OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Preliminary Environmental Information (Work in Progress) Report (PEIR)

Draft Environmental Statement

Chapter 11: Ground Conditions

On behalf of
Oxfordshire Railfreight Limited

Prepared by BWB Consulting Ltd
May 2022

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11.1 INTRODUCTION

11.1.1 This draft Chapter considers the likely significant environmental effects of the Proposed Development on the geology, soils and contaminated land beneath the Application Site and the local area on the basis of work carried out to date on the Main Site area. The final chapter assessment will include data from ground investigation on a limited Main Site area not accessed at the time of the draft report, as well as the proposed Highway Works areas, including the onsite area of the Ardley landfill to the east of B430.

11.1.2 This chapter provides a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the Application Site and surrounding area, and an assessment of the likely environmental effects of the Proposed Development during the construction works and once the Proposed Development is completed and occupied. Mitigation measures are identified (where appropriate) to avoid, reduce or offset any significant adverse effects identified, together with the nature and significance of likely residual effects. All mitigation measures will be updated on the finalised chapter.

11.1.3 Being 'preliminary' in nature, it includes an initial assessment of the potential significant effects of the Proposed Development alone or in combination with other surrounding significant proposed developments using the information available at the time of writing. It should therefore be noted that this Chapter may include data gaps to be completed at a later date; the level of detail available varies somewhat, for example, some of the baseline has been informed to date by desk studies and some by in situ assessment, but this approach still allows a clear indication of the likely significant effects to inform the consultation. Additional surveys are being undertaken as part of the ongoing preparation of the ES and these will help inform the technical assessments presented in the ES in due course.

11.1.4 In line with the 2017 EIA Regulations, this ES has been compiled by appropriately qualified, experienced, and competent experts. The author of this chapter is Matteo Marteddu BSc MSc FGS, a Geo-Environmental Consultant with 6 years of industry experience in the UK. This chapter has been reviewed by Richard Robinson BSc (Hons) MCIWEM (19 years of relevant UK experience) and approved by Tim Hull BSc MSc CGeol FGS SiLC SQP (22 years of relevant UK experience).

11.2 ASSESSMENT SCOPE AND METHODOLOGY

11.2.1 This chapter assesses the likelihood of any existing contamination being encountered during the construction process, such that it could cause significant environmental or health effects if not addressed adequately at the construction and/or operational stages. The construction will entail bringing materials onto the Application Site (such as fuel) which if spilt or leaked could result in land or groundwater contamination.

Impairment and sterilisation of geological and mineral resources will likewise be addressed.

11.2.2 A risk-based approach in accordance with Defra[1], and the Environment Agency (EA) guidance[2], has been taken to assess contamination which may have a significant effect upon the construction and operation of the Proposed Development, or upon the wider environment as a consequence of the Proposed Development.

11.2.3 Separate Phase 1 Geo-Environmental Assessment reports have been produced by Hydrock for the Main Site (**Appendix 11.1**) and Highways Works (**Appendix 11.2**). A Mineral Assessment Report (**Appendix 11.4**) has been completed by BWB Consulting covering both assessment areas. Preliminary ground investigation and assessment has been undertaken across the Main Site, with preliminary Geo-Environmental ground investigation and assessment of the Highway Works area and Ardley Landfill and will be included in the final updated version of this chapter. This is to assess potentially significant pollutant linkages associated with potential sources identified in the Hydrock Geo-Environmental desk study.

11.2.4 With regards to sites of geological interest, information has been obtained from Natural England, the British Geological Survey (BGS), Oxfordshire County Council and Cherwell District Council who hold information on such sites.

11.2.5 These reports and information provide details of the basic ground conditions at the Application Site, including information on the geology, minerals, ground conditions, the sites history, hydrogeology and contamination to inform this ES Chapter. The assessment considers the results of the specific site investigation works to date (on the Main Site) and takes into consideration the Conceptual Site Model (CSM) when assessing the potential impacts and effects of the proposed development. Where appropriate, this chapter proposes mitigation measures and considers the residual impacts following implementation of appropriate mitigation. Final mitigation proposals will be made once the full surveys and assessments have concluded in a final ES Chapter in due course.

General Approach and Data Sources

11.2.6 The general methodology for assessing effects followed standard procedures and involved the following desk-based and intrusive processes:

- Review of local, regional and national planning strategies and development plan policies (including, but not limited to, land contamination, aquifer

[1] Department for Environment, Farming and Rural Affairs; Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance; April 2012
[2] Environment Agency report Land Contamination Risk Management, 2020 (https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm) is the governments primary guidance on the assessment and management of the risks from land contamination,

protection, mineral resources);
- Review of published documents, current standards, and current best practice guidance; and
- A site reconnaissance completed by Hydrock as part of their investigations to confirm desk-based information and identify and confirm the current state and use of the Application Site.

11.2.7 A review of the following reports and information sources has been undertaken to provide site specific factual data upon geology, soils and groundwater to support the development of the baseline ground model and assessment of baseline conditions:

- Groundsure reports, reference GSIP-2021-10846-4671 and HMD-214-7439283 included within the Phase 1 Reports (**Appendix 11.1** and **Appendix 11.2**);
- 1:2,500 and 1:10,000 scale Historical Ordnance Survey Mapping;
- Historical aerial photographs (Google Earth) and other imagery (Groundsure Reports within **Appendix 11.1** and **Appendix 11.2**);
- BGS 1:50 000 Scale, 'Buckingham', Sheet 219, Solid and Drift, (2002);
- BGS online geological maps and exploratory hole records (www.bgs.ac.uk);
- MAGIC website (www.natureonthemap.naturalengland.org.uk/magicmap);
- Coal Authority Interactive Map Viewer (http://mapapps2.bgs.ac.uk/coalauthority/ home.html);
- Regional Unexploded Ordnance (UXO) risk maps, (https://zeticauxo.com/downloads-and-resources/risk-maps/); and
- 'Oxfordshire RFI Ardley, Oxon Factual Ground Investigation Report' by Exploration & Testing Associates for BWB Consulting Ltd, reference C10172-FGIR-01, dated November 2021 (within **Appendix 11.3**).

11.2.8 Consultations with the EA groundwater protection team and Oxfordshire County Council, Cherwell District County Council, and other relevant stakeholders has been undertaken throughout the process.

11.2.9 The earthworks construction phase of the Proposed Development will comprise a phased enabling works package to prepare development platforms, comprising the stripping of topsoil and bulk earthworks using site won materials and provision of primary infrastructure. Construction of the rail terminal will commence and buildings will follow in a number of phases. Current earthwork models indicate up to 7.0m of earth will be cut from the west and northwest of the Main Site and re-engineered across the central and eastern extents to raise levels and create suitable development platforms.

11.2.10 The key activities of the operational phase will comprise road and rail logistics, maintenance of vehicles and rail stock, and the storage and distribution of goods.

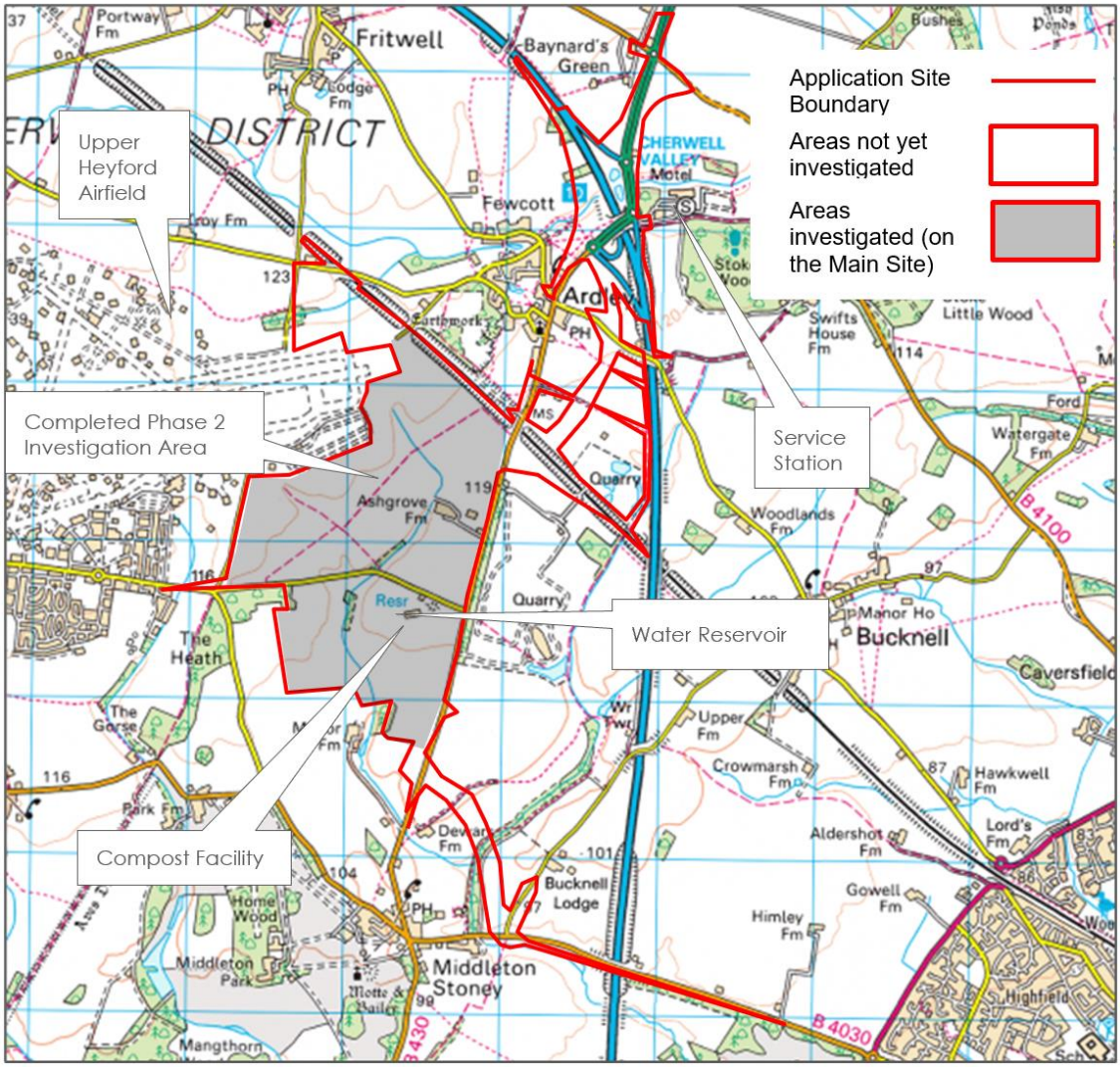
11.2.11 Where necessary suitable mitigation options are detailed and their residual effect measured using updated and extended qualitative risk assessment matrices to demonstrate the effect, and post mitigation effects.

11.2.12 Cumulative effects have been considered where other schemes are planned that might affect the same receptors.

Study Area

11.2.13 The extent of the Ground Conditions Study Area is the Application Site (Order Limit, **Figure 11.1**: Site Location Plan), itself comprising the Application Site and the immediate surrounding areas).

Figure 11:1: Application Site Location Plan



11.2.14 The immediate surrounding area is defined for the purposes of the assessment as land within close proximity to, or bordering the Application Site (i.e. within 250m from the Application Site boundary) which has the potential to be a contaminant source where there is a potential pathway for contaminant migration which may affect the Application Site or be affected by the Application Site.

11.2.15 The inclusion of a 250m buffer is based on the 'Guidance for the Safe Development of Housing on Land Affected by Contamination' (Environment Agency, 2008). This buffer is a conservative approach due to the lower sensitivity of commercial development relative to housing, but reasonable in the context of the scheme taking into account the distance over which contamination can migrate, and the relatively low density of development in the area of the scheme.

Identifying Risks

11.2.16 A preliminary risk assessment will be included in this chapter in line with Land Contamination Risk Management [3], which will include a geo-environmental Hazard Identification ('HAZID'), which seeks to list all the suspected contaminant sources, the receptors that might be harmed by those sources and the pathways via which the sources might reach the receptors to cause the harm. The source-pathway-receptor concept is known as a contaminant linkage (formerly a pollutant linkage) and only when a linkage is complete is there any possibility of risk of harm arising. The source-pathway-receptor concept will be assessed through production of a 'CSM'. Each pollutant linkage is risk assessed in accordance with the risk assessment methodology set out in CIRIA C5524 presented as **Appendix 11.6**.

11.2.17 Beneficial and adverse impacts have been identified, and options have been outlined for mitigating any potential adverse effects from the construction and operation in this chapter when finalized. Cumulative effects of the Proposed Development in relation to other known proposed schemes have also been addressed where necessary.

11.2.18 As well as the effects of contamination, other ground related issues / risks have been assessed, such as ground instability issues or other ground related development constraints (e.g. worked ground, mining) and loss of mineral resource.

Determining the significance of effects

11.2.19 The approach described between paragraphs 11.2.17 and 11.2.19 forms the basis of the methodology used in the assessment. For contamination to present a significant potential effect a link must first be established within the CSM. The likelihood must be

[3] Land Contamination Risk Management (https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm) is the governments primary guidance on the assessment and management of the risks from land contamination
[4] CIRIA C552 'Contaminated land risk assessment - a guide to good practice'.

demonstrated with an identifiable source (onsite or off site), a receptor and a viable pathway.

11.2.20 Potential sources have been identified from an assessment of current uses and activities on the Application Site, review of historical mapping for former uses and a review of regulatory permits, consents and authorisations contained within the Groundsure reports (Appendix 11.1 and Appendix 11.2) for potentially contaminative sites such as landfills, environmental permits, pollution controls.

11.2.21 Pathways identified are specific to the receptor type. For example, they could be:

- Ingestion, inhalation, dermal contact for human health receptors;
- Infiltration and contaminant migration through permeable strata such as the unsaturated zone for groundwater;
- A secondary pathway from groundwater contamination to surface water;
- Migration of ground gases and vapours such as permanent gases, landfill gas and volatile hydrocarbons into buildings; and/or
- Direct contact and uptake by plants.

11.2.22 In this chapter, the sensitivity is taken to be the degree of likelihood that one of the sensitive receptors suffers the impact. These are listed in **Table 11.1**.

Table 11.1 – Classification of Probability (after Rudland *et al.,* 2001)

Classification	Definition
High likelihood	There is a contaminant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Medium likelihood	There is a contaminant linkage and all elements are present and in the right place, which means that it is possible that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a contaminant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Negligible	There is a contaminant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

11.2.23 The sensitivity of geological receptors where the new development has the potential to destroy or deplete the amenity value, such as mineral resources or sites of geological interest, is judged according to the criteria in **Table 11.2**.

Table 11.2 – Sensitivity of Geological Receptors

Classification	Geological Sites	Mineral Resources
High sensitivity	High quality and rarity on regional or national or international scale. Protected by international or EU legislation (e.g. World Heritage).	Nationally important mineral. Large resource.
Medium sensitivity	High quality and rarity on national or local scale (e.g. SSSI).	Medium resource.
Low sensitivity	Medium quality and rarity on a local scale (e.g. Local Geological Site / RIGS).	Small resource.
Negligible	Little or no geological interest.	No mineral resource.

11.2.24 The magnitude of land contamination effects have been assessed by comparing all contaminant linkages at a baseline value (existing condition) to those during construction and operational circumstances. This provides a way of assessing adverse and beneficial effects through the project lifecycle. The magnitude will be assessed using a four-point scale as shown in **Table 11.3**.

Table 11.3: Effect Magnitude Criteria

Impact Type	Major	Moderate	Minor	Negligible
Human health impacts from chemicals in the ground.	Short-term (acute) effects likely to result in significant harm e.g. high concentration of cyanide on the surface of an informal recreational area.	Long-term (chronic) effects likely to result in significant harm e.g. high concentration of contaminants close to the surface of a development site.	Harm but probably not significant harm unless particularly sensitive individual within the receptor group. May be aesthetic/ olfactory impacts.	No measurable effects.
New planting impacts from chemicals in the ground.	Complete and rapid die-back of landscaped areas.	Stressed or dead plants in landscaped areas.	Damage to plants in landscaped areas, e.g. stunted growth, discoloration.	No measurable effects.

Impact Type	Major	Moderate	Minor	Negligible
Controlled Waters impacts from chemicals in the ground.	Short-term pollution, e.g. major spillage into controlled water. Substances leaching from contaminated soil cause receiving waters to exceed surface water and groundwater quality indicators (EQS/DWS) over a large area.	Pollution of sensitive water resources, e.g. leaching into Principal or Secondary aquifers or rivers. Substances leaching from contaminated soil cause receiving waters to exceed surface water and groundwater quality indicators (EQS/DWS) in limited areas.	Pollution of non-sensitive water bodies e.g. leaching into non-classified groundwater or minor ditches. Substances leaching from contaminated soil cause receiving waters to slightly exceed surface water and groundwater quality indicators (EQS/DWS) (based on professional judgement).	No measurable effects. Substances leaching from contaminated soil do not cause receiving waters to exceed surface water and groundwater quality indicators (EQS/DWS).
Ecosystems impacts from chemicals in the ground.	Short-term risk to a particular ecosystem or organism forming part of that ecosystem in a designated protected area, e.g. by contamination spillage. Damage to a protected area of international significance (e.g. Ramsar site).	Death of species in a particular ecosystem in a designated protected area, e.g. by contamination spillage. Damage to a protected area of national significance (e.g. Site of Special Scientific Interest).	Minor change in a particular ecosystem in a designated protected area, but not significant harm. Damage to a locally important area.	No measurable effects. Plausible pollution linkage but no important or protected area.
Site workers impacts from contaminants in the ground.	Risk assessment required to determine required personal protective equipment (PPE) and this may involve high level of protection similar to USEPA Level A, B or C.	Risk assessment required to determine required personal protective equipment (PPE) and this may involve high level of protection similar to USEPA Level B, C or D.	Risk assessment required to determine required personal protective equipment (PPE) and this may involve moderate level of protection similar to USEPA Level C or D.	No measurable effects, but simple personal protective equipment (PPE) required (similar to USEPA Level D protection, i.e. overalls, boots, goggles, hard hat).
Buildings etc. impacts from flammable ground gas.	Catastrophic damage, e.g. gas explosion causing collapse.	Damage renders unsafe to occupy.	Damage to sensitive buildings etc.	No measurable effects.

Impact Type	Major	Moderate	Minor	Negligible
Damage to building products from chemicals in the ground (e.g. sulphate attack of concrete, organic solvent decay of plastics).	Maximum soil concentration exceeds industry accepted trigger value over a large area.	Maximum soil concentration exceeds industry accepted trigger value in limited areas.	Maximum soil concentration slightly exceeds industry accepted trigger value in limited areas.	Maximum soil concentration less than industry accepted trigger value.
Human health impact from ground gases. Such as radon and landfill gas where exceedance of a risk-based trigger indicates the potential for harm.	Pollution linkage identified over a large area.	Pollution linkage identified in limited areas.	Pollution linkage uncertain.	Plausible pollution linkage not established.
Impacts to people, property or infrastructure cause by excessive ground movements.	Major damage involving destruction of buildings or infrastructure, blocking of river courses and major flooding or loss of life.	Significant damage to property or infrastructure, minor damage to river channels, injury to people.	Minor damage to property or infrastructure, minor blocking of river channels.	Minor ground movements but no significant damage to property, infrastructure, river channels or human health.
Impacts to Geological SSSI	Damage to a protected area of international significance (e.g. Ramsar site).	Damage to a protected area of national significance (e.g. Site of Special Scientific Interest).	Damage to a locally important area.	No measurable effects. Plausible pollution linkage but no important or protected area.
Impacts to viable mineral resource	Loss of resource at an operational minerals site, or approved extension of an operational mineral site.	Loss of mineral resource on land allocated in the Minerals and Waste Core Plan.	Loss of potential resource in a Mineral Resource Area.	No loss of resource.

11.2.25 The assessment of significance is based on the magnitude of the effect and the importance or sensitivity of the receptors as set out below in **Table 11.4**. The significance of the potential effects is identified, as well as those of the residual effects for geological and mineral effects. Appropriate mitigation measures will be

recommended in order to reduce/control any significant adverse effects on sensitive receptors. Once remediated, there should be no residual effects with respect to land contamination issues.

Table 11.4: Significance of Effect Matrix

		Sensitivity			
		High Likelihood	**Moderate Likelihood**	**Low Likelihood**	**Unlikely**
Magnitude	**Major**	Major significance	Major significance	Moderate significance	Minor significance
	Moderate	Major significance	Moderate significance	Minor significance	Negligible significance
	Minor	Moderate significance	Minor significance	Minor significance	Negligible significance
	Negligible	Minor significance	Negligible significance	Negligible significance	Negligible significance

11.2.26 Effects have the potential to be adverse, beneficial and temporary or permanent. For example, in terms of beneficial effects, the Proposed Development may remove a source of contamination, or it may break a pathway that currently links a source to a receptor. The effects criteria are presented in **Table 11.5**. The duration of the effect is also considered.

- Long-term: 15 years onwards for the life of the Proposed Development;
- Medium-term: 5 to 15 years; and
- Short-term: 0 to 5 years including the construction period and on completion.

Table 11.5: Significance Effect Criteria

Significance	Description
Major adverse	Short term (acute) risk to human health likely to result in “significant harm” as defined by the Environment Protection Act 1990, Part IIA. Short term risk of pollution of sensitive water resource. Catastrophic damage to buildings/ property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem.
Moderate adverse	Chronic damage to Human Health (“significant harm”). Pollution of sensitive water resources. A significant change in a particular ecosystem, or organism forming part of such ecosystem.
Slight adverse	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.
Neutral	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by measures such as protective clothing etc.). Easily repairable effects of damage to

Significance	Description
	buildings, structures and services.
Slight beneficial	Minor reduction in risk (slight, short or highly localised effect)
Moderate beneficial	Moderate reduction in risk, Improvement in water quality
Major beneficial	Major reduction in risk

11.2.27 Effects of moderate or greater significance are considered to be significant in terms of the EIA. Where effects are considered as marginal, i.e. moderate/slight a precautionary approach will be adopted.

Limitations and Assumptions

11.2.28 At the time of writing, intrusive ground investigation has only been completed within the Main Site excluding the north east portion on Ardley Landfill (see Figure 11.1). Investigation of the remaining areas within the Application Site will be completed prior to final ES submission.

11.3 POLICY CONTEXT

11.3.1 The applicable legislative framework for Contaminated Land is set out in Part 2A of the Environment Act 1990 and associated statutory guidance. Non statutory Guidance on management of Contaminated Land (Land Contamination Risk Management) is issued by the Environment Agency.

Part IIA of the Environmental Protection Act, (1990)[5]

11.3.2 Part IIA of the Environmental Protection Act, (1990) and the supporting statutory guidance describes a regulatory role for Local Authorities in dealing with contaminated land.

11.3.3 Environment Act, (1995) creates a system whereby Local Authorities must identify, and if necessary, arrange for the remediation of contaminated sites. The provisions are set out in Section 57. In addition to these requirements, the operation of the regime is subject to regulation and statutory guidance.

11.3.4 Contaminated Land (England) (Amendment) Regulations (2012) - provides a definition of what constitutes 'contaminated land' and sets out the responsibilities of the Local Authority and the EA in the identification and management of contaminated land. Under the Regulations, contaminated land is defined as 'land' which is in the

[5]Department for Environment Food and Rural Affairs, Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance; April 2012, https://www.gov.uk/government/publications/contaminated-land-statutory-guidance

opinion of the Local Authority to be in such a condition by reason of substances in or under the land that:

- Significant harm is being caused or there is significant possibility of significant harm being caused; and/or
- Significant pollution of Controlled Waters is being caused or there is a significant possibility of significant pollution of Controlled Waters being caused'.

National Policy Statement for National Networks (NPSNN) 2014[6]

11.3.5 Issues relating to discharges or emissions from a proposed development which affect air quality, water quality, land quality, and the marine environment, or which include noise and vibration, may be subject to separate regulation under the pollution control framework or other consenting and licensing regimes. Relevant permissions will need to be obtained for any activities within the development that are regulated under those regimes before the activities can be operated (paragraph 4.46 of the NPSNN).

11.3.6 In deciding an application, the Examining Authority and the Secretary of State should focus on whether the development itself is an acceptable use of the land, and on the impacts of that use, rather than the control of processes, emissions or discharges themselves. They should assess the potential impacts of processes, emissions or discharges to inform decision making, but should work on the assumption that in terms of the control and enforcement, the relevant pollution control regime will be properly applied and enforced. Decisions under the Planning Act should complement but not duplicate those taken under the relevant pollution control regime (paragraph 4.50 of the NPSNN).

11.3.7 The Secretary of State should be satisfied that development consent can be granted taking full account of environmental effects. This will require close cooperation with the Environment Agency and/or the pollution control authority, and other relevant bodies, such as the MMO, Natural England, Drainage Boards, and water and sewerage undertakers, to ensure that in the case of potentially polluting developments (paragraph 4.55 of the NPSNN):

- The relevant pollution control authority is satisfied that potential releases can be adequately regulated under the pollution control framework; and
- The effects of existing sources of pollution in and around the project are not such that the cumulative effects of pollution when the proposed development

[6] National Policy Statement for National Networks (NPSNN) 2014, Presented to Parliament pursuant to Section 9(8) and Section 5(4) of the Planning Act 2008, December 2014 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf

is added would make that development unacceptable, particularly in relation to statutory environmental quality limits.

11.3.8 Where necessary, land stability should be considered in respect of new development, as set out in the National Planning Policy Framework and supporting planning guidance. Specifically, proposals should be appropriate for the location, including preventing unacceptable risks from land instability. If land stability could be an issue, applicants should seek appropriate technical and environmental expert advice to assess the likely consequences of proposed developments on sites where subsidence, landslides and ground compression is known or suspected (paragraph 5.117 of the NPSNN).

11.3.9 A preliminary assessment of ground instability should be carried out at the earliest possible stage before a detailed application for development consent is prepared. Applicants should ensure that any necessary investigations are undertaken to ascertain that their sites are and will remain stable or can be made so as part of the development. The site needs to be assessed in context of surrounding areas where subsidence, landslides and land compression could threaten the development during its anticipated life or damage neighboring land or property. This could be in the form of a land stability or slope stability risk assessment report (paragraph 5.118 of the NPSNN).

11.3.10 Applicants should safeguard any mineral resources on the proposed site 'as far as possible' (paragraph 5.169 of the NPSNN).

National Planning Policy Framework (NPPF)[7]

11.3.11 The National Planning Policy Framework (NPPF) (2021) sets out the Government's planning policies for England and supersedes the previous NPPF published in 2012 and updated in 2018. It makes the following reference to Contaminated Land and ground conditions in the section entitled Conserving and enhancing the natural environment:

11.3.12 Paragraph 174 of the NPPF states that planning policies and decisions should contribute to and enhance the natural and local environment by:

e) *"Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air*

[7]The National Planning Policy Framework (NPPF) was first published on 27 March 2012 and updated on 24 July 2018 and 19 February 2019. This sets out the government's planning policies for England and how these are expected to be applied. https://www.gov.uk/guidance/national-planning-policy-framework

and water quality, taking into account relevant information such as river basin management plans; and

f) Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

11.3.13 Paragraph 183 of the NPPF also makes the following references to ground conditions and pollution by stating that planning policies and decisions should ensure that:

a) "A site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and

c) Adequate site investigation information, prepared by a competent person, is available to inform these assessments."

11.3.14 Paragraph 184 sets out that where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

Local Policies and Relevant Guidance

11.3.15 Assessment of the impact of the Proposed Development will also be undertaken in accordance with, but not limited to, the below policies:

- Adopted Cherwell Local Plan 2011-2031 (Part 1) adopted by the Council on 20 July 2015. Policy Bicester 13 was re-adopted on 19 December 2016;
- Cherwell District Council Water Cycle Study (WCS) was published in November 2017 and its addendum;
- Cherwell District Council Water Cycle Study (WCS) was published in November 2017 and its addendum;
- Oxfordshire Minerals and Waste Local Plan adopted on 12th September 2017;
- EA Guidance on Land Contamination Risk Management (LCRM); and
- EA Groundwater Protection Guidance.

Adopted Cherwell Local Plan 2011 - 2031 Part 1[8] - Policy ESD08: Water Resources

11.3.16 Paragraph B.221 states:

- *"Research carried out by the Environment Agency and set out in the Catchment Abstraction Management Strategies (CAMs) shows that Cherwell District lies within an area of serious water stress and the Upper Cherwell area (including Banbury) has been over-abstracted. Policy ESD 8 will be used to ensure that new development is located in areas where adequate water supply can be provided from existing and potential water supply infrastructure.*
- *The Council will seek to maintain water quality, ensure adequate water resources and promote sustainability in water use. 100 Cherwell Local Plan 2011-2031 Part 1 Section B – Policies for Development in Cherwell Water quality will be maintained and enhanced by avoiding adverse effects of development on the water environment. Development proposals which would adversely affect the water quality of surface or underground waterbodies, including rivers, canals, lakes and reservoirs, as a result of directly attributable factors, will not be permitted.*
- *Development will only be permitted where adequate water resources exist or can be provided without detriment to existing uses. Where appropriate, phasing of development will be used to enable the relevant water infrastructure to be put in place in advance of development commencing".*

Adopted Cherwell Local Plan 2011 – 2031 Part 1 - Policy ESD10: protection and Enhancement of Biodiversity and the Natural Environment

11.3.17 This policy states:

"Protection and enhancement of biodiversity and the natural environment will be achieved by the following:

- *The reuse of soils will be sought.*
- *If significant harm resulting from a Development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or as a last resort, compensated for, then Development will not be permitted.*
- *Development which would result in damage to or loss of a site of international value will be subject to the Habitats Regulations Assessment process and will not be permitted unless it can be demonstrated that there will be no likely significant effects on the international site or that effects can be mitigated.*

[8]Adopted Cherwell Local Plan 2011-2031 Part 1 (incorporating Policy Bicester 13, Development Plan Document Adopted December 2016 https://www.cherwell.gov.uk/downloads/download/45/adopted-cherwell-local-plan-2011-2031-part-1-incorporating-policy-bicester-13-re-adopted-on-19-december-2016

- *Development which would result in damage to or loss of a site of biodiversity or geological value of national importance will not be permitted unless the benefits of the Development clearly outweigh the harm it would cause to the site and the wider national network of SSSIs, and the loss can be mitigated to achieve a net gain in biodiversity/geodiversity."*

Oxfordshire Minerals And Waste Local Plan 2017[9]

11.3.18 This document sets out the following relevant policies.

11.3.19 Policy M2: Provision for working aggregate minerals states:

"Provision will be made through policies M3 and M4 to enable the supply of:

- "*Sharp sand and gravel - 1.015 mtpa giving a total provision requirement of 18.270 million tonnes*
- *Soft sand - 0.189 mtpa giving a total provision requirement of 3.402 million tonnes; and*
- *Crushed rock - 0.584 mtpa giving a total provision requirement of 10.512 million tonnes*

from land-won sources within Oxfordshire for the period 2014 – 2031 inclusive."

11.3.20 In terms of locations for working aggregate minerals, the plan states:

"Minerals can only be extracted where they exist in the ground. The identification of locations where extraction is likely to be able to take place acceptably provides greater certainty of where mineral working will take place and where it will not take place. Policy M3 identifies the broad locations –strategic resource areas – within which it is proposed that future working for sharp sand and gravel, soft sand and crushed rock should take place" (paragraph 4.22).

And…

"The Local Aggregate Assessment 2014 indicates no requirement for further areas for crushed rock working during the plan period, due to the relatively high level of permitted reserves of this mineral remaining to be worked. Actual sales of crushed rock in 2014 and 2015 were well above the provision rate of 0.584 million tonnes a year. Consequently, the level of permitted reserves remaining has fallen more than expected, as they have been extracted more quickly. If on-going annual monitoring

[9]Oxfordshire Minerals And Waste Local Plan 2017 adopted on12 December 2017. https://www2.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/planning/mineralsandwaste/September2017/AdoptedMineralsWasteCoreStrategySept2017.pdf

shows this to be a continuing trend, additional permissions could be needed towards the end of the plan period and there could be a requirement for additional provisions to be made through the allocation of sites for working in the Site Allocations Document. If required, this additional provision should preferably be made through extensions to existing quarries rather than from new quarries, to make efficient use of existing plant and infrastructure, and minimise additional impact. It is unlikely that any new quarries will be needed during the period of this plan. In view of this, and given that crushed rock resources in Oxfordshire – in particular the resources of limestone outside of Areas of Outstanding Natural Beauty – are extensive, strategic resource areas for possible future crushed rock working are included in policy M3" (paragraph 4.44).

11.3.21 Policy M5: Provision for working aggregate minerals states:

"Permission will exceptionally be granted for borrow pits to supply mineral to associated construction projects, having due regard to policies C1 – C12, provided that all of the following apply:

- *The site lies on or in close proximity to the project area so that extracted mineral can be conveyed to its point of use with minimal use of public highways and without undue interference with footpaths and bridleways;*
- *The mineral extracted will only be used in connection with the project;*
- *It can be demonstrated that supply of the mineral from the borrow pit would have less environmental impact than if the mineral were supplied from an existing source;*
- *The borrow pit can be restored without the use of imported material, other than that generated by the project; and*
- *Use of the borrow pit is limited to the life of the project"*

11.3.22 Policy M8: Safeguarding mineral resources states:

"Mineral resources in the Mineral Safeguarding Areas shown on the Policies Map are safeguarded for possible future use. Development that would prevent or otherwise hinder the possible future working of the mineral will not be permitted unless it can be shown that:

- *The site has been allocated for development in an adopted local plan or neighbourhood plan; or*
- *The need for the development outweighs the economic and sustainability considerations relating to the mineral resource; or*
- *The mineral will be extracted prior to the development taking place.*

Mineral Consultation Areas, based on the Mineral Safeguarding Areas, are shown on the Policies Map. Within these areas the District Councils will consult the County Council on planning applications for non-mineral development."

Construction (Design & Management) Regulations

11.3.23 The Construction (Design & Management) (CDM) Regulations[10] make explicit duties that exist under the Health and Safety at Work Act[11] and the Management of Health and Safety at Work Regulations[12]. This requires clients to use their influence to ensure that the arrangements made by other duty holders are sufficient to safeguard the health and safety of those working or those affected by that work.

Other Guidance

11.3.24 Alongside the legislation listed above, there is a range of non-statutory guidance material and British Standards which, where relevant, have been taken into account in this assessment, including:

- British Standards Institution (BSI): BS 10175:2011+A2:2017, (2017), Investigation of Potentially Contaminated Sites, Code of Practice;
- British Standards Institution (BSI): BS 5930:2015+A1:2020, (2020), Code of Practice for Ground Investigations;
- British Standards Institution (BSI): BS 8485:2015+A1:2019, (2019), Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments;
- British Standards Institution (BSI): BS 8576:2013, (2013), Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds (VOCs);
- British Standards Institution (BSI): BS EN 1997-1:2004, (2004), Eurocode 7: Geotechnical Design – Part 1: General Rules;
- British Standards Institution (BSI): BS EN 1997-2:2007, (2007), Eurocode 7 Geotechnical Design – Part 2: Ground Investigation and Testing;
- Environment Agency Report, Land Contamination Risk Management (2020);
- Construction Industry Research and Information Association (CIRIA) Report C665, (2007), Assessing Risk Posed by Hazardous Ground Gases to Buildings;
- Construction Industry Research and Information Association (CIRIA) Report C741, (2015), Environmental Good Practice on Site 4th Edition;
- Contaminated Land: Applications in Real Environments (CL:AIRE) Definition of Waste: Development Industry Code of Practice Version 2, (2011);
- Environment Agency Science Report SC050021/SR2, (2009), Human Health Toxicological Assessment of Contaminants in Soil;

[10] Construction (Design & Management) (CDM) Regulations (2015)
[11] Health and Safety at Work Act (1974)
[12] Management of Health and Safety at Work Regulations (1999)

- Environment Agency Science Report SC050021/SR3, (2009), Updated Technical Background to the CLEA Model, 2009;
- Environment Agency Science Report SC050021/SR4, (2009), CLEA Software (Version 1.06) Handbook; and
- Environment Agency, The Environment Agency's approach to groundwater protection February 2018 Version 1.2.

11.4 BASELINE CONDITIONS

Site Description

11.4.1 The Application Site stretches from Baynard's Green field north of Junction 10 of the M40 down south to Middleton Stoney village along the B430 road.

Area between the North of J10 M40 and South of J10 M40

11.4.2 The area to the north includes an agricultural field between the M40, the A43 and B4100, most of the area is generally flat and at an elevation of approximately 120m Above Ordnance Datum (AOD). The field is divided in two by the junction slip road, with an isolated parcel of land comprising two balancing ponds to the south. The slip roads associated with Junction 10 of the M40 are on embankments and lead to the A34 to the northeast through a roundabout, and southwest towards Ardley through Padbury roundabout. The junction lies within the valley of Stoke Lyne Brook that runs east to west, sloping down from an elevation of approximately 120m to 110m AOD. A portion of the valley and its watercourse is included within the area to the west of the M40 and to the north of Ardley. A free flow link construction is anticipated on this area.

Area between the South of the J10 M40 and –the Ardley Bypass)

11.4.3 The area south of the junction J10 includes agricultural fields between the B430, the M40 (here low cutting then at grade) and the Chiltern Main Line rail (on cutting) with exclusion to a quarry area to the southeast. The area is cut in two fields by Ardley Road and generally slopes to the southeast and includes farm buildings close to the B430. Small portions of fields are included east of the M40 and south of the railway, in an area accessed by Ardley Field Household Waste facility.

Area to the Southeast of B430 including the Heyford Park Link Road and Middleton Stoney Relief Road

11.4.4 The village of Middleton Stoney lies several kilometers to the south of the Main Site. A strip of land running to the east of the B430 with a northwest to southeast direction terminating into the B4030 Road, is included within the masterplan for the development of Middleton Stoney Relief Road. The area itself consists of a mixture of predominately arable and pasture fields with Gagle Brook flowing from the northeast

to the south. Its topography is generally flat but slopes gently towards the watercourse towards the south of the area. In addition, dense vegetation exists in the vicinity of the watercourse.

Main Site Area

11.4.5 The largest and main area is located within an open agricultural field including Ashgrove Farm, bounded by the Chiltern Main Line rail to the northeast, the B430 to the east, Chilgrove Drive and the former Upper Heyford airbase to the west and northwest, and extending further south Camp Road towards parcels of land belonging to Manor Farm. The area generally gently slopes from an elevation of 115m to 105m AOD from north to south, and it includes an unnamed watercourse tributary to the Gagle Brook which flows north to south. The field parcels are separated by hedgerows and strips of land with dense tree vegetation are present in the vicinity of the watercourse. Ashgrove Farm cottages and buildings are present within the field, and an infilled pond surface has been identified through consultation with the landlord. To the south of Camp Road, two adjacent fenced areas are present which hosts Ardley Composting Facility and a covered Water Reservoir on earthwork.

Application Site History

11.4.6 To the north of the M40 the crossroads between the A43(T) crossing north to south with the A41(T) evolved during the mapping period until being replaced by Baynard Roundabout by 1981. Grove Farm structures and Baynard House were shown 10m west of the current roundabout. Early mapping shows old quarries present 50m west and 50m southwest of Sycamore Grove which were no longer present by 1974. Diverson of Stoke Lyne Brook took place between 1974 and 1981. M40 had been constructed to the west of A43(T) by 1992, with Cherwell Valley Services shown on 2010 maps. A petrol station and associated services were present to the northwest of the Baynard Roundabout by 2004. Padbury Roundabout and Ardley Roundabout had been constructed between 2004-2013, in the same period J10 slips roads and the Cherwell Roundabout realignment had been completed. The B430 had been constructed by 1992.

11.4.7 Historically, the Main Site has remained predominately agricultural land, with Ashgrove Farm present since the earliest available mapping (1870s) and several smaller farm buildings in the west. By the late 1910s, a Great Western Railway (Now Chiltern Railway Line) was constructed aligned southeast to northwest to the east of Upper Heyford Airfield (offsite). By the 1980s, several tanks were present in the vicinity of the offsite airfield, an electrical substation was constructed opposite Ashgrove Farm, and a caravan park in the west of the Main Site. From the late 1980s, a water tower was present towards the south of the ground investigation area, later replaced as the present-day water pumping station, along with a covered reservoir. No significant changes take place with the Main Site until the early 2010s when a composting facility was constructed adjacent to the covered reservoir.

11.4.8 Ardley Quarry is shown to the east of the B430 (beyond Ardley Fields Farm) from the late 1890s, which appears to expand north to south by the 1980s encroaching into the northern Ardley bypass road and Rail Corridor (north and south of the Chiltern Railway Line). Limestone extraction continued at Ardley Quarry until the late 1990s and progressively backfilled as Ardley Landfill; a refuse tip was labelled to the north of the quarry from the early 2000s. The northern portion of the quarry appears to have been infilled by 2010, with the majority of Ardley Quarry infilled by 2019.

11.4.9 In the area to the north of the Chiltern Railway Line and between M40 and B430, three agricultural fields were shown to be excavated and potentially quarried between 2004 and 2010. Operations appears to be ceased by 2013 with some areas restored and others forming large ponds and surface water features.

11.4.10 Historically, offsite features relate to several farms and barns to the south and east of the site and several small quarries to the north, east and northwest of the Main Site from the mid-1870s. By 1919, the majority of quarries were listed as old or disused. It is noted that the Upper Heyford Airfield (to the west of the site) was used as a former RAF grass aerodrome in World War 1 which was not labelled on historical mapping (understood to be for national security reasons) until the 1950s; the airfield was shown to expand to adjacent the northwest boundary of the area subject to ground investigation in Main Site by the 1980s. The majority of former quarries were no longer shown from the mid-1960s. Ardley Wood Quarry was shown to the north of the Main Site on the northern side of the railway from the early-1980s and appears to have been infilled by the early 2000s; it is noted that the quarry was operational since the late 1800s and was mined more extensively in the late 1970s and early 1980s. Ardley / Dewars Farm Quarry is shown from 2013 to the south of Ardley Quarry and the Viridor Ardley Energy Recovery Facility (ERF) in which the ERF was under construction to the east of the Main Site in 2013. By the late 2010s, the ERF has been constructed. By 2020, Ardley / Dewars Farm quarry had been extended south and remains active, with the north western part appearing to be in the process of restoration.

11.4.11 It is noted that the offsite airfield to the northwest of the Main Site was sold in 1994 and is in the process of being redeveloped as a mixed residential and commercial development at the time of the Hydrock report.

11.4.12 The area southeast of the B430 Heyford Park Link Road – Middleton Stoney Relief Road, underwent little modification during the mapping history, apart from the construction of the B430, the construction to the access of Ardley Quarry to the north of the proposed route and the expansion of the quarry itself towards the area.

Ground Conditions

Superficial Deposits

11.4.13 Information published by the BGS has mapped localized Made Ground[13] to be present to the east of the Main Site and the B430 and south Chiltern Railway Line (Railway Corridor and Ardley Bypass (Highway Works – Area E), where landfilling has occurred (Ardley Landfill) in the northern extents of the Smiths Ardley Quarry. In addition, several areas of artificial ground are present immediately to the northwest (airfield, railway cutting and Ardley Wood), north (M40 and service station) and east of the Application Site (Ardley / Fields Farm Quarry and Ardley Landfill).

11.4.14 The BGS data indicates that superficial deposit[14] units are predominately absent across the Application Site, isolated pockets of Head Deposits are indicated to be present in the north of the Highway Works (A43 / M40 interchange) and in the northwest and north – central areas of the Main Site. Alluvium deposits are indicated along stream courses running through the center of the Main Site trending north to south and in the northwest corner of the Main Site and in the northwest and north – central areas of the Main Site. Alluvium deposits are indicated along stream courses running through the center of the Main Site trending north to south and in the northwest corner of the Main Site.

11.4.15 A geological fault is shown to transect the north and northwest corner of the Main Site, trending west to northeast and downthrown to the north.

Bedrock Deposits

11.4.16 BGS mapping for the Study Area indicates that the Main Site is predominantly underlain by White Limestone Formation (comprising limestone, wackestone, packstone, grainstone and mudstone), with superficial deposits generally absent. The entire Application Site area is underlain by Sedimentary Bedrock formed during the Jurassic Period. A geological fault is shown to transect the north and northwest corner of the Application Site, trending west to northeast and downthrown to the north.

11.4.17 The Application Site is also interspersed with smaller areas of Rutland Formation (comprising mudstone, siltstone, and sandstone), and Forest Marble Formation Limestone (comprising mudstone, limestone, and sandstone) in the northwest of the Main Site. Superficial deposits of Head (comprising Clay, Silt, Sand and Gravel) and Alluvium (comprising Clay, Silt, Sand and Gravel) are recorded along stream courses

[13]Made Ground defined as anthropogenic (mand made) ground in which the material has been placed without engineering control and/or manufactured by man in some way, such as through crushing or washing, or arising from an industrial process.
[14]Superficial deposits refer to geological deposits typically of Quaternary age. These geologically recent unconsolidated sediments may include stream channel and floodplain deposits, beach sands, talus gravels and glacial drift and moraine. All pre-Quaternary deposits are referred to as bedrock.

running through the centre of the Main Site trending north to south and in the northwest corner.

11.4.18 It is noted in the Hydrock (2021) desk study report, that the White Limestone Formation is subdivided into the Blandon Member (clay/mudstone), the Ardley Member (limestone, wackestone, packstone and mudstone) and the Shipton Member (limestone, wackestone, packstone and mudstone), based on geological cross sections within the BGS map that encompasses the Application Site area.

Third Party Investigation Logs

11.4.19 A summary of a previous ground investigation undertaken at Ashgrove Farm (BRD, 2015) provided within the Hydrock report generally confirmed the published geological sequences. The ground conditions generally comprised:

- Surface cover of scrub, concrete or tarmac/roadstone to 0.1m below ground level (bgl); over
- Made Ground of sandy gravelly clay, with gravel of flint, limestone, brick and concrete, to between 0.1m and 1.4m bgl; over
- Reworked or weathered White Limestone of medium dense/dense sandy clayey gravel or sandy;Gravelly clay, between 0.1m and 1.6m bgl (probable reworked or weathered limestone); over
- White Limestone: weak, becoming strong limestone, recovered as sandy gravel of limestone, to between 3.9m bgl and 4.0m bgl; over
- A mudstone or siltstone layer (top of the Shipton Member of the White Limestone Formation); over
- Interbedded siltstone, mudrock and limestone (Shipton Member of the White Limestone.

BWB Investigation Logs

11.4.20 Ground investigation works completed by BWB in September 2021 on the Main Site generally confirmed the anticipated geological sequences typically recording varying thickness of topsoil and subsoil (up to 1.0m thick) over slightly clayey to clayey sandy limestone recovered as a gravel.

11.4.21 Limited Made Ground was recorded, mainly encountered around the Ashgrove Farm area.

11.4.22 Alluvium was encountered in two locations, to the north and southwest of Ashgrove Farm. The deposits were recorded as a soft to firm clayey silt or silty clay.

11.4.23 The White Limestone Formation was encountered across the site at proven thicknesses ranging between 0.26m and 9.80m, recovered as a very dense, greyish/orangish brown slightly clayey sandy gravel and gravelly sand, with gravels

of limestone and some shell fragments and calcareous concretions. Interbedded layers of very dense grey slightly sandy gravel of limestone and orange, brown clayey sand was encountered towards the southeast of the site.

11.4.24 Rutland Formation was encountered at one location to the southwest of Ashgrove Farm from 2.4m to 3.03m bgl, comprising firm greenish grey slightly silty, sandy, slightly gravelly clay with occasional shell fragments and gravels of limestone.

Aquifer Designation

11.4.25 The groundwater body beneath the majority of the Application Site is the Tackley Jurassic and is classified as Good Chemical and Quantitative status under the Water Framework Directive (EEA, 2021) for the latest available year (2019). The Upper Bedford Ouse Oolite Principal 1 groundwater body is present beneath the far northern portion of the Application Site and is classified as Good Chemical and Quantitative status for the same year.

11.4.26 The underlying ground conditions have been classified by the EA as follows:

11.4.27 Superficial Deposits:

- Alluvium: Secondary (A) Aquifer; and
- Head Deposit: Secondary Undifferentiated Aquifer.

11.4.28 Bedrock:

- White Limestone Formation: Principal Aquifer;
- Forest Marble Formation: Principal Aquifer; and
- Rutland Formation: Secondary (B) Aquifer.

11.4.29 Hydrock state that previous ground investigations on site reported groundwater in the White Limestone Formation at depths between 3.4 and 3.7m bgl. Two groundwater bodies were expected by Hydrock at the base of each of the limestones, with the less permeable mudstone/siltstones/clays acting as an aquitard between the shallower and deeper groundwater bodies.

11.4.30 Groundwater was considered by Hydrock to be in hydraulic continuity with the surface water features on the Application Site. Hydrock state that groundwater flow was generally towards the southeast, although there may be some localised flow towards the railway cutting in the north, and the streams at the base of valleys in the south.

11.4.31 The Application Site is not located within, or near, an EA designated groundwater Source Protection Zone.

Groundwater Conditions Encountered

11.4.32 During the 2021 ground investigation, limited to the Main Site area, shallow groundwater strikes during excavation and drilling were encountered at depths between 1.3m and 2.0m bgl. Water strikes were generally noted to be confined, with stratum of cohesive material identified above and below the water strike. During deeper rotary open hole drilling air mist flush was used with resting water levels recorded at the completion of drilling works.

11.4.33 It is considered that two groundwater bodies are present at the Main Site; one is limited quantities of perched groundwater considered to be present within shallow deposits, while the second is within the deeper limestone deposits.

11.4.34 For the shallow groundwater unit, during the post-ground investigation monitoring programme resting groundwater levels were measured at depths ranging between 0.35m bgl (recorded on 04/10/2021) and 1.43m bgl (recorded on 11/10/2021). The resting levels were recorded at elevations raging between 106.42m AOD (recorded on 11/10/2021) and 107.77m AOD (recorded on 04/10/2021). The shallow groundwater body is considered to be a discontinuous groundwater unit, which was only identified in two locations at the site, as such no flow direction or hydraulic gradient has been calculated.

11.4.35 For the deeper groundwater unit, during the post-ground investigation monitoring programme resting groundwater levels were measured at depths ranging between 2.62m bgl (recorded on 18/10/2021) and 5.9m bgl (recorded on 04/10/2021). The resting levels were recorded at elevations raging between 93.68m AOD (recorded on 28/09/2021) and 115.1m AOD (recorded on 11/10/2021). The resting groundwater levels and site locations have been used to infer the likely groundwater flow direction at the Main Site, which is indicated to be in a south easterly direction with a gradient of approximately 1.74%.

11.4.36 Permeability testing in line with Buildings Research Establishment ('BRE') 365 guidance[15] was undertaken in eleven locations (SA01 to SA11) (refer to Appendix 11.3) across the Main Site. Permeability results ranged between $1.66x10^{-04}$m/s to $4.3x10^{-06}$m/s, the shallow section of the limestone aquifer falls into a low to medium permeability class, with good drainage characteristics. Permeability testing was undertaken within the limestone at deep rotary borehole located across the Main Site, with a testing section between 3.00m and 10.00m. As permeability results ranged between $4.16x10^{-06}$m/s to $4.52x10^{-07}$m/s, the limestone aquifer falls into a low permeability class, with good drainage characteristics.

[15] BRE Digest 365 'Soakaway design' (2016)

Surface Water Features

11.4.37 Several surface watercourses are present in and in the vicinity of the Application Site which are presented below:

Table 11.6: Surface Water Features

Surface Water Feature	Location (Site Area)	Location (Flow)
Gagle Brook All options of the Middleton Stoney Relief Road will cross the brook and it runs approximately 100m south-east of the proposed M40 J10 south facing slips.	Generally, to the east of the site but crosses the site boundary in the southeast (**southeast on site**) flowing to the southeast.	Overall, hydraulically downgradient
Padbury Brook Classified as Good Chemical and Moderate Ecological status under the Water Framework Directive for the latest available year (2019). It is noted to be heavily modified.	North of the site crossing the M40 to the north of J10 (**north onsite**) flowing to the east	Hydraulically upgradient
M40 J10 balancing ponds Two balancing ponds are located between the M40 (west) and the A43 (east).	North of the site (**north on site**)	Hydraulically upgradient
Covered Reservoir Appears to have been constructed in the 1980s. Reservoir to be retained as part of proposed development.	Centre west of the site (**central onsite**)	Hydraulically cross-gradient. No continuity is expected.
Unnamed watercourses Two issues located central onsite which join the Gagle Brook offsite in the south[16]. The proposed link to Heyford Park via Camp Road will cross this watercourse.	Centre of the site (**central on site**) flowing southeast	Hydraulically up/ cross-gradient
Gallos Brook (& Leys Farms Ditch) Classified as Good Chemical and Moderate Ecological status under the Water Framework Directive for the latest available year (2019).	200m west (**west off site**) flowing south	Hydraulically upgradient
Balancing ponds Two balancing ponds are located at the Viridor Ardley Energy Recovery Facility.	400m east (**east off site**)	Hydraulically cross/downgradient
River Cherwell Classified as Good Chemical and Moderate Ecological status under the Water Framework Directive for the latest available year (2019).	3km west (**west off site**) flowing south	Hydraulically upgradient
River Ray Classified as Good Chemical and Bad	10km southeast (**southeast off site**) flowing	Hydraulically downgradient

[16] One of these tributaries has been referred to as the Ashgrove Brook in the draft Water Chapter.

Surface Water Feature	Location (Site Area)	Location (Flow)
Ecological status under the Water Framework Directive for the latest available year (2019).	southwest	

11.4.38 Several small drains and ponds and historic springs are also located towards the south of the Application Site. There are no active licensed surface water abstractions on or within 1km of the site. There are four active licensed surface water discharges within 1km of the site which all discharge into Leys Farm Ditch for either trade discharge (site drainage) or sewage discharge (final/treated effluent).

11.4.39 The majority of the Application Site is considered by the EA to be at low risk of flooding (less than 1 in 1000 (0.1%) from rivers and the sea, with no noted flood defences or flood water storage areas in the vicinity of the Application Site. However, small parts of the Application Site (in the north and south) are in Flood Zone 3 in the location of the streams (Padbury Brook, Gagle Brook and Unnamed watercourses). A detailed flood risk assessment will be submitted in support of the final ES.

Ground Gas and Radon

11.4.40 Based on the desk study and the ground investigation undertaken, the following potential sources of hazardous ground gas have been identified:

- Very localised Made Ground across the Application Site;
- Ardley Landfill to the east of B430 (northern extent onsite encroaching Main Site (rail) and Highway Works - Ardley Bypass);
- Natural organic material associated with alluvium has potential for low level gas generating, although this is considered to be limited; and
- Ardley Wood Landfill approximately 10m north of the Main Site, beyond the railway cutting.

11.4.41 Given the majority of the Application Site has a very low gas generation potential, BWB have undertaken four gas monitoring visits over a period of one month. Based on the available data, the gas regime is assessed as CS1 (Characteristic Situation 1), i.e. 'Very Low Risk',in accordance with BS8485:2015+A1:2019[17] across the Main Site, for which no gas protection is required. The gas data indicates no shallow ground gas risk in the east of the site adjacent to Ardley Landfill. However, finished floor levels of the buildings in this area will be around 3.0m below existing ground levels and so the main gas risk will be via gas migration through fracturing in the deeper limestone. Additionally, it is understood that active ground gas management is installed at Ardley Landfill which is likely to restrict potential for gas migration onto site.

[17]BS8485:2015+A1:2019: Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.

11.4.42 Sections of the Application Site in the far north and south are in Radon Affected Areas (radon levels in 1-3% of homes are above the action level), although the majority of the Main Site is not in a Radon Affected Area. Radon protection measures are not required for new buildings on the Main Site.

Waste Management Facilities

11.4.43 A review of waste management in the vicinity of the site was undertaken and a summary of the Hydrock findings is presented in **Table 11:7** below:

Table 11.7: Waste Facilities

Waste Management in the Vicinity of the Application Site	Location
Operational composting facility (The Agrivert IVC) for the composting of waste. Dated from 2007.	South of Ashgrove Farm **(Main Site)**
Historical Landfill (Ardley Landfill / Ardley Fields Farm) was licensed for inert, non-hazardous, stable non-reactive hazardous waste (in the form of asbestos) and hazardous waste. Dated from 1979 to 2014. The southern extension was operated as a co-disposal landfill from July 2000.	Onsite, northern extent of landfill encroaches into the Ardley Bypass road alignment **and rail interchange southern connection (Rail Corridor, Main Site)**
Operational Household, Commercial & Industrial Waste Transfer Station, located at the former Ardley Landfill/Ardley Fields Farm Landfill. Wastes accepted include household, commercial and industrial waste.	Northern portion of former Ardley Landfill **(north eastern area of the Main Site).**
Operational ERF (Viridor) for the incineration of waste. Wastes accepted include household, commercial and industrial waste. Dated from 2014.	Southern portion of the former Ardley Landfill **(east off Main site)**
An **active biological treatment facility (Ardley Leachate Treatment Plant)** at Viridor ERF	Southern portion of the former Ardley Landfill **(east off Main site)**
Historical landfill (Ardley Wood) was licensed for inert, industrial, commercial, household, and liquid sludge. Dated from 1940 to 1980.	North of the proposed highway works on the northern side of the railway line **(north off Main site)**

Site of Special Scientific Interest (SSSI)

11.4.44 Two SSSI's are recorded within the vicinity of the Application Site and further details are provided in **Table 11:8** below, the locations of which are set-out in Chapter 9: 'Ecology including Arboriculture'.

Table 11.8: Site of Special Scientific Interest (SSSI)

Site of Special Scientific Interest (SSSI) within 500m of the Application Site	Location (Site Area)
Ardley Cutting and Quarry, which is designated due to geological interest for its exposures of Jurassic rocks and has biological interest associated with limestone grassland, scrub, ancient woodland, and wetland habitats. Dated from 1988. It is	Along the Chiltern Railway Line cutting, (east of the B430)

noted that this SSSI is listed as 'unfavourable – recovering'.[18]	
Ardley Trackways, which is designated due to the presence of fossilised dinosaur (sauropod and theropod footprints) which form trackways. Dated from 2010.	Southern unit at Ardley / Dewars Farm Quarry **offsite** (southeast of the Application Site)

Soil and Groundwater Contamination

11.4.45 Hydrock Phase 1 Assessments (**Appendix 11.1**) and BWB Phase 2 preliminary ground investigation for the Main Site (**Appendix 11.2**) concluded that limited potential contamination sources had been identified at the Application Site. The contamination sources within each area are described below. Contamination Sources will be updated in the final Chapter following the proposed additional ground investigations.

Contamination Sources: Main Site

- Localised Made Ground associated with isolated areas of historical development and field spreading. Potential contaminants may include metals, asbestos and PAHs;
- Leaking from former and current above and below ground storage tanks and oil storage at Ashgrove Farm. Potential contaminants may include petroleum hydrocarbons and VOCs;
- Leaking from the transformers in the electrical substation at Ashgrove Farm. Potential contaminants may include PCBs and oils;
- Asbestos fibres from insulation or ACMs in the buildings; and
- Herbicides / pesticides / agrochemicals used historically on farms and stored in storage facilities. Potential contaminants may include pesticides and herbicides.

Contamination Sources: – including the J10 Highway Improvements and Ardley Bypass)

- Localised Made Ground associated with isolated areas of historical development and old quarries infilled quarries and field spreading. Potential contaminants may include metals, asbestos and polycyclic aromatic hydrocarbons (PAHs); and
- Landfill Made Ground materials present in the historical landfill south of Chiltern Railway Line. (East of B430) Potential contaminants may include metals, asbestos fibres, PAHs and petroleum hydrocarbons, phenols, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

[18] The Applicant's Ecology team are arranging access with Network Rail, but there is no pedestrian access to observe / log the geological features.

- Localised Made Ground associated with isolated areas of historical development, road network and field spreading. Potential contaminants may include metals, asbestos and PAHs.

Area including the Middleton Stoney Relief Road

- Localised Made Ground associated with isolated areas of historical development, road network and field spreading. Potential contaminants may include metals, asbestos and PAHs.
- Landfill Made Ground materials may be present in the areas belonging to the historical Ardley Landfill located to the east of the B430 site and to the south of the Chiltern Railway Line, a portion of the designed Ardley Bypass. Potential contaminants may include metals, asbestos fibres, PAHs and petroleum hydrocarbons, phenols, VOCs and SVOCs.

Potential Contamination Sources: Offsite (250m buffer from Application Site, definition in paragraph 11.2.17)

- Landfill Made Ground materials present in the historical landfill in the east of the Application Site. (East of B430) Potential contaminants may include metals, asbestos fibres, PAHs and petroleum hydrocarbons, phenols, VOCs and SVOCs;
- Landfill Made Ground materials present in the historical Ardley Wood landfill approximately 10m north of the Main Site. Potential contaminants may include metals, PAHs and petroleum hydrocarbons, phenols, VOCs and SVOCs;
- Impacted Groundwater associated with Former Upper Heyford Airfield as an airbase and leakage from petrol, oil, and lubrication (POL) storage. Potential contaminants may include phenols and petroleum hydrocarbons PFAS and PFOS; and
- Groundwater containing hydrocarbon fuels, lubricants, and solvents from the operation of the garage north of the A43 realignment works including leakage from Underground Storage Tanks (USTs), Above Ground Storage Tanks (ASTs), the pipework between tanks and pumps, and general spillage, together with uncontrolled disposal and spillage from waste receptacles. (This source is more likely to affect the Highways Works areas).

Receptors: On the Application Site

- Secondary Undifferentiated Aquifer – Head Deposit;
- Underlying Principal Aquifer – White Limestone Formation;
- Underlying Principal Aquifer – Forest Marble Formation;
- Underlying Secondary B Aquifer – Rutland Formation;
- Surface water receptors and possible abstractors;
- Aquatic ecosystems;
- Current and future site users;

- Ground Workers during construction;
- Intrusive maintenance works;
- Future Buildings;
- Water supply pipes; and
- Flora and Fauna (Including Ardley Cutting and Quarry SSSI).

Receptors: Offsite (250m buffer from Application Site)

- Wider Secondary Undifferentiated Aquifer – Head Deposit;
- Wider Underlying Principal Aquifer – White Limestone Formation;
- Wider Underlying Principal Aquifer – Forest Marble Formation;
- Wider Underlying Secondary B Aquifer – Rutland Formation;
- Surface water receptors – off site, downstream watercourses;
- Site neighbours; and
- Flora and Fauna (Including Ardley Cutting and Quarry SSSI).

Ground Investigation and Contamination Assessment (Main Site)

11.4.46 The 2021 BWB ground investigation on the Main Site area (**Appendix 11.3**) involved chemical sampling of soil and groundwater produced from 30 dynamic sampling and 70 trial pit locations. The sampling strategy was designed to generally understand the initial contamination status across the site (Made Ground) while targeting potential localised sources where access could be arranged; this included locations at Ashgrove Farm (to assess hydrocarbon impact from current/former tanks and oil storage) and the eastern boundary (to assess potential gas migration from Ardley Landfill).

11.4.47 Deeper boreholes, spread across the whole Main Site, were produced via open hole rotary technique, with all 10 locations installed for monitoring purposes. Water samples were collected from 4 of the 10 deep installations. Superficial water samples were further collected at the unnamed watercourse located central onsite which join the Gagle Brook offsite in the south, and 2 additional samples were collected from other 2 deep locations.

11.4.48 No significant contamination was recorded, visual, olfactory or through chemical testing, at the electrical substation or former/current fuel and oil storage at Ashgrove Farm. Access could not be gained at the composting facility and covered reservoir; however, it is unlikely that significant contamination is present based on the uses at those sites.

11.4.49 Made Ground was limited to two locations in the vicinity of Ashgrove Farm up to 1.3m bgl, with no significant contamination recorded. No Made Ground was recorded in the northeast of the site in the location of the former Ardley Landfill.

11.4.50 Groundwater and surface water contamination data have been compared to assessment criteria where the primary receptor is considered to be the underlying Principal Aquifer. The criteria includes reference to UK Drinking Water Standards (DWS), Guidelines for Drinking Water Quality (EQS Freshwater) and WHO health standards (WHO).

11.4.51 No groundwater and surface water samples exceeded the relevant screening criteria.

11.4.52 No significant ground gas concentrations have been recorded.

Conceptual Site Model (Main Site)

11.4.53 The following sections discuss all the identified potential on and off-site sources, pathways and receptors in the context of the proposed development and plausible pollutant linkages which may represent a risk to identified receptors such as human health and/or Controlled Waters from the data gained from the desk studies completed (Appendix 11.1 and Appendix 11.2). The assessment is qualitative and aimed to determine all likely pollutant linkages, with consideration of significance and allowing for uncertainties. The CSM derived for the full Application Site area is provided in Table 11.19.

11.4.54 The remaining pollutant linkages associated with the rest of the Application Site including areas within Ardley Landfill and Highway Works area will be updated in the final ES chapter following ground investigation in these areas.

Table 11.19: Conceptual Site Model (Main Site)

S1: Onsite: Made Ground (Main Site) associated with isolated areas of historical development and field spreading. Potential contaminants may include metals, asbestos and PAHs. .	**P1:** Direct contact, incidental ingestion, and inhalation of particulates.	**R1**: Site users	Mi	Lw	L	Ground investigation identified no exceedances in soils and limited leachate exceedances of metals in relation to Controlled Waters. Made Ground was limited to a small area in the centre of the Main Site away from Main Site boundaries. Access was limited in several areas of the Main Site due to ecological and access constraints. While no significant contamination has been identified, the presence of unexpected contamination cannot be fully discounted and localised areas may exist in relation to former buildings and structures. Contact with these materials is likely to be limited to areas of landscaping, especially at the proposed conversion of Ashgrove Farm. However, over the majority of the Main Site, the risk will be low as the proposed development will comprise hardstanding and building footprints. Should asbestos be identified during redevelopment works mitigation would typically comprise hand picking and disposal, along with
	P2: Inhalation of fugitive dust.	**R2:** Site Neighbours	Md	Ul	L	
	P3: Vertical migration of contaminants in the soil leachate through the unsaturated zone.	**R3:** Underlying Principal Aquifer	Md	Ul	L	
	P4: Surface run-off.	**R4:** Aquatic ecosystems	Md	Ul	L	
		R5: Surface water receptors and possible abstractors	Md	Ul	L	
	P5: Base flow from contaminated groundwater.	**R4:** Aquatic ecosystems	Md	Ul	L	
		R5: Surface water receptors and possible abstractors	Md	Ul	L	
	P6: Direct contact.	**R6:** Water supply pipes	Md	Ul	L	

						materials management and reuse of Made Ground soils at depth below hardstanding and away from service corridors. Assessment of re-use of soils containing asbestos should be undertaken by a competent person. The exposure to construction workers/services personnel can be mitigated by utilising appropriate PPE and maintaining good hygiene levels, considered to be managed through CDM regulations. The Main Site is underlain by high permeability strata. Groundwater flow is calculated to be to the southeast. Leachable concentrations identified in localised soils were not identified in groundwater. No hydrocarbons were encountered during the ground investigation, and it is unlikely that water supply pipes would be impacted.
	P7: Root uptake.	**R7:** Landscape planning	Mr	Ul	VL	Made Ground was encountered in limited areas of historical development (as above). Limited exceedances were recorded in soil leachates. Suitability of Made Ground for reuse should be considered and assessment of soils as suitable growth

						medium should be undertaken in planned landscaped areas. This requirement will be informed by the future landscaped design. Whilst root uptake is possible in areas of landscaping, the plants currently on the Main Site did not show any signs of growth issues.
S2: Onsite (Main Site) – Leaking from former and current above and below ground storage tanks and oil storage at Ashgrove Farm. Potential contaminants may include petroleum hydrocarbons and VOCs.	**P1:** Direct contact, incidental ingestion, and inhalation of particulates.	**R1**: Site users	Md	Ul	L	Ground investigation identified no exceedances in soils and limited leachate exceedances of metals in relation to Controlled Waters. Access was limited in several areas of the MainSite due to ecological and access constraints. While no significant contamination has been identified, the presence cannot be fully discounted and localised areas of unexpected contamination may exist in relation to former buildings and structures. No significant vapours detected in historical investigations and most recent investigation. The risk of significant generation of dust is likely only during site development process and can therefore be controlled. Mitigation may be required if unexpected
	P8: Vapour inhalation.	**R2:** Site Neighbours	Md	Ul	L	
	P2: Inhalation of fugitive dust.		Md	Ul	L	
	P3: Vertical migration of contaminants in the soil leachate through the unsaturated zone.	**R3:** Underlying Principal Aquifer and possible abstractors	Md	Ul	L	
	P4: Surface run-off.	**R4:** Aquatic ecosystems	Md	Ul	L	
		R5: Surface water receptors and possible abstractors	Md	Ul	L	
	P5: Base flow from contaminated groundwater.	**R4:** Aquatic ecosystems	Md	Ul	L	
		R5: Surface water receptors and possible abstractors	Md	Ul	L	
	P6: Direct contact.	**R6:** Water supply pipes	Md	Ul	L	

						contamination is identified. Currently, no redevelopment is proposed at Ashgrove Farm
S3: Onsite (Main Site)– leaking from the transforms in the electrical substation at Ashgrove Farm. Potential contaminants may include PCBs and oils.	**P1:** Direct contact and incidental ingestion.	**R1**: Site users	Md	Ul	L	An electrical substation has been present on the Main Site, which has the potential to have leaked. While no significant contamination has been identified, the presence cannot be fully discounted. No PCB testing was completed. However, concentrations of TPH were recorded below detection limits. Additionally, no redevelopment is currently proposed at Ashgrove Farm. Contact with these materials is likely to be limited to localised areas. However, over the majority of the Main Site, the risk is considered to be low. No significant dust generation is not anticipated in this area of the Main Site; however, dust generation should be managed through good practice in this area if required during the redevelopment works. If unexpected contamination is identified, mitigation may comprise small scale excavation, reuse of Made Ground / impacted
	P2: Inhalation and ingestion of fugitive dust.	**R1**: Site users	Md	Ul	L	
		R2: Site Neighbours	Md	Ul	L	
	P3: Vertical migration of contaminants in the soil leachate through the unsaturated zone.	**R3:** Underlying Principal Aquifer	Md	Ul	L	

						soils at depth in landscaped areas and possibly small-scale bioremediation or disposal.
S4: Onsite (Main Site) – ground gases (carbon dioxide and methane) from organic materials in the Made Ground and in natural ground below the Main Site.	**P9:** Migration, build up and asphyxiation.	**R1**: Site users	Sv	Ul	M/L	Made ground was limited across the Main Site and monitoring installs were generally installed in natural deposits. One installation was completed in deep topsoil in which the gas regime has been assessed as CS2, however, topsoil will be stripped and is not suitable for use beneath buildings. The site has been assessed as CS1 low risk.
	P10: Migration, build up and explosion.	**R1**: Site users	Sv	Ul	M/L	
		R8: Buildings on site	Sv	Ul	M/L	
S5: On site (Main Site)– Asbestos fibres from insulation or ACMs in the buildings.	**P2:** Inhalation of fugitive dust.	**R1**: Site users	Md	Ul	L	Potential Asbestos was noted to be present in buildings (suspected asbestos cement roofs) and structures onsite at Ashgrove Farm. No asbestos was identified in the Made Ground samples collected in this location. However, its is anticipated that no redevelopment will be undertaken within this area with buildings retained as a farm
		R2: Site Neighbours	Md	Ul	L	
S6: On site (Main Site)- Herbicides / pesticides / agrochemicals used historically	**P1:** Direct contact, incidental ingestion, and inhalation of particulates.	**R1**: Site users	Mi	Ul	VL	No pesticides or herbicides were recorded during the current ground investigation.

on farms and stored in storage facilities. Potential contaminants may include pesticides and herbicides.	**P2:** Inhalation of fugitive dust.	**R2:** Site Neighbours	Mi	Ul	VL	In the future development scenario contact with soils is likely in limited areas of landscaping. However, over the majority of the Main Site, the risk will be low as the proposed development will comprise hardstanding and building footprint. The risk of significant generation of dust is likely only during site development process and can therefore be controlled. The Main Site is underlain by high permeability strata and Principal Aquifers. There are no groundwater abstractions within 1km of the Main Site. The topography of the Main Site would cause surface water to run into onsite drainage ditches.
	P3: Vertical migration of contaminants in the soil leachate through the unsaturated zone.	**R3:** Underlying Principal Aquifer and possible abstractors	Mi	Ul	VL	
	P4: Surface run-off.	**R4:** Aquatic ecosystems	Mi	Ul	VL	
		R5: Surface water receptors and possible abstractors	Mi	Ul	VL	
	P5: Base flow from contaminated groundwater.	**R4:** Aquatic ecosystems	Mi	Ul	VL	
		R5: Surface water receptors and possible abstractors	Mi	Ul	VL	
S7: Off site (Outside Main Site -Area C)- Landfill Made Ground materials present in the historical Ardley Landfill to the east of the site. Potential contaminants may include metals, asbestos fibres, PAHs and petroleum hydrocarbons, phenols, VOCs and SVOCs.	**P1:** Direct contact, incidental ingestion, and inhalation of particulates.	**R1**: Site users	Md	Lw	M/L	Further assessment of the soils and groundwater in this area cannot be undertaken as ground investigation locations were not advanced within the Ardley Landfill area. Further assessment of this source will be required for the future road/railway corridor works.
	P2: Inhalation of fugitive dust.	**R1**: Site users	Md	Ul	L	
	P3: Vertical migration of contaminants in the soil leachate through the unsaturated zone.	**R3:** Underlying Principal Aquifer	Md	Ul	L	
	P4: Surface run-off.	**R4:** Aquatic ecosystems	Mi	Lw	L	

		R5: Surface water receptors and possible abstractors	Mi	Lw	L	
	P5: Base flow from contaminated groundwater.	**R4:** Aquatic ecosystems	Mi	Lw	L	
		R5: Surface water receptors and possible abstractors	Mi	Lw	L	
	P6: Direct contact.	**R6:** Water supply pipes	Md	Ul	L	
S7: Off site (Outside Main Site -Area C)– ground gases (carbon dioxide and methane) from organic materials from Ardley Landfill to the east of Main Site.	**P9:** Migration, build up and asphyxiation.	**R1**: Site users	Md / Sv	Lw	M	No investigation was undertaken within the Ardley Landfill. Information on the permit surrender, ongoing gassing and the construction of the landfill should be sought prior to ground investigation and gas monitoring in this area. Further gas monitoring is recommended along with a gas assessment during rapidly falling pressure to assess the worst case. Any gas risk is considered to be limited to proposed units 1 to 3.
	P10: Migration, build up and explosion.	**R1**: Site users	Md / Sv	Lw	M	
		R8: Buildings on site	Md / Sv	Lw	M	
S8: Contaminated water associated with Offsite – Former Upper Heyford Airfield as an airbase and leakage from petrol, oil, and lubrication (POL) storage. Potential contaminants	**P1:** Direct contact and incidental ingestion.	**R1**: Site users	Md	Ul	L	Groundwater flow direction has been calculated to be southeast at the Main Site, and the former airfield is considered to be upgradient. No petroleum hydrocarbons or phenol was recorded at elevated concentrations
	P4: Surface run-off.	**R4:** Aquatic ecosystems	Md	Ul	L	
		R5: Surface water receptors and possible abstractors	Md	Ul	L	
	P5: Base flow from	**R4:** Aquatic ecosystems	Md	Ul	L	

may include phenols and petroleum hydrocarbons. PFAS and PFOS.	contaminated groundwater.	**R5:** Surface water receptors and possible abstractors	Md	Ul	L	in groundwater at the site. It is understood that remediation works have been completed at the former airfield and if available these documents should be reviewed. It is recommended that additional groundwater monitoring is completed to confirm the groundwater condition beneath the site. The adjacent former airfield closed in December 1993. Given the length of time since its closure and the potential limited use of PFAS/PFOS firefighting foam products on the airfield, this contaminant source is not considered further.
S9: Offsite - Landfill Made Ground materials present in the historical landfill approximately 10m north of the Main Site. Potential contaminants may include metals, PAHs and petroleum hydrocarbons, phenols, VOCs and SVOCs. Ground gases (carbon dioxide and methane) from organic materials	**P4:** Surface run-off.	**R4:** Aquatic ecosystems	Md	Ul	L	Given the landfill is the opposite site of the railway, which is within a deep cutting, plausible linkages are limited to on site receptors. Users of this part of the Main Site are likely to be limited to rail/terminal workers, and therefore unlikely to encounter the soils. No landscaping likely for this part of the Main Site (railway siding). No exceedances were recorded at elevated concentrations in groundwater at the Main Site.
		R5: Surface water receptors and possible abstractors	Md	Ul	L	
	P5: Base flow from contaminated groundwater.	**R4:** Aquatic ecosystems	Md	Ul	L	
		R5: Surface water receptors and possible abstractors	Md	Ul	L	

						It is recommended that additional groundwater monitoring is completed. Surface run-off will be limited by the woodland in this area. Confirmation of the construction of the landfill should be sought, it is assumed in this assessment that the landfill is capped.
	P9: Migration, build up and asphyxiation.	**R1**: Site users	Md	Ul	L	Given the landfill is the opposite site of the railway, which is within a deep cutting, plausible linkages are limited to on site receptors. Buildings proposed as part of the development are also some distance from the railway. The rating is largely dictated by the severity should significant gas migration occur.
	P10: Migration, build up and explosion.	**R1**: Site users	Md	Ul	L	
		R8: Buildings on site	Md	Ul	L	
VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor Hi = High, Li = Likely, Lw = Low Likelihood, Ul = Unlikely						

Mineral Assessment

11.4.55 Mineral extraction has been undertaken historically in the surrounding area, with several small-scale limestone pits and quarries noted on historical maps and in the Groundsure reports (within **Appendix 11.1** and **Appendix 11.2**). In addition, significant limestone quarrying operations have occurred at:

- The historical Ardley Quarry (also known as Ardley Fields Farm Quarry), located to the east of the Main Site, on the eastern side of the B430 road. Small scale mining occurred historically (late 19th Century). Large scale quarrying appears to have commenced in the late 1970s and worked north to south. Mineral extraction appears to have been completed by the late 1990s in this area and the area was backfilled as a landfill (Ardley landfill). Restoration commenced in the early 2000's and the Ardley ERF facility was constructed in the south of the area during the early 2010s.
- The historical Ardley Woods Quarry, located to the north of the Main Site (on the northern side of the railway line). This was quarried (small scale) in the

late 19th Century and appears to have been mined more extensively in the late 1970s and early 1980s. It is noted as disused by 1992. Ardley Cutting and Quarry SSSI (**Table 11.8**).

- The historical Ardley Quarry Extension, located to the north-west of the site; north of the Ardley Quarry (on the northern side of the railway line). This was quarried in the early 2000s and is now partially restored (vegetated, with ponds in the east of the former quarry). This quarry now forms part of the Ardley Trackways SSSI.
- Ardley/ Dewar's Farm Quarry, located to the south of Ardley Quarry; to the immediate east / south-east of the site. This quarry is noted to be 'active'. For further information with regard to the Ardley/ Dewar's Farm Quarry, please refer to the information below.

11.4.56 The Oxfordshire Mineral and Waste Local Plan (2017), policy M2 paragraph 4.22 states that preference will be given to the expansion of existing quarries, such as the expansion of the Ardley Quarry. The Local Plan also states that demand for crushed rock for the plan period, ending in 2031, will be met by the existing quarries across the county.

11.4.57 It is currently anticipated that the extraction of the full currently permitted extent of the Ardley Quarry in 2018 will not be impacted by the construction of the Middleton Stoney Relief Road.

11.4.58 A potentially viable mineral resource exists on the Main Site, however, there is no economic demand for the resource to be removed for sale in the next decade or more. Limestone is generally recorded within 1.0m of the site surface, with a workable thickness of limestone of approximately 6.0m across the site. Given the approximate site area of 200ha, this equates to an estimated 27.6 million tonnes of limestone present on site; assuming that 50% of the mineral was extractable, this would generate more rock from one source then is required to fulfil the entire Local Plan requirement from 2014 to 2031 of 10.512 million tonnes (Policy M2), Therefore, it is considered unlikely that there will be an economic demand for the mineral if extracted for sale within the lifetime of the current plan.

11.4.59 Permissions for development over a protected mineral could be granted (Policy M5) if it can be demonstrated that the mineral can be excavated (through a borrow pit for example) and used on site during the construction phase with minimal use of public highways. Any mineral excavated in this way can only be used in connection with the project.

11.4.60 It was therefore concluded that minerals extraction at the site is not economically viable although reuse of material on site as part of delivering a cut/fill balance on-site should and will be the target such that the development does not require the import of crushed rock.

Future Baseline

11.4.61 Based on the assessment of the current state of the baseline conditions, there are no significant adverse effects on the Main Site from the current activities. With regard to the other areas of the Application Site, unless further investigation identifies soil concentrations in excess of the applied Human Health screening criteria in the vicinity of the contamination sources identified such as Ardley Landfill, the soil treatment facility and the service station beyond the A43, risk to human health will remain low.

11.4.62 The risk to groundwater bodies and surface water is not expected to change at the Application Site as no change of use is otherwise anticipated and existing site uses are unlikely to cause significant impact.

11.4.63 The actual conservation state of the Ardley Cutting and Quarry SSSI is listed as 'unfavourable – recovering', which is considered likely to continue unless some improvement is scheduled by regulatory action.

11.5 ASSESSMENT OF LIKELY EFFECTS

Application Site - Construction Phase

11.5.1 As part of the development of the Main Site a large earthworks exercise will be undertaken, with up to 7.0m of cut required. The earthworks model has been designed to balance the amount of cut taken and the amount of fill required, with the intention that no additional material will be required to be imported or exported from the Main Site presenting a negligible effect on mineral resource. Earthworks modelling for the highways is yet to be assessed in detail but will seek to establish a cut fill balance negating unnecessary import or export requirements.

11.5.2 A large earthworks operation will be required at the Main Site to create level development plateaus. Most units will be located on plateaus with a portion of cut and fill required on each plot. Currently, only the western edge of Zone A3 on the draft Parameters Plan is placed wholly in cut (**Appendix 11.5**, Preliminary Earthworks). Given the shallow bedrock, breaking out competent rock will create a significant constraint at the Main Site. The rock will need to be removed by ripping utilising tracked bulldozers.

11.5.3 Based on the proposed earthworks strategy, assuming that material is placed to a suitable specification then shallow footings and ground bearing floor slabs are expected to be suitable for the Proposed Development.

Risk to Human Health

11.5.4 Due to the predominantly greenfield and agricultural nature of the Main Site, currently and historically, it is unlikely that there will be widespread soil and/or groundwater contamination present that could represent a risk to human health or Controlled Waters receptors. If unforeseen contamination is identified ground workers may be exposed through direct exposure, dermal contact and inhalation of dusts and particulates, although this is unlikely. There is a low likelihood that localized spillages of hydrocarbons could contaminate soils and generate vapours with the potential to migrate into confined spaces within buildings. The magnitude would be negligible and so overall significance of effect would be negligible.

11.5.5 The effect of contaminated soils on construction workers are considered to be of minor significance based on a low likelihood and minor magnitude, confined to a localised areas and of short duration. The risk is increased where groundworks are required within the former Ardley Landfill Area. The effect will be assessed following ground investigation and assessment in that area.

Risks to Controlled Waters

11.5.6 There is a low likelihood that localised contamination may be mobilised during construction, where soils are excavated, and incident rainfall leaches soluble contaminants across most of the site. However, the risk is increased where groundworks are required within the former Ardley Landfill Area. The effect will be assessed following ground investigation and assessment in that area. Additionally, earthworks in general have a medium likelihood to increase erosion and migration of particulate matter and suspended solids into water courses, running towards the unnamed watercourse and consequently to Gagle Brook. The effect on Controlled Waters during construction are considered to be of minor adverse significance, confined to a localised area and of short / medium duration, with potential minor increased likelihood due to Climate Change.

11.5.7 While the earthworks strategy is still being progressed, it is possible that some areas of the Main Site may permanently cut into the groundwater table, notably at the western portion of Zone A4 on the draft Parameters Plan, the northwestern edge of Zone A3, and at the Rail Freight Terminal. If so, this will likely need a permanent drainage solution to manage groundwater. At this stage the proposed drainage strategy is expected to mimic existing conditions where much of the surface water is infiltrated into the ground feeding watercourse within and surrounding the Application Site. The potential effect will be updated including with regard to the final drainage strategy in the final ES chapter.

Risks to Buildings and Structures

11.5.8 The earthworks could require the cut and fill of approximately 3.6Mm^3 of soils and rock across the Main Site to create development platforms, railbed and roadways. Earthworks have a low likelihood to cause local instability of moderate magnitude in particular around existing slopes and retaining structures associated with the rail mainline cutting and M40 embankments. The effect on buildings and structures during construction are considered to be of minor adverse significance, confined to localised areas but could be permanent duration. There is the low possibility that Climate Change could increase precipitation inundation short term potentially increasing the likelihood of failure of temporary earth structures that could result in a a slight adverse effect.

Other Risks

11.5.9 Control on the impacts of noise, vibration, dust, and odour will be employed throughout the construction in consideration of the residential properties in the vicinity of the Application Site. These effects are considered in detail in the Chapter 4: Air quality, Chapter 5 Noise and Vibration and Chapter 6: Ecology including Arboriculture of this ES.

11.5.10 The mineral resources will be conserved by using all excavated minerals from development of the Main Site whilst avoiding additional demand on the existing mineral supply and fulfilling the requirement to minimise the use of public highways for mineral transport. There is therefore minor adverse effect as a result of the low likelihood of loss of mineral resource having moderate impact. Additionally, there is the potential for the proposed rail terminal to be utilised to export the limestone extracted from the Ardley quarry to the wider county and further markets reducing lorry carriage and potential minor beneficial impact on Climate Change.

11.5.11 The risk from items of UXO is not considered to be homogenous across the Main Site. There is an assessed [19] Medium Risk from items of German aerial delivered UXO, items of anti-aircraft UXO and items of Allied UXO within the north-western section of the site. Whereas there is an assessed Low Risk from items of German aerial delivered UXO, items of anti-aircraft UXO and items of Allied UXO across the remainder of the Main Site and Highway Works. The impact is slight adverse based on a high magnitude of impact but unlikely to occur.

11.5.12 The construction has to remove small areas of limestone rock face along the railway which is a low sensitivity geological SSSI (Ardley Cutting and Quarry SSSI). The impact would be minor and so this would present a slight adverse effect. However, this SSSI is currently inaccessible and the development has a moderate likelihood of creating opportunity to observe like rock faces and so may have short-term slight beneficial effect. The ecological significance of this SSSI is discussed in Chapter 6.

[19] 1st Line Defence, DA13850-00 Detailed UXO Risk Assessment, RAF Heyford (within Appendix 11.3).

Application Site Operational Phase

Risk to Human Health

11.5.13 The Application Site will be predominantly hard cover and therefore there is a low likelihood of future site users being exposed to any soil or groundwater contamination. Contact with unlikely potentially contaminated materials is likely to be limited to areas of landscaping, especially at the proposed conversion of Ashgrove Farm, and other localised areas in relation to former buildings and agricultural infrastructure such as tanks and storage units associated with the farm, the magnitude would be moderate and so the potential effect is minor adverse. Low concentrations of ground gas have been recorded and are not expected to be at significant levels beneath the Main Site. Further assessment is being undertaken for development zones A1a, A1b and A2 in the east of the Main Site due to potential for ground gas migration from Ardley Landfill, which will be presented in the final chapter in support of the ES. However, there is a low potential for a major impact which presents a potential moderate adverse effect.

11.5.14 The effect on human health during operation is considered to be of negligible to slight adverse significance.

Risks to Controlled Waters

11.5.15 The presence of significant hardstanding will reduce the infiltration of rainfall and subsequent leaching of any soluble contamination in shallow soils into underlying groundwater (Undifferentiated, Secondary B and Principal Aquifers) and surface waters.

11.5.16 Runoff from goods vehicles using the Main Site and Highways has the potential to be impacted by heavy metals and petroleum hydrocarbons.

11.5.17 Railway maintenance areas may involve storage of chemicals including fuels, lubricants and cleaning products. Temporary waste storage areas may be required.

11.5.18 The effect on Controlled Waters during operation across the Application Site are considered to be of slight adverse effect significance based on low likelihood and moderate impact and would be confined to a localized area and of short to medium duration.

Risks to Buildings and Structures

11.5.19 Based upon the proposed earthworks, some buildings will be constructed on a significant thickness of engineered fill. There is a moderate likelihood that poorly compacted or uncontrolled earthworks could cause significant settlements which could have a moderate adverse effect to buildings. Due to many of the proposed warehousing units (based in the Illustrative Masteplan) potentially being placed on a

combination of cut (into solid limestone bedrock) and fill (excavated soils and/or rock), there is the potential for differential settlement issues arising.

11.6 MITIGATION AND RESIDUAL EFFECTS

Application Site Construction Phase

Risk to Human Health

11.6.1 If unforeseen contamination is identified, mitigation will comprise small scale excavation, reuse of Made Ground / impacted soils at depth and/or possibly small-scale treatment or disposal dependent upon the most sustainable method.

11.6.2 It is understood that part of Ashgrove Farm is to be retained and redeveloped (re-used) as part of an on-site 'hub' for facilities. Prior to the demolition of existing structures, a pre-demolition asbestos survey will be undertaken, in accordance with Control of Asbestos Regulations 2012. This must be completed to identify all asbestos and enable a plan of work to be prepared to safely remove any asbestos.

11.6.3 Asbestos contaminated soils may be retained on the Main Site beneath hardstanding subject to a risk assessment and preparation or a safe system of work under the Control of Asbestos Regulations 2012.

Risks to Controlled Waters

11.6.4 During the construction phase, spillages (such as oil, fuel, cement, chemicals etc.) and soil erosion or the generation of suspended solids during construction activities (including excavations and plant/wheel washing) will be controlled through the implementation of a CEMP (Construction Environmental Management Plan) which will be submitted as part of the application documentation with the final application. This would include prevention measures such as: bunded storage; designated wheel washing areas; settling basins; screening stockpiles of materials; dampening exposed soils as appropriate; and set out requirements for ongoing monitoring and liaison (with the local community, the EA and the local authorities, as appropriate). Designated fuelling areas for plant will be set up with suitable double bunding for tanks, spill kits available and an emergency plan in place for dealing with any spills. Plant operators will receive appropriate training to avoid spills. The revoked EA Pollution Prevention Guidance provides useful recommendations of best practice for refuelling, including regular testing and maintenance of storage tanks. All fuel tanks will be bunded with a minimum capacity of 110% of the tank volume. Spill kits should be available at all fueling locations and regular training provided on dealing with spillages. Drip trays will be used under vehicles where appropriate to ensure that oil is collected and contained to prevent infiltration of contaminated waters.

11.6.5 During the construction phase, the Proposed Development is anticipated to include enabling works related to site levelling and bunding, soil stockpiling, and the exposure of other new areas of ground, such as site compounds. Measures will be undertaken in these areas as appropriate, in line with CIRIA C741 Good Practice on Site[20] and with a CEMP, to minimise the potential for the movement of sediments into surface watercourses.

11.6.6 To avoid infiltration of polluted water from vehicles or accidental spillage, vehicles will be inspected regularly and maintained to reduce the risk of leakages. Vehicle wash-down areas will be at least 10m from any surface waters and located in a designated bunded impermeable area. Any runoff will be treated through oil interceptors prior to discharge.

11.6.7 The CEMP will set out the requirements for management of dusts, odours and other sources of potential nuisance. There will be a particular focus on management of run off and protection of water courses from suspended solids in runoff and prevention of erosion and dust generation. This will include construction of temporary settlement ponds, silt fences and seeding of temporary stockpiles if necessary.

11.6.8 Additional detailed ground investigation of the Application Site, including areas of Highways Works will be completed post application submission but prior to development to ensure that excavated materials are suitable for use and any areas of potential contamination fully characterised and remediation strategies prepared. The scale of the development will allow any required soil treatment such as bioremediation to be completed and soils retained for re-use. Any remediation would be completed under an Environmental Permit or appropriate exemption.

Risks to Buildings and Structures

11.6.9 The design will incorporate significant earthworks to prepare platforms for development. A cut and fill balance will be obtained to avoid importation or export of materials. Topsoil will be stripped and stockpiled with a volume retained for use in soft landscaping. Surplus of topsoil will require removal although where feasible this will be reused. An earthworks specification will be prepared setting out the methods by which materials will be handled and re-engineered and the verification requirements to demonstrate that works have been completed to an acceptable standard.

11.6.10 The timescales for the Proposed Development allow receiver sites to be found as the project progresses to avoid disposal of material to landfill. Re-use of soil materials would be facilitated under a Material Management Plan (MMP) under the CL:AIRE Definition of Waste Code of Practice (DoWCoP) [21] prepared prior to development commencing.

[20] CIRIA C741[20] Good Practice on Site (4th edition 2015)
[21] CL:AIRE The Definition of Waste: Development Industry Code of Practice Version 2 March 2011

11.6.11 The CL:AIRE Definition of Waste: Code of Practice is used to demonstrate that excavated soils that are re-used meet the criteria for:

- Protection of human health and protection of the environment;
- Suitable for use without further treatment;
- Quantity of use; and
- Certainty of use.

11.6.12 Fill materials will be placed to an end-product specification to avoid differential settlement issues and additional reinforcement is likely to provide support where any structures span over cut and fill areas. Additionally, cut and fill slopes will be suitably designed to achieve global stability and ensure health and safety of any workers and the public is ensured.

11.6.13 Works near to existing rail and road structures will be subject to detailed geotechnical design and assessment approval in accordance with Highways England Design Manual for Roads and Bridges CD 622[22] in the case of the National Highways and to Network Rail Standards. Slopes will require detailed assessment and appropriate design, retaining and temporary shoring.

Other risks

11.6.14 The recommended mitigation measures for UXO in all areas of the Main Site comprise:

- Site Specific UXO Awareness Briefings – a service recommended to all personnel conducting intrusive works; and
- UXO Risk Management Plan.

11.6.15 In Medium Risk Areas of the site:

- Non-Intrusive UXO Magnetometer Survey and Target Investigation (where appropriate);
- UXO Specialist - a service to support open intrusive works; and
- Intrusive Magnetometer Survey – a service to support any borehole or pile locations/clusters down to an assessed maximum bomb penetration depth.

Operational Phase

Risk to Human Health

11.6.16 The risk to Units developed in Zones A2, A1b and A1a (as shown on the Parameters Plan) from ground gas migration from Ardley Landfill is currently unclear. A data

[22] CD 622 , Managing geotechnical Geotechnical Risk, Version 1 March 2020

request with the EA is currently pending which may provide much more clarity on the plausible ground gas source and of the risk ground gases may present on the Main Site. Additional gas monitoring and/or well points may be recommended following this review if a plausible risk remains. Monitoring should be undertaken during a period of rapidly falling pressure to represent the worst case. Eventual mitigation measures may incorporate the floor slab, gas impermeable membrane and/or sub sab ventilation in accordance with current best practice.

11.6.17 Fuel storage facilities required for the rail terminal will be bunded with appropriate wet stock management and spill management systems. Refueling areas will be constructed on impermeable cover.

Residual Effects

Physical Effects

11.6.18 The earthworks will be designed to deliver a cut and fill balance to eliminate the need for offsite disposal of surplus soils or import of soils. The residual effect will be negligible due to negligible magnitude of effect of a low sensitivity resource.

11.6.19 The CEMP will set out the various measures to manage the effects from earthworks, which may include seeding of stockpiles, silt traps and temporary drainage grips. The residual effect will be negligible to minor magnitude of effect of a low to high sensitivity of controlled water receptors.

11.6.20 Stripped topsoil should be stored in separate resource bunds no more than 3m high and kept grassed and free from construction traffic until required for re-use. The Construction Code of Practice for Sustainable Use of Soils on Construction Sites (Defra, 2009) provides guidance on good practice in soil handling. The residual effect will be negligible due to negligible magnitude of effect of a medium sensitivity resource.

11.6.21 Detailed foundation design, and the associated methodology remains subject to post submission intrusive ground investigations, to be undertaken at the appropriate time (post consent) once detailed engineering designs are sufficiently developed.

Climate Change

11.6.22 Careful control and monitoring of earthworks will ensure that the engineered soils are placed in accordance with the earthworks specification. Climate Change has the potential have increase likelihood for extreme weather events such as precipitation and/or draught which may increase environmental effects such as increase runoff, dust generation and/or geotechnical impact from waterlogged or desiccated soils. However, the impacts will be minimal and the mitigation measures outlined are appropriate for dealing with such eventualities.

Human Health

11.6.23 Completion of a further period of gas monitoring will be undertaken at the Main Site which will inform appropriate ground gas risk assessment and allow design of appropriate protection measures that need to be installed into new buildings in accordance with BS8485: 2015 +A1: 2019. Preliminary gas monitoring completed in 2021 indicated that the Main Site would be classified CS1. The gas data indicates no shallow ground gas risk in the east of the site adjacent to Ardley Landfill. However, finished floor levels of the buildings in this area will be around 3.0m below existing ground levels and so the main gas risk will be via gas migration through fracturing in the deeper limestone. Monitoring may therefore be required prior to and on completion of earthworks to demonstrate removal of gas sources. The residual effect will be negligible due to negligible magnitude impact and is unlikely.

11.6.24 There will be a small increased potential for direct human exposure to potential contamination identified in shallow soils through ingestion, direct contact or inhalation of contaminated soil or dust by construction workers in the short-term during construction works. To mitigate against such risks, construction workers and services personnel will follow guidance stated in 'HSE 66 Protection of Workers and the General Public during Development of Contaminated Land' during construction works. Adequate standard personal protective equipment and the development of basic hygiene measures will be undertaken. The residual effect will be negligible. Completion of ground investigation, and implementation of any required eventual remediation strategy will remove any unacceptable risk to future site users. The residual effect will be negligible due to low likelihood of a negligible magnitude impact.

Risks to Controlled Waters

11.6.25 Lubricants and refueling facilities will be positioned away from the most sensitive receptors during the operational phase at the Application Site and operate in accordance with best practice. The residual effect will be negligible due to low likelihood of a negligible magnitude impact.

11.6.26 The predominantly hardstanding covering which will be present during the operational phase will minimise the infiltration of rainfall and recharge through the unsaturated zone, thereby minimising potential contaminant mobility and reducing the risk to the underlying aquifer. The residual effect will be negligible due to an unlikely minor magnitude impact.

11.7 CUMULATIVE EFFECTS

11.7.1 A list of the 'committed developments' to be considered across the ES for an assessment of likely cumulative effects will be agreed with the local authority. However, there are current existing or permitted schemes that are relevant to, or could

represent a cumulative impact with, the Proposed Development regarding Ground Conditions, which includes; the consented development at Upper Heyford Airfield; Bicester urban extension (northwest Bicester); and, the 'Great Wolf' leisure resort near Chesterton (west of Bicester). The main potential cumulative impact would be potential loss of mineral resource although this development would achieve many of the other strategic requirements of the Local Plan by taking away haulage traffic away from local villages and increasing potential crushed rock movement by rail.

11.7.2 Land contamination is subject to the same national guidance and all developments must meet a common standard for safe development with a requirement to undertake a phased investigation of the site including Phase 1 preliminary risk assessment, Phase 2 intrusive investigation remediation strategy, remediation implementation and verification in accordance with LCRM. It is considered that there will be no significant cumulative effects on ground conditions and contamination resulting from the Proposed Development and the cumulative schemes considered as part of the assessment, as each development will incorporate appropriate mitigation measures to have overall negligible, or slight positive effects.

11.8 SUMMARY AND CONCLUSIONS

11.8.1 This preliminary draft chapter assesses the potential effects of the Proposed Development on Ground Conditions and Land Contamination. It describes the methods used to assess the effects, the baseline conditions currently existing at the Application Site and Order Limits, the potential direct and indirect effects of the Proposed Development and the mitigation measures required to prevent, reduce or offset the potential effects and the residual effects.

11.8.2 The Chapter is supported by a Phase 1 Preliminary Risk Assessment for the Main Site (**Appendix 11.1**) and one for the highways (**Appendix 11.2**), a preliminary Ground Investigation Phase 2 Report for the Main Site (**Appendix 11.3**) and a Mineral Assessment (**Appendix 11.4**) which are provided as technical appendices.

11.8.3 The Main Site has predominantly remained undeveloped agricultural land with a number of farm buildings, a soil treatment facility and a water reservoir within its boundary.

11.8.4 Below Topsoil, the Application Site is indicated to be predominantly directly underlain by White Limestone Formation, with superficial deposits generally absent. The Application Site is also interspersed with smaller areas of Rutland Formation and Forest Marble Formation Limestone in the northwest. Superficial deposits of Head and Alluvium are recorded along stream courses.

11.8.5 The limestone deposits present onsite are considered to be the only significant resource of hard rock mineral with respect to the Oxfordshire Minerals and Waste

Local Plan (2017), however, the demand for crushed rock by 2031 will be met by the expansion of the existing active quarry. The conservation of the mineral resources will be guarantee, as supported by the guidance within the Local Plan, by using all excavated minerals from the subject site on the development of the site whilst not putting additional demand on the existing mineral supply.

11.8.6 For the Main Site a cut and fill operation will be undertaken to create the development platform, with an approximate cut and fill balance to retain as much material as possible. Re-use of soils will be completed under an earthworks specification and a MMP in accordance with the DoWCoP to be prepared prior to the start of works.

11.8.7 Potential effects have been identified during construction associated with mobilisation of dusts and particulates, damage to excavated topsoil and from foundation works creating pathways.

11.8.8 A CEMP will set the procedures to ensure that mobilisation of soils during the construction phase is minimised. The CEMP will outline detailed methodologies and monitoring requirements to prevent adverse effects on or from ground conditions.

11.8.9 No significant contamination of soils or groundwater is expected at the site. No significant sources of contamination or ground gas have been recorded on the Main site or are anticipated on the Highways. However, sources of ground gas exist at shallow depth associated with Ardley landfill to the east of the site which is also present in the north east of the Main Site and will be subject to ground investigation and assessment which will be included in the final version of this chapter.

11.8.10 Further intrusive ground investigation will be completed post application to support detailed design and confirm ground conditions, assess the localised presence of any soil or groundwater contamination and obtain information for foundation design.

11.8.11 Nearby developments are subject to the same national guidance, with a requirement to deliver a safe development, including remediation of contamination where necessary, therefore, there are unlikely to be any significant cumulative effects requiring mitigation.

11.8.12 Overall, based on the assessment and investigations undertaken to date, it is considered that potential effects from the construction and operational phases of the development will be negligible following the implementation of appropriate mitigation measures.