use via direct loss of agricultural land, indirect changes to soil quality, interference with agriculture activities and changes to access	× ✓ ×	Low	Negligible	Negligible to minor adverse	n/a	Negligible	None

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