The Sizewell C Project

6.5 Volume 4 Southern Park and Ride

Chapter 11 Geology and Land Quality

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Contents

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Appendix 11C: Impact Assessment Tables

11 Geology and Land Quality

11.1 Introduction

11.1.1 This chapter of **Volume 4** of the **Environmental Statement** (**ES**) (Doc Ref. 6.5) presents an assessment of the potential effects on geology and land quality arising from the construction, operation and removal and reinstatement phases of the southern park and ride site at Wickham Market (referred to throughout this volume as the 'proposed development'). This includes an assessment of potential impacts, the significance of effects, the requirements for mitigation, and the residual effects.

11.1.2 Detailed descriptions of the southern park and ride site (referred to throughout this volume as the 'site'), the proposed development and the different phases of development are provided in **Chapters 1** and **2** of this volume of the **ES**. A glossary of terms and list of abbreviations used in this chapter is provided in **Appendix 1A** of **Volume 1** of the **ES** (Doc Ref. 6.2).

11.1.3 The Government's Good Practice Guide for Environmental Impact Assessment[1] (EIA) (Ref. 11.1) outlines the potential environmental effects that should be considered for geology and land quality e.g. physical effects of the development, effects on geology, and effects on contamination. Further information on these potential environmental effects and those which have been scoped into the geology and land quality assessment can be found in **Appendix 6N** of **Volume 1** of the **ES**.

11.1.4 This assessment has been informed by data from the following other assessments:

- **Chapter 10** of this volume: Soils and Agriculture.
- **Chapter 12** of this volume: Groundwater and Surface Water.

11.1.5 This assessment has also been informed by data presented in the following technical appendices:

- **Appendix 11A** of this volume: Southern Park and Ride Site, Wickham Market: Phase 1 Desk Study Report.
- **Appendix 11B** of this volume: Conceptual Site Models.

[1] It should be noted that this document has been withdrawn; however, it still constitutes good advice and should be referred to in the absence of alternative guidance documents

- **Appendix 11C** of this volume: Impact Assessment Tables.

11.2 Legislation, policy and guidance

11.2.1 **Appendix 6N** of **Volume 1** of the **ES**, identifies and describes legislation, policy and guidance of relevance to the assessment of the potential geology and land quality impacts associated with the Sizewell C Project across all **ES** volumes.

11.2.2 This section provides an overview of the legislation, policy and guidance specific to the assessment of the proposed development.

a) International

11.2.3 International legislation or policy relevant to the geology and land quality assessment includes the Water Framework Directive (WFD) 2000/60/EC and the Waste Framework Directive 2008. The requirements of these, as relevant the geology and land quality assessment, are described in **Appendix 6N** of **Volume 1** of the **ES**.

b) National

11.2.4 National legislation relevant to the geology and land quality assessment includes:

- Part IIA of the Environmental Protection Act 1990.
- Water Resources Act 1991.
- The Control of Substances Hazardous to Human Health Regulations 2002.
- Construction (Design and Management) Regulations 2015.
- Waste Management Regulations 2016.
- Landfill (England and Wales) Regulations 2005.
- Hazardous Waste (England and Wales) Regulations 2005.
- The Environmental Permitting (England and Wales) Regulations 2016.

11.2.5 The requirements of these, as relevant to the geology and land quality assessment, are described in **Appendix 6N** of **Volume 1** of the **ES.**

i. Planning policies

11.2.6 National Policy Statements (NPS) set out national policy for energy infrastructure. The overarching NPS for Energy (NPS EN-1) (Ref. 11.2) and NPS for Nuclear Power Generation (NPS EN-6) (Ref. 11.3) provide the primary policy framework within which the proposed development will be considered. The requirements of these, as relevant the geology and land quality assessment, are described in **Appendix 6N** of **Volume 1** of the **ES**.

11.2.7 Other national policies relevant to the geology and land quality assessment include the National Planning Policy Framework 2019 (Ref. 11.4), Planning Practice Guidance 2019 (Ref. 11.5) and the Government's 25 Year Environment Plan 2018 (Ref. 11.6). The requirements of these are described in **Appendix 6N** of **Volume 1** of the **ES**.

c) Regional

11.2.8 No regional policy is deemed relevant to the assessment of geology and land quality for this site.

d) Local

11.2.9 **Appendix 6N** of **Volume 1** of the **ES** summarises the requirements of Suffolk Coastal District Council Local Plan Core Strategy and Development Management Polices (Ref. 11.7), and Suffolk Coast Local Plan (Ref. 11.8).

i. Guidance

11.2.10 Guidance relating to the geology and land quality assessment include:

- The Department for Environment, Food and Rural Affairs (Defra) Contaminated Land Statutory Guidance 2012 (Ref. 11.9).
- Contaminated Land Report (CLR) 11[2] (Ref. 11.10).
- Guiding Principles for Land Contamination (Ref. 11.11).
- The Definition of Waste: Development Industry Code of Practice (Ref. 11.12).

[2] It is noted that CLR11 is due to be withdrawn in early 2020 and replaced by updated online guidance: Environment Agency Land contamination: Risk Management (LCRM).

- The Design Manual for Roads and Bridges (2008) Volume 11, Section 2, Part 5 Assessment and Management of Environmental Effects (Ref. 11.13).
- The Design Manual for Roads and Bridges (1993) Volume 11, Section 3, Part 11 Geology and Soils (Ref. 11.14).
- Department of the Environment (1995) Industry Profiles for previously developed land, Environment Agency (Ref. 11.15).
- Construction Industry Research and Information Association (CIRIA) C552 (2001) Contaminated Land Risk Assessment – A Guide to Good Practice (Ref. 11.16).
- National House-Building Council (NHBC) and Environment Agency (2008) Guidance on the Safe Development of Housing on Land Affected by Contamination (Ref. 11.17).
- CIRIA C665 (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings (Ref. 11.18).
- British Standards (2015) BS 8485 +A1:2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (Ref. 11.19).
- CIRIA C681 (2009) Unexploded Ordnance (UXO) – A Guide for the Construction Industry (Ref. 11.20).
- CIRIA C733 (2014) Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks (Ref. 11.21).
- CIRIA C682 (2009) The Volatile Organic Contaminants Handbook (Ref. 11.22).
- British Standards (2015) BS 5930 – Code of practice for ground investigations (Ref. 11.23).
- British Standards (2017) BS 10175:2011+A2:2017 – Code of Practice for Investigation of Potentially Contaminated Sites (Ref. 11.24).

11.2.11 Further detail on this guidance, as relevant to the geology and land quality assessment is set out in **Appendix 6N** of **Volume 1** of the **ES**.

11.3 Methodology

a) Scope of the assessment

11.3.1 The generic EIA methodology is detailed in **Volume 1**, **Chapter 6** of the **ES** (Doc Ref. 6.2).

11.3.2 The full method of assessment for geology and land quality that has been applied for the Sizewell C Project is included in **Appendix 6N** of **Volume 1** of the **ES**.

11.3.3 This section provides specific details of the geology and land quality methodology applied to the assessment of the proposed development, and a summary of the general approach to provide appropriate context for the assessment that follows. The scope of assessment considers the impacts of the construction, operation, and removal and reinstatement phases of the proposed development.

11.3.4 The scope of this assessment has been established through a formal EIA scoping process undertaken with the Planning Inspectorate. A request for an EIA scoping opinion was initially issued to the Planning Inspectorate in 2014, with an updated request issued in 2019, see **Appendix 6A** of **Volume 1** of the **ES**.

11.3.5 Comments raised in the EIA Scoping Opinion received in 2014 and 2019 have been taken into account in the development of the assessment methodology. These are detailed in **Appendices 6A** to **6C** of **Volume 1** of the **ES.**

11.3.6 The Government's Good Practice Guide[3] for EIA states that the following potential environmental effects should be considered for geology and land quality:

- physical effects of the development: such as changes in topography, soil compaction, soil erosion, ground stability, etc.;
- effects on geology as a valuable resource: such as mineral resource sterilisation, loss or damage to regionally important geological sites, geological Sites of Special Scientific Interest (SSSIs) etc.;

[3] It should be noted that this document has been withdrawn; however, it still constitutes good advice and should be referred to in the absence of alternative guidance documents

- effects on soil as a valuable resource: such as loss or damage to soil of good agricultural quality;
- effects associated with ground contamination that may already exist on-site: such as introducing or changing pathways and receptors;
- effects associated with the potential for polluting substances used (during the various phases) to cause new ground contamination issues on-site, such as introducing or changing the source of contamination and/or pathways; and
- effects associated with re-use of soils and waste soils: such as re-use of site-sourced materials on- or off-site, disposal of site-sourced materials off-site, importation of materials to the site etc.

11.3.7 The proposed development is considered unlikely to have an impact on important geological sites as no geological SSSIs or Local Geological Sites have been identified within the study area, as described in **section 11.3 c** of this chapter. However, given the comments in the revised Scoping Opinion received in 2019 in relation to effects on geology as a valuable resource, an assessment of the effects on mineral resources has been included.

11.3.8 The proposed development would involve minor earthworks comprising minor levelling of the site, the removal of topsoil and potentially some limited subsoil, and excavations for pad foundations, roads, drainage and services. Given existing ground conditions and the proposed works, the proposed development is considered unlikely to have a significant impact on soil compaction and ground stability. Physical effects in relation to changes in topography, including landscape fabric and character, are discussed in **Chapter 6** of this volume.

11.3.9 The effects on soil as a valuable resource are discussed in **Chapter 10** of **Volume 3** of the **ES** (Doc Ref. 6.4). Management of site-sourced waste materials, other than site soils (i.e. general waste materials from construction, operational and removal and reinstatement phases) is summarised in **Chapter 2** of **Volume 3** of the **ES**, with further details provided in the **Waste Management Strategy** presented in **Appendix 8A** of **Volume 2** of the **ES** (Doc Ref. 6.3).

11.3.10 Therefore, the following remaining environmental effects have been considered and form part of the assessment in this chapter:

- physical effects of soil erosion;

- mineral resource loss, damage or sterilisation;
- effects associated with existing ground contamination and potential new ground contamination issues; and
- effects associated with the re-use or disposal of site sourced soils and waste soils.

11.3.11 Potential impacts from existing and new contamination sources on controlled waters have been considered as part of the geology and land quality assessment to determine, and classify, potential effects associated with ground contamination. Further description of the effects from contamination to groundwater and surface water is provided in **Chapter 12** of **Volume 3** of the **ES**.

11.3.12 This chapter provides an initial indication of chronic long-term risks to construction and maintenance workers. In accordance with the **Code of Construction Practice** (**CoCP**) (Doc Ref. 8.11), short-term acute risks should be assessed, managed and mitigated by the contractor with appropriate risk assessments and methods statements, and subsequent control measures.

b) Consultation

11.3.13 The scope of the assessment has also been informed by ongoing consultation and engagement with statutory consultees throughout the design and assessment process as outlined in **Appendix 6N** of **Volume 1** of the **ES**.

c) Study area

11.3.14 To consider the physical effects of the proposed development and the effects associated with mineral resources, the re-use of soils and waste soils, the study area is defined as the area within the site boundary. The site boundary of the proposed development is presented in **Chapter 1, Figure 1.1** of this volume.

11.3.15 The study area for the consideration of effects on human receptors, controlled waters, ecological receptors, and property receptors includes the site and land immediately beyond it to a distance of 500 metres (m). This area takes into account the transport, and final destination of potential contaminants of concern in the environment, and the connectivity of these contaminants via pathways of migration/exposure to the receptors identified.

11.3.16 Based on the contaminated land desk study provided in **Appendix 11A** of this volume, this study area was considered sufficient for the assessment of the potential land contamination and associated potential contaminant linkages[4] risks as the land has previously undergone limited development, and as such contamination, if present, is likely to be limited in extent or have a limited lateral mobility if present.

d) Assessment scenarios

11.3.17 The assessment of effects on geology and land quality includes the assessment of the construction, operational, and removal and reinstatement phases of the proposed development, rather than specific assessment years.

e) Assessment criteria

11.3.18 As described in **Volume 1**, **Chapter 6** of the **ES**, the EIA methodology considers whether impacts of the proposed development would have an effect on any resources or receptors. For physical effects and effects associated with mineral resources, waste soils, and soil re-use, the assessments broadly consider the magnitude of impacts and value or sensitivity of resources, or receptors that could be affected in order to classify effects. For land contamination, the assessment considers the change in the level of contaminative risks to the relevant receptors in order to classify effects.

11.3.19 A summary of the two assessment methods and assessment criteria used in the geology and land quality assessment is presented in the following sub-sections.

i. Physical effects and effects associated with mineral resources, waste soils, and soil re-use

11.3.20 An impact assessment of the potential physical effects of the proposed development on geology and the effects associated with mineral resources, soils re-use, and waste soils has been undertaken using a qualitative approach which considers the effects of the construction, operational, and removal and reinstatement phases of the proposed development on soil erosion, mineral resources, potential for soil re-use, and waste soil generation.

[4] Where a linkage exists or is considered likely to be present between a potential contamination hazard/source, pathway and receptor relevant to the site.

Value/sensitivity

11.3.21 The value/sensitivity of a receptor is considered when determining the consequence of an effect in the impact assessment. Where the attribute falls within two value/sensitivity criteria, the worst case value/sensitivity is selected. The value/sensitivity of soil and geological receptors has been determined using the classifications given in **Table 11.1**.

Table 11.1: Criteria for classifying the value and/or sensitivity of environmental resources/receptors

Value/Sensitivity	Criteria	Description
High	Attribute possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site/receptor. Attribute has a very low capacity to accommodate the proposed change.	Regionally important mineral resource. Within a Mineral Safeguarding Area. Major ground stability, soil compaction or erosion hazards currently present at the site. High potential for soils re-use.
Medium	Attribute possesses key characteristics which contribute significantly to the distinctiveness, rarity, and character of the site/receptor. Attribute has a low capacity to accommodate the proposed change.	Moderately economically viable mineral resource. Adjacent to a Mineral Safeguarding Area. Moderate ground stability, soil compaction or erosion hazards currently present at the site. Moderate potential for soils re-use.
Low	Attribute only possesses characteristics which are locally significant. Attribute has some tolerance to accommodate the proposed change.	Low economically viable minerals. Low ground stability, soil compaction or erosion hazards currently present at the site. Limited opportunity for soils re-use.
Very Low	Attribute characteristics do not make a significant contribution to local character or distinctiveness. Attribute is generally tolerant and can accommodate the proposed change.	No economically viable minerals. No ground stability, soil compaction or erosion hazards currently present at the site. No opportunity for soils re-use.

Magnitude

11.3.22 Following determination of the value/sensitivity of the receptors, the magnitude of potential impacts are determined. The criteria for the assessment of impact magnitude for physical effects and effects associated

with mineral resources, waste soils and soil re-use are defined in **Table 11.2**.

Table 11.2: Assessment of magnitude of impacts for physical effects and effects associated with mineral resources, waste soils and soil re-use

Magnitude	Criteria
High	Total loss or major alterations to one or more of the key elements, features or characteristics of the baseline. The situation will be fundamentally different.
Medium	Partial loss or alteration to one or more of the key elements or characteristics of the baseline. The situation will be partially changed.
Low	Minor loss or alteration to one or more of the key elements, features or characteristics of the baseline. The change will be discernible but the underlying situation will remain similar to the baseline.
Very Low	Very minor loss or alteration to one or more of the key elements, features or characteristics of the baseline, such that the change will be barely discernible, approximating to the 'no change' situation.

Effect definitions

11.3.23 The overall potential significance of physical effects and effects associated with mineral resources, waste soils, and soil re-use is defined using the matrix presented in **Table 11.3**, which describes the relationship between the value/sensitivity of the receptor as defined in **Table 11.1**, and the magnitude (change) of the potential impact as defined in **Table 11.2**.

11.3.24 Following the classification of an effect as presented in **Table 11.3**, a clear statement is made in the assessment as to whether the effect is 'significant' or 'not significant'. Major and moderate effects are considered to be significant, and minor and negligible effects are considered to be not significant. However, professional judgement is also applied where appropriate.

Table 11.3: Criteria for determining the significance of physical effects and effects associated with mineral resources, waste soils and soil re-use

		Value/Sensitivity of Receptor			
		Very Low	Low	Medium	High
Magnitude	Very Low	Negligible	Negligible	Minor	Minor
	Low	Negligible	Minor	Minor	Moderate
	Medium	Minor	Minor	Moderate	Major

		Value/Sensitivity of Receptor			
	High	Minor	Moderate	Major	Major

11.3.25 Physical effects, and effects associated with mineral resources, waste soils, and soil re-use are described as adverse/negative or beneficial/positive, considering the value of the receptor, area over which the impact may occur, whether the impact is direct or indirect, the duration of the impact (short-term: under three years, medium term: three to ten years or long-term: over ten years), and whether the impact is permanent or temporary.

11.3.26 The classifications of physical effects and effects associated with mineral resources, waste soils and soil re-use are described in **Table 11.4**.

Table 11.4: Classification of effects

Classification	Effect
Major Adverse	Major sterilisation of mineral resources from either an active mining/quarrying site or Mineral Safeguarding Area. Major soil erosion, soil compaction or ground instability that is permanent in nature. The generation of major volumes of soils classified as hazardous waste requiring off-site disposal.
Moderate Adverse	Moderate sterilisation of a mineral resource or Mineral Safeguarding Area. Moderate soil erosion, soil compaction, or ground instability that is either permanent or long-term in nature. The generation of moderate volume of waste requiring off-site disposal.
Minor Adverse	Minor sterilisation of a mineral resource or Mineral Safeguarding Area. Limited medium-term soil erosion, soil compaction, or ground instability. The generation of a minor amount of waste soil requiring off-site disposal.
Negligible	No change to a mineral resource or Mineral Safeguarding Area. No measurable impact on soil erosion, soil compaction, waste volumes, or ground instability or impacts that are only temporary in nature (less than three years). No change in contamination risks.
Minor Beneficial	Minor improvement in access to a mineral resource potentially facilitating future mineral extraction. Limited medium-term reduction in existing soil erosion, soil compaction, or ground instability issues.

Classification	Effect
	A minor amount of materials re-use on-site, thereby reducing off-site disposal volumes.
Moderate Beneficial	Moderate improvement in access to a mineral resource facilitating future mineral extraction. Moderate permanent or long-term reduction in existing soil erosion, soil compaction, or ground instability issues. A moderate amount of materials reuse as part of the development, thereby reducing off-site disposal volumes by a significant extent.
Major Beneficial	Major improvement in access to a mineral resource facilitating future mineral extraction. Major permanent reduction in existing soil erosion, soil compaction or ground instability issues. Sustainable reuse of materials on-site with no, or only minimal, off-site disposal of waste soils.

ii. Land contamination

11.3.27 The generic EIA methodology as described in **Chapter 6** of **Volume 1** of the **ES** is not used to consider the effects on land contamination from the proposed development. Instead, the assessment considers the risks to various receptors from land contamination and the change in this risk profile during construction, operation, and removal and reinstatement. As such the magnitude of the impact is not determined, being replaced by the change in risk level to the various receptors, which is subsequently used to define the effect.

11.3.28 The assessment of the potential impacts of the proposed development on land contamination has been undertaken over two stages including:

- stage 1 – a land contamination risk assessment; and
- stage 2 – a land contamination impact assessment.

Stage 1 – Risk assessment

11.3.29 **Appendix 11A** of this volume was prepared for the site and sets out the baseline environmental characteristics for the proposed development and study area. The baseline assessment was undertaken using existing data, publicly available information and historical records. The Phase 1 Desk Study Report also defines the preliminary conceptual site model (PCSM).

11.3.30 Based on the PCSM qualitative risk assessments have been undertaken in accordance with relevant guidance, considering the potential sources,

pathways and receptors present during the baseline, construction, operational and removal and reinstatement phases and are included in **Appendix 11B** of this volume.

11.3.31 To assist in the risk assessment process by helping determine the consequence of contamination being present, as discussed in **section 11.3.33** of this chapter, a value/sensitivity has been assigned to each of the contaminated land receptors. The definition of each of these is given in **Table 11.5**.

Table 11.5: Assessment of the value or sensitivity of receptors associated with land contamination

Value/ Sensitivity	Criteria	Description
High	Attribute possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site/receptor. Attribute has a very low capacity to accommodate the proposed change.	Principal aquifer providing potable water to a large population, within an inner or outer groundwater source protection zone (SPZ) (SPZ 1 or SPZ 2). WFD high status water body (surface water) providing potable water to a small population. Sensitive human health receptors, for example young children/other users of residential areas, schools and parks. Buildings, including services and foundations but of high historic value or other sensitivity for example statutory historic designations, schools, residential dwellings. Ecological statutory designations with high sensitivity or international designations for example Special Area of Conservation, Special Protection Area, RAMSAR etc. Crops and livestock with a high commercial/economic value.
Medium	Attribute possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site/receptor. Attribute has a low capacity to accommodate the proposed change.	Principal aquifer beyond a SPZ secondary aquifer providing abstraction water for single private potable water supplies, agricultural or industrial use. WFD good status water body (surface water). Moderate sensitivity human health receptors, for example commercial/industrial users. Buildings and infrastructure of high regional value, or high sensitivity for example schools, hospitals, residential

Value/ Sensitivity	Criteria	Description
		dwellings. Ecological statutory designations with medium sensitivity or national designations for example SSSI, National Nature Reserve, Area of Outstanding Natural Beauty, Marine Conservation Zone. Local Geological Site or Regionally Important Geological Sites. Crops and livestock with a medium commercial/economic value.
Low	Attribute only possesses characteristics which are locally significant. Attribute has some tolerance to accommodate the proposed change.	Secondary aquifer not currently used for groundwater abstraction. WFD moderate status (surface water). Less sensitive human health receptors, for example construction workers using mitigation measures. Buildings and infrastructure of local importance or low sensitivity (commercial/industrial buildings, main roads, railways). Ecological statutory designations with low sensitivity or sites with local designations for example Local Nature Reserve. Crops and livestock with a low commercial/economic value.
Very Low	Attribute characteristics do not make a significant contribution to local character or distinctiveness. Attribute is generally tolerant and can accommodate the proposed change.	Non-productive strata (groundwater). WFD poor status (surface water). No sensitive human receptors. Locally important infrastructure (local roads, bridges, footpaths). Land with low sensitivity and/or non-statutory designations. No crop or livestock receptors.

11.3.32 The risk assessment then applies the principles given in the NHBC and Environment Agency Guidance on the Safe Development of Housing on Land Affected by Contamination, and CIRIA Contaminated Land Risk Assessment – A Guide to Good Practice, which provide guidance on the preparation and application of the consequence and probability matrix, as presented in **Table 11.6**, for contaminated land risk assessment.

11.3.33 The potential risk to a receptor is a function of the probability and the consequence of a potential contaminant linkage being realised. Probability (likelihood of an event occurring) takes into account both the presence of the hazard and the receptor and the integrity of the exposure pathway. Consequence takes into account both the potential severity of the hazard and the value/sensitivity of the receptor. Definitions of probability, consequence and the classified risks adopted for this assessment are detailed in **Appendix 6N** of **Volume 1** of the **ES**.

Table 11.6: Land quality estimation of the level of risk by comparison of consequence and probability

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High Risk.	High Risk.	Moderate Risk.	Moderate/Low Risk.
	Likely	High Risk.	Moderate Risk.	Moderate/Low Risk.	Low Risk.
	Low Likelihood	Moderate Risk.	Moderate/Low Risk.	Low Risk.	Very Low Risk.
	Unlikely	Moderate/Low Risk.	Low Risk.	Very Low Risk.	Very Low Risk.

11.3.34 The descriptions of the classified risks and likely action required as given in R&D66 are detailed in **Appendix 6N** of **Volume 1** of the **ES**.

Stage 2 – Impact assessment

11.3.35 The impact assessment has been undertaken by comparing the baseline risk assessments with the construction, operation, and removal and reinstatement phase risk assessments. This approach enables changes in the contaminated land status during the various phases to be identified and recorded.

Effect definitions

11.3.36 The effects of the proposed development are described as adverse/negative or beneficial/positive and major, moderate, minor or negligible on the basis of **Table 11.7.**

Table 11.7: Classification of effects

Classification	Effect
Major Adverse	An increase in contamination risk from the existing baseline conditions of four or five risk levels in the risk matrix, e.g. land that has a very low contamination risk in the baseline becomes a

Classification	Effect
	high or very high risk. Land that does not meet the statutory definition of Contaminated Land in the existing baseline becomes capable of being determined under Part IIA of the Environmental Protection Act 1990.
Moderate Adverse	An increase in contamination risk from the existing baseline conditions of two or three risk levels in the risk matrix, e.g. land that has a low contamination risk in the baseline becomes a moderate or high risk. Land that does not meet the statutory definition of Contaminated Land in the existing baseline becomes capable of being determined under Part IIA of the Environmental Protection Act 1990.
Minor Adverse	An increase in contamination risk from the existing baseline conditions of one risk level in the risk matrix, e.g. land that has a low contamination risk in the baseline becomes a moderate to low risk.
Negligible	No change in contamination risks.
Minor Beneficial	A reduction in contamination risk from the existing baseline conditions of one risk level in the risk matrix, e.g. land that has a moderate to low contamination risk in the baseline becomes a low risk.
Moderate Beneficial	A reduction in contamination risk from the existing baseline conditions of two or three risk levels in the risk matrix, e.g. land that has a high contamination risk in the baseline becomes a moderate to low or low risk. Land that meets the statutory definition of Contaminated Land in the existing baseline is no longer capable of being determined under Part IIA of the Environmental Protection Act 1990.
Major Beneficial	A reduction in contamination risk from the existing baseline conditions of four or five risk levels in the risk matrix, e.g. land that has a very high contamination risk in the baseline becomes a low or very low risk. Land that meets the statutory definition of Contaminated Land in the existing baseline is no longer capable of being determined under Part IIA of the Environmental Protection Act 1990.

11.3.37 Following the classification of an effect as presented in **Table 11.7**, a clear statement is made as to whether the effect is 'significant' or 'not significant'. Major and moderate effects are considered to be significant and minor and negligible effects are considered to be not significant.

11.3.38 It should be noted that, given the information known at the time of writing, professional judgement has been applied in certain circumstances where

the introduction or removal of a receptor has automatically triggered a minor adverse or minor beneficial effect.

f) Assessment methodology

11.3.39 Detailed assessment methodologies for geology and land quality are presented in **Appendix 6N** of **Volume 1** of the **ES**. A summary is provided in the following sections.

General approach

11.3.40 The approach to the geology and land quality assessment comprises:

- establishing the baseline conditions for the study area with respect to geology, ground stability, hydrology, hydrogeology, contaminated land (including the potential for unexploded ordnance and ground gases) and historical uses;
- identification of potential impacts on identified resources and receptors from the construction, operation and removal and reinstatement phases of the proposed development;
- assessment of the significance of likely effects from the proposed development including the consideration of mitigation measures; and
- identification of any residual effects and secondary mitigation where required.

i. Establishing the baseline

11.3.41 The baseline assessment has relied on existing data, previous desk study and historical records. The following sources have been reviewed:

- historical mapping and additional environmental information including historical landfill information, and contemporary trade directories provided in an Envirocheck report which is appended to the Phase 1 Desk Study Report;
- publicly available information from the British Geological Survey (BGS) (Ref. 11.25) online mapping resource;
- Suffolk County Council (SCC) minerals local plan (Ref. 11.26);
- Suffolk Biodiversity Information Service website (Ref. 11.27);

- publicly available information from the Defra Multi-Agency Geographic Information for the Countryside website (Ref. 11.28);
- publicly available information from the Environment Agency (Ref. 11.29);
- the Yell website (Ref. 11.30); and
- Zetica online unexploded ordnance UXO risk maps (Ref. 11.31).

11.3.42 It is noted that the Envirocheck report found within **Appendix 11A** of this volume was obtained in 2012. Updated information has therefore been obtained from publicly available sources of information. Information obtained during the site visit undertaken in March 2019 was also used to determine whether there had been any substantial changes between 2012 and present day.

ii. Assessment of effects

11.3.43 An impact assessment of the potential physical effects of the proposed development on geology, and the effects associated with soils re-use, and waste soils has been undertaken using a qualitative approach considering the effects on soil erosion, mineral resources, the potential for soil re-use and waste soil generation in accordance with methods outlined previously.

11.3.44 The assessment of the potential impacts of the construction, operation and removal and reinstatement phases of the proposed development on land contamination has been undertaken in accordance with the method outlined previously.

g) Assumptions and limitations

11.3.45 The following assumptions have been made in this assessment:

- all assessment considers development within the site parameters as set out in the description of development in **Chapter 2** of this volume of the **ES** and as illustrated in **Figure 2.2**;
- stockpiling of materials and the landscape bunds would remain within the site boundary;
- landscape bunds would be 3m high, as detailed in **Chapter 2** of this volume, and the vegetation, topsoil and potentially subsoil would be stripped in accordance with the **Outline Soil Management Plan** (**SMP**) presented in **Appendix 17C** of **Volume 2** of the **ES**;

- the use of grid connections for electricity rather than generators to reduce the potential for storage of fuels on-site; and
- following removal and reinstatement, the site would be restored back to agricultural use and as such the majority of the underground services (apart from the existing Cadent medium pressure gas main), foundations and other below ground structures installed for the operation of the site would be removed.

11.3.46 The following limitations have been identified:

- ground investigation data is not available for the site and the baseline has been prepared using BGS mapping.

11.4 Baseline environment

11.4.1 This section presents a description of the baseline environmental characteristics within the study area.

11.4.2 Further detail can also be found in **Appendix 11A** of this volume.

a) Current baseline

i. Site visit

11.4.3 A site visit was undertaken during March 2019 to gain further information on the site setting and study area, to consider the context of the site, and to support the desk-study mapping, and aerial photographs. Additionally, it was an opportunity to identify potential visual or olfactory contamination present at the site at the time of the visit.

11.4.4 The majority of the site comprises farmed agricultural land. The B1078 (Main Road), the B1078 slip road and A12 are located within the south and south-west of the site. An area along the western site boundary, which is identified on historical and current mapping to be a disused sand pit, was noted to be overgrown and surrounded by trees, with a fenced area located towards the eastern edge of the disused sand pit. A track is present in the east of the site running from south-east to south-west parallel with the A12.

11.4.5 Key hazards which were identified during the site visit on-site are as follows:

- fly-tipped areas on-site around the area of the former disused sand pit (identified on historical maps). It is not known what has been tipped

there previously, but localised evidence of plastics, tyres, metal and old drums were visible during the site visit;

- uneven ground, mounds of soil and dense vegetation in the disused sand pit area. The contents of the stockpiles are unknown, and therefore could be contaminating the ground, or pose risk to site workers, for example if they contained asbestos. These and any other infilled areas would also need to be considered during construction, as differential settlement of the ground may occur due to the infilled material; and
- a fenced-off area within the disused sand pit and an intermediate bulk container, drum and canister in the adjacent area are considered to be a potential risk as the contents are unknown. However, it was noted during the site visit that these were likely to have been used to store water and feed, as they were present within an area of fencing which appeared to have been used to rear game birds. Similar containers and pheasants were observed in adjacent woodland areas.

11.4.6 Further details on observations made during the site visit including photographs can be found in **Appendix 11A** of this volume.

ii. Site history

11.4.7 **Table 11.8** summarises the key historical land use information of the study area. This has been compiled using an Envirocheck report presented in **Appendix 11A** of this volume and more recent mapping.

Table 11.8: Historical development on the site

Map Date	Key Contamination Sources On-Site	Key Contamination Sources in Study Area
1884 (1:2,500)	The site is shown as predominantly fields. A road is present running along the south of the site from north-east to south-west. The road connects to two further roads in the south-west of the site running from north-west to south-east. Beggar's Barn is shown in the north-west corner of the site comprising of an approximately square building. A sand pit is shown in the south-west section of the site adjacent to the site boundary.	Two sand pits are shown approximately 70m and 130m to the north-east of the site. The Great Eastern Railway is shown approximately 420m north-east of the site in a north-west to south-east orientation.
1884 - 1885 (1:10,560)		
1904 (1:2,500)	No substantial changes.	The sand pit approximately 70m north-east of the site is no longer shown, presumed to be infilled. The sand pit approximately 130m north-
1905		

Map Date	Key Contamination Sources On-Site	Key Contamination Sources in Study Area
(1:10,560)		east is now labelled as a gravel pit.
1951 (1:10,560)	No substantial changes.	Residential properties have been constructed approximately 150m south-west of the site.
1957 (1:10,000)	No substantial changes.	No substantial changes.
1975 (1:2,500)	The sand pit is now labelled as 'disused'.	The Great Eastern Railway is now labelled as 'dismantled railway'.
1978 (1:2,500)	The road in the south of the site is shown as being upgraded, and extended to the south-west, with associated earthworks. The new road is labelled as the A12 (Main Road) and the original road is now labelled as B1078 (Main Road) with a slip road leading on the A12 (Main Road). The layout of the two original roads in the south-west of the site have also changed as part of the construction works. These roads are labelled as B1078 and Station Road.	The A12 (Main Road) to the east of the site is being upgraded/extended.
1980 - 1982 (1:10,000)	No substantial changes.	The gravel pit to the north-east of the site is no longer shown, and is now vegetated with trees. An electrical substation is indicated to be present approximately 250m south of the site.
2012 (1:10,000)	Beggar's Barn is no longer shown, the building presumably demolished. The construction of the A12 (Main Road) has been completed, and the A12 (Main Road), B1078 (Main Road), and B1078 slip road are shown in their current layout.	No substantial changes.
Present day	No substantial changes based on the site visit completed in 2019.	No substantial changes based on the site visit completed in 2019.

iii. Geology

11.4.8 Made Ground is not shown on the BGS online mapping. However, there is potential for Made Ground to be encountered in the soil mounds, and disturbed ground observed during the site visit in the disused sand pit which is likely to have been infilled; in the areas associated with the construction of the B1078 (Main Road); the B1078 slip road; the A12 (Main Road) within the south and south-west of the site; and within the infilled pits located off-site.

11.4.9 Available BGS records indicate that the majority of the site is shown to be underlain by superficial deposits of the Lowestoft Formation. The south-western and north-eastern sides of the site are underlain by sands and gravels of the Lowestoft Formation whereas the central area of the site is underlain by diamicton deposits of the Lowestoft Formation, comprising poorly-sorted matrix-supported deposits.

11.4.10 According to the BGS website, the bedrock geology comprises sands of the Crag Group, described as shallow-water marine and estuarine sands, gravels, silts and clays.

11.4.11 BGS borehole logs located along the A12 indicate that sand and gravel deposits are present within the south of the site. Lithological descriptions detailed within the trial pit logs and borehole logs generally include clay, sand and gravel with occasional chalk up to approximately 6m below ground level (m bgl). The underlying material becomes denser and sandier with depth, with bedrock not proven up to a depth of 20m bgl.

11.4.12 The Envirocheck report indicates that there is either no hazard or very low potential for landslides, ground stability hazards and ground dissolution stability hazards at the site, and a low potential for shrinking or swelling clay. There are also no geological faults located within the study area.

iv. Mineral extraction

11.4.13 The Envirocheck report indicates that the site is in an area unlikely to be affected by mining for coal or other mineral resources.

11.4.14 The Envirocheck report indicates no historical extractive activities within the study area. The SCC minerals local plan also indicates that the site is not located within a Minerals Safeguarding Area, and there are no planned areas of mineral extraction within the study area. However, as detailed in **Table 11.7**, historical maps and site visit indicate the presence of a sand pit on-site, a sand pit 70m north-east, and a gravel pit 130m north-east indicating historical extraction of sands and gravels.

v. Local geological sites

11.4.15 According to protected sites mapping on the Suffolk Biodiversity Information Service website the study area is not located within or in proximity to a geological SSSI or Local Geological Site.

vi. Hydrogeology

11.4.16 According to the Multi-Agency Geographic Information for the Countryside website the superficial deposits in the south-west and north-eastern areas of the site are classified by the Environment Agency as a Secondary A Aquifer[5], associated with the Lowestoft Formation Sand and Gravel. The superficial deposits in the centre of the site are classified as Secondary Undifferentiated Aquifer[6], and are associated with the Lowestoft Formation Diamicton.

11.4.17 According to Multi-Agency Geographic Information for the Countryside and the Envirocheck report, the Crag Group bedrock underlying the site is classified as a Principal Aquifer[7]. The site lies within a groundwater SPZ[8] Zone 3 (total catchment)[9]. An Inner Protection Zone (Zone 1)[10] is approximately 500m south of the site.

11.4.18 The Envirocheck report indicates that there is one licensed groundwater abstraction approximately 60m east of the site for general agricultural use for spray irrigation. The abstraction is used seasonally between 1st April and 31st October and has a maximum annual abstraction limit of 31,700m^3. There is the potential for unknown Private Water Supplies to be in use within the study area. Should any Private Water Supply exist, they would likely be associated with the isolated farm buildings, and residential properties in the study area.

11.4.19 Further baseline hydrogeology information for the proposed development is provided in **Chapter 12** of this volume**.**

[5] Secondary A Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
[6] Assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
[7] Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
[8] SPZs show the risk of contamination from activities that might cause pollution in the area. The closer the activity, the greater the risk.
[9] Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. There is still the need to define individual source protection areas to assist operators in catchment management.
[10] Inner Protection Zones (Zone 1) are defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50m radius. It is based principally on biological decay criteria and is designed to protect against the transmission of toxic chemicals and water-borne disease.

vii. Hydrology

11.4.20 A small pond is shown to be present south of Whin Belt in the area of the disused sand pit in the south-west of the site on current mapping. However, the pond was not able to be located during the site visit in March 2019 and appeared to have dried up. A drainage ditch with approximately 0.1m of surface water was noted adjacent to the western boundary of the site during the site visit in 2019.

11.4.21 Two ponds are located approximately 10m and 30m west of the site boundary within a small area of woodland immediately north-west of the site. A network of drains associated with the River Deben floodplain is present 250m to the south of the site around Lower Hacheston. A tributary of the River Deben also flows in a southerly direction to the west of the B1116 approximately 340m west of the site. A drainage ditch was noted adjacent to the western boundary of the site during the site visit. The River Ore is located approximately 480m to the north-east of the site at its closest point.

11.4.22 The Envirocheck report indicates that there is one licensed surface water abstraction located 420m to the west of the site for general agricultural use for spray irrigation. The abstraction is used seasonally between 1st May and 30th September. The maximum annual abstraction limit of is unknown.

11.4.23 Further consideration of the hydrology of the site is provided in **Chapter 12** of this volume.

viii. Flood risk

11.4.24 The Environment Agency flood risk map contained within the Envirocheck report, and the Environment Agency website indicate that the majority of the site is located in Flood Zone 1 and has a very low risk of flooding from rivers or the sea without defences. Risks associated with groundwater flooding at the site are also considered to be low.

11.4.25 The River Ore located approximately 480m north-east of the site, is located in a Flood Zone 2 and 3, and at high risk of extreme flooding from rivers or the sea without defences. The network of drains located 250m south of the site are also indicated to be within a Flood Zone 2 and 3.

11.4.26 The Environment Agency's long-term flood risk mapping shows that the majority of the site is also at very low risk of flooding from surface water. However, there are four isolated areas of low risk of surface water flooding within the site including:

- across the proposed access road;
- along the southern boundary with the A12;
- along the site boundary beyond the eastern extent of the parking area; and
- at the north-east boundary outside of the grassed spoil bunds.

11.4.27 There are also two areas of combined 'medium' and 'high' risk within the site. One covers the lower section of one of the swales in the proposed layout and a small section of the parking area, located in the north-west corner of the main parking block. The second area is adjacent to the north-bound A12 slip road.

11.4.28 Towards the southern extent of the wider proposed development, there is a large area of 'high' surface water flood risk, situated on the A12 at the B1078 junction.

11.4.29 Further details on flood risk are provided in the **Southern Park and Ride Flood Risk Assessment** (Doc Ref. 5.4).

ix. Historic and environmentally sensitive sites

11.4.30 A review of the Multi-Agency Geographic Information for the Countryside website indicates there are two Grade II Listed Buildings within the study area located approximately 500m south of the site in Lower Hacheston (Ash Cottage and 36 Ash Road). Both buildings were listed in November 1984.

11.4.31 Extensive evidence of a Late Iron Age settlement, and the Romano-British settlement of Hacheston has been found in the vicinity of the site.

11.4.32 There are no other historic or ecologically sensitive sites within the study area.

11.4.33 Further consideration of designated sites for ecology and historic environment, both statutory and non-statutory is provided in **Chapter 7** and **Chapter 9** of this volume respectively.

x. Waste management and other permitted sites

11.4.34 The Envirocheck report confirms that there are none of the following facilities within the study area:

- historic landfill sites;
- authorised landfill sites;
- waste transfer sites;
- Control of Major Accident Hazards Sites;
- explosive sites;
- Notification of Installations Handling Hazardous Substances;
- Planning Hazardous Substance Consents; and
- Planning Hazardous Substance Enforcements.

xi. Service stations

11.4.35 There are no service stations within the study area according to the Envirocheck report and the Yell website.

xii. Industrial and other potentially contaminative land uses

11.4.36 The Envirocheck report indicates there are no contemporary trade directory entries within the study area. However, it is noted that the site is currently used for agricultural purposes, and there are several farms present within the study area which have the potential to use contaminants of concern.

xiii. Potential for Unexploded Ordnance

11.4.37 A Zetica UXO map was obtained to assess the risk of encountering UXO at the site and is appended to the Phase 1 Desk Study Report. The map indicates that the site is within an area with a low risk of encountering UXO.

xiv. Previous ground investigations

11.4.38 There have been no previous ground investigations undertaken at the site.

b) Future baseline

11.4.39 There are no committed development(s) or forecasted changes that would materially alter the baseline conditions during the construction, operation, and removal and reinstatement phases of the proposed development.

c) Preliminary conceptual site model

11.4.40 A PCSM identifies the potential or known sources of contamination, receptors and pathways between the two. Where all three are present or are considered likely to be present (source-pathway-receptor linkage), they are called a potential contaminant linkage.

11.4.41 Four PCSMs (baseline, construction, operational, and removal and reinstatement) have been produced for the proposed development using the information summarised previously.

11.4.42 A summary of potential contamination sources is provided in **Table 11.9**, and a summary of potential pathways and receptors identified is provided in **Table 11.10**.

Table 11.9: Existing potential sources of contamination for the proposed development

Potential Source of Contamination	Potential Contamination	Approximate Location
Beggar's Barn, historically present in the north-west of the site, previously used for cattle and dairy farming.	Metals, inorganics, fuels, oils and pesticides, herbicides, silage, effluent, and fuel/engine oils associated with various farming practices and stored on-site.	On-site
Made Ground associated with the construction of the B1078 (Main Road), A12 and B1078 slip road within the south and south-west of the site as well as activities associated with their operation.	A range of inorganic and organic contaminants including polyaromatic hydrocarbons (PAHs), coal tars, asbestos and ground gases. Fuels and oils attributed to spills from vehicles on the roads included within the site boundary, plus exhaust particulates.	
Containers with unknown contents located in the disused sand pit area (i.e. intermediate bulk container, drum, canister) which could have leaked or been spilled.	Metals, inorganics, fuels, oils, chemicals and pesticides.	
Made Ground associated with the disused sand pit in the south-west of the site (presumed to have been infilled), and the mounds/disturbed ground on-site.	Gas associated with biodegrading material and a range of inorganic and organic contaminants including metals and hydrocarbons, Polychlorinated Biphenyl (PCBs), asbestos, etc.	
Fly-tipped waste within the	Asbestos and a range of	

Potential Source of Contamination	Potential Contamination	Approximate Location
disused sand pit area.	inorganic and organic contaminants including metals and hydrocarbons.	
Farmland within site boundary. Potential for other unmapped farmers tips.	Contamination risk from herbicides, pesticides, silage, effluent, and fuel oils. Risk of inorganic and organic contamination including metals and hydrocarbons, PCBs, asbestos, etc.	
Made Ground associated with the construction of the A12 (Main Road) to the south-west of the site, as well as activities associated with their operation, and with residential properties within 250m of the site.	A range of inorganic and organic contaminants including the potential for asbestos and ground gas. Fuels and oils attributed to spills from vehicles on the roads included within the site boundary, plus exhaust particulates.	Off-site
Electrical substation located 250m south of the site.	Oils, metals and PCBs.	
Farmland surrounding the site.	Fuels, oils and pesticides associated with various farming practices.	
Made Ground associated with the former Great Eastern Railway located 420m north-east and activities associated with its operation.	A range of organic contaminants including hydrocarbons, PCBs, PAHs, solvents and creosote; metals; and ash and fill used in the construction of the Great Eastern Railway.	
Made Ground associated with the disused sand pits located 70m and 130m to the north-east.	Ground gas and a range of inorganic and organic contaminants including the potential for asbestos.	

Table 11.10: Potential receptors and contaminant exposure and migration pathways at baseline and resulting from the proposed development

Receptor Group	Receptor	Principal Contaminant Migration Pathways
Human Health (on-site)	Construction and maintenance workers.	Dermal contact with and ingestion of contaminants in soils, soil-derived dusts and water; and inhalation of soil-derived dust, fibres, gas and vapours.
	Users of the new park and ride site.	
	Farmers and workers on	

Receptor Group	Receptor	Principal Contaminant Migration Pathways
	agricultural land.	
Human Health (off-site)	Farmers on adjoining agricultural land.	Dermal contact with. and ingestion of, contaminants in soil-derived dusts and water that may have migrated off-site; and inhalation of soil-derived dust, fibres, gas and vapours which may have migrated off-site.
	Pedestrians, cyclists and horse riders accessing public footpaths, bridleways and local roads within the study area.	
	Residents within the study area.	
Controlled Waters: Groundwater (on-site and off-site)	Groundwater in Principal bedrock aquifer, Groundwater in Secondary A and Secondary Undifferentiated Superficial aquifer.	Leaching of contaminants in soil to groundwater in underlying aquifers; and migration of contaminated water through preferential pathways such as underground services, pipes and granular material to groundwater in underlying aquifers.
Controlled Waters: Surface waters (off-site)	River Ore, ponds, ditches and drains off-site within the study area.	Lateral migration of contaminated groundwater with discharge to surface watercourses as base flow; and discharge of contaminants entrained in groundwater and/or surface water run-off followed by overland flow and discharge.
Property (on-site and off-site)	Existing on-site services and structures on-site and off-site including listed buildings and archaeological features. Proposed on-site services and structures.	Direct contact of contaminants in soil and/or groundwater with existing and proposed structures and buried services; and migration of contaminated groundwater, ground gas and/or vapours along strata and preferential pathways such as service routes or differentially permeable strata.
	Crops and livestock on-site and off-site within the study area.	Migration of contaminated waters/dust/fibres; and subsequent uptake by crops or ingestion/inhalation/dermal contact by livestock.

11.5 Environmental design and mitigation

11.5.1 As detailed in **Volume 1**, **Chapter 6** of the **ES** (Doc Ref. 6.2), a number of primary mitigation measures have been identified through the iterative EIA process, and have been incorporated into the design and construction planning of the proposed development. Tertiary mitigation measures are legal requirements, or are standard practices that would be implemented as part of the proposed development.

11.5.2 The assessment of likely significant effects of the proposed development assumes that primary and tertiary mitigation measures are in place. These measures are summarised in this section so that it is clear where and why these measures have been included, and the way in which they have contributed to the management and reduction of environmental effects.

a) Primary mitigation

11.5.3 Primary mitigation is often referred to as 'embedded mitigation' and includes modifications to the location or design to mitigate impacts; these measures become an inherent part of the proposed development.

11.5.4 Primary mitigation measures for the proposed development would include:

- The design of the access road and car parking areas and the selection of construction materials would be in accordance with the Design Manual for Roads and Bridges, British Standards and best practice guidance at the time of the design. The design would be required to take into account the ground conditions including the potential for ground movement, compaction, ground gas and ground aggressivity;
- Gas mitigation measures would be provided in the buildings on-site (such as the amenity and welfare building, security building, security booth), and other relevant structures where required, the design of which would be dependent on the risk profile and the nature/usage of the building/structure;
- Hardstanding would be used on the access road and internal roads to reduce spills and leaks infiltrating into the ground where required; and
- The use of appropriate drainage systems in accordance with the **Drainage Strategy** presented in **Appendix 2B** of **Volume 2** of the **ES** (Doc Ref. 6.3) to reduce the potential for contamination to migrate and impact on the ground, groundwaters and surface waters. This would include the use of lined drainage and bypass separators where

necessary, to protect the ground and underlying groundwater and separate out oils/hydrocarbons for suitable off-site disposal.

b) Tertiary mitigation

11.5.5 Tertiary mitigation will be required regardless of any EIA assessment, as it is imposed, for example, as a result of legislative requirements and/or standard sectoral practices.

11.5.6 Tertiary mitigation measures to be incorporated into the proposed development during construction, operation and the removal and reinstatement phases, as set out in the **CoCP** (Doc Ref. 8.11) include:

- Prior to stockpiling or other groundworks, topsoil present is to be removed and appropriately stored for potential re-use in landscaping areas and landscape bunds, subject to demonstrating suitability for reuse criteria. This process would reduce the potential for buried topsoil to generate ground gas beneath the proposed development which may pose a risk to human health;
- Development of health and safety risk assessments and method statements by the contractor (including emergency response procedures), and provision of appropriate personal protective equipment (PPE) for the protection of construction workers;
- Implementation of a contamination watching brief by suitably qualified and experienced personnel would be completed for the proposed development when excavating areas of potential contamination risk. If unidentified contamination is encountered, works will be temporarily suspended in the area and appropriate investigations and remediation will be discussed, and agreed with stakeholders and completed in accordance with current best practice;
- Implementation of appropriate dust suppression measures to reduce migration of contaminated dust, further details are provided in **Chapter 5** of this volume;
- Minimising the area and duration of soil exposure and timely reinstatement of vegetation or hardstanding to reduce soil erosion and reduce temporary effects on soil compaction;
- Stockpile management (such as water spraying and avoiding over stockpiling to reduce compaction of soil and loss of integrity) to reduce windblown dust and surface water run-off;

- Clear segregation between stockpiled material including imported material, excavated material stockpiled for re-use and excavated waste material stockpiled for treatment and/or off-site disposal;
- Covering/hydroseeding of the landscape bunds and temporary stockpiles may be completed to reduce soil erosion and dust generation;
- Stockpiles would be located a minimum of 10m from the nearest watercourse;
- Implementation of working methods during construction to ensure that surface water run-off from the works, landscape bunds, stockpiles or working area is minimised, and captured prior to entry into adjacent surface watercourses, or leaching into underlying groundwater in accordance with best practice;
- Implementation of appropriate pollution incident control e.g. plant drip trays and spill kits and suitable training and toolbox talks completed; and
- Implementation of appropriate and safe storage of fuel, oils, chemicals and equipment during construction in accordance with Control of Substances Hazardous to Human Health Regulations and oil storage regulations.

11.5.7 Additional tertiary mitigation that would be anticipated and referenced in the **CoCP** includes:

- Implementation of an appropriate materials management strategy to document how the excavated materials would be dealt with via **Materials Management Plan(s)** (**MMP**) and verification report(s) to record the excavation and placement of materials at the site. Further details are provided in the **Materials Management Strategy** presented in **Appendix 3B** of **Volume 2** of the **ES** (Doc Ref. 6.3);
- Implementation of a site **Waste Management Plan** in accordance with the **Waste Management Strategy** presented in **Appendix 8A** of **Volume 2** of the **ES**; and
- Implementation of an **Outline SMP** as presented in **Appendix 17C** of **Volume 2** of the **ES** (Doc Ref. 6.3).

11.5.8 For the operational phase, storage and disposal of wastes and hazardous substances where required would be managed in accordance with current guidance and legislative requirements.

11.6 Assessment

a) Introduction

11.6.1 This section presents the findings of the geology and land quality assessment for the construction, operation and removal and reinstatement phases of the proposed development.

11.6.2 This section identifies any likely significant effects that are predicted to occur and **section 11.7** of this chapter highlights the secondary mitigation and monitoring measures that are proposed to minimise any adverse significant effects (if required).

b) Construction

i. Physical effects

11.6.3 A qualitative approach has been undertaken to assess the likely physical effects of the proposed development. The effects have then been categorised in accordance with the methodology outlined in **Appendix 6N** of **Volume 1** of the **ES** (Doc Ref. 6.2), and summarised in **section 11.3** of this chapter, and confirmed as either temporary or permanent, adverse or beneficial and significant (moderate or major effects) or not significant (minor or negligible).

11.6.4 The Phase 1 Desk Study Report presented in **Appendix 11A** of this volume indicates that there is either no hazard or a very low or low potential for landslides, ground stability hazards, ground dissolution stability hazards and shrinking or swelling clay to occur at the site. Given this and the nature of the works, ground instability, and soil compaction have been scoped out of further assessment.

ii. Soil erosion

11.6.5 The construction phase of the proposed development may result in effects on soil erosion associated with stripping of topsoil, vegetation clearance, stockpiling, earthworks and construction of new buildings, infrastructure and landscaping. Earthworks, including areas for temporary works, are anticipated for the construction of the proposed development and topsoil would be stockpiled in up to 3m high landscape bunds around the site. There is the potential for increased soil erosion and surface water run-off with a high sediment load which may impact local surface waters.

11.6.6 Earthworks would be managed in accordance with the **CoCP** (Doc Ref. 8.11) to minimise soil exposure as far as practicable. Stockpiles would be

managed in accordance within primary and tertiary measures set out in **section 11.5** of this chapter, and the **CoCP** to reduce soil erosion and dust generation by management practices (including water spraying and hydroseeding). The impacts on soil erosion during the construction phase are therefore considered to be temporary, short-term, and direct.

11.6.7 Given that there are limited soil erosion hazards at the site, the value/sensitivity of the receptor is classed as low. With the primary and tertiary mitigation measures set out in **section 11.5** of this chapter, the magnitude of the impact is considered to be very low. The overall effect is therefore considered to be negligible and classed as **not significant**.

iii. Mineral resources

11.6.8 A qualitative approach has been undertaken to assess the likely effects of the proposed development on mineral resources in accordance with the methodology outlined in **Appendix 6N** of **Volume 1** of the **ES** and summarised in **section 11.3** of this chapter.

11.6.9 The proposed development has the potential to impact mineral resources and associated Mineral Safeguarding Areas through the loss, damage or sterilisation of an important mineral resource.

11.6.10 The baseline assessment indicates the presence of a former sand pit on-site, a former sand pit 70m north-east and a former gravel pit 130m north-east indicating historical extraction of minerals within the study area. These extraction processes ceased in the early 1900s, and it is unlikely that there would be substantial additional mineral extraction in the study area. The site and study area are also not located within a coal mining area, an area of planned mineral extraction or a Minerals Safeguarding Area. Therefore, there would be a limited impact on the regional mineral resources from the proposed development. The impacts on mineral resources during the construction phase are therefore considered to be temporary, short-term and direct.

11.6.11 Given that there are some mineral resources located within the study area but no plans to extract them, the value/sensitivity of the receptor is classed as low. The magnitude of the impact is considered to be very low as there would be limited loss of regional mineral resources. The overall effect is therefore considered to be negligible and classed as **not significant**.

iv. Effects associated with ground contamination

11.6.12 The construction PCSM and risk assessment are presented in **Appendix 11B** of this volume and the impact assessment in **Appendix 11C** of this

volume. The construction impact assessment is undertaken by comparing the baseline land contamination risks to those predicted during construction, while considering any new sources and pollution pathways introduced by construction activities.

11.6.13 The construction phase would potentially introduce new sources of contamination, and disturb and mobilise existing sources of contamination. Construction activities, such as excavation may introduce new pathways for migration of existing contamination and exposure of contaminated soil, remobilisation of contaminants through soil disturbance, and the creation of preferential pathways for surface water run-off and ground gas migration. Potential changes to the baseline situation creating potential contaminant linkages, which have been assessed within this chapter are:

- the potential for mobilising contaminants by excavation and stockpiling of material, increasing the risk to controlled water receptors through leaching and run-off. Earthworks could provide opportunities for run-off to contain suspended solids if not carried out in line with required management procedure;
- the potential for introducing new sources of contamination i.e. from spillages and leaks;
- the potential for exposure of human receptors by generation of potentially contaminated dust and vapours released by the construction works; and
- the potential for creation of new pathways to groundwater during groundworks, through opening up ground temporarily and construction activities, such as earthworks, installation of drainage and other below-ground services and foundations.

11.6.14 The impacts on land contamination are considered to be permanent and direct. Primary and tertiary mitigation measures would be incorporated into the construction process as outlined in **section 11.5** of this chapter. These would include the adoption of working methods during construction to manage groundwater appropriately, implementation of appropriate pollution incident control, and implementation of appropriate and safe storage of fuel, oils and equipment.

11.6.15 A summary of the construction phase PCSM and impact assessment is provided in **Table 11.11** and includes the risks identified to the receptors. A more detailed assessment of construction risk and impact assessment is provided in **Appendices 11C** and **11D** of this volume.

11.6.16 It is considered that with the primary and tertiary mitigation measures adopted, the risks identified to human health, controlled waters and property receptors during construction would range from very low to moderate/low. Compared to the existing baseline, the level of risk to receptors has generally remained the same, or increased during the construction phase. An overall negligible to minor adverse effect has therefore been predicted for on-site and off-site humans, surface waters and property which is classed as **not significant**. However, an overall minor to moderate adverse effect for groundwater is anticipated which is classed as **not significant**.

Table 11.11: Construction phase effects for the proposed development

Receptor	Value/ Sensitivity	Baseline Risk	Construction Risk	Classification of Effect
Human (on-site)	High	Receptor not present to low	Receptor not present to low	Negligible to minor adverse (**not significant**).
Human (off-site)	High	Very low	Low	Minor adverse (**not significant**).
Controlled waters: groundwater (on-site and off-site)	Medium	Low to moderate/low	Moderate/low to Moderate	Minor to moderate adverse (**not significant**).
Controlled waters: surface water (on-site and off-site)	Low	Low	Moderate/low	Minor adverse (**not significant**).
Property: existing and future structures and services (on-site and off-site)	Medium	Very low	Low	Minor adverse (**not significant**).
Property: crops and livestock (on-site and off-site)	Medium	Very low to low	Low	Minor adverse (**not significant**).

v. Effects associated with waste soils and soil re-use

11.6.17 Waste soils would be generated during construction through excavations and the installation of the sustainable urban drainage system (SuDS) or services. There is the potential that waste soil generated from the earthworks would be classified as geotechnically and/or chemically unsuitable for reuse on-site or hazardous, therefore requiring removal from site. Waste soils would be dealt with in accordance with the **Waste Management Strategy** presented in **Appendix 8A** of **Volume 2** of the **ES** (Doc Ref. 6.3).

11.6.18 A **MMP** in accordance with the **Materials Management Strategy** would set out how material is managed on-site during construction and removal and reinstatement in accordance with appropriate guidance such as the Contaminated Land: Applications in Real Environments (CL: AIRE) Development Industry Code of Practice, to allow the sustainable re-use of suitable soils during the construction, and removal and reinstatement of the proposed development.

11.6.19 An **Outline SMP** as presented in **Appendix 17C** of **Volume 2** of the **ES** would also be implemented to manage the reinstatement of agricultural land.

11.6.20 In line with the waste hierarchy, the design would seek, as far as reasonably practicable, to reduce the amount of soil/materials excavated and/or of a hazardous nature, to reuse and recycle waste soils/materials on-site where possible and to manage soils/materials suitably including off-site disposal of waste, if required, in accordance with relevant legislation. Therefore, the impacts associated with waste soils and soil re-use during the construction phase are considered to be temporary, short-term and direct.

11.6.21 Given that Made Ground may present within several areas of the site, there is a moderate potential for soils reuse, the value/sensitivity of the receptor is classed as medium. With the primary and tertiary mitigation measures, the magnitude of the impact is considered to be low. The overall effect is therefore considered to be minor adverse, and therefore **not significant**.

vi. Inter-relationship effects

11.6.22 This section provides a description of the identified inter-relationship effects that are anticipated to occur on geology and land quality receptors between the individual environmental effects arising from construction of the proposed development.

11.6.23 There are anticipated to be inter-relationship effects between geology and land quality, soils and agriculture, heritage and groundwater and surface water in relation to potential receptors which could be impacted by ground contamination during the construction of the proposed development.

11.6.24 Potential impacts would include the contamination of sensitive/high value receptors such as good quality or best and most versatile (BMV) agricultural land, listed buildings, Principal Aquifers, WFD rivers and groundwater SPZs during construction works. Construction activities may introduce new sources of contamination, new pathways for migration of contamination and disturb and mobilise existing sources of contamination.

11.6.25 However, given the primary and tertiary mitigation measures proposed in relation to these disciplines as outlined in **section 11.5** of this chapter, it is not expected that the combined impact of these inter-relationship effects would be greater than those effects predicted for the geology and land quality assessment as presented within this chapter. Only minor adverse inter-relationship effects are anticipated, which are classified as **not significant**. Further details are provided in **Chapter 10** and **Chapter 12** of this volume.

c) Operation

i. Physical effects: Soil erosion

11.6.26 Physical effects are considered to be mainly related to the construction phase. During operation, there would be limited effects on soil erosion through maintenance operations. Suitable design and subsequent maintenance works would also minimise physical effects and the proposed development would be operated in accordance with the relevant regulations and best practicable measures. The impacts on soil erosion during the operational phase are therefore considered to be temporary, short-term, and direct.

11.6.27 Given that there are limited soil erosion hazards at the site and hazards would be mitigated during the construction phase, the value/sensitivity of the receptor is classed as low. With the primary and tertiary mitigation measures the magnitude of the impact is considered to be very low. Therefore, it is considered that physical effects would remain as negligible and are classed as **not significant**.

ii. Mineral resources

11.6.28 Effects in relation to mineral resources during the operation phase relate to the permanent sterilisation/loss of minerals, preventing future extraction.

The impacts on mineral resources during the operational phase are therefore considered to be temporary, medium term, and direct.

11.6.29 Given that there are some mineral resources located within the study area but no plans to extract them, the value/sensitivity of the receptor is classed as low. The magnitude of the impact is considered to be very low as there would be limited loss of regional mineral resources. Effects in relation to mineral resources would remain as minor adverse and are classed as **not significant**.

iii. Effects associated with ground contamination

11.6.30 The operational PCSM and risk assessment are presented in **Appendix 11B** of this volume and the impact assessment in **Appendix 11C** of this volume. The operational impact assessment has been undertaken by comparing the baseline land contamination risks to those predicted during operation, while considering any new sources and pollution pathways introduced by operational activities.

11.6.31 The operation of the proposed development would potentially introduce new sources of contamination. Spillages and leaks may occur and below ground services could create additional potential pathways for the migration of potential contamination that were not present at baseline. The impacts on land contamination during the operational phase are considered to be permanent and direct.

11.6.32 A summary of the operational phase contamination effects is provided in **Table 11.12**. A more detailed assessment of operation risk and impact assessment is provided in **Appendices 11B** and **11C** of this volume. It is considered that with proposed mitigation, risks identified to human health, controlled waters and property receptors during operation are assessed as very low to low. Compared to the existing baseline, the level of risk to receptors has generally remained the same or decreased. An overall negligible to minor beneficial effect is therefore anticipated which is classed as **not significant**.

Table 11.12: Operational phase effects for the proposed development

Receptor	Sensitivity/ Value	Baseline Risk	Operation Risk	Classification of Effect
Human (on-site)	High	Receptor not present/low	Low	Negligible (**not significant**).
Human (off-site)	High	Very low	Very low	Negligible (**not significant**).
Controlled	Medium	Low to	Low to very	Minor beneficial

Receptor	Sensitivity/ Value	Baseline Risk	Operation Risk	Classification of Effect
waters: groundwater (on-site and off-site)		moderate/low	low	(**not significant**).
Controlled waters: surface water (on-site and off-site)	Low	Low	Very low	Minor beneficial (**not significant**).
Property: existing and future structures and services (on-site and off-site)	Medium	Very low	Very low	Negligible (**not significant**).
Property: crops and livestock (on-site and off-site)	Medium	Very low to low	Low	Negligible to minor beneficial (**not significant**).

iv. Effects associated with waste soils and soil re-use

11.6.33 The proposed development may also generate limited waste soils during operation due to maintenance requirements which may include excavations for landscaping and for repairs or maintenance of services. The proposed development would also be operated in accordance with the relevant regulations, and best practice pollution prevention guidance. The impacts associated with waste soils and soils reuse during the operational phase are assessed to be temporary, short-term and indirect.

11.6.34 Given that there is less potential for soil reuse during the operation phase, the value/sensitivity of the receptor is classed as low**.** With the primary and tertiary mitigation measures, the magnitude of the impact is considered to be very low. The overall effect is therefore assessed to be negligible and classed as **not significant**.

v. Inter-relationship effects

11.6.35 This section provides a description of the identified inter-relationship effects that are anticipated to occur on geology and land quality receptors between the individual environmental effects arising from operation of the proposed development.

11.6.36 There are anticipated to be inter-relationship effects between geology and land quality, soils and agriculture, heritage, and groundwater and surface water in relation to potential receptors which could be impacted by ground contamination during the operation of the proposed development.

11.6.37 Potential impacts would include the contamination of sensitive/high value receptors such as good quality or BMV agricultural land, listed buildings, Principal Aquifers, WFD rivers and groundwater SPZs during operation. Operation of the proposed development may introduce new sources of contamination and new pathways for migration of contamination.

11.6.38 However, given the primary and tertiary mitigation measures proposed in relation to these disciplines as outlined in **section 11.5** of this chapter, it is not expected that the combined impact of these inter-relationship effects would be greater than those effects predicted for the geology and land quality assessment as presented within this chapter. Only minor adverse inter-project effects are anticipated, which are classified as **not significant**. Further details are provided in **Chapter 10** and **Chapter 12** of this volume.

d) Removal and reinstatement

i. Physical effects: Soil erosion

11.6.39 The removal and reinstatement phase may result in effects on soil erosion associated with the removal and reinstatement of structures, pad foundations, pavements, SuDS and earthworks including the reinstatement of subsoil/topsoil.

11.6.40 Earthworks are anticipated for the removal of the landscape bunds and reinstatement of the topsoil/subsoil across the site. There is the potential for increased surface water run-off with a high sediment load that is likely to impact local surface waters. Further details of impacts on surface waters are provided in **Chapter 12** of this volume. In accordance with the **CoCP**, and defined tertiary mitigation, earthworks would be planned to minimise soil exposure as far as practicable and would be managed to reduce soil erosion and dust production. The impacts on soil erosion during the removal and reinstatement phase are therefore considered to be temporary, short-term, and direct.

11.6.41 Given the proposed works, the primary and tertiary mitigation and that there are limited soil erosion hazards at the site, the value/sensitivity of the receptor is classed as low. With proposed mitigation, the magnitude of the impact are considered to be very low. The overall effects on soil erosion are considered to be negligible and classed as **not significant**.

ii. Mineral resources

11.6.42 Given that there are some mineral resources located within the study area but no plans to extract them, the value/sensitivity of the receptor is classed as low. The impacts on mineral resources during the removal and

reinstatement phase are considered to be temporary, short-term and direct. The magnitude of the impact is considered to be very low as there would be limited loss of regional mineral resources. Effects in relation to mineral resources would therefore be negligible, and are classed as **not significant**.

iii. Effects associated with ground contamination

11.6.43 The proposed development would be removed and reinstated to agricultural use. The removal and reinstatement impact assessment is undertaken by comparing the baseline land contamination risks to those predicted during removal and reinstatement, while considering any new sources and pollution pathways which may be introduced by removal and reinstatement activities.

11.6.44 A summary of the risks identified during the removal and reinstatement phase to the identified receptors and impact assessment is presented in **Table 11.13.** Further detail is provided in **Appendices 11B** and **11C** of this volume. The impacts on land contamination during the removal and reinstatement phase are considered to be permanent and direct.

11.6.45 With proposed mitigation incorporated into the design and effectively implemented during the removal and reinstatement phase, risks identified to human health, controlled waters, and property receptors are assessed as very low to moderate/low. Compared to the existing baseline, the level of risk to receptors during the removal and reinstatement phase has generally remained the same or increased. An overall negligible to minor adverse effect is therefore anticipated for on-site and off-site humans, surface waters and property which is classed as **not significant**. An overall minor to moderate adverse effect for groundwater is anticipated which is classed as **significant**.

Table 11.13: Removal and reinstatement phase effects for the proposed development

Receptor	Sensitivity/ Value	Baseline Risk	Removal and Reinstatement Risk	Classification of Effect
Human (on-site).	High	Receptor not present to low	Receptor not present to low	Negligible to minor adverse (**not significant**).
Human (off-site)	High	Very low	Low	Minor adverse (**not significant**).
Controlled waters: groundwater	Medium	Low to Moderate/low	Moderate/low to moderate	Minor (**not significant**) to moderate adverse

Receptor	Sensitivity/ Value	Baseline Risk	Removal and Reinstatement Risk	Classification of Effect
(on-site and off-site)				(**significant**).
Controlled waters: surface water (on-site and off-site)	Low	Low	Moderate/low	Minor adverse (**not significant**).
Property: existing and future structures and services (on-site and off-site)	Medium	Very low	Low	Minor adverse (**not significant**).
Property: crops and livestock (on-site and off-site)	Medium	Very low to low	Low	Minor adverse (**not significant**).

iv. Effects associated with waste soils and soil re-use

11.6.46 Waste soils would be generated during removal and reinstatement through excavation and the removal of pad foundations, SuDS, utilities/services. There is the potential that waste soil generated from the earthworks is classified as unsuitable for reuse on-site or as hazardous, requiring removal from the site. Waste soils would be dealt with in accordance with the **Waste Management Strategy** presented in **Appendix 8A** of **Volume 2** of the **ES**.

11.6.47 Soils would be managed as part of the proposed primary and tertiary mitigation for the removal and reinstatement works through an **MMP** to allow the re-use of suitable soils during the removal and reinstatement phase of the proposed development. Therefore, the impacts on waste soils and soil re-use during the removal and reinstatement phase are considered to be temporary, short-term and direct.

11.6.48 The value/sensitivity is classed as medium. With the primary and tertiary mitigation measures, the magnitude of the impact is considered to be low. The overall effect is therefore considered to be minor adverse and classed as **not significant**.

v. Inter-relationship effects

11.6.49 This section provides a description of the identified inter-relationship effects that are anticipated to occur on geology and land quality receptors between the individual environmental effects arising from operation of the proposed development.

11.6.50 There are anticipated to be inter-relationship effects between geology and land quality soils and agriculture, heritage and groundwater and surface water in relation to potential receptors which could be impacted by ground contamination during the removal and reinstatement of the proposed development.

11.6.51 Potential impacts would include the contamination of sensitive/high value receptors such as good quality or BMV agricultural land, listed buildings, Principal Aquifers, WFD rivers and groundwater SPZs during construction works. Removal and reinstatement activities may introduce new sources of contamination, new pathways for migration of contamination and disturb and mobilise existing sources of contamination.

11.6.52 However, given the primary and tertiary mitigation measures proposed in relation to these disciplines as outlined in **section 11.5**, it is not expected that the combined impact of these inter-relationship effects would be greater than those effects predicted for the geology and land quality assessment presented within this chapter. Only minor adverse inter-relationship effects are anticipated, which are classified as **not significant**. Further details are provided in **Chapter 10** and **Chapter 12** of this volume.

11.7 Mitigation and monitoring

a) Introduction

11.7.1 Primary and tertiary mitigation measures which have been accounted for as part of the assessment are summarised in **section 11.5** of this chapter. Where further mitigation is required this is referred to as secondary mitigation, and where reasonably practicable, secondary mitigation measures have been proposed.

11.7.2 This section describes the proposed secondary mitigation measures for geology and land quality as well as describing any monitoring required of specific receptors/resources or for the effectiveness of a mitigation measure.

b) Mitigation

11.7.3 A ground investigation would be undertaken to define the contamination profile on-site, the risk to groundwater and inform the detailed design of the proposed development, contamination status and other ground related risks. This would be completed prior to the commencement of construction works.

11.7.4 The ground investigation would include chemical testing of the soil mounds around the former sand pit to either confirm that the materials can be re-used on-site or inform the disposal route. The investigation would also target the groundwater to determine the depth to groundwater and the quality of the groundwater. Where the ground investigation and subsequent generic risk assessments identify unacceptable levels of contamination within the soil and/or groundwater and ground related risks, further detailed quantitative risk assessment followed by, where necessary, the remediation of soil and groundwater contamination prior to construction may be required. The removal of the intermediate bulk containers, and other containers would also be undertaken prior to construction works.

11.7.5 Intrusive ground investigation would also be undertaken post operation of the development as part of the removal and reinstatement phase. This ground investigation would confirm the ground conditions, contamination status and other ground related risks at the site following the operational phase. Remediation of soil or ground contamination would be undertaken if deemed necessary.

c) Monitoring

11.7.6 A programme of short-term gas and groundwater monitoring would be designed as part of the ground investigation, and would be required prior to construction works commencing. The results of this short-term monitoring would determine whether further long-term gas and groundwater monitoring is required during construction and operational phases.

11.8 Residual effects

11.8.1 **Tables 11.14-16** present a summary of the geology and land quality assessment. They identify the receptor(s) likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect.

Table 11.14: Summary of effects for the construction phase

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Secondary Mitigation	Residual Effects
Geology	Soil erosion	Health and safety risk assessments, method statements and appropriate PPE for the protection of construction workers. Implementation of measures in the **CoCP** (Doc Ref. 8.11) during construction works. Design and selection of construction materials in accordance with best practice.	Negligible	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	Negligible (**not significant**).
Mineral resources	Loss or destruction		Negligible		Negligible (**not significant**).
Human	Contamination from on-site and off-site sources		Negligible to minor adverse		Negligible to minor beneficial (**not significant**).
Controlled waters (groundwater)	Contamination from on-site and off-site sources		Minor to moderate adverse		Minor beneficial (**not significant**).
Controlled waters (surface water)	Contamination from on-site and off-site sources		Minor adverse		Minor beneficial (**not significant**).
Property (existing and future structures and services)	Contamination from on-site and off-site sources		Minor adverse		Negligible (**not significant**).
Property (crops and livestock)	Contamination from on-site and off-site sources		Minor adverse		Minor beneficial (**not significant**).
Soils	Impacts from waste generated during construction works		Minor adverse		Minor adverse (**not significant**).

Table 11.15: Summary of effects for the operational phase

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Secondary Mitigation	Residual Effects
Geology	Soil erosion	Use spill response kits	Negligible	Longer term gas and	Negligible (**not**

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Secondary Mitigation	Residual Effects
		and adequate staff training. Use of hardstanding to reduce impact from spills and leaks. Incorporation of bypass separators within the drainage design where considered necessary. The use of appropriate SuDS schemes. The use of grid connections where possible. Appropriate storage and disposal of chemicals, oils, fuels, materials and wastes in accordance with current guidance		groundwater monitoring if necessary.	**significant**).
Mineral resources	Loss or destruction		Minor adverse		Minor adverse (**not significant**).
Human	Contamination from on-site and off-site sources		Negligible		Negligible (**not significant**).
Controlled waters (groundwater)	Contamination from on-site and off-site sources		Minor beneficial		Minor beneficial (**not significant**).
Controlled waters (surface water)	Contamination from on-site and off-site sources		Minor beneficial		Minor beneficial (**not significant**).
Property (existing and future structures and services)	Contamination from on-site and off-site sources		Negligible		Negligible (**not significant**).
Property (crops and livestock)	Contamination from on-site and off-site sources		Negligible to minor beneficial		Negligible to minor beneficial (**not significant**).
Soils	Impacts from waste generated during operation		Negligible		Negligible (**not significant**).

Table 11.16: Summary of effects for the removal and reinstatement phase

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Secondary Mitigation	Residual Effects
Geology	Soil erosion	Implementation of measures in the **CoCP**. Health and safety risk assessments,	Negligible	Further ground investigation and risk assessment post operation to confirm the	Negligible **(not significant**).
Mineral resources	Loss or destruction		Negligible		Negligible (**not significant**).

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Secondary Mitigation	Residual Effects
Human	Contamination from on-site and off-site sources	method statements, and appropriate PPE for the protection of construction workers.	Negligible to minor adverse	risks at the time of removal and reinstatement and identify areas requiring further remediation. Remediation of soil and groundwater due to incident occurring during the operational phase if necessary.	Negligible to minor beneficial (**not significant**).
Controlled waters (groundwater)	Contamination from on-site and off-site sources		Minor to moderate adverse		Minor beneficial **(not significant**).
Controlled waters (surface water)	Contamination from on-site and off-site sources		Minor adverse		Minor beneficial (**not significant**).
Property (existing and future structures and services)	Contamination from on-site and off-site sources		Minor adverse		Negligible (**not significant**).
Property (crops and livestock)	Contamination from on-site and off-site sources		Minor adverse		Negligible (**not significant**).
Soils	Impacts from waste generated during operation		Minor adverse		Minor adverse (**not significant**).

References

11.1 Department for Communities and Local Government. Environmental Impact Assessment: A Guide to Good Practice and Procedures. A Consultation Paper (DCLG). 2006.

11.2 Department of Energy and Climate Change. Overarching National Policy Statement for Energy (EN-1). London: The Stationery Office. 2011.

11.3 Department of Energy and Climate Change. National Policy Statement for Nuclear Power Generation (EN-6). London: The Stationery Office. 2011.

11.4 MHCLG (2019) National Planning Policy Framework https://www.gov.uk/government/publications/national-planning-policy-framework--2 [Accessed July 2019].

11.5 MHCLG (2019) Planning Practice Guidance https://www.gov.uk/government/collections/planning-practice-guidance [Accessed July 2019].

11.6 DEFRA (2018) Government's 25 Year Environment Plan. https://www.gov.uk/government/publications/25-year-environment-plan [Accessed July 2019]

11.7 ESC (2013) Suffolk Coastal District Council Core Strategy and Development Management Policies. https://www.eastsuffolk.gov.uk/planning/local-plans/suffolk-coastal-local-plan/existing-local-plan/core-strategy-and-development-management-policies/ [Accessed July 2019].

11.8 ESC (2019) Suffolk Coastal District Council Final Draft Local Plan https://www.eastsuffolk.gov.uk/planning/local-plans/suffolk-coastal-local-plan/local-plan-review/final-draft-local-plan/ [Accessed July 2019].

11.9 Department for Environment, Food and Rural Affairs. Environmental Protection Act: Part 2A Contaminated land Statutory Guidance. 2012.

11.10 Department for Environment, Food and Rural Affairs and Environment Agency. Contaminated Land Report (CLR) 11: Model Procedures for the Management of Land Contamination. 2012.

11.11 Environment Agency. GPLC1 – Guiding Principles for Land Contamination. March 2010.

11.12 CL:AIRE. The Definition of Waste: Development Industry Code of Practice. March 2011.

11.13 Highways England, "Design Manual for Roads and Bridges. Volume 11, Section 2, Part 5 Assessment and Management of Environmental Effects," August 2008.

11.14 Highways England, "Design Manual for Roads and Bridges. Volume 11, Section 3, Part 11 Geology and Soils," June 1993.

11.15 Environment Agency, "Department of the Environment (DoE) – Industry Profiles for previously developed land," 1995.

11.16 Construction Industry Research and Information Association, "C552 – Contaminated Land Risk Assessment – A Guide to Good Practice," 2001.

11.17 NHBC and Environment Agency, R&D Publication 66 - Guidance for the Safe Development of Housing on Land Affected by Contamination, 2008.

11.18 CIRIA, "C665 – Assessing Risks Posed by Hazardous Ground Gases to Buildings," 2007.

11.19 British Standards, "BS 8485 - Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings," 2015.

11.20 CIRIA, "C681 – Unexploded Ordnance – A Guide for the Construction Industry," 2009.

11.21 CIRIA, "C733 - Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks," 2014.

11.22 CIRIA, "C682 – The Volatile Organic Contaminants Handbook," 2009.

11.23 British Standards, "BS 5930 – Code of practice for ground investigations," 2015.

11.24 British Standards, "BS10175:2011+A2:2017 – Code of Practice for Investigation of Potentially Contaminated Sites," 2013.

11.25 British Geological Society. GeoIndex – Map Index to British Geological Survey (BGS) data website. (Online) Available from: http://www.bgs.ac.uk/GeoIndex/ [Accessed July 2019].

11.26 Suffolk County Council. Suffolk Minerals Local Plan. (Online). Available from: http://www.suffolk.gov.uk/environment-and-transport/planning-and-buildings/Minerals-and-Waste-Planning/suffolk-minerals-local-plan/ [Accessed July 2019].

11.27 Suffolk Biodiversity Information Service. (Online). Available from: https://www.suffolkbis.org.uk/suffolk-sites [Accessed July 2019].

11.28 Department for Environment, Food and Rural Affairs. Multi-Agency Geographic Information for the Countryside (MAGIC) website. (Online). Available from: http://magic.defra.gov.uk/Login.aspx?ReturnUrl=%2fMagicMap.aspx [Accessed July 2019].

11.29 Environment Agency. What's In Your Backyard website11. 2016. (Online) Available from: http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e [Accessed August 2016].

11.30 Yell.(Online). Available from: https://www.yell.com/ [Accessed July 2019].

11.31 Zetica. Unexploded Bomb Risk Maps.(Online). Available from: http://www.zetica.com/uxb_downloads.htm [Accessed July 2019].

[11] Information was obtained from the Environment Agency's 'What's in Your Backyard' website in 2016 and has been used to inform the baseline assessment. It is noted that the website is no longer in use, but the data is still considered valid for the purposes of the assessment and has been updated where applicable with current data from other sources.