

11 GROUND CONDITIONS

11.1 Introduction

11.1.1 This chapter considers the potential significant effects from ground conditions (land instability) and disturbance of potentially contaminated ground during the construction, operation and decommissioning of the proposed development. It considers potential effects from contamination and ground conditions on human health and the environment including controlled waters, as well as the effects of potentially contaminated ground or groundwater, and land stability on the proposed development.

11.1.2 This Chapter has been prepared by RPS Consulting Services Ltd (RPS).

11.1.3 This chapter (and its associated figures and appendices) is not intended to be read as a standalone assessment and reference should be made to Chapter 1 to 5 at the start of the ES, as well as Chapter 21: Summary of Effects and Cumulative Effects.

11.1.4 This chapter should also be read in conjunction with Chapter 17: Soils and Agriculture.

11.2 Methodology

11.2.1 This chapter presents the following:

- Relevant planning legislation, policy and guidance pertaining to ground and groundwater contamination and land instability;
- Information sources;
- Details of consultation;
- Methodology behind the assessment of effects, including the criteria for the determination of sensitivity of receptor and magnitude of change from the existing baseline environment;
- Explanation as to how the conclusions on potential effects have been reached; and
- Significance criteria and terminology for the assessment land instability residual effects.

Planning Policy Context

11.2.2 The UK planning approach to the management of land contamination and land stability is risk-based, as set out in the December 2023 National Planning Policy Framework (NPPF). The NPPF states that planning policies and decisions should

ensure that:

“a site is suitable for its proposed use taking account of Ground Conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation)”. – Paragraph 189.

- 11.2.3 The NPPF gives Local Authorities the power to determine the requirement for assessment and remediation of sites during the planning process.
- 11.2.4 The minimum planning requirement of a desk study, including a site walkover, and potentially a ground investigation should be carried out in accordance with BS10175 (2011) ‘Code of Practice for the Investigation of Potentially Contaminated Sites’. Furthermore, in determining applications the Local Planning Authority (LPA) will need to be satisfied that the development does not create or allow the continuation of unacceptable risk arising from the conditions of the land in question or from adjoining land.
- 11.2.5 In particular, it should demonstrate that existing significant pollutant linkages will be broken by removing the source, pathway or receptor(s) and that the development will not create any new pollutant linkages by changing or creating exposure pathways, (e.g., creating new pathways to groundwater by site investigation drilling or piling). As a minimum, the development should not be capable of determination as contaminated land under Part 2A of the Environment Protection Act (EPA) 1990.

Relevant Legislation, Regulations and Guidance

- 11.2.6 The methodology employed in assessing and evaluating the project has had regard to the following legislation:
- Contaminated Land (England) (Amendment) Regulations 2012;
 - Part 2A of the Environmental Protection Act 1990, as amended by the Environment Act 1995;
 - DEFRA Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (2012);
 - Environment Agency (2020) Land Contamination: Risk Management (LCRM 2020);
 - The Environmental Damage (Prevention and Remediation) Regulations 2015;
 - Water Resources Act (1991) (Amendment) (England and Wales) Regulations 2009

- Water Act (2003);
- Water Framework Directive (2000/60/EC);
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 and
- Infrastructure EIA Regulations 2017 (as amended).

11.2.7 The Environmental Protection Act (1990) includes contaminated land legislation, which is principally contained within Part 2A of the Act. This sets out a scheme for the identification of contaminated land and for the enforcement of remediation. This is considered to be the principal test for assessing the significance of soil/groundwater contamination in relation to environmental receptors. The Act provides a framework for the identification of statutory 'Contaminated Land' and where necessary, its remediation. The approach is based upon the principles of risk assessment, using the concept of a contaminant, a receptor and a pathway, which combine to form a pollutant linkage. The presence of a significant pollutant linkage forms the basis of a formal determination that land is contaminated.

11.2.8 The Environmental Protection Act provides the statutory definition of 'Contaminated Land' for the purposes of determining land where remedial action is required, this is as follows:

"Contaminated Land is any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that: Significant harm is being caused or there is a significant possibility of such harm being caused; or Pollution of controlled waters is being, or is likely to be, caused."

11.2.9 'Significant harm' is defined in the guidance according to risk-based criteria and must be the result of 'contaminant linkages'. Such linkages can be assessed using a qualitative and/or quantitative risk assessment that addresses the identification of:

- Contaminant sources;
- Sensitive receptors; and
- Migration pathways linking the potential contaminant source(s) to the sensitive receptor(s).

11.2.10 All three of the above must be present to complete the pollutant linkage and for a potentially significant risk to exist. As such, the presence of contamination in itself

does not necessarily indicate a need for remedial action. Accordingly, a site can only be considered 'contaminated' when a risk to the environment or human health is present due to the presence of 'contaminant-receptor-pathway' linkage. In such circumstances and where there is a significant risk post to human health and/or the environment, the above Acts state that Local Planning Authorities (LPAs) must adopt a 'suitable for use' approach. This means that the degree of site contamination remediation is dictated by the site's proposed end use.

11.2.11 Part 2A is implemented by the Contaminated Land (England) Regulations 2006 and the Contaminated Land (England) (Amendment) Regulations 2012. Supporting Contaminated Land Statutory Guidance was issued by DEFRA in April 2012.

11.2.12 The Water Resources Act (1991 and as amended 2009) introduced the definition of controlled waters and outlined measures that should be undertaken to protect water resources. The Act also details the responsibilities of the Environment Agency in relation to water pollution, resource management and flood defence.

11.2.13 The Groundwater (England and Wales) Regulations (2009) supplements existing regulations to protect groundwater in England and Wales. These regulations control groundwater pollution from contaminated land. The regulations provide a more flexible, risk-based approach than previous legislation and cover a wider range of substances.

11.2.14 The European Water Framework Directive came into force in December 2000 and became part of UK law in December 2003. The Directive aims to protect and enhance the quality of:

- Surface freshwater (including lakes, streams and rivers);
- Groundwater;
- Groundwater dependant ecosystems;
- Estuaries; and
- Coastal Waters out to one mile from low-water.

11.2.15 Where appropriate the assessment has also had regard to the following guidance documents:

- CIRIA 552: Contaminated Land Risk Assessment, A guide to good practice (CIRIA, 2001);
- Environment Agency (2020) Land Contaminated: Risk Management (LCRM 2020);

- British Standard requirements for the ‘Investigation of potentially contaminated sites – Code of practice’ (ref. BS10175:2011); and,
- National Planning Policy Framework (2023).

Local Planning Policy and Guidance

11.2.16 The Sunderland City Council Local Development Scheme July 2020 outlines the planning strategy for Sunderland. The Local Plan outlines the current development plan for Sunderland as:

- Core Strategy and Development Plan 2015-2033 (adopted January 2020);
- International Advanced Manufacturing Park (IAMP) Area Action Plan (AAP) (adopted November 2017); and
- Saved policies of the Unitary Development Plan (adopted 1998) and Unitary Development Plan Alteration No.2 (2007).

11.2.17 The new local plan is prepared in the following three separate parts:

- Part One – Core Strategy and Development Plan (Hereafter referred to as the CSDP); which sets out an overarching strategy for future change and growth in the city and includes detailed development management policies. It is a strategic Plan which covers the period 2015 to 2033. The CSDP covers the whole of the area within Sunderland’s administrative boundaries.
- Part Two – Allocations and Designations Plan (A&D Plan); which will set out site-specific policies for the development, protection and conservation of land in the city in order to deliver the overall strategy set out within the CSDP. The A&D Plan will replace the remaining saved UDP and UDP Alteration No.2 policies.
- Part Three – International Advanced Manufacturing Park (IAMP) Area Action Plan (AAP); allocates land for the comprehensive development of an advanced employment park to the north of the existing Nissan complex. Due to the cross-boundary location of the site, the AAP was prepared jointly with South Tyneside Council.

11.2.18 The site is located within the IAMP area and there this part of the planning policy is relevant to the site. The IAMP APP was adopted by Sunderland Council on 30 November 2017. A review in October 2022 concluded that the policies of the AAP remain effective and consistent with national policy.

11.2.19 Guidance on the development on contaminated land is given on Sunderland City

Council website¹. This makes reference to the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG) 'Planning guidance development on land affected by contamination' (YALPAG – Version 9.2 March 2018), which sets out a phased approach to the assessment of contaminated land in line with other statutory guidance. The document states that each phase should be submitted to, and approved by, the LPA before proceeding to the next phase.

Study area

11.2.20 The study area for the proposed development area has been refined through the tiered risk assessment approach undertaken and is based upon the determination and subsequent assessment of the environmental (geological, hydrogeological and hydrological) setting, and determination of both likely receptors and likely pathways. Identifying a defined and delineated study area for consideration within land and water quality assessments is limited by the inherent variability of the pathways considered and the potential for such pathways to link sources and receptors. The study areas are further defined at each stage of assessment and are presented within each of the baseline reports. Where historical land uses were assessed the areas immediately adjacent to the site were also considered (approximate radius of 100m from the site perimeter).

Baseline methodology

11.2.21 Certain ground conditions can be a cause of land instability, either as a result of natural processes or as a result of historical anthropogenic activities (such as mining or excavation) resulting in landslides or slips, soil creep, and ground compression.

11.2.22 The presence of contamination in land can present risks to human health and the environment, which adversely affect or restrict the beneficial use of land. Without appropriate mitigation, the presence of substances with potential to cause harm to human health, property and the wider environment may severely limit or altogether preclude development and the beneficial use of land.

11.2.23 To assess the potential effects related to ground contamination and ground condition, qualitative risk assessments have been carried out utilising a Conceptual Site Model to identify 'source-pathway-receptor' linkages for each of the following:

¹ At <https://www.sunderland.gov.uk/article/13494/Development-on-contaminated-land>.

- Baseline Conditions - based on the current sources, pathways and receptors and an assessment of the current risks related to ground contamination;
- Construction Phase - assessing the changes to sources, pathways and receptors and the consequent risks related to ground contamination during the construction of the Proposed Scheme; and
- Completed Development Phase – assessing the changes to sources, pathways and receptors and the consequent risks related to ground contamination associated with the use of the Proposed Scheme.

11.2.24 Each Conceptual Site Model (for baseline, construction phase and operational phase) considers:

- The principal pollutant hazards (the contamination sources) and land instability hazards;
- The principal pathways between the identified hazard(s) and receptor(s); and
- The principal receptor(s) at risk from the identified hazards, for example, people, environmental assets, surface or groundwater, and the development and associated infrastructure.

11.2.25 The qualitative risk is determined by the interrelationship between the potential for a source of contamination to be present, the potential for migration of the contaminant along a given pathway and the significance of potential receptors. A pollutant linkage is identified where all three elements (source-pathway-receptor) are present.

11.2.26 Assessment of the ground conditions at the Project Site has been undertaken by following a tiered approach as recommended within the industry guidance as set out above, which involves:

- Tier 1 – a qualitative assessment of historical and published information, together with a site reconnaissance, undertaken in order to develop a preliminary conceptual site model and inform a preliminary risk assessment;
- Tier 2 – an assessment of ground condition data using published generic assessment criteria to screen the site and establish whether there are actual or potential unacceptable risks; and (if required)
- Tier 3 - detailed - a quantitative assessment involving the generation of site-specific assessment criteria (SSAC).

11.2.27 To inform this Environmental Statement, a Tier 1 assessment has been undertaken as

part of a Phase 1 Geo-environmental Desk Study and Preliminary Risk Assessment carried out by RPS and is provided as Appendix 11.1. This report has been used to inform the baseline conditions and should be consulted for further detailed description.

11.2.28 The report describes the types and locations of:

- Potential Sources of Contamination (PSCs), based on identification of current and historic land use; and
- Potential Geological Hazards (PGHs), (such as ground stability that may result from artificial and natural cavities, and foundation conditions that may be affected by compressibility, shrinkage/swelling of clay stratum, groundwater and drainage).

11.2.29 The report also identifies the type and sensitivity of potential receptors (including consideration of human health, buildings, groundwater, surface water and ecological systems) and identification of possible migration or transportation pathways.

11.2.30 The assessment of ground conditions has involved the review of available information to define baseline conditions for the site in the context of the proposed development. Baseline conditions identify the geological setting of the site, potential contamination issues at the site as well as identification of historical/current land instability in the area.

11.2.31 The baseline conditions are firstly supported by the following publicly available information from a range of sources, including published data sources, and consultation with relevant organisations.

11.2.32 The desk-based appraisals are based upon available information in relation to the ground conditions at the site, obtained through published environmental and geological data from various sources including the Environment Agency, Groundsure/Envirocheck reports and the British Geological Survey (BSG).

11.2.33 A Tier 2 assessment will be undertaken as part of proposed Phase 2 ground Investigations to be undertaken at the site with the requirement for a Tier 3 assessment to be identified following the completion of the Tier 2 Assessment. The results of the Tier 1 assessment form the basis for the baseline conditions and assessment of effects within this ES chapter.

Consultation

11.2.34 Following the completion of a Phase 2 Ground investigation and Tier 2 risk assessment,

an outline remediation strategy will be prepared if required, and both the Environment Agency and relevant authorities LPA will be consulted for comment and agreement prior to implementation of the construction works.

Assessment Criteria and Assignment of Significance

11.2.35 The following section describes the approach taken to identifying the magnitude of an impact and the sensitivity/value of the receptor. The definitions used for sensitivity and magnitude are presented in Table 11.1 and Table 11.2 below and are based on professional judgement.

Table 11.1: Definitions of Sensitivity or Value			
Sensitivity	Built Environment	Human Health	Controlled Waters
Very High	Residential, commercial, education and employment development, motorways and A roads, mainline railway line, power transmission lines (grid), gas/oil pipelines	High density development, places where children may be present. Residential areas. Construction workers	Attribute with a very high quality and rarity on a regional to international scale with very limited potential for substitution. Examples include: Principal Aquifer providing potable water to a large population.
High	Dual carriageway, B roads, branch line railway, power distribution lines (local)	Moderate density development.	Attribute with a high quality and rarity on a local scale with limited potential for substitution, or attribute with a medium quality or rarity on a regional to national scale with limited potential for substitution. Examples include Aquifer providing potable water to a small population and/or large resource potential or Regionally Important Geological/Geomorphological Sites (RIGS)
Medium	Local services and C roads only.	Low density development. Public Open Space.	Attribute with a medium quality and rarity on a local scale with limited potential for substitution, or attribute with a low quality and rarity on a regional to national scale with limited potential for substitution. Examples include: Secondary aquifer unit supporting abstraction for agricultural or industrial use and/or moderate resource potential or Non-designated geological exposures important at a regional or local scale
Low	Non-permanent structures.	Limited access.	Attribute with a low quality and rarity on a local scale with limited potential for substitution. Examples include: Unproductive strata (Aquifer designation) previously disturbed land or non designated geological exposures important at a very local scale; abandoned quarries and mining activities

Table 11.1: Definitions of Sensitivity or Value			
Sensitivity	Built Environment	Human Health	Controlled Waters
Negligible	None.	Unoccupied land.	Attribute with very low importance and rarity at the local scale. Examples include non-aquifer unit that does not afford protection to underlying water bearing units;

Table 11.2: Definitions of Magnitude	
Sensitivity	Typical Descriptors
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

11.2.36 The assessment of significance is based on the following matrix.

Table 11.3: Significance Matrix					
Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

11.2.37 The broad definitions of the terms used should align with the following:

- **Substantial:** Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact

and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.

- **Major:** These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
- **Moderate:** These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
- **Minor:** These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
- **Negligible:** No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Limitation of the Assessment

11.2.38 The baseline data set out in this assessment are based on the information collated and assessed as part of the RPS Phase 1 Geo-environmental Desk Study and Preliminary Risk Assessment (see Appendix 11.1). Assumptions and limitations relevant to this assessment are as follows:

- This chapter is based on available factual and interpretative data for the site obtained from the sources described in the text and related to the site.
- The accuracy of maps cannot be guaranteed, and it should be recognised that different conditions on the site may have existed between, and subsequent to, the various map surveys.
- Any borehole data from British Geological Survey sources is included on the basis that 'The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation'.
- Where any data supplied by other sources, it has been assumed that the information is correct. No responsibility can be accepted by RPS for inaccuracies in the data supplied by any other party.

11.2.39 Notwithstanding the above, a moderate to high level of certainty has been applied to the baseline and assessment presented in this chapter. The information which was available is considered sufficient to establish a baseline for the purposes of the EIA.

Therefore, there are no data limitations that affect the robustness of the conclusions of this assessment.

11.3 Baseline conditions

11.3.1 Baseline conditions of the site are detailed in the RPS Phase 1 Geo-environmental Desk Study and Preliminary Risk Assessment (see Appendix 11.1) and a summary is provided in the following sections.

11.3.2 The BGS mapping (1:50,000-scale) indicates that the stratigraphic sequence beneath the site comprises topsoil / subsoil over superficial deposits relating to Alluvium in the north, Pelaw Clay Member, Tyne and Wear Complex and Glacial Till. The underlying Bedrock consists of the Pennine Middle Coal Measures Formation.

11.3.3 Two faults are mapped, both trending southeast to northwest. The western fault extends across the site beneath the former West Moor Farm, whereas the eastern fault is indicated to terminate 200m west of North Moor Farm.

11.3.4 Made Ground is unlikely to be present across most of the site, however localised pockets were identified previously at West Moor Farm and may be present elsewhere, particularly at North Moor Farm associated with the previous construction and demolition of farm buildings, as well as along access tracks and drainage features.

11.3.5 Environment Agency Groundwater Vulnerability mapping (1:100,000-scale) identifies the Pelaw Clay Member, and the underlying Glacial Till as Unproductive Strata and the Alluvium and Pennine Middle Coal Measures as Secondary A Aquifers.

11.3.6 According to Environment Agency data, the site is not located in a groundwater Source Protection Zone (SPZ).

11.3.7 The Interactive Map Viewer on the Coal Authority website indicates that the site is located in a coal mining reporting area, however, is not located in a Development High Risk Area. The site is located in an area where underground coal working is known to have occurred, however the depth to worked seams recorded on the interactive map viewer is between 350 and 450m bgl. The last recorded worked date beneath the site is recorded as 1974. There are no recorded mine entries on or near the site.

11.3.8 There nearest surface water course is the River Don, located 174m to the north of the site.

11.3.9 Historically, the site is indicated to have been occupied by two farms, North Moor Farm in the north, and part of West Moor Farm in the south since earliest mapping.

Both farms have undergone phases of redevelopment over their history. A pond appears to have been infilled in the early 20th century near to North Moor Farm. West Moor Farm was demolished to make way for the development of Giga 1.

- 11.3.10 Current use of the site for construction activities, and historical use of the site for agricultural purposes with associated farm buildings is unlikely to have resulted in significant widespread contamination of soil and groundwater. There is, however, the potential for localised contamination, particularly in the area of the farm buildings, associated with the current and historical storage of materials, vehicles and plant (i.e. fuels, oils, pesticides/herbicide, etc).
- 11.3.11 Made Ground may be present in some areas of the site, particularly in the area of the farm buildings and any area of land raising/ infilling. Where present this could represent a potential source of contaminants and / or ground gas. Potential contaminants could include in metals, asbestos, hydrocarbons, inorganic compounds, volatile organic compounds.
- 11.3.12 There is the limited potential for contaminants of concern (if present) beneath the site to migrate on or off-site via granular horizons of the Made Ground (if present) and the superficial deposits. These may impact controlled waters receptors or on/off-site human health receptors via the dermal contact, ingestion and vapour inhalation pathways. Drainage ditches across the site may act as pathways to the tributary of the River Don located at the northern boundary of the site.
- 11.3.13 There is a limited potential for ground gas and volatile contaminants to be present on site in localised areas such as the area of the farm buildings and any areas of filled ground, historical tipping, etc. In these areas there could potentially be a risk to future site users associated with the gas / vapour inhalation pathway in indoor areas.
- 11.3.14 The naturally occurring ground conditions at the site are anticipated to comprise variable thicknesses of superficial deposits, including localised Alluvium restricted to the north and east of the site area, the Pelaw Clay Member, Laminated Clay and Glacial Till, which in turn are underlain by Pennine Middle Coal Measures Formation. The precise thickness of each of those deposits and the variable nature of the Pennine Coal Measures formation is currently undetermined on the Plot 2 area.
- 11.3.15 The Made Ground and Alluvium on site are likely to be of low strength, high compressibility and susceptible to volume change and as such would comprise an unsuitable bearing stratum for shallow foundations.

11.3.16 The Pelaw Clay and underlying Laminated Clay and Glacial Till may have been subject to periglacial activity and may contain relic failure planes, which will need further assessment in relation to engineering within this stratum. Whilst no significant slopes are present on site, any temporary slopes created as part of the development should be subject to appropriate geotechnical design based on site-specific site investigation information.

Future Baseline Conditions

11.3.17 Assuming there is no development at or in the vicinity of the site that introduces new sources of potential contaminants of concern to the site, it is anticipated that there will be no change to baseline conditions at the site in the future, on the basis that risks from any new potential contamination sources are suitably mitigated in accordance with the requirements of the relevant environmental and construction legislation.

11.4 Assessment of effects

Construction effects

11.4.1 The site will be subject to a nominal cut and fill exercise to provide a flat development platform across the site. The cut and fill will involve the stripping of the topsoil and soils from across development area of the site. Small retaining structures are understood to be proposed in the north of the site to minimise the cut and fill exercise to beneath the development platform, only.

11.4.2 Based on the assessed qualitative risks, the potential effects of the Development related to ground contamination during the construction of the proposed development are discussed in this section with respect to the identified potential receptors.

11.4.3 Site Workers - Given the potential for contamination to be present on the site is considered to be low, the potential effect on site workers is, in general, considered to be Negligible. The exception relates to any as yet undetermined and likely relatively limited number of localised and discrete sources of contamination presenting a low risk. Considering the length of time site workers are likely to be on any such areas of the Site, the potential effect on site workers associated with any ground contamination in these areas is expected to be Minor Adverse which is Not Significant.

11.4.4 OffSite Users – Given the very low potential for contamination to be present on the Site, and the potential for generating dust, the potential effect on offsite site users/neighbours is considered to be Minor Adverse which is Not Significant.

- 11.4.5 Controlled Water – It is understood that a piled foundation solution is likely to be required to facilitate the development of the new structures. Prior to this the potential risks associated with any potential existing contamination and the chosen piling technique will be assessed in detail as part of a Piling Risk Assessment, if applicable, to protect the underlying groundwater. This assessment will consider the potential for the creation of preferential pollutant linkages and make recommendations relating to the chosen piling technique and the adoption of supplementary mitigation measures necessary to manage and control the risks to acceptable levels. This will be undertaken in consultation with the LPA.
- 11.4.6 The Phase 1 Preliminary Risk Assessment undertaken for the site has not identified the potential for significant widespread contamination and ground gas generation, there is the potential for localised contamination and Made Ground to exist, particularly in the vicinity of the North Moor farm buildings.
- 11.4.7 Further localised investigation will be undertaken at the site to further clarify the risks associated with potential contamination. If the site investigation identifies the presence of potentially significant contamination or ground gases further investigation, monitoring, risk assessment and remediation may be necessary and would be subject to regulatory approval.
- 11.4.8 In summary, the purpose of the aforementioned Piling Risk Assessment, Construction Environmental Monitoring Plan, and Remediation Method Statement (if required, subject to further investigation) is to control and mitigate potential environmental effects during the construction phase. It is assumed that these documents would be implemented effectively and therefore no significant construction phase effects associated with ground conditions are anticipated. The magnitude of impacts potentially arising during the construction phase associated with ground conditions is therefore considered to be negligible and consequently the significance of the effect is likely to be Minor Adverse, which is Not Significant.
- 11.4.9 If any significant contamination is encountered during the construction phase, this will be fully investigated, a risk assessment will be undertaken and, if necessary, remediation will be undertaken/mitigation provided in consultation with the LPA.
- 11.4.10 Ecology and Wildlife - Given the potential for migration of localised contaminants is limited given the largely relatively impermeable underlying geology; the potential effect on the ecology and wildlife in the vicinity of the Site is considered to be Negligible, which is Not Significant.

11.4.11 No future monitoring is likely to be required once the proposed development is operation.

Operational effects

11.4.12 The final development area of the site will largely be covered with low permeability hardstanding and building cover. Any impacts which may have occurred during the construction phase would have been mitigated through a staged process of ground investigation and assessment with any remedial measures having been implemented prior to operation.

11.4.13 Based on the assessed qualitative risks, the potential effects of the Development related to ground contamination during the occupation and use of the Development once completed are discussed in this section with respect to the identified potential sensitive receptors.

11.4.14 Onsite users/maintenance workers - Given the potential for contamination to be present on the Site is typically low, the potential effect on site workers is, in general, considered to be Negligible. The exception relates to the relatively limited number of localised and discrete sources of contamination presenting a low risk, and considering the number and length of time they are likely to be on this area of the Site, it is considered that the effect to soil and groundwater during the operational phase will be Negligible to Minor Beneficial based on the surface cover provided by the development, which is Not Significant.

11.4.15 Offsite Site Users / Neighbours - Given the low potential for contamination to be present on the Site, and the limited potential for generating dust, the potential effect on offsite site users/neighbours is considered to be Negligible. Should uncontrolled spillages of fuels/oils occur during the occupation then the effect could be increased to Moderate Adverse which is considered to be Not Significant.

11.4.16 Controlled Water - The risk to ground and surface waters associated with ground contamination will not change following completion of the proposed development, hence the potential effect on ground and surface waters is considered to remain as considered to be Minor Adverse. Should uncontrolled spillages of fuels/oils occur during the occupation then the effect could be increased to Moderate Adverse, which is considered to be Not Significant.

11.4.17 Ecology and Wildlife - The measures to mitigate the risk to offsite users, ground and surface waters described above will effectively mitigate the risk to ecology and

wildlife.

11.4.18 Built Environment - The risk to the built environment associated with ground contamination following completion of the proposed development, is considered to be very low and hence the potential effect on the built environment is considered to be Negligible. In relation to the geological hazards identified at the site, they are unlikely to be significant as development is not proposed in the higher risk areas of site, therefore, the potential effect is likely to be Moderate Adverse (at most), which is considered to be Not Significant.

11.4.19 Other than the measures outline below, no further mitigation is considered necessary, and no future monitoring is likely to be required once the proposed development is operational.

11.5 Mitigation measures

11.5.1 The following provides a summary of mitigation and enhancement measures that are proposed to be implemented during construction and completed development (operational) phases of the proposed development.

Construction Phase

11.5.2 A number of measures will be implemented during the construction phase to minimise potential impacts associated with the proposed development. These measures are standard in construction projects and are in line with current industry good practice for construction. These will be detailed in the Construction Environmental Management Plan (CEMP) prepared for the proposed development.

11.5.3 The purpose of the CEMP is to control environmental effects during the construction phase and ensure appropriate mitigation is provided where necessary. Contractors will be required to prepare detailed method statements and adhere to targets and best practice procedures to limit any disruption or nuisance occurring during construction. The principal contractor will ensure that wherever possible, mitigating measures are built into the construction process. By these means, temporary impacts of construction will be minimised and/or eliminated.

11.5.4 The CEMP includes specific method statements and control documents to comply with many requirements including, but not limited to the following:

- Prevention of the mobilisation of soil and soil contaminants through the generation of dust and surface water runoff;

- The provision of appropriate Personal Protection Equipment (PPE) for workers;
- Appropriate storage of fuel and other potential contaminants that are temporarily held on site during the construction phase. Any areas for the storage of bulk materials including oils, fuel and chemicals would be designed and managed according to current best practice and in compliance with prevailing legislation and Environment Agency guidance. It is anticipated that, where required (e.g. in areas of car parking), the construction site drainage surface water system would be fitted with oil interceptors;
- Leaks or spills of potentially polluting substances to be contained, collected, then removed from site in an appropriate manner e.g. use of absorbent material, bunding or booms;
- Details of the method of removal of bulk materials (including soil) and wastage off site and their disposal/reuse including appropriate disposal of waste soil generated during construction and demolition;
- Details of how any unexpected contamination identified during the construction phase would be assessed and treated. In the event that previously uncharacterised soil contamination is identified during development of the site remediation should be undertaken under a watching brief following consultation with the LPA;
- Maintenance of a 'clean/dirty area' regime, if contamination identified. Smoking, eating and drinking would not be permitted in the buildings and during demolition works. A high standard of hygiene to be maintained at all times;
- Risk assessments to ensure the safety of construction personal associated with exposure to exposed soils (and any associated contaminants including asbestos);
- Details of how the contractor will ensure that any materials imported to site (e.g. aggregates/soils) are suitable for use including provisions for testing and validation as considered appropriate;
- In order to limit disturbance, site access tracks and defined compound areas would be constructed first to allow controlled movement of vehicles around the site;

- Construction laydown areas will be demarcated, with hardstanding and bunded storage areas (or use of self-bunded tanks) for fuel or other liquids required. Internal gravelled roadways will be laid out for construction traffic. A wheel-washing station will be set up at the site entrance to minimise track-out of mud onto the access road and consequent dust generation;
- Any vegetation, topsoil and subsoil would be removed to expose a suitable sub-grade. Any soils, sub-soils or aggregate suitable for reuse would be stockpiled appropriately;
- Stockpiles will be sited a minimum distance from watercourses to avoid pollution runoff;
- Surface water, perched waters or groundwater from dewatering operations would not be discharged to surface water, foul or surface water drains without the appropriate consents from the local water or sewage company and/or the Environment Agency. The disposal of this effluent would be the responsibility of the contractor. If necessary, this water would be tanked off-site for disposal at a suitable facility;
- During construction, silt traps and oil interceptors would be placed in drains on site. No untreated surface or waste waters would be allowed to drain into water bodies during construction, operation or decommissioning. Sustainable Drainage Solutions (SuDS) would be used if found to be required;
- All foundations would be appropriately specified to resist chemical attack from soils or groundwater; and
- Foundations and underground infrastructure would also be designed so as not to present a preferential pathway for contaminant migration, if present at the development area.

11.5.5 It is anticipated that prior to development, a development-related Phase 2 site investigation will be undertaken across the site to further confirm the ground conditions and low contamination risk. Following the completion of the Phase 2 site investigation, it is considered likely that due to the nature and/or scale of the proposed land use activity that viable risk management options are readily available. It is considered that the risks can be managed through mitigation measures or localised remediation if necessary, and adoption of good practise measures during construction/demolition.

- 11.5.6 If necessary, a Remediation Strategy will be developed, if required, based upon the proposed development to mitigate risks to future site users, construction workers and adjacent site users from the chemical contaminants and asbestos identified at the site. The Remediation Strategy will include a methodology for the implementation of remedial measures (e.g., capping to mitigate risks from the presence of organic/inorganic/asbestos contamination and ground gas).
- 11.5.7 Should any previously unidentified contamination be detected at the site during the construction phase or a risk of ground gas ingress into future site buildings be identified, then such risks would be mitigated through measures that would be designed through an options appraisal process. An updated Remediation Strategy would be submitted to the LPA for acceptance prior to any additional remediation works being undertaken.
- 11.5.8 Soils that are to be reused onsite would be tested for contamination and geotechnical suitability. This would form part of a site materials and waste management strategy which would be drafted prior to construction and would focus on the re-use, recycling and reduction of waste spoil.
- 11.5.9 Any additional soil materials that are to be imported to the site would be required to have certification of their chemical concentrations to ensure that contaminative materials are not being introduced to the area.
- 11.5.10 Further, specific mitigation measures could include, for example, removal of as yet undetermined contamination hotspots following further site characterisation site investigation, development and agreement of remedial strategies with regulatory authorities, and dealing with unforeseen ground conditions.
- 11.5.11 Appropriate design requirements will be specified within the new buildings to mitigate against any residual risks from land and water quality and the associated hazards. For example, the design and depth of foundations would take account of the volume change material of cohesive materials where present, and the depth to groundwater.
- 11.5.12 The principal risk to soils and controlled waters following construction will result from the potential migration of pollutants associated with uncontrolled/accidental spillages or discharges from the development activities. Measures will be proposed to mitigate against such risk and will follow the pollution prevention guidelines issued by the Environment Agency and CIRIA, such as the use of trapped gulleys, interceptors, etcetera.

- 11.5.13 The risk to site workers during any subsequent maintenance works would relate to the risk of skin contact, inhalation and ingestion of any residual as yet undetermined contaminated material on the site. In accordance with current health and safety legislation, the contractor will be required to adopt measures to mitigate the risk to site workers and as such would be considered to be low.
- 11.5.14 Measures will be adopted to mitigate the risk to off-site users associated with air borne or settled dust arising from areas of potentially contaminated land. Such measures will include the selection of appropriate methods to reduce disturbance to the existing near-surface soils present on the Site, such as the spraying of stockpiles and other large, unsealed surfaces to limit the risk of generating air borne dust and covering of excavated materials undergoing treatment to reduce the release of odours and vapours.
- 11.5.15 The potential for ground instability has been identified within the development. The risk associated with such will be quantified further through an intrusive ground investigation, the findings of which will inform the mitigation measures to be implemented (if required).

Operation Phase

- 11.5.16 The site operator will implement an ISO14001 or equivalent Environmental Management System (EMS), which among other measures will define good housekeeping practices for the site to control the potential for leaks and spills and to ensure leaks and spills are prevented from impacting soils and groundwater. Waste will be handled and stored in an appropriate manner on hard surfacing, where any spillage can be easily managed.
- 11.5.17 Environmental management of the site will be regulated by the Environment Agency using the facility's Environmental Permit, which will specify operating techniques and will include a regular schedule of audits. The permit will also regulate discharges and emissions from the facility, specifying limits, monitoring and reporting of these. This process will ensure that any potential emissions to soil or groundwater are controlled appropriately.

11.6 Residual effects

Construction Phase

- 11.6.1 Provided the specific mitigation measures are implemented as set out in Section 11.5, there are no expected to be any residual effects above a negligible magnitude.

Operational Phase

11.6.2 Provided the specific mitigation measures are implemented as set out in Section 11.5, there are no expected to be any residual effects above a negligible magnitude.

11.7 Cumulative effects

11.7.1 Effects relating to soil and ground conditions are site-specific and planned developments in proximity to the proposed development are unlikely to adversely impact shallow soils beneath the site. With regard to groundwater receptors, it is assumed that any development schemes in the surrounding area would have sufficient mitigation measures in place during ground works to prevent adverse effects in accordance with the NPPF and relevant legislation.

11.7.2 An inter-cumulative impact would be reliant on a number of factors including construction phases coinciding and industry standard mitigation measures being ineffective at more than one site at a time. The requirements of the LPA under NPPF (i.e. Phase 1 and Phase 2 Contamination assessments and CEMPs) should effectively mitigate the effects associated with each of the sites; thereby ensuring that there are no significant inter-cumulative effects.

11.8 Limitations of study

11.8.1 RPS is not aware of any key limitations that would affect the robustness of the ground conditions assessment for EIA purposes. However, the assessment undertaken to date is based on the desk-based assessment of the ground conditions. Further studies to support detailed design will be required and will be submitted to the LPA under the planning application.

11.9 Conclusion

11.9.1 The Construction Environment Management Plan (CEMP) will include measures to mitigate the potential hazards to identified receptors during the construction phase of the proposed development. Mitigation measures detailed within the CEMP are likely to include dust mitigation, surface water run-off management, materials management and general pollution control measures.

11.9.2 The Phase 1 Preliminary Risk Assessment undertaken for the site has not identified the potential for significant widespread contamination and ground gas generation, there is the potential for localised contamination and Made Ground to exist, particularly in the vicinity of the North Moor farm buildings. Further localised investigation will be

undertaken at the site to further clarify the risks associated with potential contamination. If the site investigation identifies the presence of potentially significant contamination or ground gases further investigation, monitoring, risk assessment and remediation may be necessary and would be subject to regulatory approval.

- 11.9.3 It is standard practice that the CEMP, Phase 2 Site Investigation and Remediation Strategy (if required) are formally accepted by the LPA prior to redevelopment. In addition, the nature of the development will result in the area of structures and low permeability surface cover (incorporating a drainage system) increasing.
- 11.9.4 On the basis of the above, the construction phase impacts are short-term and of local spatial extent, the magnitude of impact would be negligible, and the significance of effects are considered to be Negligible, which is **Not Significant**.
- 11.9.5 The operational phase impacts to soil and groundwater will be Negligible to Minor Beneficial (**Not Significant**) based on the surface cover provided by the development.