TEESWORKS

LONG ACRES ENVIRONMENTAL STATEMENT

VOLUME 2: CHAPTER H
GROUND CONDITIONS AND REMEDIATION

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Long Acre, South Tees

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Chapter H: Ground Conditions and Remediation

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H1.0 Introduction

H1.1 This chapter of the Environmental Statement ('ES') has been prepared by Arcadis (UK) Ltd on behalf of the applicant, South Tees Development Corporation ('STDC'). It assesses the proposed development described in Chapter B and it considers the effects of the proposed development on the site's ground conditions and the need for remediation.

H1.2 The baseline situation is considered before the likely environmental effects of the development are identified, during the construction phase of the development. The operational phase of the development has been scoped out in relation to ground conditions and remediation, the rationale for which is provided in Chapter A of the ES and Section H3.0 of this chapter. Mitigation measures to reduce any adverse environmental effects are identified as appropriate before the residual environmental effects are assessed.

H1.3 This chapter is supported by the following technical appendices: -

1 **Appendix H1**: Site Location Plan.

2 **Appendix H2**: TS2 Teardrop Site – Phase 1 Geo-Environmental Desk Study by CH2M [CH2M 2017].

3 **Appendix H3** Warrenby 3A Draft Factual Report by Allied Exploration and Geotechnics Ltd (AEG) Contract Number 4292 dated October 2020.

4 **Appendix H4**: Petrological Examination of Four Samples from 4292 Warrenby 3A Site, Redcar, Thomas Research Services Ltd (TRS), Ref BG0H/AEG/WAR/TRS/10/20/RP2, dated 21 October 2020.

5 **Appendix H5**: Warrenby 3B Ground Investigation, Final Factual Report by Allied Exploration and Geotechnics Ltd (AEG) Contract Number 4279, dated October 2020.

6 **Appendix H6**: Petrological Examination of Four Samples from Warrenby Site 3B (4279), Thomas Research Services Ltd (TRS), Ref BG0D/AEG/WS3B/TRS/07/20/RP2, dated 31 July 2020.

7 **Appendix H7**: Phase II Environmental Site Assessment, Warrenby 3B Area, Former Steelworks, Redcar, Arcadis, Ref 10035117-AUK-XX-XX-RP-ZZ-0051-P2-Warrenby3B_ESA, dated September 2020.

8 **Appendix H8**: Groundsure Enviro & Geo Insight: Site 4, Redcar, North East England, TS10 1DZ, Ref PO_14043848 / GS-7224478 [Groundsure 2020].

9 **Appendix H9**: Landfill Closure Report for CLE31 Teesside, Tata Steel R&D, Ref 160536, dated 1st June 2015.

10 **Appendix H10**: DRAFT - Site Wide Groundwater Summary Report, Former Steelworks, Redcar, Arcadis, Ref 10035117-AUK-XX-XX-RP-ZZ-0155-01-Site_GW, dated September 2020.

11 **Appendix H11**: Outline Remediation Strategy, Former Steelworks Land, South Tees, Wood Environment & Infrastructure Solutions UK Ltd (Wood), Ref 41825-WOOD-XX-XX-RP-OC-0002_A_P02, dated 19 July 2019.

12 **Appendix H12:** Regulatory Liaison with Redcar and Cleveland Borough Council (RCBC 2020).

13 **Appendix H13**: Regulatory Liaison with Environment Agency (NA/2019/114630/01-L01, August 2019) and Regulatory Liaison with Redcar and Cleveland Borough Council (RCBC 2019) (on Wood report).

14 **Appendix H14**: Memorandum CLE 31 Technical data, Teesworks, dated 17.11.2020.

15 **Appendix H15**: Soil and Groundwater Baseline Characterisation Study Corus Teesside Works, Factual Report Volume 1 by Enviros Consulting Ltd, dated June 2004.

16 **Appendix H16:** Soil and Groundwater Baseline Characterisation Study Corus Teesside Works, Interpretative Report Volume 2 by Enviros Consulting Ltd, dated June 2004.

17 **Appendix H17:** Soil and Groundwater Baseline Characterisation Study Corus Teesside Works, Summary Report Volume 3 by Enviros Consulting Ltd, dated June 2004.

18 **Appendix H18**: Initial Findings of a Geo-Environmental Investigation HFO Spillage at Corus Teesside Works, 147407, Corus, dated 19th October 2009.

19 **Appendix H19**: Gas and Groundwater Monitoring at the CLE31 Landfill, STSC Site, Dunelm Geotechnical and Environmental, Ref D10011/01, dated 3rd April 2020.

About the Authors

H1.4 This chapter has been prepared by Gemma Francis BSc (Hons), Principal Consultant at Arcadis UK Ltd. Gemma has over 18 years' experience in contaminated land assessment, chemical analysis and remediation including the preparation of Environmental Statements for Environmental Impact Assessments (EIA) and other regulatory, permitting and planning support across a range of commercial, industrial and residential development projects.

H1.5 This chapter has been reviewed by Chris Piddington PhD, BEng (Hons), Technical Director Arcadis UK Ltd. Chris has over 18 years' experience in delivering bespoke contaminated land solutions and brownfield regeneration schemes. His work includes the preparation of Environmental Statements to support Environmental Impact Assessments in addition to providing support and guidance in relation to regulatory, permitting and planning challenges across a diverse range of development projects.

H1.6 Arcadis is a member of the IEMA EIA Quality Mark.

H2.0 Policy Context

National Policies and Legislation

H2.1 The legislation, policy and documentation applicable to Land Quality and Soil Contamination at the national level are listed in Section H10 (References) and shown below. These documents are used to guide the assessment of potential risks posed by contamination, the significance of potential impacts as well as inform mitigation measures in line with industry good practice.

1 Environmental Protection Act 1990 Part II (Ref 1);

2 Environment Act 1995 (Ref 2);

3 Environment Agency 2008, An ecological risk assessment framework for contaminants in soil. Science Report SC070009/SR1 (Ref 3);

4 Derivation and use of soil screening values for assessing ecological risks Report – ShARE id26 (revised) (Ref 4);

5 BRE Special Digest (SD) 1: Concrete in Aggressive Ground, 2015 (Ref 5);

6 Environmental Permitting (England and Wales) Regulations 2010 (Ref 6);

7 Control of Pollution (amendment) Act 1989 (Ref 7);

8 Water Framework Directive 2000/60/EC (Ref 8);

9 Groundwater Directive 2006/118/EC (Ref 9);

10 Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991 (as amended) (Ref 10);

11 Controlled Waste (England and Wales) Regulations 2012 (Ref 11);

12 Construction (Design and Management) Regulations 2015 (Ref 12);

13 Hazardous Waste (England and Wales) Regulations 2005 (Ref 13);

14 Waste (England and Wales) Regulations 2011 (Ref 14);

15 Waste Framework Directive 2008/98/EC (OJEU, 2008) (Ref 15);

16 The Contaminated Land (England) Regulations 2006 (Ref 16);

17 The Environment Damage (Prevention and Remediation) Regulations 2015 (Ref 17);

18 National Planning Policy Framework, 2019 (Ref 18);

19 Environment Agency, Guiding Principles Land Contamination (GPLC2) (Ref 19);

20 Environment Agency, Land Contamination Risk Management (2019) (Ref 20);

21 Environment Agency, Land contamination groundwater compliance points: quantitative risk assessments, 2017 (Ref 21);

22 Environment Agency, Protect groundwater and prevent groundwater pollution, 2017 (Ref 22);

23 Environment Agency, Groundwater protection technical guidance, 2017 (Ref 23);

24 Environment Agency, The Environment Agency's approach to groundwater protection, 2018 (Ref 24);

25 British Standards 10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites - Code of Practice' 2017 (Ref 25);

26 British Standards BS3882:2015 'Specification for Topsoil and Requirements for Use' 2015 (Ref 26);

27 British Standards BS EN 206:2013+A1:2016 'Concrete - Specification, Performance, Production and Conformity' 2013 (Ref 27);

28 BSI Standards Publication "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings", BS 8485:2015+A1:2019 (Ref 28);

29 CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' 2007 (Ref 29);

30 CIRIA C552 Contaminated Land Risk Assessment A Guide to Good Practice. 2001 (Ref 30);

31 CIRIA C692 Environmental Good Practice on Site. 4th Edition 2015 (Ref 31);

32 National House Building Council, Environment Agency and Chartered Institute of Environmental Health 'R&D Pub 66: Guidance for the Safe Development of Housing on Land Affected by Contamination (Volumes 1 & 2), 2008 (Ref 32);

33 National House Building Council, Guidance on Evaluation of Development Proposal on Site Where Methane and Carbon Dioxide are Present Report Edition No.4 March 2007 (Ref 33);

34 EA's 'TR P5-065/TR: Technical Aspects of Site Investigation (Volumes 1 & 2)' 2002 (Ref 34);

35 DEFRA (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance; and DEFRA Guidance, Pollution Prevention for Businesses, July 2016 (Updated May 2019) (Ref 35).

National Planning Policy

H2.2 The National Planning Policy Framework (NPPF) 2019 (Ref 36) sets out the Government planning policies for England and how these are to be applied. Chapter 11 (Making effective use of land) and Chapter 15 (Conserving and enhancing the natural environment) of the NPPF - contain the following paragraphs which are relevant to this assessment and are summarised below:

1 Paragraph 117 states that *"Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land"*;

2 Paragraph 118 (c) states that *"planning policies and decisions should give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land"*;

3 Paragraph 170 requires that the 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; (b) recognising…the wider benefits from natural capital and ecosystem services…; (d) minimising impacts on and providing net gains for biodiversity…; (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…; and (f) by remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate"*;

4 Paragraph 178 requires that *"planning policies and decisions should ensure that: (a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards*

or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation); (b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and (c) adequate site investigation information, prepared by a competent person, is available to inform these assessments"; and

5 Paragraph 179 states that *"where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner"*.

H2.3 Guidance from the Ministry of Housing, Communities & Local Government includes online planning policy guidance on 'Land affected by contamination' (2019) and 'Land stability' (2019).

Local Planning Policy

H2.4 Redcar and Cleveland Borough Council (RCBC) will determine the outline planning application in accordance with Section 38(6) of the Planning and Compulsory Purchase Act 2004, which states that planning applications must be made in accordance with the development plan unless material considerations indicate otherwise.

H2.5 In this case, the relevant statutory development plan comprises:

1 Redcar and Cleveland Local Plan (adopted May 2018);

2 Local Plan Policies Map; and

3 The Tees Valley Joint Minerals and Waste Development Plan Documents, comprising:

  a Minerals and Waste Core Strategy DPD (adopted September 2011); and

  b Minerals and Waste Policies and Sites DPD (adopted September 2011).

H2.6 Planning policies relevant to ground conditions and remediation associated with the proposed development are set out below.

H2.7 Local Plan Policy LS 4 (South Tees Spatial Strategy) includes the following aims in relation to the environment:

1 enhance the environmental quality of employment through well planned boundary treatments;

2 secure decontamination and redevelopment of potentially contaminated land;

3 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;

4 enhance the environmental quality of the River Tees and coastline; and

5 encourage improvements to access, interpretation and wildlife conservation and biodiversity across the area.

H3.0 Assessment Methodology & Significance Criteria

Assessment Methodology

H3.1 The assessment of impacts to and from the existing ground conditions and from the proposed development is undertaken using importance and significance criteria that have been developed by Arcadis, and successfully applied to other Environmental Impact Assessments. The methodology considers the potential presence of land and groundwater contamination as well as sites of geological/geomorphological significance such as geological conservation features or mineral resources. Geotechnical constraints e.g. differential settlement, subsidence and the potential for explosive ground gas accumulation are also highlighted with the built environment identified as the main sensitive receptor. The built environment includes foundations, below-ground structures, utilities equipment and buildings.

H3.2 The reports detailed below (listed as appendices paragraph H1.3 above) and an up-to-date Groundsure report have been used to establish the baseline conditions. The Conceptual Site Model (CSM) presented in the Outline Remedial Strategy (2020) (Appendix H11), is integrated into the baseline conditions. All supporting information is consistent with the risk-based framework adopted by the Environment Agency: Land Contamination Risk Management (2020).

1 TS2 Teardrop Site – Phase 1 Geo-Environmental Desk Study by CH2M [CH2M 2017].

2 Warrenby 3A Draft Factual Report by Allied Exploration and Geotechnics Ltd (AEG) Contract Number 4292 dated October 2020.

3 Petrological Examination of Four Samples from 4292 Warrenby 3A Site, Redcar, Thomas Research Services Ltd (TRS), Ref BG0H/AEG/WAR/TRS/10/20/RP2, dated 21 October 2020.

4 Warrenby 3B Ground Investigation, Final Factual Report by Allied Exploration and Geotechnics Ltd (AEG) Contract Number 4279, dated October 2020.

5 Petrological Examination of Four Samples from Warrenby Site 3B (4279), Thomas Research Services Ltd (TRS), Ref BG0D/AEG/WS3B/TRS/07/20/RP2, dated 31 July 2020.

6 Phase II Environmental Site Assessment, Warrenby 3B Area, Former Steelworks, Redcar, Arcadis, Ref 10035117-AUK-XX-XX-RP-ZZ-0051-P2-Warrenby3B_ESA, dated September 2020.

7 Landfill Closure Report for CLE31 Teesside, Tata Steel R&D, Ref 160536, dated 1st June 2015.

8 DRAFT - Site Wide Groundwater Summary Report, Former Steelworks, Redcar, Arcadis, Ref 10035117-AUK-XX-XX-RP-ZZ-0155-01-Site_GW, dated September 2020.

9 Outline Remediation Strategy, Former Steelworks Land, South Tees, Wood Environment & Infrastructure Solutions UK Ltd (Wood), Ref 41825-WOOD-XX-XX-RP-OC-0002_A_P02, dated 19 July 2019.

10 Memorandum CLE 31 Technical data, Teesworks, dated 17.11.2020.

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14 Initial Findings of a Geo-Environmental Investigation HFO Spillage at Corus Teesside Works, 147407, Corus, dated 19th October 2009.

15 Gas and Groundwater Monitoring at the CLE31 Landfill, STSC Site, Dunelm Geotechnical and Environmental, Ref D10011/01, dated 3rd April 2020.

H3.3 Potential and actual sources of contamination associated with the site are identified by considering the:

1 Current and previous land use from a study of existing reports, current and historic maps, photographs, local history sources, environmental database information, and a site inspection; and

2 Available intrusive site investigation data and contamination/ground conditions assessments.

H3.4 Following the identification of potential sources of contamination, the presence and sensitivity of receptors at risk from potential or known contamination are identified by consideration of the following:

1 Surrounding land uses, based on mapping and site visits and existing planning designations;

2 Proposed end-use, based on the nature of the proposed development;

3 Type of construction operations that will be necessary during the construction phase of development;

4 Nearby Sites of Nature Conservation Interest (SNCIs), Special Protection Areas (SPAs), Sites of Special Scientific interest (SSSI) and other protected areas; and

5 Geology, hydrogeology and hydrology of the Site and surrounding area.

H3.5 Where a significant source has been identified and potential sensitive receptors are present, the potential effects can be determined by considering the pathways through which the source/hazard may affect the receptors. The magnitude of effect and the significance of effect is then determined taking due account of the nature of the pathway between a source and a receptor.

H3.6 For each of the potential effects assessed to be likely, a qualitative assessment is made on the significance of the effect on the receptor.

Operational Phase – Scoped Out

H3.7 The operational phase of the proposed development has been scoped out from consideration regarding ground conditions and land contaminations in this chapter for the following reasons:

1 Contamination that is present at the site will be remediated and managed during the construction phase and therefore the risk from historic contamination during operation will be Negligible and Not Significant;

2 It is assumed further assessment of ground gas risks will be undertaken in order to identify appropriate gas protection measures, if required, based on specific development proposals. The required gas protection measures would be incorporated into the buildings during construction and therefore the risk to the occupiers would be Negligible and Not Significant;

3 Whilst the proposed operational site is mainly industrial (Class B2, B8 and E) and therefore may use, handle and/or store hazardous substances or wastes, it is assumed that should this be undertaken they would need appropriate permits and would be governed by legislation in order to operate safely, therefore the risk from new contamination would be Negligible and Not Significant. Where required, storage tanks will be located within controlled areas and within bunding sufficient to contain liquids in case of spillage or rupture;

4 It is also noted that post development the sites would mainly be covered by buildings and hardstanding (access roads and car parks etc) which would also reduce the risk of contamination in spillage events from adversely affecting surface water or groundwater as well as reduce leaching of residual soil contamination due to rainfall;

5 It is assumed areas of hardstanding will be designed to avoid uncontrolled discharges to drains. Site drainage and networks will be lined with impermeable geomembrane so there is no interaction with contaminated land. Soakaways or SUDS will be not be employed to limit mobilisation of contaminants. The groundwater beneath the site is considered low sensitivity;

6 A clean or lined service run area will be installed, as required, to protect both future land users (maintenance) and utility assets. A no dig layer may be installed. It is assumed maintenance workers that are required to undertake ground excavations during the operational life of development will be provided with sufficient information on the nature of each sub-area, upon which to base site and task specific risk assessments;

7 Materials used in infrastructure will be designed and specified accordingly taking due account of the potential for aggressive ground conditions such as those related to the possible presence of elevated sulphate or the presence of ground gas;

8 The preparation of a geotechnically suitable development platform for a specific redevelopment is the responsibility of the developer.

H3.8 As discussed below, consultation has taken place and the Environment Agency (EA) has agreed to the operational phase being scoped out of this chapter.

Significance Criteria

H3.9 The impact is assessed in terms of the sensitivity or importance of a receptor or feature, and the magnitude of change or scale of impact during the construction phase of the proposed development. The importance of potentially affected geological/geomorphological features and the sensitivity of receptors, which may be affected by land contamination impacts, have been assessed according to the four-point scale shown in Table H3.1 below.

Table H3.1 Significance criteria - sensitivity of receptors

Sensitivity / Value of Receptor	Receptors Susceptible to Land Contamination and Ground Hazard Impacts	Soil and Geological Resources
Very High	Residential areas or schools within 50 m of construction works Construction workers involved in below ground works Water features deemed to be of high value Ecological features deemed to be of high value	Internationally and nationally designated sites Regionally important sites with limited potential for substitution High quality agricultural soils (Grade 1 and 2) or soils of high nature conservation or landscape importance

Sensitivity / Value of Receptor	Receptors Susceptible to Land Contamination and Ground Hazard Impacts	Soil and Geological Resources
	Allotments, arable farmland, livestock or market gardens on or adjacent to the site	Presence of significant mineral reserves and within a Mineral Consultation Area Soil/materials disposal required following earthworks resulting in a significant increase in demand on waste management infrastructure
High	Residential areas or schools within 50 to 250 m of construction works Commercial areas within 50 m of construction works Construction workers involved in above ground works Water features deemed to be of medium value Ecological features deemed to be of medium value The built environment including buildings and infrastructure	Regionally important sites with potential for substitution Locally designated sites with limited potential for substitution Good quality agricultural soils (Grade 3a) or soils of medium conservation or landscape importance Site within a Mineral Consultation Area Soils/materials disposal required following earthworks resulting in a moderate increase in demand on waste management infrastructure
Medium	Residential areas >250 m from construction works Commercial areas within 50 to 250 m of construction works Water features deemed to be of low value Ecological features deemed to be of low value	Undesignated sites of some local earth heritage interest Moderate or poor-quality agricultural soils (Grade 3b or 4) or soils of low nature conservation or landscape importance Limited potential for mineral reserves and site not within a Mineral Consultation Area Soil/materials disposal required following earthworks resulting in a limited or minor increase in demand on waste management infrastructure
Low	Areas where there are no built structures, crops, or livestock Commercial areas within >250 m of construction works Ecological features deemed to be of negligible value	Other sites with little or no local earth heritage interest Very poor-quality agricultural soils (Grade 5) or soils of negligible nature conservation or landscape importance. Negligible potential for mineral reserves to exist

H3.10 Table H3.2 below sets out the magnitude criteria used to assess the magnitude of impacts in this chapter.

Table H3.2 Significance Criteria - Magnitude of Impacts

Magnitude of Impact	Receptors Susceptible to Land Contamination and Ground Hazard Impacts	Soil and Geological Resources
High	Human Health: Acute risk to human health Surface waters and/or groundwater: Substantial acute pollution or long-term degradation of sensitive water resources (Principal Aquifer, groundwater source protection zone, surface waters of good or very good quality) Ecology: Significant change to the number of one or more species or ecosystems Built Environment: Catastrophic damage to buildings, structures or the environment Landscaping/Agriculture: Loss in value of livestock or crops as a result of death, disease, or physical damage.	Loss of feature or attribute Earthworks resulting in high volume of surplus soil for off-site disposal Classification of surplus soil as Hazardous Waste where the intention is to discard
Medium	Human Health: Chronic risk to human health Surface water and/or groundwater: Pollution of non-sensitive water resources or small-scale pollution of sensitive water resources (Principal or Secondary Aquifers of water courses of fair quality or below1) Ecology: Change to population densities of non-sensitive species Built Environment: Damage to buildings, structures or the environment Landscaping/Agriculture: Non-permanent health effects to vegetation/crops from disease or physical damage, which results in a reduction in value.	Impact on integrity of or partial loss of feature or attribute Earthworks resulting in moderate volume of surplus soil for off-site disposal
Low	Human Health: Slight reversible short-term effects to human health Surface waters and/or groundwater: Slight pollution of non- sensitive water resources Ecology: Some change to population densities of non- sensitive species with no negative effects on the function of the ecosystem Built Environment: Easily reparable effects of damage to buildings or structures Landscaping/Agriculture: Slight or short-term health effects which result in slight reduction in value	Minor impact on feature or attribute Earthworks resulting in low volume of surplus soil for off-site disposal

Magnitude of Impact	Receptors Susceptible to Land Contamination and Ground Hazard Impacts	Soil and Geological Resources
Negligible	Human Health: No measurable effects on humans Surface waters and/or groundwater: Insubstantial pollution to non-sensitive water resource Ecology: No significant changes to population densities in the environment or in any ecosystem Built Environment: Very slight non-structural damage or cosmetic harm to buildings or structures Landscaping/Agriculture: No significant reduction in landscape value.	Impact of insufficient magnitude to affect use or integrity of feature or attribute No off-site disposal of surplus soil required

H3.11 The significance of the effect of the impact has been determined in accordance with the matrix shown in Table H3.3 below.

Table H3.3 Significance Criteria - Significance of Effect

	Magnitude of Impact			
Sensitivity/value of a Receptor	High	Medium	Low	Negligible
Very High	Substantial	Substantial	Moderate	Minor
High	Substantial	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible

H3.12 The above significance of effects criteria are all considered to be Adverse. It is considered that any potential impact determined with a significance of Moderate Adverse or Substantial Adverse is a significant impact for the purposes of this EIA.

Consultation

H3.13 Arcadis (UK) Ltd undertook consultation regarding this chapter with Mick Gent, Contaminated Land Officer, RCBC on 9th November 2020 and Caitlin Newby, EA on 4th December 2020 concerning the basis for the assessment including the available sources of information, scoping out the operational phase of the assessment and the suitability of the Significance Criteria described above.

H3.14 Mick Gent agreed via email dated 7th December (see Appendix H12) that the Significance Criteria are acceptable. No formal response has been received by Caitlin Newby, but she confirmed in the meeting that scoping out the operational phase was acceptable.

Assumptions and Limitations

H3.15 The conclusions reached within this ES chapter are based in part upon information and/or documents that have been prepared by third parties. In view of this, we accept no responsibility or liability of any kind in relation to such third-party information and no representation, warranty or undertaking of any kind, express or implied, is made with respect to the completeness, accuracy or adequacy of such third-party information.

H3.16 There are currently a number of data gaps regarding the geochemical and geotechnical characterisation of ground conditions and contamination at the site which will likely require further site investigation and risk assessment in order to further inform the CSM and confirm the significance of the potential Source Pathway Receptor ('SPR') linkages.

H3.17 This assessment assumes that as part of the redevelopment of the Long Acre site, the land raise (Warrenby Landfill CLE31) which is present on site, will be removed as part of the first phase of development and the material within the landfill will be recovered and reused to level the site or removed to other parts of the Teesworks development. This will be undertaken under a Deposit for Recovery process.

H3.18 The assessment undertaken within this chapter is supported by an Outline Remediation Strategy (Wood, 2019) which identifies the relevant SPR linkages (based on 2019) and a possible approach to addressing the potential risks to identified receptors. This report, which covers the whole of the Long Acre site, indicates that no active groundwater remediation is required on the site due to previous discussions with the EA. Comments on the Wood strategy have been obtained from the EA (NA/2019/114630/01-L01, August 2019 (Appendix H13). These state that past industrial activity is considered to pose a medium risk of pollution to controlled waters. The Outline Remediation Strategy also considers that the potential hazard to controlled waters is medium but that given the low likelihood of occurrence and low sensitivity of the controlled water receptors the significance of this risk is moderate / low and that no active remediation of groundwater is required. Comments received from RCBC (Ref:153731, 06/08/2019) (Appendix H13) state that they are satisfied that the Wood strategy adequately covers parts (a) (Site characterisation) and (b) (Submission of a Remediation Scheme) of the standard contaminated land conditions.

H3.19 It is assumed that existing permits associated with specific areas within the proposed development area, including permitted activities regulated by the EA and by RCBC, will be surrendered in accordance with relevant regulations and guidance to the satisfaction of the relevant authority alongside remediation works prior to site redevelopment.

H4.0 Baseline Conditions

Existing Conditions

H4.1 The development site is 67 ha in size and is centred at Ordnance Survey (OS) National Grid Reference 457529E, 524700N. It is brownfield industrial land and is free of active use and built development and is bisected by the Fleet watercourse, as discussed in further detail below.

H4.2 A site location plan is included in Appendix H1.

H4.3 The site is located approximately 2.4km north west of Redcar town centre. It is around 0.8km south from the coast and around 2.8km south west of the bank of the River Tees. It is located within the north eastern part of the Teesworks area and is also known as the 'Teardrop site in the STDC Master Plan, the site has also been referred to as TS2, Warrenby, and also contains the CLE31 area. In relation to the wider Teesworks area, it lies to the south east of the 'Redcar Works Complex', to the west of 'Coatham Marsh' and to the north of the 'Redcar Steel House and surrounding area'.

H4.4 The site is immediately bounded by the Darlington to Saltburn Railway line to the south east beyond which is the Steel House Teesworks site; a private internal road and open industrial land forming the Teesworks Foundry and NetZero sites to the north west. To the north east the site is bounded by Coatham Marsh, industrial land, and the South Gare Road. To the south west the site is bounded by the Teesworks TS1 area beyond which is the Bran Sands Water Treatment Works.

H4.5 The development site is triangular in shape and is largely defined by the existing surrounding infrastructure. The site was previously partially occupied by the Warrenby iron and steel works and in part has been previously used as a licensed landfill for the disposal of byproducts from iron and steel making, principally slag. Warrenby 3A Landfill or CLE31 covers an area of some 7ha and holds around one million cubic metres of waste material, which is predominantly steelmaking slag with small amounts of paper and canteen wastes from the works.

H4.6 Whilst the site is free from built structures, it contains a number of permanent roads and rail line. This includes the former Hot Metals Transfer Railway line and adjacent road which cross the site from south to north and has an embankment which is around 10m above ordnance datum AOD) at the southern end, approximately 4m above surrounding ground level, which gradually lowers to meet existing ground levels at its northern end. The Fleet watercourse crosses the site in an east west direction, although it arcs in a southerly direction before heading in a north west direction. A second surface water feature, the culverted Mill Race, crosses the southern extremity of the site in an approximate east west direction.

H4.7 The area to the east of the former Hot Metals Transfer Railway line and north of the Fleet watercourse was the area previously used as a landfill and is now a steep sided mound with a flat plateau at 19.5m AOD. The ground levels surrounding the mound vary from 7.5m AOD to 9m AOD. The ground cover on the plateau is principally the slag material from the landfill use, with the sides of the mound and beyond being covered in grasses and shrub type vegetation, with some trees alongside the former railway line and the Fleet. A landscaped embankment is present at the site boundary north of the CLE31 landfill.

H4.8 The area to the south of the Fleet watercourse and north of the Darlington to Saltburn Railway line (Warrenby 3B) is a flat area that was prepared as a landfill site, but never used as such. It has recently been prepared for stockpiling of mudstone.

H4.9 The area to the west of the former Hot Metals Transfer Railway line contains former internal road infrastructure at its southern end, and otherwise the ground cover is a mixture of grass and

scrub-type vegetation interspersed with areas of bare ground comprising materials associated with former uses. The ground levels in this area vary according to on site infrastructure and range from 11m AOD at the road embankment on the north western boundary of the site to 6m AOD in a relatively large flat area in the centre of this part of the site.

H4.10 STDC's internal road network runs across the site. It includes a road running in a north south direction alongside the route of the former Hot Metals Transfer Railway line, which branches in a westerly direction in the northern part of the site. A small internal road network is also present in the south western corner of the site.

H4.11 The Darlington to Saltburn Railway line, which provides the south east boundary of the site is an operational passenger railway line and the Redcar British Steel station is located on the boundary of the site, just to the south east of the intersection between the two railway lines.

H4.12 A high voltage power transmission line crosses under the site in a north south direction under the route of the internal road.

H4.13 The Fleet watercourse enters the site in a westerly direction from Coatham Marsh and arcs round in a south westerly direction. It is then culverted in a north westerly direction under the former Hot Metals Transfer Railway and internal road and emerges on the other side where it continues in a straight culvert in a north west direction. Outside of the site, the Fleet continues in a culvert heading south until it discharges into Dabholm Gut.

H4.14 A second surface water feature the culverted Mill Race crosses the southern extremity of the site in an approximate east west direction before joining the Fleet after it has left the site.

H4.15 The operational RWE Breagh high pressure gas pipeline crosses the northern part of the site in a north-west south-east direction, and the CATS high pressure gas pipeline runs down the north western edge of the site. Running parallel to the CATS pipeline are the former Heavy Fuel oil transfer pipeline and the Coke Oven Gas Main (COGM) both of which are above ground. Water infrastructure present on the site comprises potable water supply pipes and an industrial water mains, both of which cross the northern part of the site in a north-west south-east direction.

Historical Setting

H4.16 A review of the historical development of the site was undertaken as part of the Phase 1 Geo-Environmental Desk Study (CH2M 2017) which included information from Sahaviriya Steel Industries (SSI) site records and in the Wood Outline Remediation Strategy (Wood, 2019). These reports, combined with Groundsure Insights OS maps which Arcadis acquired in November 2020, have been reviewed and summarised in Table H4.1 below.

H4.17 Furthermore, historic maps at a scale of 1:1250, 1:2,500, and 1:10,000 between 1857 and to 2020 have been reviewed and are summarised in Table H4.1 below.

Table H4.1 Summary of Historical Mapping Data

Mapping Date	On Site	Off Site
1857	The majority of the site is shown as Coatham Marsh, the Tees Estuary lies west of the site. The Middlesbrough to Redcar Railway Line is already present running through the northern third of the site.	Site is surrounded by the Coatham Marshes and is mostly undeveloped.
1874	Development of the Redcar Iron Works.	No maps available.

Mapping Date	On Site	Off Site
1893/94	The centre of the site is occupied by the Redcar Iron Works along with four blast furnace chimneys evident. The Iron Works is linked to the adjacent Middlesbrough to Redcar Railway line to the west with a complex series of rail lines linking to the site. The Fleet watercourse runs through the centre of the site from north east to south west and is partially culverted under the Redcar Iron Works. A number of small ponds are also shown on site. This watercourse also picks up other drainage channels which run through the southern section of the site. Marsh hills and ancient salt hills were recorded along the southern boundary of the site. Immediately north of the Middlesbrough to Redcar Rail line the Coatham Iron Works is shown partially within the site boundary and includes a number of small reservoirs. The Mill Race is shown but not labelled entering the south of the site and has a spur to the Fleet.	North of the Coatham Iron Works a tramway network connects to the docks and the Tees Estuary. The area north of the iron works also appears to have been largely over tipped to allow the tramways to be constructed. This truncates earlier drainage patterns. South of the site is shown to be largely undeveloped. A small development northeast of the site labelled Warrenby contains a school, a church and a hospital.
1913/15	Further development of the rail lines and tramways north of the Redcar Iron Works is shown, as well as an extension to the fill platform. There are two areas recorded as Slag Wool Works, within and north of the Iron Works, respectively. Also, north of the Iron Works a Slag Brick Works is also shown. A tar and macadam works, and slag wool works are shown as part of the expanded Coatham Iron Works.	No significant changes have been made around the site.
1929	The railway/tramway network in the north and centre of the site has been significantly extended. The buildings of the Slag Brickworks and Slag Wool Works have also been extended.	The Coatham Ironworks has been significantly expanded north of the site and includes a series of new buildings, chimneys and water coolers. South of the site Dormanstown has been established. Sidings have been constructed to the east of the site in the vicinity of the current Steel House
1954	The original buildings of the Coatham Iron Works are no longer shown although the later off-site structures remain. South of the Fleet watercourse, a significant area of the site is shown to	Sidings have been extended to the east of the site in the vicinity of the current Steel House.

Mapping Date	On Site	Off Site
	have been raised using fill. This resulted in the drainage pattern being altered. The Mill Race is no longer joined to the Fleet, which has been diverted to its current position in the Warrenby 3A / 3B area. Fill is shown in the Warrenby 3A	
1973/74	The buildings associated with the Redcar Iron Works have been largely removed. Some additional rail lines are present in the south of the site.	The northern part of the map is unavailable. The area to the west of the site has been reclaimed from the Tees Estuary and is marked as "Active Workings".
1980-83	The site is close to its current layout the public railway has been moved to its present position south east of the site. The Hot Metal Route, Fleet, and site roadways are shown in their current position. A few small structures remain in the vicinity of Warrenby 3A. The Warrenby 3B area is labelled as "workings".	There have been major changes including the construction of Steel House and associated car parks south east of the site and the current Redcar Steelworks infrastructure to the north west. West of the site a new works has been constructed, partially over the area where the Steelworks used to be.
2000/01	Majority of the site remains the same as shown in 1986 maps. An area of apparent active land raising is taking place to the east between the internal road / rail link and the Fleet channel.	The Pellet Plant to the west of the site is no longer shown, the Bran Sands Water Treatment Works is shown.
2006	No apparent changes have been made to the site	No significant changes.
2008	Limited changes evident.	No significant changes.
2012	Limited changes evident.	No significant changes.
2020	Limited changes evident.	No significant changes.

Summary of Site History

H4.18 Historical mapping shows that by 1893 the Redcar Iron Works occupied the central area of the site and the Coatham Iron Works the north of the site, with numerous railway tracks to the north linking to the adjacent main line. The area south of the works has largely remained undeveloped. It has historically been crosscut by several channels which drained towards The Fleet, which flows to the north west through the site. Mounds recorded as marsh and ancient salt hills have also been shown along the southern perimeter.

H4.19 Much of the area north of the Redcar Iron Work had been infilled by 1894, allowing the construction of the Slag Wool Works and Slag Brick buildings, a tarmacadam works was associated with the Cotham Iron Works. By 1954 the Coatham Iron Works had been extended off site and the on-site structures largely removed. The Redcar Iron Works site was largely demolished by 1973. Sometime between 1973 and 1986 the Middlesbrough to Redcar line was rediverted along the southern boundary. The area to the south of the former Iron Works had also been re-graded, with earthworks constructed for the present-day road and railway alignments.

Previous Environmental Assessments

H4.20 Available and relevant historic reports and exploratory location records have been identified by Arcadis and these are used to inform the baseline assessment to this EIA.

H4.21 The scope and relevance of previous intrusive environmental site investigations is given in Table H4.2 below

Table H4.2 Summary of Previous Site Investigations

Relevant & Available Reports	Relevant Site Area	Outline Scope
Soil and Groundwater Baseline Characterisation Study (Enviros 2004)	TS2 – area known as the Teardrop on western side of site.	Excavation of 9No shallow trial pits (11BT5 – 11BT10) using a 20-tonne tracked excavator and breaker. Advancing 2No groundwater monitoring boreholes using shell and auger (cable percussive) rig. Recovery of 22No soil samples from Made Ground and natural strata (where encountered) and recovery of one groundwater sample. Soil samples were analysed for soil samples were analysed for asbestos, heavy metals, PAH, cyanides, pH, sulphate, and petroleum hydrocarbons. A single round of groundwater monitoring was conducted with samples analysed for heavy metals, PAH, cyanides, pH, sulphate, phenols, and petroleum hydrocarbons.
Initial Findings of a Geo-Environmental Investigation HFO Spillage at Corus Teesside Works, 147407, Corus, dated 19th October 2009	Immediately SW of site.	22No trial pits excavated in the vicinity of a leak from the HFO pipeline. Soil samples were analysed for PAH, petroleum hydrocarbons and semi volatile organic compounds (SVOC).
Petrological Examination of Four Samples From 4292 Warrenby 3A Site, Redcar For Allied Exploration & Geotechnics Ltd (TRS 2020)	Warrenby 3A (central portion of site).	Four bulk samples were tested to identify the range and relative concentrations of any iron and steelmaking slag present in the soil and whether there was any potential for volumetric instability from the materials.
Petrological Examination of Four Samples From 4292 Warrenby Site 3B, For Allied Exploration & Geotechnics Ltd (TRS 2020)	Warrenby 3B (south eastern portion of site).	Four bulk samples were tested to identify the range and relative concentrations of any iron and steelmaking slag present in the soil and whether there was any potential for volumetric instability from the materials.
Warrenby Site 3A Ground Investigation:	Warrenby 3A (central portion of site).	Five sonic sample holes. Twenty mechanically excavated trial pits.

Relevant & Available Reports	Relevant Site Area	Outline Scope
Draft Factual Report (AEG 2020) Phase II Environmental Site Assessment, Warrenby 3A Area, Former Steelworks, Redcar (Arcadis 2020, in press and not available at the time of ES submission)		Soil and soil leachate samples were analysed for soil samples were analysed for asbestos, heavy metals, PAH, cyanides, thiocyanate, pH, sulphate, phenol, and petroleum hydrocarbons. Selected samples were also analysed for polychlorinated biphenyl (PCBs) volatile organic compounds (VOC) and SVOC. Collection of in-situ standard and laboratory geotechnical data. In-situ water quality parameter and hydraulic conductivity testing. Installation of gas/groundwater monitoring instrumentation. Two post site work gas/groundwater monitoring and sampling visits of new and historical installations. Groundwater samples analysed for heavy metals, PAH, cyanides, thiocyanate, pH, sulphate, phenol, and petroleum hydrocarbons. Selected samples were also analysed for PCBs VOC and SVOC.
Warrenby Site 3B Ground Investigation: Final Factual Report (AEG 2020) Phase II Environmental Site Assessment, Warrenby 3B Area, Former Steelworks, Redcar (Arcadis 2020)	Warrenby 3B (south eastern portion of site).	Six cable percussive boreholes, three of which were further advanced using rotary open hole/coring techniques. Seventeen mechanically excavated trial pits. Soil and soil leachate samples were analysed for soil samples were analysed for asbestos, heavy metals, PAH, cyanides, thiocyanate, pH, sulphate, phenol, and petroleum hydrocarbons. Selected samples were also analysed for PCBs VOC and SVOC. Collection of in-situ standard and laboratory geotechnical data. In-situ water quality parameter and hydraulic conductivity testing. Installation of gas/groundwater monitoring instrumentation. Post site work gas/groundwater monitoring and sampling visit. Groundwater samples analysed for heavy metals, PAH, cyanides, thiocyanate, pH, sulphate, phenol, and petroleum hydrocarbons.
Draft data - Teardrop Ground investigation conducted September – December 2020	The site (referred to in report as TS2 / Teardrop Site).	Eight boreholes and 46 trial pits Twenty mechanically excavated trial pits Soil and soil leachate samples were analysed for soil samples were analysed for asbestos, heavy metals, PAH, cyanides, thiocyanate, pH, sulphate, phenol, and petroleum hydrocarbons. Selected samples were also analysed for PCBs VOC and SVOC.

Relevant & Available Reports	Relevant Site Area	Outline Scope
		Collection of in-situ standard and laboratory geotechnical data. In-situ water quality parameter and hydraulic conductivity testing and tidal monitoring. Installation of gas/groundwater monitoring instrumentation. Three post site work gas/groundwater monitoring and sampling visits of new and historical installations. Groundwater samples analysed for heavy metals, PAH, cyanides, thiocyanate, pH, sulphate, phenol, and petroleum hydrocarbons. Selected samples were also analysed for PCBs VOC and SVOC.

Data Gaps

H4.22 There are currently a number of data gaps regarding the geochemical and geotechnical characterisation of ground conditions and contamination at the site which will likely require further site investigation and risk assessment in order further inform the CSM and confirm the significance of the potential SPR linkages.

H4.23 The principal data gaps identified are as follows:

1 The ongoing interpretation of the site investigation undertaken by AEG at Warrenby 3A (CLE31); this is not available at the time of writing.

2 The ongoing interpretation of the site investigation undertaken by AEG at Teardrop site; this is not available at the time of writing

3 Ground Gas - future development proposals should be supported by ground gas monitoring and an associated gas risk assessment and, if necessary, should incorporate any necessary protection measures appropriate to protect buildings from gas migration. This should be undertaken once the development platform has been created.

4 Limited groundwater monitoring data exists, periodic monitoring should be undertaken to better understand the groundwater quality and inform the baseline conditions in order to provide early warning of any changes to groundwater quality during construction works. Collection of additional data is underway, but the results are not available at the time of writing.

5 Geotechnical properties – Limited geotechnical data is available from previous site investigations. Further site investigations are required to aid in the detailed design of foundations, floors and external pavements. This should include an assessment of likely settlement due to future loadings and heave potential. Collection of additional data is underway, but the results are not available at the time of writing.

H4.24 Other Assumptions and Limitation are detailed in Section H3.15 to H3.19.

Geology

H4.25 The British Geological Society (BGS) GeoIndex Onshore (online resource) and CH2M 2017 Desk Study have been reviewed in order to assess the geological composition of the site which is summarised in this section.

Made Ground

H4.26 A large area of the site was reclaimed from mudflat and marshland and by 1894 large areas of the site were subject to over tipping (land raising) as a result of the development of the Redcar Iron Works.

H4.27 Based on available BGS borehole data the made ground thickness is variable ranging from 0.50m (BHNZ52NE150) to 5.60m (NZ52SE13551/12B) of reported slag, firebricks, ballast, bricks, ash, soil, and rubble. Some records from the investigation to realign the Darlington to Saltburn railway line are available from 1975 together with localised boreholes along the Hot Metal Route. These prove slag to depths of over 6.0m in some locations with some boreholes terminating within the slag due to fused layers. Part of the site has been used for landfilling for the disposal of household, commercial and industrial waste. The nature and thickness of these materials are unknown.

H4.28 Ground investigations indicated Made Ground thickness range from 1.8m to 18.8m, the latter is within the Warrenby 3A / CLE 31 landfill which was identified to contain predominantly slag deposits. In the Warrenby 3B area Made Ground was approximately 3m thick and was composed of slag rich deposits, in the south of the site thicknesses of 2.1m to >4.5m were identified and comprised predominantly slag rich deposits. In the north of the site Made Ground thicknesses ranged from 1.8 to 7m and comprised a mixture of slag rich deposits and granular made ground with demolition materials.

Superficial Deposits

H4.29 The BGS GeoIndex 1:50,000 scale map shows that the superficial deposits underlying the Made Ground at the site are predominantly Tidal Flat deposits of sands and silts with a limited area of Blown Sand deposits towards the south of the site. The limited historic borehole data suggests the superficial deposits consist of laminated sandy clays, very soft to soft silty clays, silt, peat, sand and stony clay. Based on 1975 borehole data, the whole area is in turn underlain by Glacial Till deposits ranging from absent to 3.75m in thickness.

H4.30 Initial interpretation of the 2020 ground investigation data indicates sands and silt with varying amounts of clay comprising Tidal Flat Deposits underlie the Made Ground across much of the site, with material indicative of Blown Sand identified in the north. These deposits were underlain by Glaciolacustrine Deposits of laminated clays and a gravelly clay comprising Glacial Till; Glaciolacustrine Deposits were note identified at Warrenby 3B.

Solid Geology

H4.31 The BGS GeoIndex 1:50,000 scale map shows the site to be underlain by the Redcar Mudstone Formation of Jurassic age. The BGS Lexicon describes the Redcar Mudstone Formation as grey, fossiliferous, fissile mudstones and siltstones, with subordinate thin beds of shelly limestone in lower part, and fine-grained carbonate-cemented sandstone in upper part with argillaceous limestone concretions throughout. The limited borehole data suggest the solid geology (in the upper sections) to consist of a red clay underlain by a thin clay and shaley clay. At considerable depth (>350m) beneath the area are Permian age evaporate deposits that includes the Boulby Halite horizon which is a salt bed measuring approximately 25m thick. This deposit has been exploited by brine extraction in the wider Redcar Steelworks area.

H4.32 Initial interpretation of the 2020 ground investigation data indicate the Redcar Mudstone Formation is encountered at between -4.47m AOD in the vicinity of the former Redcar Iron Works to -16.6m AOD. The upper surface of the formation appears to increase to the north west and south west from a higher elevation in the vicinity of the Former Redcar Iron Works and Warrenby 3B.

Geotechnical and Geological Hazards

H4.33 The Groundsure Insight Report for the site indicates the risk of shrink swell clays is negligible and very low. The risk of running sands varies from low and very low along the western boundary, to high across the rest of the site. The risk presented by compressible deposits is negligible and very low along the western boundary, and moderate across the rest of the site. The risk of collapsible deposits on the site is negligible. The landslide risk is classed as very low, and the risk of ground dissolution of soluble rocks is negligible.

H4.34 With reference to the Coal Authority Interactive Map, the site is not within a Coal Mining Reporting Area. This is consistent with BGS mapping and as such coal mining is not discussed further within this report. However, the Groundsure Report records previous surface ground workings (relating to refuse heaps, ponds, reservoirs and a sand pit) and underground workings (iron workings) have taken place on the site and around the surrounding area.

H4.35 Engineering fills which contain a significant proportion of certain types of slag may pose a risk to future buildings and structures due to their potential to exhibit volumetric instability resulting in differential ground movements. In addition, slag bearing materials can contain so called 'slag skulls' which are fused slag concretions that are extremely difficult to excavate and break up.

H4.36 Limited data is available from previous site investigations in relation to the geotechnical properties of ground underlying the proposed development area. It is known additional data has been collected as part of the ground investigations conducted in 2020 but has not yet been fully reported or interpreted.

H4.37 The significant thickness of Made Ground present beneath the site (up to 7m excluding the CLE31 landfill), and normally consolidated tidal flat deposits, indicates the potential requirement for piled foundations or ground improvement works in relation to structures sensitive to movement.

H4.38 Expansive slag has been identified on site and recorded 28-day expansion values of between 0.06% and 2.11%. the samples displaying the largest expansions contained a large proportion of basic steel slag. It is known additional data has been collected as part of the ground investigations conducted in 2020 but has not yet been fully reported or interpreted.

H4.39 Slags are also characterised by elevated sulphate content, which will need to be taken into consideration when specifying concrete.

H4.40 According to a Zetica UXO Pre-Desk Study (in CH2M report (Appendix H2), the unexploded ordnance (UXO) risk for this site is Moderate. Magnetic anomalies were noted on the adjacent Teesworks Steel House and NetZero sites. It has not been possible to confirm whether these were in fact UXO, or other features. It should be assumed that UXO could present a potential risk for piling or deep foundation installation.

Hydrology and Hydrogeology

Hydrology

H4.41 The River Tees is approximately 2.8km to the west of the site boundary and is classified by the EA as a Main River. This section of the river is intertidal. Within the site the main hydrological feature is the Fleet watercourse which cuts through the site in an approximate east-west orientation and also extends to the east in open channel. The Fleet is also joined by inflow from the adjacent Steel House site surface water features.

H4.42 A second watercourse, the Mill Race, crosses the extreme south of the site in a below ground culvert

Hydrogeology

H4.43 The Groundsure Report indicates that the bedrock beneath the site is classified as a Secondary (Undifferentiated) Aquifer with the overlying Tidal Flat and Blowing Sand Deposits classified as a Secondary A Aquifer. The EA describe a Secondary A Aquifer as "permeable layer capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers". A Secondary Undifferentiated aquifer is defined as "assigned in cases where it has not been possible to attribute either category A or B". This generally means that the horizon has variable characteristics allowing it to function as both a minor and non-aquifer in different locations.

H4.44 A Groundwater Vulnerability Zone Minor Aquifer (High) is recorded along the northern perimeter of the site. This means a minor aquifer is in an area where it is able to easily transmit pollution to groundwater. The site is not in a groundwater Source Protection Zone.

H4.45 The CH2M Desk Study records groundwater levels range between 3.5m and 4.0m AOD from information obtained from the Enviros 2004 GI for Corus. It is known additional data has been collected as part of the ground investigations conducted in 2020 but has not yet been fully reported or interpreted.

Environmental Information – Landfill Sites

H4.46 A technical memorandum dated 17th November 2020, states the following in relation to Cleveland Landfill 31 (CLE 31) which is on site:

H4.47 *"CLE 31 (Cleveland Landfill 31) occupies approximately 110,000m2 area of reclaimed marsh land located to the east of the former SSI Redcar steelworks, an area now known as Long Acres within the Teesworks development. The triangular land parcel is bounded to the south east by the Fleet watercourse, to the west by the former SSI Hot Metal Railway and to the northern edge by a services corridor containing industrial and potable water mains, 11kv electricity cables, and BT Openreach apparatus serving the former Redcar steelworks site area. Natural England's Teesmouth and Cleveland Coast Site of Special Scientific Interest (SSSI) sits approximately 78m to the north and Teesmouth and the Cleveland Coast Special Protection Area (SPA), along with the SSSI, sits approximately 165m to the east.*

H4.48 *The landfill is thought to have been in use from as early as the nineteenth century, with 2-6m depth of material already deposited there by the Second World War, these deposits were made prior to the formal landfill license granted on the 13th June 1977. CLE 31 accepted waste until 15th May 2002 and has remained closed since that date, no further waste is thought to have been deposited.*

H4.49 *CLE 31 is estimated to have a current approximate volume of 1 million cubic metres. TATA Landfill Closure report (2015) states that the CLE 31 landfill formation consists of 95% of mixed steel making by-product slag with the outstanding other non-hazardous industrial waste such as clay, subsoil, topsoil, paper, and canteen waste."*

H4.50 The Landfill Closure Report (2015) concludes that there are no significant risks from ground gases, leached contaminants, stability and no risks to the surrounding habitats. However, it stated that a restoration, maintenance and monitoring programme should be undertaken until the site monitoring indicates that the site license can be surrendered. This includes quarterly monitoring of surface water, groundwater and landfill gas, quarterly site walkovers conducted to

inspect the landfill, topographic surveys every two years, installation of a manufactured soil cap, 1m in depth.

H4.51 Information is provided in the Groundsure report on the historic and active landfill sites around the site. There are two active landfill sites and a further four historic landfill sites within 500m of the Long Acres site in addition to CLE31. These are summarised in the table below.

Table H4.3 Landfill Information

Landfill Name	Active / Historical	Onsite / Offsite	Comments
Unknown	Closure	Onsite	Embankment to the north of CLE31 is registered as a closed landfill. Permit - EA/ERP/KP3790ZE/V002.
West Coatham Lane	Historical	366m SE of site	Received inert waste between 1992 and 1993. Licence holder Langbaurgh Borough Council.
Redcar Trunk Road Landscaping	Historical	316m SE of site	Received inert waste between 1977 and 1979. British Steel reference CLE51.
Bran Sands	Closure	203m W of site	Licenced to receive special waste. Permit - EA/EPR/FB3601GS/Voo2.

H4.52 Land Contamination

Potential Sources of On-Site Contamination

H4.53 The potential pollutant linkages on the site are

1 Made Ground, including slag deposits;

2 Former Redcar and Coatham Ironworks, slag brick, slag wool works, tar macadam works potentially coke works;

3 CLE31 landfill and northern embankment landfill; and

4 Railway lines and sidings

Potential Sources of Off-Site Contamination

H4.54 Notable historic and contemporary features outside of the site boundary which may have implications for land contamination include but are not limited to:

1 Wider Coatham Iron Works;

2 Current Redcar Steelworks structures and demolished Pellet Plant;

3 HFO line and COGM;

4 Bran Sands landfill;

5 Railway lines and sidings;

6 Bran Sands Water Treatment Works; and

7 Fuel spill from HFO line adjacent to south western site boundary (2009).

TS2 Teardrop Site – Phase 1 Geo-Environmental Desk Study (CH2M 2017)

H4.55 Potential sources of contamination include:

1 Made Ground – Contaminant groups within the Made Ground at this site could include slag, elevated pH, soil gases, metals, domestic waste and sulphides/sulphates/carbonates;

2 Tidal Flats / Glaciolacustrine Deposits – Ground gases from the underlying strata could include carbon dioxide, methane and hydrogen sulphide;

3 Former Ironworks, Slag Brick and Slag Wool Works, potentially Coke Works – fuels and oils from the works, transformer oils, metals, asbestos and other contaminants such as coal, coal tar, boiler as, ammoniacal liquor, cyanide and sulphides/sulphates may also be on site;

4 Railway Lines – Asbestos and fuels and oils may possibly be a contamination source on site; and

5 Highways – The dual carriageway along the southern boundary, and the internal network of roads on site may contain diesel and petrol and other oil and grease associated with vehicles.

Soil and Groundwater Baseline Characterisation Study (Enviros 2004)

H4.56 Investigation of Warrenby 3A only identified Made Ground comprising sandy coarse gravel, cobbles and boulders of slag with furnace bricks and ferrous metal debris was encountered to depths of up to 7.2m bgl (below ground level) with occasional lenses of sand and reworked clay. Based on screening criteria at the time, elevated concentrations of lead, zinc, boron and TPH (Total Petroleum Hydrcarbons) were noted but all concentrations were below the calculated 95th percentiles.

Initial Findings of a Geo-Environmental Investigation HFO Spillage at Corus Teesside Works, 147407, Corus, dated 19th October 2009

H4.57 The ground investigation was conducted following a leak from the HFO line, visual and olfactory evidence of contamination including free product was identified in 3 of the 22 trial pits excavated. Elevated concentrations of PAH (Polycyclic Aromatic Hydrocarbns) and petroleum hydrocarbons were measured in soils. The report concluded the residual impacts represented a low to moderate risk and recommended further work to assess the requirement for remediation.

Petrological Examination of Four Samples from 4292 Warrenby 3A Site (TRS 2020)

H4.58 Blast furnace slag and basic steel slag was present in all four samples. Old weathered blast furnace slag may occasionally contain pockets of potentially expansive material. Expansion testing of the samples containing medium to large amounts of basic steel slag recorded expansion results of between 0.59 and 2.11 percent.

Petrological Examination of Four Samples from Warrenby Site 3B (TRS 2020)

H4.59 Blast furnace slag was the dominant constituent of all four samples. The slag showed moderate levels of alteration due to weathering. Old weathered blast furnace slag may contain pockets of potentially expansive material. Expansion testing was carried out on all four samples. The TRS accelerated expansion test recorded only modest potential for expansion (up to 0.13%).

Phase II Environmental Site Assessment, Warrenby 3B Area (Arcadis 2020)

H4.60 Potential risks to human health via intake of a range of contaminants from shallow soils (Made Ground including slag materials) were assessed using Generic Assessment Criteria (GAC). None of the contaminants for which GACs were available exceeded the criteria and therefore no unacceptable risks were identified from contact with or ingestion of soils on the site.

Contaminants without GACs were qualitatively reviewed and no potentially significant risks identified.

H4.61 Asbestos was recorded in 1 out of 18 samples of Made Ground across the site and quantified to 0.006 % by mass. This was associated with the isolated area of granular Made Ground at the site.

H4.62 Several exceedances of Water Quality Standards (WQS) were recorded in soil leachate samples from Made Ground and groundwater samples from the Redcar Mudstone Formation and Tidal Flat Deposits. Some, but not all, dissolved contaminants in groundwater were consistent with soil leachate analysis results indicating that some leaching is occurring into shallow groundwater from the slag deposits and hydrocarbon impacts on the site. For some contaminants such as phenol, ammoniacal nitrogen and heavy metals, concentrations were significantly lower in leachate than in groundwater indicating either that the source of these contaminants had not yet been identified or that they represent a residual source that has previously leached from soils.

H4.63 Whilst concentrations of CoC have been measured in excess of Drinking Water Standards (DWS) in groundwater samples collected from the site, taking the wider environmental setting into account and proximity to the estuary and coast, the resource value of the aquifer was likely to be low. As such, a significant remedial target was not identified.

H4.64 Groundwater flows were inferred towards the north-east (Tidal Flats) and north-west (mudstone), towards the Fleet watercourse which runs along the northern boundary of the site and flows to the west, away from the Coatham Marsh Local Wildlife site and towards the River Tees. Given that concentrations were measured above the WQS for contaminants including heavy metals, ammoniacal nitrogen, thiocyanate and phenol, and that groundwater flow is inferred to be towards the surface water feature, further assessment of the risk to surface water was concluded to be warranted. Based on the groundwater flow direction to the north-east, north-west, the distance to the Coatham Marsh Local Wildlife site and the flow of the Fleet to the west, the risk to the Local Wildlife Site from concentrations of CoC measured in leachate and groundwater was concluded to likely be low.

Relevant Sensitive Receptors

H4.65 The following receptors have been identified for the site:

Table H4.4 Identified Receptors

Receptor	Phase	Sensitivity (as defined in Table G3.1)
	Construction	
Human Health Receptors		
Construction Workers	Applicable	Very High
Offsite Human Health Receptors	Applicable	Medium to High
Environmental Receptors		
Surface Waters	Applicable	Medium
Groundwater	Applicable	Medium
Built Environment		
Waste Management Infrastructure	Applicable	Medium

Sources

H4.66 The following key sources have been defined from the previous investigations with regard development of the site:

1 **Made Ground -** The site is known to extensively comprise reclaimed land, made up of slag and a range of contaminants including heavy metals, elevated pH and sulphate/sulphides. Whilst the current concentrations recorded are below the Commercial GACs, assessment across the whole site has not been undertaken. The abundant nature of such materials across the site and its prevalence at the surface is one of the key sources of contamination regarding development of the site.

2 **Hazardous Ground Gases** – Limited gas monitoring on site has been undertaken with ground gases (methane (flammable gas) and carbon dioxide) likely to be derived from the historical legacy of landfilling, infilling and reclamation both on and off the site. Further monitoring is recommended to understand the gas regime based on the proposed layout of the development and after the site has been re-profiled. Based on ground gas concentrations and a range of exposure pathways, the presence of ground gases may present a risk to current and future onsite and offsite human health (e.g. asphyxiation) as well as onsite and offsite properties (e.g. explosion). Based on available data, no volatile compounds are present within the underlying soils.

3 **Asbestos** – Investigation data has identified the presence of asbestos in Made Ground which is likely to be derived from the historical legacy of landfilling, infilling and reclamation activities as well as operational aspects associated with the site.

Source Pathway Receptor Linkages

H4.67 Key contaminant linkages (CL) identified as requiring some form of mitigation are summarised in the table below.

Table H4.5 Potential Contaminant Linkages requiring mitigation

Contaminant Linkage No.	Contaminant Linkage Description
CL1	Construction workers and offsite human health receptors via inhalation of asbestos fibres associated with Made Ground.
CL2	Construction workers and offsite human health receptors via dermal contact, accidental ingestion and dust inhalation of organic and inorganic contamination within Made Ground.
CL3	Leaching of contaminants within the Made Ground into the groundwater and migration into surface water

Future Baseline

H4.68 The site preparation and infrastructure installation is assumed to commence in 2022 with first floor space delivered in 2023. Completion is assumed to be in 2033 in line with market demand.

H4.69 As described in Section H4 (Existing Conditions), there are a number of potential on site sources of contamination (former Ironworks infrastructure and landfill) as well as potential off-site sources (surrounding steelworks, landfills, and water treatment works). The identified contamination beneath the site to date predominantly relates to historic land use and it is considered that no significant deterioration in ground conditions will occur in the absence of development. It is assumed that any ongoing operations / procedures of current works / industry will be controlled in line with modern industry regulations and best practice.

H4.70 Therefore, existing baseline conditions with respect to geology, hydrogeology and land quality would be unlikely to change significantly between now and the completion of the works in the absence of the proposed development.

H5.0 Potential Effects

Embedded Mitigation

H5.1 The proposed embedded mitigation measures relevant to ground conditions include:

1 Earthworks: for the purpose of this EIA the earthworks are proposed to be cut and fill neutral within the Teesworks area. Any site won material that cannot be accommodated on site will stay within the Teesworks area;

2 Site Levels: the proposed minimum finished floor level will be 5.2m AOD.

3 Implementation of Construction Environmental Management Plan (CEMP) (the CEMP principles outlined in Section B7.0 of Chapter B will be conditioned and there will be a requirement to provide an updated and detailed CEMP for each development phase based on these principles);

4 All temporary construction works will be designed to meet engineering and health and safety standards;

5 Further site and ground investigation surveys will be undertaken in order to identify the need, or otherwise, for additional survey work and / or remediation work. This work would include soil and groundwater analysis and gas monitoring as required;

6 Construction of construction compounds and waste, fuel and storage areas ahead of construction work commencing. Materials for active phase of development only to be stored onsite;

7 Hazardous and non-hazardous waste to be sent to the Highfield landfill site;

8 A piling risk assessment is to be prepared for each phase of development;

H5.2 These embedded mitigation measures have been taken into account during this assessment when assessing potential effects. Measures included in the Framework CEMP will not be repeated below or in Section H6.0: Mitigation and Monitoring.

Major Hazards and Accidents

H5.3 Major Hazards and Accidents have been considered in the assessment below. It is assumed that COMAH related risks would be removed during the demolition of the site. The main aspects are therefore considered to be explosion from UXO, land instability and risk from contamination. Mitigation is detailed, in Section H6.0, with regards to UXO and risk from contamination. With regards to land instability, this would be mitigated during the detailed design stage of the buildings / structures on site which would consider the ground conditions present. No significant effects from major hazards and accidents from a ground conditions perspective are considered likely.

Phasing

H5.4 Remediation and other measures to manage potential risks to identified receptors due to ground contamination and other ground conditions will be undertaken prior to and during the construction phase. Therefore, the subsequent phasing of future developments is not considered relevant for this chapter.

During Construction

Impacts on Human Health Receptors

H5.5 The use of heavy equipment and activities such as excavation, backfilling, and compaction may disturb the soil and result in dust generation as well as provide opportunities for direct contact and inhalation of contaminants. Made Ground is present across the site with a proven maximum depth recorded of 7m bgl (excluding the CLE31 Landfill) although deeper made ground may exist elsewhere. The site is known to extensively comprise infilled land, made up of slag, together with supplementary Made Ground deposits slag, brick, concrete and occasionally clinker, coke, coal and/or metal.

H5.6 The use of heavy equipment and activities such as excavation, screening, backfilling, and compaction will be required to recover the material from the CLE31 landfill and reuse it elsewhere on the Long Acres site or elsewhere within the Teesworks area. This will disturb the soil and result in dust generation as well as provide opportunities for direct contact and inhalation of contaminants. Approximately 1 million cubic metres of material primarily comprising slag is present within the CLE31 landfill. Unrecoverable material will require separation and appropriate off-site disposal.

H5.7 Asbestos screening was undertaken on soil sampled from across the site and fibres have been identified within the Made Ground. Further assessment will be required, and a conservative approach adopted to defining protective measures (see the following section of the chapter).

H5.8 Analysis of the Made Ground to date have indicated that the potential contaminant concentrations are generally below commercial end use criteria, however unexpected contamination may exist in areas not investigated.

H5.9 During construction there is a risk of disturbance of UXO which may be present on the site. The main risk from explosions is to Construction Workers and off-site human health receptors.

H5.10 Low concentrations of ground gases are present on the site. During construction this could pose a risk to construction workers, however as detailed in the CEMP, appropriate health and safety measures would be put in place to safeguard the workforce.

H5.11 Based on existing survey data available, the sensitivity of the human receptors is very high for construction workers and medium too high for off-site receptors. The magnitude of impact prior to mitigation but considering the embedded mitigation is medium due to the presence of asbestos fibres within the Made Ground. This could lead to impacts of **Substantial Adverse** in relation to construction workers and at worst **Moderate Adverse** in relation to off-site receptors (considered '**Significant**' in EIA terms) if mitigation actions are not carried out.

Environmental Receptors (Surface Waters and Groundwater)

H5.12 As detailed above limited groundwater samples were obtained from across the site and dissolved concentrations of metals, TPH and PAH compounds were recorded above the Water Quality Standards. A risk to groundwater resources through leaching of contaminants was identified. A potential linkage into the deeper bedrock aquifer was not discounted.

H5.13 As detailed in section H3.18, the EA has reviewed the Outline Remediation Strategy (Wood, 2019) and confirmed that active remediation of groundwater is not required.

H5.14 The sensitivity of the controlled water receptors (surface waters and groundwater) is considered to be medium (reflecting a water receptor deemed to be of low value) and that given the low magnitude of likely impact from construction when embedded mitigation is considered, the significance is considered Negligible and therefore Not Significant.

Impacts on the Built Environment (Waste Management Facilities)

H5.15 For the purpose of this EIA process, it is assumed that the proposed development site will be cut and fill neutral within the wider Teesworks area. The assessment includes for the recovery of the bulk of the waste (95%) within the CLE31 landfill into beneficial re-use either elsewhere on the Long Acres site or within the Teesworks facility. The project will thus reduce the amount of material in waste management facilities. Non recoverable materials from the CLE31 landfill, will go to the Highfield Landfill Site in the South Bank area as detailed above.

H5.16 The sensitivity of the built environment is medium and the magnitude of impact prior to mitigation is medium. This is due to the potential for soil/materials disposal required following earthworks resulting in a limited or minor increase in demand on waste management infrastructure and the potential for damage to buildings, structures or the environment. Thus, the impact on the built environment – principally waste management facilities, is considered to be of Minor Adverse significance which is considered 'Not Significant' in terms of this EIA assessment.

H6.0 Mitigation and Monitoring

During Construction

H6.1 Embedded mitigation is detailed in H5.1 above which includes further investigation, a piling risk assessment and best practice detailed within the Framework CEMP. Additional mitigation is detailed below.

Remediation

H6.2 An Outline Remediation Strategy (Wood 2019) has been prepared based on the information known at the time of writing and includes elements which will mitigate potential environmental risks as part of the proposed remedial works, such as:

1 Excavation and disposal / Capping in situ to reduce the risk from the asbestos fibres that have been encountered to date.

H6.3 Remedial Options Appraisals for other sites within the Teesworks area have also concluded engineering controls are required to address the geotechnical issues identified. This approach is considered applicable to the Long Acres site.

H6.4 The detailed design for each of the development plots will determine the detailed remediation approach based on the intended layout and form of development and results of any further investigation and assessment. The Outline Remediation Strategy would provide a basis for this and will be developed into a Detailed Remediation Strategy for each phase of development after reprofiling has taken place.

Unanticipated Contamination

H6.5 In the event that contamination is encountered at any time when carrying out the remediation and reclamation works that was not previously identified, an investigation and a risk assessment will be undertaken and where remediation is considered necessary additional remediation will be agreed with the relevant authorities.

H6.6 Where unanticipated contamination is encountered within excavated material that is similar to that encountered elsewhere within the site, then the process set out below will be followed:

1 Sampling for, and undertaking chemical analysis;

2 Assessment of chemical data; and,

3 Sentencing for remediation and/or processing, as necessary.

H6.7 Where identified environmental contamination extends below 2.5m bgl, any requirement for deeper excavation works will be assessed on a case specific basis following consultation with stakeholders.

H6.8 The location of any such unanticipated contamination encountered will be recorded, including the results of chemical testing, the volumes sentenced for treatment by remediation, the validation data showing compliance with the relevant remediation objectives and the location of the area of reuse of the remediated material within the development platform.

Measures to protect Human Health Receptors

H6.9 Based on the results of the previous ground investigations as well as any further investigation undertaken, areas that pose a risk to human health as a result of identified contamination would be delineated and remediated prior to construction works. Further assessments are

recommended to include, but are not limited to, the following tasks which will identify the need for further mitigation.

1 Additional ground gas monitoring at greater density is recommended prior to any specific redevelopment to determine the risk from ground gases on the site, the scope of this investigation would depend on the proposed redevelopment scenario.

2 Previous assessment has identified a Medium risk of UXO for activities disturbing the natural Superficial Deposits. Further mitigation activities such as detailed risk assessment or site mitigations are considered essential to reduce the UXO risk on the site to As Low As is Reasonably Practicable (ALARP).

H6.10 In the event that suspected materials are observed associated with excavations, sampling will be undertaken to confirm the asbestos type and quantification. Where Asbestos Containing Materials (ACM) have to be removed to facilitate the removal of structures it shall be separately stockpiled and covered to control potential dust generation. Any soils containing asbestos that are also in in excess of the remediation reuse criteria will not be subject to mechanical screening where free fibres have been detected or are suspected. Where necessary soils containing asbestos will be managed by maintaining mist sprays to keep the soils wet whilst handled and may also be covered when stockpiled if necessary.

H6.11 In the event that materials are impacted with visible fragments of ACM, the ACM materials shall be handpicked by a suitably licenced asbestos contractor with additional control measures implemented based on the sampling results. Where soils containing Contaminants of Concern (CoC) in excess of the reuse criteria and, due to the presence of asbestos cannot be safely handled or successfully treated, they will be disposed of offsite. Where concentrations are below the reuse threshold soils may be reused as infill to excavation voids at depths below 0.6 m of final ground level.

H6.12 Asbestos should be presumed to be within all Made Ground deposits, and therefore will need to be included in a foundation works risk assessment.

Environmental Receptors (Surface Waters and Groundwater)

H6.13 No specific additional measures to reduce the impact on controlled waters are currently proposed. There remains a data gap with respect to groundwater quality and soil leaching potential across the site and further investigation and/or groundwater monitoring may be required to inform the CSM and confirm the overall significance of likely impact to groundwater and surface water determined within this assessment.

H6.14 Remediation of soils as detailed above, will however reduce the impact on these environmental receptors providing overall betterment of the groundwater quality.

Impacts on Waste Management Facilities

H6.15 The disposal of solid waste, contaminated or otherwise, to landfill sites will be best mitigated by prevention or minimisation of the overall quantities of waste generated during construction and by ensuring that excavated material consigned to landfill is deposited within the existing adjacent Highfield Landfill. To reduce the material going to landfill, a Deposit for Recovery permit would be obtained for re-use of the material within Warrenby CLE31 landfill. Use of the CL:AiRE DoWCoP (Definition of Waste: Code of Practice) and associated Materials Management Plan will be adopted for materials outside the landfill area, subject to regulatory approval. This approach would be considered when the detailed remediation strategy for the site is prepared. Further consideration of this is set out in Chapter M: Waste and Materials Management.

H6.16 As part of the Deposit for Recovery permit or Materials Management Plan the records of all materials movements on-site and off-site will be kept by the Reclamation / Earthworks Contractor in paper and electronic format for a minimum period of 2 years following completion of the works. Details of all material movement records, and associated testing will be included Validation / Verification Report produced for the scheme once it is completed. To allow auditing of the Materials Management Plan; data will be stored electronically in a specifically designed database on site. Daily data uploads would be undertaken. All data would be geo-referenced, and all stockpile sample nomenclature would ensure individual identification.

H7.0 Residual Effects

During Construction

Impacts on Human Health Receptors

H7.1 The sensitivity of human receptors (construction workers and offsite human health receptors) is very high too high to medium respectively and the magnitude of impact following mitigation, outlined in Section H6.0 above, is negligible. Following the implementation of the additional mitigation measures outlined in Section H6.0, there are likely to be impacts on construction workers of Minor Adverse significance and impacts on nearby residents of Negligible significance. These effects are considered Not Significant in EIA terms.

Environmental Receptors (Surface Waters and Groundwater)

H7.2 The sensitivity of the surface water and/or groundwater is medium, and the magnitude of impact following additional mitigation e.g. soil remediation is negligible. Therefore, the impacts after the implementation of mitigation measures are considered to be of Negligible significance. This is not considered significant in EIA terms.

Impacts on Built Environment

H7.3 The sensitivity of the waste management facilities is medium and the magnitude of impact following mitigation identified in Section H6.0 is Low and thus the impact on waste management facilities during the construction phase is considered to be of Negligible significance. This is considered 'Not Significant' in EIA terms.

H8.0 Summary & Conclusions

H8.1 A number of potential impacts of varying significance to receptors, associated with land quality, ground conditions and contamination have been identified. These potential impacts have been considered and assessed within the context of the proposed construction. The operational phase has been scoped out of the assessment.

H8.2 There are currently a number of data gaps regarding the geochemical and geotechnical characterisation of ground conditions and contamination at the site which will likely require further site investigation and risk assessment in order to inform detailed design statements (in line with the overall remedial strategy) produced to support the development of specific areas during subsequent phases of development.

H8.3 The sensitivity of the human receptors (construction workers and off-site human health receptors of surrounding area) is very high and high to medium respectively while the groundwater and principal surface water feature (River Tees) are considered of low value and hence considered a medium sensitivity. The built environment, mainly waste management facilities, are considered to have medium sensitivity.

H8.4 Mitigation that is designed to protect the identified receptors susceptible to impacts from contamination in Made Ground soils have been set out below in Table 8.1. The residual significance of the impacts identified is considered to be Minor Adverse / Negligible and Not Significant following the implementation of the mitigation measures.

Table E8.1 Summary of Effects

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
During Construction				
Construction Workers and Offsite Human Health Receptor	Exposure to contaminated soils, asbestos fibres and ground gas mainly during earthworks. Risks associated with UXO.	Substantial Adverse: Construction workers and at worst Moderate Adverse: nearby residents and Significant	Remediation / Unforeseen Contamination Remediation Design Statement Additional ground gas monitoring Detailed UXO risk assessment Investigation beneath building footprints. Best practice Asbestos Mitigation	Minor Adverse: Construction workers and Negligible: off-site human health receptors and Not Significant
Surface Water	Potential leaching of contaminants impacting the groundwater / surface water	Negligible and Not Significant	Remediation / Unforeseen Contamination	Negligible and Not Significant
Groundwater				

Receptor	Impact	Potential Effects (taking account of embedded mitigation)	Additional Mitigation and Monitoring	Residual Effects
Built Environment: waste facilities	Soil/materials disposal required following earthworks resulting in a limited or minor increase in demand	Minor Adverse and Not Significant	Minimisation of waste materials generated Material disposed in Highfield Landfill Deposit to Recovery permit Materials Management Plan	Negligible and Not Significant

H9.0 Abbreviations & Definitions

1	AOD	Above Ordnance Datum
2	BGS	British Geological Society
3	CSM	Conceptual Site Model
4	CEMP	Construction Environmental Management Plan
5	DEFRA	Department Environment Food and Rural Affairs
6	DPD	Development Plan Document
7	EA	Environment Agency
8	ES	Environmental Statement
9	GAC	Generic Assessment Criteria
10	NPPF	National Planning Policy Framework
11	PPE	Personal Protective Equipment
12	PAH	Polycyclic Aromatic Hydrocarbons
13	RCBC	Redcar and Cleveland Borough Council
14	SVOC	Semi Volatile Organic Compounds
15	SNCI	Sites of Nature Conservation Interest
16	SPR	Source Pathway Receptor
17	STDC	South Tees Development Corporation
18	TPH	Total Petroleum Hydrocarbons
19	VOC	Volatile Organic Compounds

H10.0 References

National Policies and Legislation

1 Environmental Protection Act 1990 Part II;

2 Environment Act 1995;

3 Environment Agency 2008, An ecological risk assessment framework for contaminants in soil. Science Report SC070009/SR1;

4 Derivation and use of soil screening values for assessing ecological risks Report – ShARE id26 (revised);

5 BRE Special Digest (SD) 1: Concrete in Aggressive Ground, 2015;

6 Environmental Permitting (England and Wales) Regulations 2010;

7 Control of Pollution (amendment) Act 1989;

8 Water Framework Directive 2000/60/EC;

9 Groundwater Directive 2006/118/EC;

10 Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991 (as amended);

11 Controlled Waste (England and Wales) Regulations 2012;

12 Construction (Design and Management) Regulations 2015;

13 Hazardous Waste (England and Wales) Regulations 2005;

14 Waste (England and Wales) Regulations 2011;

15 Waste Framework Directive 2008/98/EC (OJEU, 2008);

16 The Contaminated Land (England) Regulations 2006;

17 The Environment Damage (Prevention and Remediation) Regulations 2015;

18 National Planning Policy Framework, 2019;

19 Environment Agency, Guiding Principles Land Contamination (GPLC2);

20 Environment Agency, Land Contamination Risk Management (2019);

21 Environment Agency, Land contamination groundwater compliance points: quantitative risk assessments, 2017;

22 Environment Agency, Protect groundwater and prevent groundwater pollution, 2017;

23 Environment Agency, Groundwater protection technical guidance, 2017;

24 Environment Agency, The Environment Agency's approach to groundwater protection, 2018;

25 British Standards 10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites - Code of Practice' 2017;

26 British Standards BS3882:2015 'Specification for Topsoil and Requirements for Use' 2015;

27 British Standards BS EN 206:2013+A1:2016 'Concrete - Specification, Performance, Production and Conformity' 2013;

28 BSI Standards Publication "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings", BS 8485:2015+A1:2019;

29 CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' 2007;

30 CIRIA C552 Contaminated Land Risk Assessment A Guide to Good Practice. 2001;

31 CIRIA C692 Environmental Good Practice on Site. 4th Edition 2015;

32 National House Building Council, Environment Agency and Chartered Institute of Environmental Health 'R&D Pub 66: Guidance for the Safe Development of Housing on Land Affected by Contamination (Volumes 1 & 2), 2008;

33 National House Building Council, Guidance on Evaluation of Development Proposal on Site Where Methane and Carbon Dioxide are Present Report Edition No.4 March 2007;

34 EA's 'TR P5-065/TR: Technical Aspects of Site Investigation (Volumes 1 & 2)' 2002;

35 DEFRA (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance; and DEFRA Guidance, Pollution Prevention for Businesses, July 2016 (Updated May 2019);

36 Ministry of Housing, Communities and Local Government, National Planning Policy Framework, February 2019.

Previous Environmental Reports

37 Groundsure Enviro & Geo Insight: Site 4, Redcar, North East England, TS10 1DZ, Ref PO_14043848 / GS-7224478 [Groundsure 2020];

38 Warrenby 3A Draft Factual Report by Allied Exploration and Geotechnics Ltd (AEG) Contract Number 4292 dated October 2020;

39 Petrological Examination of Four Samples from 4292 Warrenby 3A Site, Redcar, Thomas Research Services Ltd (TRS), BG0H/AEG/WAR/TRS/10/20/RP2, dated 21 October 2020;

40 Landfill Closure Report for CLE31 Teesside, Tata Steel R&D, Ref 160536, dated 1st June 2015;

41 Gas and Groundwater Monitoring at the CLE31 Landfill, STSC Site, Dunelm Geotechnical and Environmental, Ref D10011/01, dated 3rd April 2020;

42 Warrenby 3B Ground Investigation, Final Factual Report by Allied Exploration and Geotechnics Ltd (AEG) Contract Number 4279, dated October 2020;

43 Examination of Four Samples from Warrenby Site 3B (4279), Thomas Research Services Ltd (TRS), Ref BG0D/AEG/WS3B/TRS/07/20/RP2, dated 31 July 2020;

44 Phase II Environmental Site Assessment, Former Steelworks, Redcar, Arcadis, Ref 10035117-AUK-XX-XX-RP -0051-P1-Warrenby3B_ESA, dated June 2020;

45 Phase II Environmental Site Assessment, Warrenby 3B Area, Former Steelworks, Redcar, Arcadis, Ref 10035117-AUK-XX-XX-RP-ZZ-0051-P2-Warrenby3B_ESA, dated September 2020;

46 DRAFT - Site Wide Groundwater Summary Report, Former Steelworks, Redcar, Arcadis, Ref 10035117-AUK-XX-XX-RP-ZZ-0155-01-Site_GW, dated September 2020;

47 Initial findings of a Geo-Environmental Investigation, HFO Spillage at Corus Teesside Works, Corus Research, Development & Technology, Ref 147407, dated 19 October 2009;

48 TS2 Teardrop Site – Phase 1 Geo-Environmental Desk Study, Ref 678079_TS2_001 [CH2M 2017];

49 Former Steelworks Land, South Tees Outline Remedial Strategy, Prepared for South Tees Development Corporation by Wood, Ref 41825-wood-XX-XX-RP-OC-0001_S0_P01 dated 25th June 2019 [Wood 2019];

50 Outline Remediation Strategy, Former Steelworks Land, South Tees, Wood Environment & Infrastructure Solutions UK Ltd (Wood), Ref 41825-WOOD-XX-XX-RP-OC-0002_A_P02, dated 19 July 2019;

51 Memorandum CLE 31 Technical data, Teesworks, dated 17.11.2020;

52 Soil and Groundwater Baseline Characterisation Study Corus Teesside Works, Factual Report Volume 1 by Enviros Consulting Ltd, dated June 2004;

53 Soil and Groundwater Baseline Characterisation Study Corus Teesside Works, Interpretative Report Volume 2 by Enviros Consulting Ltd, dated June 2004;

54 Soil and Groundwater Baseline Characterisation Study Corus Teesside Works, Summary Report Volume 3 by Enviros Consulting Ltd, dated June 2004.