8 LAND QUALITY AND GEOLOGY

8.1 Introduction

This section of the EIA Report considers the likely effects of the proposed scheme with respect to land quality and geology and how this could affect human health, the natural and the built environment. It describes the methods used to assess potential effects, the baseline conditions currently existing at the proposed scheme footprint and surrounding area, the mitigation measures required to prevent, reduce or off-set any significant adverse effects, and the likely residual effects after these measures have been adopted.

The findings of this assessment have the potential to influence other technical sections within this EIA Report, namely **Section 11**, **20** and **25**.

8.2 Policy and consultation

There are a number of overarching international, national and regional items of legislation, policy and guidance applicable to the proposed scheme, as detailed in **Section 4**. The following sections build on the information provided in **Section 4** by focusing on key legislation, policy and guidance with specific reference to land quality and geology.

8.2.1 National policy and guidance

National Planning Policy Framework

The NPPF (Ministry of Housing, Communities and Local Government, 2019) provides guidance to planning authorities on how to assess planning applications. **Table 8.1** provides a summary of the requirements of the NPPF with regard to land quality and geology and signposts to the applicable section of this EIA Report where the requirement has been addressed.

Table 8.1 NPPF guidance relevant to land quality and geology

NPPF reference	NPPF requirement	EIA reference
NPPF15-170	The planning system should contribute to and enhance the natural and local environment by: • protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan); • 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; • remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.	The existing environment within the proposed scheme footprint is discussed in **Section 8.4**. Potential impacts and subsequent mitigation measures are discussed in **Sections 8.5** and **8.6**.
NNPF15 - 178	Planning policies and decisions ensure that: • a site is suitable for its proposed use taking account of ground conditions and any risk arising from land instability and contamination. This includes risks arising from natural hazards or former activities	The existing environment for ground conditions and contamination is discussed in **Section 8.4.** Potential linkages and impacts arising from ground conditions and contamination

NPPF reference	NPPF requirement	EIA reference
	such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation); • after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and • adequate site investigation information, prepared by a competent person, is available to inform these assessments"	are discussed within the land quality preliminary risk assessment (PRA) included as **Appendix 7**.
NPPF15 -179 and NPPF15-180	Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and / or landowner. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: • mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life; • identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and • limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.	The existing environment in relation to any sources of contaminated land is discussed in **Section 8.4**. The potential impacts relating to contaminated land during the construction and operational phases of the proposed scheme are discussed in **Sections 8.5** and **8.6** respectively.
NPPF15-183	The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.	The existing environment and baseline in relation to the proposed scheme is addressed in Section 8.4. An assessment of any potential effects from the proposed scheme during construction and operational phases is given in Sections 8.5 and 8.6.

Environmental Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance

The Environmental Protection Act 1990 makes provision for the improved control of pollution arising from certain industrial and other processes. Part 2A of the Act provides the statutory definition of contaminated land: "*Contaminated Land is any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under the land that:*

- *Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- *Significant pollution of controlled waters is being or is likely to be caused*."

The guidance also provided the regulatory basis for the identification, designation and remediation of contaminated land. The proposed scheme could have an effect on land potentially affected by contamination. This requires assessment to ensure that the land is suitable for use following the proposed scheme, and that the land cannot be determined as contaminated land under Part 2A of the Act.

Contaminated Land (England) Regulations (2006) and 2012 amendment

The Contaminated Land (England) Regulations 2006 provides an update to the Part 2A regime to cover land contaminated by radioactive material. The 2012 addendum includes changing to the wording of paragraphs in the 2006 regulations in relation to controlled waters and remediation notices.

Environmental Permitting (England and Wales) Regulations 2016

The Environmental Permitting (England and Wales) Regulations 2016 (Her Majesty's Stationery Office (HMSO), 2016) consolidate and replace the Environmental Permitting (England and Wales) Regulations 2010 (S.I. 2010/275), which have been amended several times. The 2016 Regulations were amended in 2018 (S.I.2018 No.110) (HMSO, 2018).

The 2016 Regulations (as amended) set out an environmental permitting and compliance regime that applies to various activities and industries, including the management of waste. The environmental permitting regime is a common framework for applying for, receiving, varying or transferring and surrendering permits, along with compliance, enforcement and appeals arrangements. It rationalises the previous permitting and compliance regimes into a common framework that is easier to understand and simpler to use.

A key component is that it allows applicants that would otherwise require several permits for activities falling under various regulations on a single site to complete a single application, and to be issued with one permit. The framework introduces different levels of control, based on risk: exclusions (lower risk activities which may be undertaken without any permit), exceptions (lower risk activities which may be undertaken after registering, which is free), standard rules permits (standard requirements and conditions for the relevant activities are set out so that applicants can determine in advance whether the permit is applicable to their proposals) and bespoke permits (permits written specifically for activities which are unique or of higher risk).

If the regulator considers that an operator has contravened, is contravening or is likely to contravene an environmental permit condition, the regulator may serve a notice on the operator to remedy any environmental effects, including pollution.

Land Contamination Risk Management 2020 Framework

The Environment Agency Land Contamination Risk Management (2020) Framework provides an update to the former Environment Agency Model Procedures for the Management of Land Contamination, Contaminated Land Report 11 (CLR11). The principles of the guidance are to help those assessing potentially contaminated sites identify and assess the risks posed to sensitive receptors, make appropriate decisions in relation to the outcome of the assessment and take the required actions necessary e.g. implement remediation, if deemed necessary following the assessment.

Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

The aim of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 is for all waterbodies to achieve Good Status by 2027 (which is comprised of scoring for both Ecological and Chemical Status) and to ensure that there is no deterioration from current status. This legislation is relevant to land quality as it will assist in determining the sensitivity of waterbodies within the proposed scheme. The WFD compliance assessment is presented in **Section 28.**

Groundwater (Water Framework Directive) (England) Direction 2016
The aim of the Groundwater (Water Framework Directive) (England) Direction (2016) is to set out instructions and obligations for the Environment Agency to protect groundwater, including monitoring and setting threshold values for both existing and new pollutants in groundwater. This legislation is relevant to land quality as it will assist in determining the sensitivity of groundwater resources within the proposed scheme.

Water Resources Act
The Water Resources Act (1991) as amended by the Water Act (2003) provides the definition of and regulatory controls for the protection of water resources, including the quality standards expected for controlled waters. This legislation is relevant to land quality as it will assist in determining the sensitivity of controlled waters within the proposed scheme, particularly when assessing the effect of the proposed scheme from construction and operational activities.

Environment Act
The Environment Act (1995) established the Environment Agency and gave it responsibility for environmental protection of controlled waters. This legislation is relevant to land quality as it will help aid identification of the sensitivity and potential effects of the proposed scheme during construction and operational activities. It will also aid in the identification of suitable mitigation measures to provide protection to controlled waters.

Environmental Damage Regulation
The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 transposes into domestic law the EU Directive 2004/35/EC on environmental liability with regards to the prevention and remedying of environmental damage. This legislation is relevant to land quality as it will aid in the identification of suitable preventative measures and mitigation techniques for the construction and operational phases of the proposed scheme.

Construction (Design and Management) Regulations
The Construction (Design and Management (CDM)) Regulations 2015 are the main set of regulations used to manage the health, safety and welfare of construction projects. This legislation is relevant to both land quality and the construction activities of the proposed scheme as a whole as it ensures the safety of human receptors involved in the construction phase.

Guiding Principles for Contaminated Land
The Guiding Principles for Contaminated Land comprise three documents produced by the Environment Agency. The documents include GPCL 1 – Guiding principles for land contamination introduction, GPCL 2 – FAQs, technical information, detailed advice and references, and GPCL 3 – reporting checklist. The aims of these documents are to provide guidance to those who are involved with contaminated land, encourage good practice, promote compliance with regulatory requirements and to provide reference to applicable guidance.

8.2.2 Local policy guidance

The RCBC Local Plan and the subsequent South Tees Area Supplementary Planning Document (both adopted in May 2018) outline the statutory guidelines for developments within the borough. Policy LS4 of the South Tees Spatial Strategy includes guidance relevant to the environment. This policy includes a requirement to undertake the following, which are directly or indirectly linked to this section of the EIA Report:

- enhance the environmental quality of employment through well planned boundary treatments;
- secure decontamination and redevelopment of potentially contaminated land;

- protect European sites, and safeguard and improve sites of biodiversity interest particularly along the River Tees and the estuary and encourage integrated habitat creation and management;
- enhance the environmental quality of the River Tees and coastline; and,
- encourage improvements to access, interpretation and wildlife conservation and biodiversity across the area;

8.2.3 Consultation

Consultation is a key part of the EIA process. Consultation regarding land quality and geology has been conducted through the scoping process (**Appendix 2** and **Appendix 3**). There were no comments received during the scoping process that have impacted on the proposed approach set out in the scoping note. The assessment has therefore been undertaken in accordance with that set out in **Appendix 2**.

8.2.4 Assessment guidance

The land quality assessment has been carried out in accordance with the principles contained within the following key guidance documents:

- Environment Agency Land Contamination: Risk Management (formerly – Environment Agency Model Procedures for the Management of Land Contamination, Contaminated Land Report 11) (Environment Agency, 2020);
- Contaminated Land Risk Assessment, A Guide to Good Practice (CIRIA C552 2001);
- British Standard BS10175:2011 +A2:2017 Investigation of Potentially Contaminated Sites;
- Department for Environment, Food and Rural Affairs (Defra), Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance;
- Environment Agency, Guiding Principles Land Contamination (GPLC2); Environment Agency, Land contamination groundwater compliance points: quantitative risk assessments, 2017; and,
- Environment Agency, The Environment Agency's approach to groundwater protection, 2018.

8.3 Methodology

8.3.1 Study area

The land quality and geology study area is defined by the distance over which impacts from the proposed scheme may occur and by the location of any receptors that may be affected by those potential impacts. The land quality and geology study area incorporates the landside elements of the proposed scheme plus an additional buffer up to 250m for direct impacts and 1km for indirect impacts. This has been established by professional judgement supported by a land quality desk study and PRA (**Appendix 7**).

Contamination sources are considered within the 1km buffer of the proposed scheme within the land quality PRA (**Appendix 7**). The direct impacts associated with contamination sources greater than 1km are not considered as part of the PRA as it is anticipated that with increasing distance the risk from potential sources of contamination to the proposed scheme diminishes, due to factors such as an absence of viable pathways.

8.3.2 Assessment parameters

This section identifies the project parameters utilised for the land quality assessment of the proposed scheme. **Section 3** provides more detail regarding specific activities and their durations. **Table 8.2** identifies those assessment parameters within **Section 3** that are relevant to the potential impacts on land quality and geology during the construction and operational phases of the proposed scheme.

Table 8.2 Assessment parameters for land quality and geology assessment

Impact	Assessment parameters	Notes
Direct impact on surface waters and associated ecological receptors	Volume of soils to be excavated is approximately 1,415,000m^3 (approximately 1,140,000m^3 of excavation to create the berth pocket and 275,000m^3 of excavation to install the tie rods between the combi-wall and the anchor structure). .	There is the potential for earthworks to disturb pre-existing contamination and mobilise contaminants resulting in the migration of contaminants to surface waters. This may impact both surface water quality and / or usability and associated ecological receptors. Details of surface water features and abstraction licenses are included within **Section 8.3.4** and sensitive land use in **Section 8.3.5**. Details of the potential impacts on surface waters are discussed in **Section 8.5** and **8.6**.
Direct impact on groundwater	Volume of excavated soils circa 1,415,000m^3. The proposed scheme is predicted to require up to 3,000 piles on land to construct the quay.	There is the potential for earthworks and piling activities to disturb pre-existing contamination which may be present within the proposed scheme footprint. The works may result in the migration of contaminants to the underlying aquifers and create new pathways which may impact both groundwater quality and / or usability. Details of aquifers, Source Protection Zones (SPZs) and groundwater abstraction licences are included within **Section 8.3.3**. The details of the potential impacts on groundwater are discussed in **Section 8.5** and **8.6**.
Direct impact on geology	Volume of excavated soils circa 1,415,000m^3. The proposed scheme is predicted to require up to 3,000 piles on land to construct the quay..	Earthworks and piling activities have the potential to impact the geology within the proposed scheme footprint through physical intrusion into the geology. Details of the geology within the proposed scheme footprint is presented in **Section 8.4.2**. Due to the absence of designated geological sites within the proposed scheme footprint, the geological sensitivity is considered to be negligible. As there are no designated geological sites recorded within the proposed scheme footprint, or within 250m of it, impacts to geology during construction and operational phases of the proposed scheme have not been considered further.
Direct impact on human health	Volume of excavated soils circa 1,415,000m^3.	Earthwork required during the construction phase have potential to disturb pre-existing contamination within the proposed scheme footprint. Construction activities have the potential to create pollutant linkages through ingestion, inhalation and direct dermal contact pathways.

Impact	Assessment parameters	Notes
		Details of the potential impacts on human health are discussed in **Section 8.5** and **8.6**.

8.3.3 Assessment of potential environmental impacts

The criteria for determining the significance of environmental impacts is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of effect. This section describes the criteria applied to assign values to the sensitivity of receptors and the magnitude of potential effects. The terms used to define the sensitivity, magnitude and overall significance are based on those outlined in **Section 5**.

Receptor sensitivity

Receptor sensitivity has been defined with reference to the adaptability, tolerance, recoverability and value of individual receptors. **Table 8.3** provides an example of the likely criteria for appraisal of sensitivity for identified land quality receptors based on professional judgement.

Table 8.3 Definitions of sensitivity levels for land quality receptors

Importance	Definition
High	Has very limited or no capacity to accommodate physical or chemical changes
Medium	Has limited capacity to accommodate physical or chemical changes
Low	Has moderate capacity to accommodate physical or chemical changes
Negligible	Is generally tolerant of physical or chemical changes

Receptor value considers, for example, whether the receptor:

- is rare;
- has protected or threatened status;
- has importance at a local, regional or national scale; or
- has a key role in ecosystem function (in the case of biological receptors).

Generic receptor sensitivity examples based on the above criteria are presented below in **Table 8.4**.

Table 8.4 Receptor sensitivity criteria

Sensitivity	Examples
Very high	**General** Receptor is internationally or nationally important / rare with limited potential for offsetting / compensation.
	Land quality – Human health • construction workers involved in below ground construction works; • public and local residents / school aged children (off-site within50 m); and • future end users (residential or allotment end use).
	Land quality – Controlled waters and ecology • groundwater SPZ 1; • public water supplies / licensed surface water and groundwater abstractions for potable use; • supports habitats or species that are highly sensitive to changes in surface hydrology or water quality; and • surface and groundwaters supporting internationally designated sites.
	Land quality – Built environment • sites of international importance, World Heritage Sites and Scheduled Monuments.
High	**General** Receptor is regionally important / rare with limited potential for offsetting / compensation.

Sensitivity	Examples
	Land quality – Human health • future end users (commercial / industrial end use/ open space); • public and local residents / school aged children (off-site at distances >50m but <250m); • commercial workers (off-site within 50m); and • construction workers (above ground).
	Land quality – Controlled waters • groundwater SPZ 2 and SPZ 3; • private water supplies; • Principal Aquifers; and • surface and groundwaters supporting nationally designated sites SSSI, SPA, Ramsar sites).
	Built environment • commercial or residential buildings.
Medium	**General** Receptor is locally important / rare.
	Land quality – Human health • future end users (transport end use such as car parks or highways); • public and local residents / school aged children (off-site >250m); and • commercial workers (off-site at distances >50m but <250m).
	Land quality – Controlled waters • Secondary A and B Aquifers; and • groundwater or surface waters supporting regionally important sites (e.g. Local Nature Reserve (LNR), Statuary Nature Conservation Organisation (SNCO)).
	Built environment • car parks, highways, transport infrastructure and utilities.
Low	**General** Receptor is not considered to be particularly important / rare.
	Land quality – Human health Commercial workers (off-site >250 m).
	Land quality – Controlled waters • unproductive strata; and • supports or contributes to habitats that are not sensitive to changes in surface hydrology or water quality.

Magnitude of change/ effect

Potential effects may be adverse, beneficial or neutral. The magnitude of an effect is assessed qualitatively, according to the criteria set out in **Table 8.5**. The following definitions apply to time periods used in the magnitude assessment:

- long-term: > 5 years;
- medium-term: 1 to 5 years; and
- short-term: < 1 year.

For effects related to human health, magnitude reflects the likely increase or decrease in exposure risk for a receptor. For controlled waters, magnitude represents the likely effect that an activity would have on resource availability or value, at the receptor. Magnitude is therefore affected by the distance and connectivity between an impact source and the receptor.

Table 8.5 Definition of magnitude levels for land quality

Magnitude	*Definition*
High – permanent or large-scale change affecting usability, risk or value over a wide area, or certain to affect regulatory compliance	**Land quality – Human health** • permanent or major change to existing risk of exposure (adverse / beneficial); • unacceptable risks/ severe harm to one of more receptors over the long-term or permanently (adverse); or • remediation and complete source removal (beneficial).
	Land quality – Controlled waters and ecology • permanent, long-term or wide scale effects on water quality or availability (adverse / beneficial); • permanent loss or long-term derogation of a water supply source resulting in prosecution (adverse); • change in WFD water body status / potential or its ability to achieve WFD status objectives in the future (adverse / beneficial); • permanent habitat creation or complete loss (adverse / beneficial); or • measurable habitat change that is sustainable / recoverable over the long-term (adverse / beneficial).
	Land quality – Built environment • catastrophic damage to buildings or structures.
Moderate – permanent or long-term reversible change affecting usability, value, or risk, over the medium-term or local area: possibly affecting regulatory compliance	**Land quality – Human health** • medium-term or moderate change to existing risk of exposure (adverse / beneficial); • unacceptable risks to one or more receptors over the medium-term (adverse); or • serious concerns or opposition from Statutory Consultees (adverse).
	Land quality – Controlled waters and ecology • medium-term or local scale effects on water quality or availability (adverse / beneficial); • medium-term derogation of a water supply source, possibly resulting in prosecution (adverse); • observable habitat change that is sustainable / recoverable over the medium-term (adverse / beneficial); or • temporary change in status / potential of a WFD waterbody or its ability to meet objectives (adverse / beneficial).
	Land quality – Built environment • damage to buildings or structures.
Low – temporary change affecting usability, risk or value over the short-term or within the site; measurable permanent change with minimal effect, usability, risk or value; no effect on regulatory compliance	**Land quality – Human health** • short-term temporary or minor change to existing risk exposure (adverse / beneficial); or • unacceptable risks to one or more receptors over the short-term (adverse).
	Land quality – Controlled waters and ecology • short-term or very localised effects on water quality or availability (adverse / beneficial); • short-term derogation of a water supply source (adverse); • measurable permanent effects on a water supply source that do not impact on its operations (adverse); • observable habitat change that is sustainable / recoverable over the short-term (adverse / beneficial); or • no change in status / potential of a WFD waterbody or its ability to meet objectives (neutral).
	Land quality – Built environment • easily repairable damage to buildings or structures.
Very Low – minor permanent or temporary change, indiscernible over the medium to long-term.	**Land quality – Human health** • negligible change to existing risk of exposure; or • activity is unlikely to result in unacceptable risks to receptors (neutral).
	Land Quality – Controlled waters and ecology

Magnitude	*Definition*
Short-term with no effect on usability, risk or value	• very minor or intermittent impact on local water quality or availability (adverse / beneficial); • usability of a water supply source will be unaffected (neutral); • very slight local changes that have no observable impact on dependent receptors (neutral); or • no change in status / potential of a WFD waterbody or its ability to meet objectives (neutral).
	Land Quality – Built environment • Very slight non-structural damage or cosmetic harm to buildings or structures.

Impact significance

The impact significance assessment combines receptor sensitivity with magnitude of effect as shown in **Table 8.6**. Assessment of impact significance is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive, formulaic tool.

Table 8.6 Impact significance matrix

		Magnitude							
		High	**Medium**	**Low**	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
Sensitivity	**Very high**	Major adverse	Major adverse	Moderate adverse	Minor adverse	Minor beneficial	Moderate beneficial	Major beneficial	Major beneficial
	High	Major adverse	Moderate adverse	Minor adverse	Minor adverse	Minor beneficial	Minor beneficial	Moderate beneficial	Major beneficial
	Medium	Moderate adverse	Minor adverse	Minor adverse	Negligible	Negligible	Minor beneficial	Minor beneficial	Moderate beneficial
	Low	Minor adverse	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor beneficial

Major or moderate environmental impacts are considered to be 'significant' in EIA terms. Whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant (negligible) impacts as they may contribute to significant impacts cumulatively or through interactions.

The definitions of significant impacts are presented in **Table 8.7**.

Table 8.7 Impact significance definitions

Impact significance (level)	Definition
Major	Very large or large change in receptor condition (adverse or beneficial), which are likely to be key factors in the decision-making process because they contribute to achieving international, national or regional objectives, or could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition (adverse or beneficial), which are likely to be important considerations in the decision-making process because they contribute to achieving local objectives or could result in exceedance of statutory objectives and / or breaches of legislation.
Minor	Small change in receptor condition (adverse or beneficial), which may be important but are unlikely to be important considerations in the decision-making process.
Negligible	Very small changes in receptor condition (adverse or beneficial), which may be raised as local issues but are unlikely to be important in the decision-making process.
No change	No or imperceptible effects, within normal variations or within the margins of forecasting error.

Assessment of interaction effects
Prior to undertaking the primary assessment, the potential for interactions between land quality and other factors was considered. The assessment identified **Section 11**, **Section 20** and **Section 25** as having potential interactions with land quality.

8.4 Existing environment

The characterisation of the existing environment has been undertaken using the data sources listed in **Table 8.8** plus other relevant literature.

Table 8.8 Data sources used to inform the land quality assessment

Data	Source
Historical maps	Groundsure Insight Report (provided within Wood, 2019)
Site sensitivity data	Groundsure Insight Report (provided within Wood, 2019) Natural England
Geology & ground conditions	British Geological Survey (BGS) onshore Geoindex map: http://mapapps2.bgs.ac.uk/geoindex/home.html Groundsure Insight Report (provided within Wood, 2019)
Hydrogeology & hydrology	Environment Agency: http://apps.environment-agency.gov.uk/wiyby/117020.aspx Groundsure Insight Report (provided within Wood, 2019) Department for Environment, Food and Rural Affairs (DEFRA) MAGIC (Multi Agency Government Information for the Countryside) Map: https://magic.defra.gov.uk/magicmap.aspx
Regulatory information	Groundsure Insight Report (provided within Wood, 2019)
Unexploded bomb (UXO) risk	Zetica UXO: https://zeticauxo.com/
Radon gas risk	Public Health England UK radon affected areas: http://www.ukradon.org/information/ukmaps
Historical landfill sites	Groundsure Insight Report (provided within Wood, 2019)
Permitted waste sites – authorised landfill site boundaries	Groundsure Insight Report (provided within Wood, 2019)

Pre-existing publicly available reports were also used to inform the land quality PRA which helped inform the understanding of the baseline environment, including:

- South Tees Development Corporation, Former Steelworks Land, South Tees Outline Remedial Strategy, Ref. 41825-wood-XX-XX-RP-OC-0001_S0_P01, June 2019 (Wood, 2019);
- Design of a Site Protection and Monitoring Programme for Cleveland Works, Teesside (CORUS UK LTD, 2004),;
- Soil and Groundwater Baseline Characterisation Study Teesside Works, Factual Report June 2004 (Enviros, 2004);
- First Phase Reporting of the Site Protection and Monitoring Programme (CORUS UK LTD, 2008); and,
- Data Review, TS4 South Bank – Phase 1 Geo Environmental Desk Study. August 2017 (CH2M Hill, 2017).

8.4.1 Assumptions and limitations

The land quality PRA (**Appendix 7**) was informed by a range of publicly available information, including the findings of previous ground investigations undertaken within the proposed scheme footprint. However, due to the limited number of sample positions within the proposed scheme footprint in addition to the age of the

survey data (2004 and 2008), the assessment has relied heavily on publicly available information and so has adopted 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 clarify whether the linkage exists. It is proposed that the ground investigation works recommended within the land quality PRA will be undertaken post submission of this EIA; this therefore reaffirms the precautionary approach undertaken within the assessment on land quality and geology.

8.4.2 Geology

Information on the reported geological conditions within the proposed scheme footprint has been collated from BGS datasets, including 1:50,000 scale geological mapping and historical borehole records, and a Groundsure Insight Report. The anticipated geological sequence within the proposed scheme footprint is outlined in **Table 8.9** below.

Table 8.9 Reported geology within the proposed scheme footprint

Stratum	*Unit*	Depth to base of stratum (m bgl*)	Approximate thickness (m)	Description
Made Ground		Up to 10.00	5.00 – 10.00	Granular deposits comprising silty / sandy ash, clinker with cobbles and boulder sized fragments of grey blast furnace slag. The site and wider area are known to comprise reclaimed mudflat and marshland and therefore Made Ground is likely to have been used to raise site levels and widespread across the site.
Superficial Deposits	Tidal Flat Deposits	10.20	4.00	Post glacial estuarine and marine Alluvium identified as sand, silt and clay. Superficial Deposits formed up to 2 million years ago in the Quaternary Period.
	Glaciolacustrine Deposits	Not recorded		Clay and silt formed 2 million years ago in the Quaternary Period.
	Glacial Till	Not recorded		Glacial Till deposits formed 2 million years ago in the Quaternary Period.
Bedrock	Mercia Mudstone Group	Not recorded		Red mudstone and subordinate siltstone formed approximately 201 to 252 million years ago in the Triassic Period.

*bgl – below ground level

As reported earlier, due to the absence of designated geological sites within the proposed scheme footprint, the geological sensitivity is considered to be negligible. As there are no designated geological sites recorded within the proposed scheme footprint, or within 250m of it, impacts to geology during construction and operational phases of the proposed scheme are not considered further.

8.4.3 Hydrogeology

The land quality PRA (**Appendix 7**) indicates that the Tidal Flat Deposits are classified as a Secondary Undifferentiated Aquifer. This designation is assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifers in different locations due to the variable characteristics of the rock type.

The underlying Mercia Mudstone Group has been designated as a Secondary B Aquifer, these types of aquifers are predominantly composed of lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

The land quality PRA (**Appendix 7**) indicates that the proposed scheme has been assigned a medium to high groundwater vulnerability risk by the Environment Agency. A high groundwater vulnerability designation indicates that the soil is easily able to transmit pollution to groundwater, which is characterised by high leaching potential of soils and the absence of low permeability superficial deposits. A medium groundwater vulnerability designation indicates that there are areas present which offer some groundwater protection.

There are no recorded groundwater abstractions both within the footprint of the proposed scheme or within 1km of its boundary. The proposed scheme footprint is not located within a groundwater SPZ or within 500m of one.

Given that the landward parts of the proposed scheme footprint are immediately adjacent to the tidal River Tees, it is considered likely that the aquifers present beneath the proposed scheme footprint have been impacted by saline intrusion. Given this assumption, it is further assumed that the groundwater present would not be considered suitable for potable groundwater abstraction.

Due to the aquifer designations of both the superficial deposits and underlying Mercia Mudstone Group, the lack of potable groundwater abstractions, likely saline intrusion and the absence of a SPZ, groundwater within the footprint of the proposed scheme is considered to have a low sensitivity.

8.4.4 Hydrology and surface drainage

Information provided within the land quality PRA (**Appendix 7**) indicates that there is one record of a surface inland river (Mill Stream) within the footprint of the proposed scheme. The tidal River Tees runs immediately adjacent to the landward parts of the proposed scheme footprint Mill Stream is culverted beneath the proposed scheme footprint, running under an access track before it outfalls into the Tees at the downstream end of South Bank Wharf. The land quality PRA notes that given the history of the site, it is possible that additional culverted watercourses may be present beneath the site.

The River Tees is a WFD water body, known as Tees (waterbody ID: GB510302509900). The overall rating of the waterbody is moderate with an ecological rating of moderate and a chemical rating of fail (Environment Agency, 2016). Further information regarding this water body from a WFD perspective is detailed in **Section 28**.

There are no recorded surface water abstractions located within the proposed scheme footprint. Two historical surface water abstraction licenses were held by Tees Bulk Handling Limited, located approximately 750m north east of the proposed scheme footprint, for the purpose of general use and dust suppression.

The land quality PRA indicates that the land inshore of the River Tees is classified as Flood Zone 1 with a 1 in 1,000 (<0.1%) annual probability of flooding from rivers. Further information with regard to flood risk at the site is contained within **Section 20**.

The Tees estuary adjacent to the landward parts of the proposed scheme footprint is designated as the Teesmouth and Cleveland Coast SPA, Ramsar site and SSSI.

Based on the above, hydrological receptors are considered to be of high to very high sensitivity.

8.4.5 Sensitive land use

Sensitive land use sites are considered, by statutory agencies, to be of special importance due to their intrinsic qualities which are unique to those areas. There are no designated sites located within the landward parts of the proposed scheme footprint. However, as noted above, the Tees estuary is designated as the Teesmouth and Cleveland Coast SPA, Ramsar site and SSSI.

The sensitivity of the designated sites within 250m of the proposed scheme is considered to be very high.

Further information regarding designated sites can be found in **Section 9, Section 12** and **Section 29**.

8.4.6 Historical setting

The research undertaken to inform the land duality PRA (**Appendix 7**) indicates that the landward parts of the proposed scheme footprint were reclaimed from mudflats using slag fill in the late 1800s when Eston Wharf was constructed (now South Bank Wharf). Travelling cranes and railways were used along the wharf, which served the surrounding industries. Riverside Pumping Station was constructed immediately landward of the wharf in the early 1900s to provide water to the industries to the south of the site. The wharf was redeveloped into South Bank Wharf at this time with further expansion to the north east. The area to the south west of the Riverside Pumping Station was a Benzole Plant from the 1950s to 1987. Between 1959 to 1964 there was a slag crushing works partially within the north of the site. In 1968 the oil depot was developed to the north east of the pumping station, half of which is within the proposed scheme.

During the late 1800s and early 1900s there was significant industrial activity within the landward areas surrounding the proposed scheme footprint including an iron works, sheet and galvanising works, dock yards, iron refinery and basic slag works; these were connected to the proposed scheme footprint via travelling cranes and railways. Industrial activity continued throughout the 20th century including the construction of a tank farm at Teesport to the north, an ore crushing plant (later a ferro manganese crushing plant) to the south and the Teesside Works Cleveland (steel works).

A summary of the historical features that may give rise to potential sources of contamination, is provided below in **Table 8.10**.

Table 8.10 Historical features and activities

Feature	Details
Made Ground across the whole site including demolished buildings, structures, slag and ash associated with the adjacent steel work.	The wharf, originally referred to as Eston Wharf, is first recorded between 1894 to 1899 in the south western part of the proposed scheme footprint. Prior to this the site is reported as sand and mud and the land was reclaimed to form the wharf. The OS map for 1913 to 1915 indicates that the wharf has increased in size and had been renamed South Bank Wharf, no significant changes are reported following this.
Riverside Pumping Station buildings (sterilisation and motors for pumps)	The pumping station is recorded as being within the proposed scheme footprint on the 1913 to 1915 map onwards to the 2010 map (latest map reviewed as part of the PRA). Originally comprising of two buildings, one had been demolished by 1964 to 1968 with the remaining building being extended during this same time period.
Electrical substations and transformers	The first record of an electrical substation within the proposed scheme footprint is on the 1952 to 1953 OS map, an additional substations and a transformer is recorded to the east of the existing substation by 1964 to 1968 until the 2010 map (latest map reviewed as part of the PRA).
Pipelines	Approximately four pipelines recorded on the 1952 to1953 map which run from the pumping station to the wharf. On the maps dated 1964 to 1968 the pipelines are shown to run from the south (South Bank Iron Works) to the north and across the proposed scheme footprint from west to east.

Feature	Details
Wharf usage and travelling cranes	A travelling crane is reported as running along the wharf on the 1913 to 1915 OS map.
Oil depot tanks and pipelines	An oil depot comprising five circular storage tanks is recorded as being partially on site on the 1964 to 1968 OS map onwards to the 2010 map (latest map reviewed as part of the PRA), three of these tanks were located within the proposed scheme boundary. Information contained within the Land Quality PRA indicates that the oil depot installation comprised a jetty with the facility for discharging fuel oil from ships up to approximately 30,000 tonnes capacity, five 10,000 tonne capacity oil storage tanks located within a single bund, a pumphouse for oil distribution and loading of tankers, and two package boilers to provide steam for tank heating and pipeline tracing. The report also indicates that the oil storage depot was fed by a series of tanks running parallel to the river to the south of the access road within the proposed scheme.
Tanks to the east of the Riverside Pumping Station which have now been demolished	A series of tanks are recorded, along with four rectangular buildings to the east of the Riverside Pumping station on the 1952 to 1953 OS map onwards to 2010 (latest map reviewed as part of the PRA). The PRA states, however, that these tanks have now been demolished.
Benzole plant and associated tanks which have been demolished	Two circular tanks, reported to be a Benzole Plant, are shown 50m to the south of the Riverside Pumping Station on the 1927 OS map. A third smaller tank associated with the plant is recorded on the 1952 to 1953 OS map. The Benzole Plant is no longer recorded on the 1987 OS map.
Slag crushing works (former), Tarmac Teesport Asphalt Plant (asphalt and concrete plant	The slag crushing works, located partially within the proposed scheme footprint and partially off-site, is recorded on the 1959 to 1964 OS map before being referred to as 'works' on the 1981 OS map onwards to the 2010 map (latest reviewed as part of the PRA).
Off-site sources	From the late 1800s and early 1900s there was significant industrial activity in the area surrounding the proposed scheme footprint including Iron Works, Sheet and Galvanising Works, Dock Yards, Iron Refinery and a Basic Slag Works, these were connected to the site via travelling cranes and railways. Industrial activity continued throughout the 20th century including the construction of a tank farm at Teesport to the north, an ore crushing plant (later a ferro manganese crushing plant) to the south and Teesside Works Cleveland (steel works).

8.4.7 Previous ground investigations and environmental assessments

Details of previous ground investigation works undertaken within the landward parts of the proposed scheme footprint are provided in the land quality PRA (**Appendix 7**). A summary of the key findings is provided below.

An investigation undertaken by Enviros in 2004 included exploratory hole locations in and around the oil depot. This described Made Ground soils as black and ashy overlying slag cobbles and boulders. Black odorous tar was observed in shallow soils within one exploratory hole location within the oil depot boundary. Soil samples collected from this location recorded total petroleum hydrocarbons (TPH) at 90,000mg/kg and xylenes at 304mg/kg.

As part of the Environ 2004 investigation, seven trial pits were also excavated from the Riverside Pumping Station to the western boundary of the proposed scheme footprint. The encountered geology was described as ashy Made Ground overlying slag gravels and boulders. Within Made Ground soil samples, there were recorded exceedances of metals and Polycyclic Aromatic Hydrocarbons (PAHs) above generic screening criteria protective of a commercial land use that were applicable in 2004 (but now withdrawn from use).

In 2008, an intrusive investigation was undertaken in and around the oil depot (partially located within the footprint of the proposed scheme) by Corus UK Ltd. The investigation consisted of two boreholes within the proposed scheme boundary and an addition borehole located off-site. The geology was described as slag fill to a maximum depth of 13mbgl underlain by Alluvium. Made Ground soil analysis recorded TPH at a

maximum concentration of 285mg/kg and PAHs at 25mg/kg. Groundwater analysis recorded a maximum concentration of TPH at 63µg/kg and PAHs at less than the laboratory detection limit.

A contaminated land remediation strategy was developed by Wood in 2019 which covers STDCs current landholding and encompasses most of the proposed scheme footprint, with the exception of a narrow strip of land closest to the River Tees. The objective of the remediation strategy was to mitigate the level of ground remediation required across the STDC area, minimise conflicts with the many safety restrictions (including various prevailing safety hazard zones) and avoid introducing future end users that would otherwise conflict with the existing industrial and commercial activities within the area.

Numerous remediation options were considered by Wood and screened against a range of generic contaminant groups. Given the size of the landholding under consideration, together with the range and distribution of contaminants and apparent limited risks to potential future industrial end users, the remediation option taken forward by Wood comprised the formation of a capping layer across the area (including part of the proposed scheme footprint which is the subject of this EIA) to break the Made Ground contaminative linkages. This technique included the placement of chemically 'suitable for use' materials over contaminated ground (up to 0.3m in thickness). Clean service runs were also recommended by Wood, to protect both future land users (notably maintenance workers) and utility assets. The option for selective excavation and disposal at the adjacent hazardous waste facility of limited 'hotspots' of contamination was also recommended to complement the capping layer remediation approach.

The Wood report provided 'suitable for use' chemical criteria for soils, based on generic assessment criteria (CL:AIRE, Category 4 Screening Levels (C4SLs) and LQM, Suitable for Use Levels (S4Uls)) protective of human health under a commercial land use scenario. No 'suitable for use' chemical criteria for soils or groundwater, protective of controlled water receptors were provided.

8.4.8 Potential sources of contamination

Table 8.11 below sets out the key sources of contamination which have been identified both within and adjacent to the proposed scheme footprint.

Table 8.11 Potential on-site sources of contamination

Potential source	Potential associated contaminants
Made Ground across the landward parts of the proposed scheme footprint including demolished buildings, structures, slag and ash associated with the adjacent steel work.	Asbestos, metals and metalloids, polycyclic aromatic hydrocarbons (PAHs), fuel and oil hydrocarbons, aromatic hydrocarbons (SVOCs and VOCs), phenols, cyanides, ammonium, chlorides and sulphates.
Riverside Pumping Station buildings (sterilisation and motors for pumps)	Asbestos, inorganic compounds (chlorine, sodium chloride), fuel and oil hydrocarbons.
Electrical sub-stations and transformers	Asbestos, metals and metalloids, polycyclic aromatic hydrocarbons (PAHs), fuel and oil hydrocarbons, polychlorinated biphenyls (PCBs).
Pipelines	Unknown contents and potentially associated with oil depot and may contain fuel and oil hydrocarbons.
Wharf usage, travelling cranes and railway tracks	Fuel and oil hydrocarbons, metals and metalloid, PAHs, phenols, asbestos, organotins, sulphates and sulphides, chlorinated solvents. Potential leaks and spillages from loading of cargo onto ships. Potential re-fuelling of vessels.
Oil depot tanks and pipelines	Asbestos, metals and metalloids, polycyclic aromatic hydrocarbons (PAHs), fuel and oil hydrocarbons, volatile and semi-volatile organic compounds (VOCs and SVOCs), phenols and PCBs.
Tanks to the east of the pumping station which have now been demolished.	
Benzole plant and associated tanks which have been demolished.	

Potential source	Potential associated contaminants
Slag crushing works (former) Tarmac Teesport Asphalt Plant (Asphalt and Concrete Plant)	Phenols, PAHs, PCBs, bitumen, hydrochloric acid, organic compounds, fuel and oil hydrocarbons, metals and metalloids.
Off-site sources including: • Easton Sheet and Galvanising Works; • Teesport; • Slag crushing works; • Ore crushing plant; • Travelling cranes and railways; • Hanson Ready-mixed concrete; • Landfill sites; • Teesside Works Cleveland; • Made Ground from land reclamation and infilling of reservoirs; and • Dockyards including saw and timber mills.	Asbestos, metals and metalloids, PAHs, fuel and oil hydrocarbons, volatile and semi-volatile organic compounds (VOCs and SVOCs), phenols, cyanides, ammonium, chlorides, sulphates and sulphides. Ground gases.

8.4.9 Anticipated trends in baseline conditions

Section 8.3.8 highlights a number of potential sources of contamination both within and adjacent to the proposed scheme footprint. Land affected by contamination is primarily managed in the UK through the Town Country Planning Act, 1990 but also by Part 2A of the Environmental Protection Act, 1990 (EPA,1990). Part 2A of the Environmental Protection Act requires local authorities to identify contaminated land and ensure potential risks are assessed and mitigated accordingly.

The Town Country Planning Act and the Environmental Protection Act do not consider future uses. However, future uses would require a specific grant of planning permission and consideration of the potential for contamination to represent unacceptable risks to ensure the site is suitable for the proposed end use. Consequently, in relation to the proposed scheme, and its immediate receiving environment, it is reasonable to predict that no new sources of contaminated land would be introduced and there would be no significant deterioration in ground conditions in the absence of proposed scheme.

Therefore, existing baseline conditions with respect to geology, hydrogeology and land quality would be unlikely to significantly change in the absence of the proposed scheme.

8.4.10 Identification of sensitive receptors

Through the production of the land quality PRA, a number of receptors that may potentially be impacted by the proposed scheme were identified. The receptors identified within the PRA (**Appendix 7**) and used in this assessment are outlined in **Table 8.12**.

Table 8.12 Receptors requiring assessment for land quality

Receptor group	Receptors included with group	Sensitivity
Hydrogeology	Aquifers – Secondary B and Secondary Undifferentiated Aquifers	Low
Hydrology	Surface waters including culverted watercourses and those protected by European and national designations (Tees estuary)	High to Very High
Human health	Construction workers and maintenance workers	Very High
	Site users	Medium
	Off-site users	High
Infrastructure and utilities	New infrastructure and utilities	Medium

8.5 Potential impacts during the construction phase

8.5.1 Impacts on groundwater quality during earthworks and piling

The landward parts of the proposed scheme footprint are underlain by a Secondary Undifferentiated Aquifer associated with the Tidal Flat Deposits and a Secondary B Aquifer associated with the Mercia Mudstone. There are no licenced groundwater abstractions, including potable water, recorded either within the proposed scheme footprint or within 1km of it and there are no SPZs either within or 500m from the proposed scheme footprint.

Construction of the proposed scheme will require substantial earthworks with up to 1,415,000m^3 of soils being excavated in order to facilitate the creation of the berthing pocket and construction of the quay wall. Approximately 3,000 piles will also be required to construct the quay.

During construction, both Made Ground and superficial deposits will be excavated, allowing increased infiltration of rainwater and surface water run-off to the subsurface. This could potentially mobilise contamination already present within the overlying strata, including within perched water that may be present within the Made Ground deposits. These contaminants could potentially migrate and / or be physically transported by the act of excavation itself into the underlying aquifers.

Piling also has the potential to create preferential pathways, allowing contaminant migration to the underlying aquifers. Piling also has the potential to physically drag down contaminants from the overlying Made Ground deposits as well as allowing for potentially contaminated perched groundwater to migrate to the underlying aquifers.

The outline remediation strategy (Wood, 2019) considers that the potential hazard to groundwater is medium but given the low likelihood of occurrence and low sensitivity, in addition to the productivity of the aquifers and likely saline intrusion, the significance of risk to groundwater is moderate to low and Wood concluded that no active remediation of groundwater is required. Comments received by RCBC (Ref:153731, 06/08/2019) following submission of the outline remediation strategy to them confirmed that the Council is satisfied that the strategy adequately covers the standard contaminated land conditions (notably parts a - Site characterisation and b - Submission of a Remediation Scheme). Therefore, it is assumed that the overarching remediation scheme described within the outline remediation strategy is acceptable and that active remediation of groundwater is not required as part of the proposed scheme.

The assessment of the impacts to the Secondary Undifferentiated Aquifer and Secondary B Aquifer concurs with the agreed outline remediation strategy and considers the sensitivity of the aquifers to be **medium**. Given that the aquifers located below the proposed scheme footprint are likely to be impacted by saline intrusion thus rendering the groundwater unsuitable for potable water abstraction, the likely magnitude of effect to the groundwater is considered to be **low.** Therefore the overall impact on groundwater quality during construction is considered to be of **negligible** significance.

Mitigation measures and residual impact

No mitigation measures are required and residual impact would be of **negligible** significance.

There remains a data gap with respect to the quality of groundwater across the proposed scheme footprint. Prior to the commencement of construction activities, a programme of site characterisation works will be undertaken which will comprise intrusive ground investigation works to facilitate the recovery of soil and groundwater samples for laboratory analysis, and to facilitate the monitoring of groundwater. The findings of the intrusive investigation will allow appropriate assessments to be undertaken to ascertain if contaminants are present at concentrations that could result in harm to controlled waters. If unacceptable

risks are identified a detailed remediation strategy will be designed for the proposed scheme and implemented as an extension of the currently agreed outline remediation strategy (Wood, 2019).

8.5.2 Impact on surface water quality from the discharge of dissolved phase contaminants in groundwater and surface runoff

The landward parts of the proposed scheme footprint are located adjacent to the Tees estuary, and the Mill Stream is reported to be present in a culvert underneath the proposed scheme footprint prior to discharging into the Tees estuary. Of particular note is the presence of the Teesmouth and Cleveland Coast SSSI, SPA and Ramsar site located immediately adjacent to the landward parts of the proposed scheme footprint. It is anticipated that groundwater within the proposed scheme footprint is in hydraulic connectivity with the surface waters identified above.

As mentioned in **Table 8.10** and the land quality PRA (**Appendix 7**), potential sources of contamination have been identified within the proposed scheme footprint. Construction of the proposed scheme will require substantial earthworks and piling; these activities have the potential to disturb potential contamination which could migrate via groundwater or via surface run-off from Made Ground soils, run-off from stockpiling potentially contaminated soils and demolition materials or by accidental spillage whilst handling, storage or treatment of potentially contaminated water or soils.

The sensitivity of the Tees estuary is considered to be very high due to the European and national designations protecting it. The magnitude of potential effect to surface waters is considered to be low with adoption of the embedded mitigation measures outlined in **Section 3**, including the use of the CEMP. The overall impact during construction works is therefore considered to be of **moderate adverse** significance.

Mitigation measures and residual impact

To further assess the potential impact to surface water receptors from impacted groundwater or surface run off during construction works, further supplementary intrusive investigation and groundwater monitoring is required to characterise the soils and groundwater within the proposed scheme footprint and assess the potential impact to surface water from construction activities. The findings of the intrusive investigation will allow appropriate assessments to be undertaken to ascertain if contaminants are present at concentrations that could result in harm to surface waters. If unacceptable risks are identified, such as the presence of mobile non aqueous phase liquids within the footprint of the proposed scheme with the potential to impact surface waters due to excavation activities, a detailed remediation strategy will be designed and implemented prior to construction. This remedial work will in addition to the currently agreed outline remediation strategy (Wood, 2019).

Following the implementation of these mitigation measures, the magnitude of effect will be very low. Therefore the impact is considered to be **minor adverse** for surface waters (very high sensitivity) which is not considered 'significant' in terms of this EIA assessment.

8.5.3 Impacts on human health as a result of construction activities

The land quality PRA (**Appendix 7**) confirmed that potential contaminants of concern, including asbestos, could be present within the proposed scheme footprint and could present an unacceptable risk to construction workers and off-site users if exposed during construction activities.

Given the historic uses of the site, there is a risk that any contamination present within the on-site soils or structures to be demolished could be mobilised resulting in risks to human health via a range of pathways including ingestion, inhalation and direct dermal contact. For on-site human health receptors (construction workers), all pathways would be relevant, but for off-site human health receptors it is likely that the critical

pathway would be inhalation of contaminated dusts, vapours or gases that may be generated during construction works. These impacts would however be temporary in nature, lasting for the duration of the construction phase only.

The sensitivity of human health receptors (construction workers and the off-site users), is considered to be medium to very high.

As discussed earlier, the assessment has been undertaken on the assumption that works would be undertaken in accordance with best practices measures to be set out within the CEMP. In addition, construction works will follow best practice and guidance including compliance with the Health and Safety at Work Act 1974 legislation, Construction (Design and Management) Regulations 2015 and Control of Substances Hazardous to Health (COSHH) Regulations. This will include the production and adoption of site and task specific health and safety plans. The plan will outline the use of risk mitigation strategies including appropriate Personal Protective Equipment (PPE), provision of welfare facilities and relevant good working practices applied to avoid potential risk to human health from any potential ground contamination, in line with relevant available guidance. As a result, the magnitude of effect is considered to be very low.

Due to the medium to very high sensitivity of human health receptors and the low magnitude of effect, the overall impact during construction is considered to be of **negligible to minor adverse** significance.

Mitigation measures and residual impact

The mitigation measures detailed in **Section 16.5** (specifically those associated with the avoidance of construction phase dust) would also be applicable to this impact. No further mitigation measures have been identified to manage the risk of human health to on-site construction workers. The residual impact is of **negligible to minor adverse** significance.

8.6 Potential impacts during the operational phase

8.6.1 Impacts on controlled waters

The proposed re-use of excavated soils on-site has the potential to affect the Tees estuary due to leaching of any contaminants which may be present. However, soils to be re-used on site will be assessed for their chemical suitability in line with the outline remediation strategy (Wood, 2019) and in accordance with waste management legislation and best practice including the CL:AIRE Definition of Waste: Code of Practice (2008). Such an approach essentially removes the risk of reductions in water quality within the Tees estuary associated with re-use of materials on site (as they would need to be proved to be suitable for re-use).

In addition, impermeable or low permeability hard standing would be installed on the surface of the proposed quay, which would minimise the potential for leaching of any contaminants. Furthermore, the presence of a piled quay wall along the river frontage is likely to reduce the connectivity of site soils with the River Tees.

The creation of the piled wall along the river frontage has the potential to create different hydraulic flow regimes along the piled wall to those that currently exists. This then creates the potential for contaminated groundwater (if present) to impact areas outside the proposed scheme footprint, for example neighbouring sites.

Following the execution of a pre-construction ground investigation, it will be possible to determine whether contaminated groundwater and mobile contaminants, e.g. non-aqueous phase liquids (NAPLs) are present within the proposed scheme footprint. If contaminated groundwater and mobile contaminants are identified during the ground investigation which have the potential to cause unacceptable risks to surface waters

receptors, remediation will be required to mitigate the impact it may have to either the proposed scheme or the neighbouring sites / controlled waters.

There are unlikely to be significant impacts to controlled waters from the operation of the proposed scheme as proposed operational phase activities will follow standard procedures, for example including appropriate control techniques to reduce the risk of pollution incidents and to limit the consequences of an accident, therefore minimising any potential impacts.

The sensitivity of the surface water is very high and the magnitude of impact following mitigation is very low beneficial. The overall impact to controlled waters during operation is therefore considered to be of **minor beneficial** significance.

Mitigation measures and residual impact
No additional mitigation measures required. The residual impact would be of **minor beneficial** significance.

8.6.2 Impacts on human health

The only building to be constructed on the quay comprises a substation. The exact construction of the substation is unknown at this stage, however it has been assumed that it would be well ventilated due to the equipment it would contain. Operational phase maintenance of the substation is likely to be the only time when the building is occupied, therefore unacceptable risks relating to the inhalation of potential ground gases and vapours that may accumulate in buildings is considered highly unlikely.

A programme of remedial works would be undertaken prior to operation of the proposed scheme which would reduce the potential for impact on human health during operation. In addition, exposure of future end-users will be further limited as the quay will be covered with hard-standing or a gravel capping layer which would break the pollutant linkage. The remediation works will be undertaken in accordance with the Outline Remediation Strategy (Wood, 2019).

The sensitivity of human receptors during operation is medium and the magnitude of effect is considered to very low. Thus, the impact to human receptors is of **negligible** significance.

Mitigation measures and residual impact
No additional mitigation measures required. The residual impact would be of **negligible** significance.

8.6.3 Impacts to the built environment

Construction material including concrete to be used in the proposed scheme have the potential to undergo degradation due to chemical attack from aggressive ground, should acids or sulphates be present. This has the potential to compromise the integrity of structures.

As set out in the Outline Remediation Strategy (Wood, 2019), clean or lined service corridors will be installed to protect land users and utilities. This will mitigate against the potential for material degradation of utilities during the operational phase of the proposed scheme.

The sensitivity of the built environment during operation is medium and the magnitude of the impact is considered to medium following development. Thus, the impact to the built environment is of **minor adverse** significance.

Mitigation measures and residual impact

The material for use in the development will be specified taking into consideration aggressive ground conditions at the design/ construction phase. The assessment methodology is set out in BRE Special Digest 1 (20015) will be adopted to determine concrete classification in the development.

Following implementation of the mitigation described above the magnitude of the impact is considered to be very low and the residual impact would be of **negligible** significance.