



**ENVIRONMENTAL STATEMENT**  
**VOLUME 1**  
**CHAPTER 11 – GROUND CONDITIONS**



## 11. GROUND CONDITIONS

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### 11.1. INTRODUCTION

- 11.1.1. This Chapter reports the outcome of the assessment of likely significant effects arising from the Proposed Development upon ground conditions. This includes the likely significant effects of existing ground conditions and contamination on identified receptors as part of the Proposed Development.
- 11.1.2. The Chapter describes the assessment methodology, the baseline conditions at the Site and in the surrounding area, any primary and tertiary mitigation adopted for the purposes of the assessment, a summary of the likely significant effects taking into account national legislation, the further mitigation measures required to prevent, reduce or offset any significant negative effects (secondary mitigation), and the likely residual effects and any required monitoring after these measures have been employed.
- 11.1.3. This Chapter (and its associated figures and appendices) is intended to be read as part of the wider ES, with particular reference to **Chapter 12: Water Resources, Flood Risk and Drainage** and **Chapter 14: Cumulative Effects**.

### 11.2. LEGISLATION, POLICY AND GUIDANCE

#### LEGISLATIVE FRAMEWORK

- 11.2.1. The applicable legislative framework is summarised as follows:
- The Environmental Protection Act (EPA) (1990): Part 2A Section 78 (HMSO, 1990) (**Ref 11.1**);
  - The Environment Act (HMSO, 1995) (**Ref 11.2**);
  - Control of Substances Hazardous to Human Health Regulations (As Amended) (HMSO, 2002) (**Ref 11.3**);
  - The Contaminated Land Regulations (HMSO, 2012a) (**Ref 11.4**);
  - The Control of Asbestos Regulations (HMSO, 2012b) (**Ref 11.5**);
  - The Construction (Design & Management) Regulations (HMSO, 2015a) (**Ref 11.6**);
  - The Environmental Damage (Prevention and Remediation) (England) Regulations (HMSO, 2015b) (**Ref 11.7**);
  - The Environmental Permitting Regulations (HMSO, 2016) (**Ref 11.8**);
  - The Water Environment (Water Framework Directive) (England and Wales) Regulations (HMSO, 2017) (**Ref 11.9**);
  - The Groundwater Directive 2006/118/EC (**Ref. 11.10**); and
  - Water Resources Act (1991) (**Ref. 11.11**).

#### PLANNING POLICY

##### National Planning Policy

- 11.2.1. The following national planning policy guidance documents have been used:
- National Planning Policy Framework (NPPF) published March 2012 and updated June 2019 Paragraphs 178 to 179 (**Ref. 11.12**);
  - National Planning Practice Guidance, Land Affected by Contamination, July 2019 (**Ref. 11.13**);

11.2.2. The Cherwell Local Plan 2011-2031 (**Ref 11.14**) was formally adopted on 20 July 2015 and contains strategic planning policies for development and the use of land. Relevant policies include:

- Policy ESD 8: Water Resources, B220; and
- Policy ESD 10: Protection and Enhancement of Biodiversity and the Natural Environment, B236

## **GUIDANCE**

11.2.3. The following guidance documents have been used during the preparation of this Chapter:

- Environment Agency (EA), Model Procedures for the Management of Land Contamination (CLR11) (2004) (**Ref 11.15**);
- Construction Industry Research and Information Association (CIRIA) C552: Contaminated Land Risk Assessment: A guide to good practice (CIRIA, 2001) (**Ref 11.16**).
- CIRIA C532: Control of Pollution from Construction Sites (CIRIA, 2001) (**Ref 11.17**).
- CIRIA C665: Assessing Risks Posed by Hazardous Ground Gases to Buildings (CIRIA, 2007) (**Ref 11.18**);
- CIRIA C681: Unexploded Ordnance (UXO) - A Guide for the Construction Industry (CIRIA, 2009) (**Ref 11.19**);
- CIRIA C682: The VOCs Handbook (CIRIA, 2009b) (**Ref 11.20**);
- CIRIA C733: Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks (CIRIA, 2014) (**Ref 11.21**);
- EPA 1990: Part 2A, Contaminated Land Statutory Guidance (HMSO, 2012) (**Ref 11.22**);
- British Standard (BS) 8576:2013 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds (VOCs) (BSI 2013) (**Ref 11.23**);
- National House Building Council (NHBC), EA, Chartered Institute of Environmental Health, Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66: 2008 (**Ref 11.24**);
- BS5930: 2015 Code of Practice for ground investigations (BSI 2015) (**Ref 11.25**);
- BS 8485: 2015+A1 Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings (BSI 2019) (**Ref 11.26**);
- BS 10175:2011+A2 Investigation of Potentially Contaminated Sites – Code of Practice (BSI 2017) (**Ref 11.27**); and
- EA Groundwater Protection Technical Guidance (2017) (**Ref 11.28**).

11.2.4. In addition, this Chapter has been prepared in accordance with the Government's National Planning Policy Framework (**Ref. 11.29**).

## **11.3. CONSULTATION, SCOPE, METHODOLOGY AND SIGNIFICANCE CRITERIA**

### **CONSULTATION UNDERTAKEN TO DATE**

11.3.1. **Table 11.1** provides a summary of the consultation activities undertaken in support of the preparation of this Chapter, including those undertaken in 2018 to inform the desk study (which remain valid for this assessment).

**Table 11.1 - Summary of Consultation Undertaken to Date**

<b>Body / organisation</b>	<b>Individual / stat body / organisation</b>	<b>Meeting dates and other forms of consultation</b>	<b>Summary of outcome of discussions</b>
Environment Agency	Environment Agency general enquiries	Email dated 6 February 2018	Response received by email dated 20 February 2018 and relevant information is included under the Baseline Conditions section.
Environment Agency	Samuel Pocock, Planning Advisor	Scoping report dated June 2019	Response received 29 July 2019 indicating they have no comments regarding the Proposed Development.
Cherwell District Council	Neil Whitton, Environmental Health Officer (EHO)	Email dated 6 February 2018	Response received as part of the Scoping Opinion, 16 August 2019. The EHO stated that the scope of works was satisfactory.

## **SCOPE OF THE ASSESSMENT**

- 11.3.2. An EIA Scoping Report was submitted to Cherwell District Council in June 2019, as presented in **Appendix 2.1**. Further information can be found in **Chapter 2: Approach to the Assessment**.
- 11.3.3. This section provides a summary of the scope of the assessment which remains unchanged from the scope of the assessment listed within the Scoping Report.
- 11.3.4. The EA's guidance CLR11 (2004) advocates the use of a conceptual risk assessment model (Conceptual Site Model). The basis of this approach comprises three elements: a source, a pathway and a receptor. Further details of this methodology are provided in **Section 11.3.18 - 11.3.20**.
- 11.3.5. The potential effect of the Proposed Development on ground conditions, and/or the effect of ground conditions on the Proposed Development, has been assessed during the construction and operational phases. The significance level attributed to each effect has been assessed based on the magnitude of change due to the Proposed Development and the importance/sensitivity of the affected receptor / receiving environment to change.

## **ELEMENTS SCOPED INTO THE ASSESSMENT**

### **Potentially Significant Effects**

#### **Construction Phase**

- 11.3.6. The following elements are considered to have the potential to give rise to likely significant effects during construction of the Proposed Development and have therefore been considered within the ES:
- Potential effects on human health from exposure to contamination and/or ground gas associated with historical and current land use; and,
  - Potential for increased mobilisation of chemical contaminants into surface water and / or groundwater.



## Operational Phase

11.3.7. The following elements are considered to have the potential to give rise to likely significant effects during operation of the Proposed Development and have therefore been considered within the ES:

- Potential effects on human health from exposure to contamination and/or ground gas/vapours associated with historical and current land use;
- Potential for increased mobilisation of chemical contaminants into surface water and / or groundwater;
- Potential impact to buildings from ground gas; and
- Potential degradation/permeation of water supply pipes from contaminants.

## Insignificant Effects

At the Scoping Report stage no insignificant effects were identified.

## EXTENT OF THE STUDY AREA

11.3.8. The 'study area' includes the area within the Site boundary described in **Chapter 1: Introduction** and consists of the area within the red line boundary as well as identified receptors within the immediate vicinity.

11.3.9. The search radius for current surrounding features and for historical mapping was up to 500m from the Site boundary. Consideration has been given to controlled waters receptors within a nominal 500m radius of the Site, and a 1km radius for groundwater abstractions, in general accordance with current guidance (**Ref. 11.9**).

## METHOD OF BASELINE DATA COLLATION

### Desk Study

11.3.10. The baseline information is based on the WSP Preliminary Risk Assessment (PRA) prepared in February 2018<sup>1</sup> and the Curtins Phase 1 Preliminary Site Risk Assessment<sup>2</sup> prepared in April 2019, (see **Appendix 11.1**). The red line boundary within the WSP report includes the subject Site and the wider surrounding area, whilst the Curtins report is based solely on the subject Site.

11.3.11. The key aims of the desk studies were to:

- Develop a preliminary Conceptual Site Model (CSM) to identify potential contamination risks associated with the proposed development of the Site; and,
- Evaluate likely contaminated land exposure pathways and their potential significance on identified receptors to support the Proposed Development.

11.3.12. The scope of works for the desk studies included:

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<sup>1</sup> WSP (2018). GWR Bicester, Preliminary Risk Assessment, 70042711\_PRA. February 2018.

<sup>2</sup> Curtins (2019). Great Wolf Lodge, Chesterton, Phase 1 Preliminary Site Risk Assessment, 071596.001-CUR-00-XX-RP-GE-00001-V00\_FINAL, Revision 00. 18 April 2019.



- A review of plans made available by the Client, publicly available regulatory information and available historical Ordnance Survey maps, to assess the current and historical potentially contaminative uses of the Site, and of land uses in the vicinity of the Site;
- A review of publicly available information pertaining to the geology, hydrogeology and hydrology of the Site and surrounding area, to assess ground conditions and the presence of plausible sensitive environmental receptors. This included a review of available borehole data, regulatory databases, mapping and historical reports, where available;
- A site walkover to document the current land use, potential sources of contamination, observations of current potential impact and site setting;
- Liaison with relevant authorities including the EA and Cherwell District Council (CDC), to gather information relevant to the Site; and
- Derivation of a baseline CSM through the identification of plausible contaminant linkages in order to provide a qualitative, ranked assessment of the likelihood of potential sources of land contamination posing a significant risk to the human health and the environment.

11.3.13. The following sources of information were used to complete desk studies:

- Envirocheck reports, dated 25 January 2018, Order Ref: 154470925\_1\_1 (**Ref 11.30**);
- Envirocheck reports, dated 28 February 2019, Order Ref: 195713619\_1\_1 (**Ref 11.31**);
- EA Long Term Flood Risk Information website, accessed on 6 February 2018 (**Ref 11.32**);
- British Geological Society (BGS), Geological map Sheet No.219 Buckingham, 1:50,000, Solid and Drift Edition (2002) (online), accessed on 02 February 2018 (**Ref 11.33**);
- Zetica Pre-Desk Study Assessment Unexploded Ordnance (UXO) risk report, dated 8 February 2018 (**Ref 11.34**);
- Zetica Pre-Desk Study Assessment UXO risk report, dated 6 March 2019 (**Ref 11.35**);
- 1<sup>st</sup> Line Defence Preliminary UXO Risk Assessment, dated 6 March 2019 (**Ref 11.36**);
- 1<sup>st</sup> Line Defence Detailed UXO Risk Assessment, dated 3 April 2019 (**Ref 11.37**);
- British Geological Survey (BGS). Geology of Britain Viewer. British Geological Survey. <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> (**Ref 11.38**);
- BGS. 2017. Geindex Onshore <http://mapapps2.bgs.ac.uk/geoindex/home.html>. (**Ref 11.39**);
- BGS [http://scans.bgs.ac.uk/sobi\\_scans/boreholes/1063613/images/12528627.html](http://scans.bgs.ac.uk/sobi_scans/boreholes/1063613/images/12528627.html) (**Ref 11.40**);
- BGS GeoRecords Plus+ <http://mapapps.bgs.ac.uk/GeoRecords/GeoRecords.html> (**Ref 11.41**);
- The Coal Authority. Interactive Coal Mining Risk Map <http://mapapps2.bgs.ac.uk/coalauthority/home.html>. (**Ref 11.42**);
- Public Health England and BGS. UK Radon Map <http://www.ukradon.org/information/ukmaps>. (**Ref 11.43**);
- Building Research Establishment (BRE). Radon: guidance on protective measures for new buildings, originally introduced in 1991 and amended in 1992, 1999 and 2007 covering England and Wales. 2015. BRE 211 (**Ref 11.44**); and
- CIRIA. C681 Unexploded Ordnance (UXO); A guide for the construction industry. London, 2009 (**Ref 11.45**).

### Site Visit

11.3.14. A site walkover was completed on 1 February 2018 by WSP and 27 March 2019 by Curtins.



## ASSESSMENT METHODOLOGY

11.3.15. The EA's guidance CLR11 (**Ref. 11.15**) advocates the use of a CSM. The basis of this approach comprises three elements: a source, a pathway and a receptor. Without each of these there can be no contamination risk. Therefore, the presence of measurable concentrations of contaminants within the ground and subsurface environment does not automatically imply that a contamination risk exists, since the contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors, which are relevant to a particular site, will vary according to the intended use of the site, its characteristics and its surroundings. The potential for harm to occur requires three conditions to be satisfied:

- The presence of substances (potential contaminants/pollutants) that may cause harm (the 'Source' of pollution);
- The presence of a receptor that may be harmed, (e.g. the water environment or humans, buildings, fauna and flora) (the 'Receptor'); and
- The existence of a linkage between the source and the receptor (the 'Pathway').

11.3.16. CLR11 was used as a technical framework in the understanding of how contamination issues that may arise on the Site could be managed.

11.3.17. The CSM was used to identify and assess the potential effects on the identified sensitive receptors (including human health, controlled waters, buildings and services) and outline mitigation measures to manage the risks identified in the assessment. The assessment has been prepared in accordance with legislation and guidance referenced above.

## SIGNIFICANCE CRITERIA

11.3.18. The assessment of potential effects as a result of the Proposed Development has taken into account both the construction and operational phases. The construction phase includes enabling works, earthworks and construction activities as set out in **Chapter 4: The Proposed Development**.

11.3.19. The classification of each effect has been assessed based on the magnitude of change due to the Proposed Development and the sensitivity of the affected receptor, as well as a number of other factors that are outlined in more detail in **Chapter 2: Approach to the Assessment**. The sensitivity of the affected receptor is assessed on a scale of high, medium, low and negligible, and the magnitude of change is assessed on a scale of high, medium, low and negligible (as shown in **Chapter 2: Approach to the Assessment**).

11.3.20. Risk, probability and consequence inform the magnitude of change (CIRIA C552 guidance; **Ref 11.16**). The magnitude of change has been assessed on a scale of high, medium, low, and negligible as defined in **Table 11-2**.



**Table 11-2 – Magnitude Criteria**

Magnitude of Impact	Definition
High	A severe or acute impact to human health. Major derogation of aquifer /surface water quality or status. Impacts which are predicted to result in a major or irreversible change in the habitat/community of ecosystems.
Medium	Minor detrimental impact to human health. Minor derogation of aquifer /surface water quality or status. Impacts with potential to affect key attributes of habitats/communities but without changing overall viability.
Low	A discernible effect that is, however, unlikely to significantly alter human health, aquifer /surface water quality, or the attributes of receptor habitats.
Negligible	Unlikely to have a discernible impact to human health, aquifer /surface water quality or status, or the attributes of receptor habitats/communities.

11.3.21. The sensitivity of the affected receptor / receiving environment has been assessed on a scale of high, medium and low as defined in **Table 11-3**.

**Table 11-3 - Sensitivity / Importance Criteria**

Sensitivity / Importance	Receptor
High	On-site occupants Off-site occupants (residential) Surface water bodies of high quality and/or in use as public water supply. Aquifers currently used, or likely to be suitable for use, as public potable supplies (e.g. Principal Aquifers, Source Protection Zone for a potable groundwater supply). Controlled waters that are nationally designated areas e.g. SSSI; internationally designated areas e.g. SAC, SPA, RAMSAR.
Medium	Construction and maintenance workers Off-site occupants (non-residential) Surface water bodies of moderate quality. Aquifer providing abstraction water for agricultural or industrial use. (e.g. Secondary A Aquifers). Controlled waters that are regionally designated areas e.g. local nature reserves
Low	Local water bodies of poor or worse chemical or biological status. Secondary B and undifferentiated aquifers; unproductive strata. Undesignated sites or controlled waters features which appreciably enrich the local habitat resource.



## EFFECT SIGNIFICANCE

11.3.22. The following terms have been used to define the effects identified and apply to both beneficial and adverse effects:

- **Major effect:** where the Proposed Development could be expected to have a very noticeable effect (either beneficial or adverse) on receptors (see **Section 11.4** for receptors);
- **Moderate effect:** where the Proposed Development could be expected to have a noticeable effect (either beneficial or adverse) on receptors;
- **Minor effect:** where the Proposed Development could be expected to result in a small, barely noticeable effect (either beneficial or adverse) on receptors; and
- **Negligible:** where no discernible effect is expected as a result of the Proposed Development on receptors.

11.3.23. The terms presented in **Table 11.4** have been used to classify the effects. Where a range has been provided, professional judgement has been used to define the effect. The impacts are described as beneficial or adverse. An effect is considered to be significant if assessed as moderate or above.

**Table 11.4 – Classification of Effects**

		Sensitivity / Importance of Receptor			
		High	Medium	Low	Negligible
Magnitude of Change	High	Major	Major	Moderate	Negligible
	Medium	Major	Moderate	Minor to Moderate	Negligible
	Low	Moderate	Minor to Moderate	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

11.3.24. As set out in **Chapter 2: Approach to the Assessment**, effects that are classified as **major or moderate** (either beneficial or adverse) are considered to be **significant**. Effects classified as **minor or negligible** are considered to be **not significant**.

11.3.25. The assessment of environmental impacts relating to ground conditions will comprise:

- Short and medium term, temporary effects; and,
- Long term, permanent effects.

## 11.4. BASELINE CONDITIONS

### SITE DESCRIPTION

11.4.1. The Site is irregularly shaped and is approximately 18.6 hectares (ha) in size. The Site is located immediately south of the A4095 and east of the M40.

11.4.2. The Site currently forms the northern half of the Bicester Hotel Golf and Spa (BHGS) with associated buildings, road access, parking and landscaped areas. A number of surface water features (ponds) are present on-site, generally located in the northern half of the Site (specifically at the north-western corner and the north-eastern corner) with drains running from west to east.



- 11.4.3. Several mounds (approximately 1.2 m to 2.0 m height) were observed on-site as part of the golf course. These mounds are understood to have been created with re-worked natural soils; however, one of the mounds located on the northern boundary was noted to have brick and concrete in material at surface. The current material/environmental quality of the mounds is unknown.

### **SURROUNDING LAND USE**

- 11.4.4. The Site is located in a predominantly rural area, consisting of farm land and recreational land to the north, south and west. The Site is approximately 2.75 km south-west of Bicester town centre and directly west of the village of Chesterton.
- 11.4.5. Tanora Cottage (200m from Site), Stableford House and Vicarage Farm (both approximately 40m from Site) residential properties are located to the east of the Site, along the A4095. The surrounding land use is primarily agricultural to the west (across the M40) and south of the Site. Bignall Park Barns (business use) are to the north-east and the village of Chesterton is to the east.
- 11.4.6. A residential construction site was recorded adjacent to the east of the Site during the WSP walkover.
- 11.4.7. W I G Engineering Limited, a structural steelwork fabricator, is located approximately 400m to the south of the Site, adjacent to the main access to BHGS.
- 11.4.8. Several rusted steel drums and a bunded oil tank were stored off-site within the wider golf course area. Five bunded oil tanks, six propane gas tanks, sodium hypochlorite 10L bottles, Turf complex fertilizer bottles and engine oil bottles were recorded adjacent to the clubhouse and leisure complex structures. There was minimal evidence recorded of staining and spillages.
- 11.4.9. A gas governor and four air conditioning units were located to the north of the main clubhouse and leisure complex structures.
- 11.4.10. An electrical substation was situated immediately north of the main clubhouse and leisure complex structures.
- 11.4.11. Large material stockpiles were recorded to the south-west. The stockpiles consisted of limestone, mudstone and silt mixed with occasional construction waste.
- 11.4.12. Small stockpiles of topsoil and sand were recorded to the south of a storage unit, adjacent to the BHGS car park. It is assumed these are used in the maintenance of the golf course. Waste stockpiles were also noted in this location consisting of tyres, plastics, timber and office furniture.
- 11.4.13. Four rusted steel drums were noted outside of the Site, adjacent to Tanora Cottage.

### **SITE HISTORY**

- 11.4.14. The history of the Site and the study area is summarised below in **Table 11-5** taken from **Appendix 11.1**.

**Table 11-5 – History of the Site and Study Area**

Date	On-site	Off-site
1875-1885	The Site is recorded as open fields with several paths present.	<p>The surrounding areas are recorded as open fields.</p> <p>Spring Well Farm and Spring Well Pond are located approximately 400 m south-west of the Site boundary, Doctor's Barn is approximately 400m east, College Farm approximately 400m north-west and Field Barn 400m north-east.</p>
1899-1923	By 1922, a quarry is located along the northern boundary of the Site.	<p>Orchards have been planted in the open fields located north and north-east of the Site (Bignell Park). Several drains are recorded in this area.</p> <p>Several Quarries are located in excess of 250m (within 800m) from the Site boundaries.</p> <p>By 1922, an unidentified structure is located approximately 110m east of the Site.</p> <p>A pump house and sewage tank are located approximately 400m to 500m to the east.</p>
1967-1968	No significant changes to the Site.	<p>An unidentified structure is located approximately 150 m north-west of the Site boundary.</p> <p>Vicarage Farm which incorporates several buildings is located approximately 40 m east of the Site.</p> <p>The sewage tank is no longer present.</p>
1970-1996	<p>By 1970s the Quarry located at the northern section of the Site appears to have been backfilled.</p> <p>By 1974, a drain is located at the northern section of the Site.</p> <p>By 1985, a pond is located at the south-eastern end of the Site and by 1995, a second pond is located at the south-eastern corner of the Site.</p> <p>By 1991, the north-western corner of the Site appears to be utilised as farm land. A golf course is now situated on the rest of the Site.</p>	<p>The 1970 map shows a tank approximately 400m east of the Site.</p> <p>By 1981, the buildings located at the southern end of Vicarage Farm have been renamed Club house. Land situated just south-east of the Site is now a golf course.</p> <p>By 1991, the western site boundary is delineated by the M40. Some earthworks with potential Made Ground related to the M40 have taken place at the western Site boundary and the north-western corner of the Site. A pond is recorded 250m south of the Site.</p> <p>By 1994, the orchards located north and north-east of the Site appear to no longer be located on the plans. The surrounding area appears to be used for farming.</p> <p>The pump house is no longer present.</p>

Date	On-site	Off-site
1999-2019	No significant changes to the Site, with the exception of new ponds in the north-west corner (2006).	No significant changes to the surrounding area, with the exception of some development works at the club house located south-east of the Site boundary (2019).

## UNEXPLODED ORDNANCE (UXO)

- 11.4.15. A pre desk study UXO enquiry with Zetica (**Ref 11.34** and **11.35**) indicated that the Site was in an area which officially recorded 278No. High Explosive (HE) bombs with a regional bombing density of 3.5 bombs per 405 ha. No readily available records were found to indicate that the Site was bombed.
- 11.4.16. The information from the Zetica assessment was confirmed by the preliminary and detailed UXO assessment completed by 1<sup>st</sup> Line Defence (**Ref 11.36** and **11.37**), which assessed that the risk from UXO at the Site was low. There was no evidence within any of the available bomb records to suggest that any bomb strikes fell specifically on or next to the Site. Despite the low bombing density, available records indicate that Chesterton, was subject to three air-raids during the initial stages of the war, largely due to its proximity to RAF Weston-on-the-Green.
- 11.4.17. The detailed UXO assessment (**Ref 11.37**) recommended that prior to works commencing on-site a UXO Risk Management Plan should be produced and site specific UXO awareness briefings provided to all personnel conducting intrusive works.

## REGULATORY INFORMATION

- 11.4.18. Relevant information from the Envirocheck report (**Ref 11.31**) is summarised below:
- There is a discharge consent 446m south-east of the Site, relating to W I G Engineering Limited for the discharge of sewage to a freshwater stream/river.
  - The nearest groundwater abstraction point is 585m north-west of the Site relating to general farming and domestic purposes.
  - A BGS Recorded Mineral Site is located in the north-east of the Site. It was an opencast mine (Cornbrash Formation – Limestone) and operations are recorded as ceased. Chesterton Quarry is recorded 122m north of the Site. Operations have ceased and the opencast mine once extracted Cornbrash Formation – Limestone.
  - The Site is located within a Nitrate Vulnerable Zone.
  - There are two Contemporary Trade Directory Entries within 500m of the Site, relating to an inactive car dealers 416m north and an inactive non-ferrous metal distributor, also 416m north.

## Environment Agency Correspondence

- 11.4.19. The Environment Agency was contacted by WSP (via email on the 6 February 2018) regarding any general environmentally pertinent information held relating to the Site. A response was received by email on 20 February 2018. Relevant information from the EA is summarised below:
- No available records of permitted operations within 500m of the Site.
  - No available records of any storage tanks or gas meters in the area.



- No records of any authorised or historic landfill sites or any waste transfer activities within 1 km of the Site.
- There were five pollution incidents within 500m of the Site, with one being located on-site. These incidents included:
  - On-site (south-west): Spring Well Farm; illegal waste site (inert materials and waste, construction and demolition materials and waste); minor impact to land.
  - 100m south-west: M40 Junction 9, containment and control failure resulting from a road accident; diesel pollutant causing minor impact to land.
  - 120m west: Chesterton Fields Farm; fly tipping (inert materials and wastes); minor impact to land.
  - 350m south: Greystone Court; unauthorised waste management activity; minor impact to land and water.
  - 400m south: Greystone Court; inert materials and waste, construction and demolition materials and waste; minor impact to land.

## **GEOLOGY, HYDROGEOLOGY AND HYDROLOGY**

### **Geology**

- 11.4.20. BGS information (**Ref 11.38 to 11.41**) indicates that superficial deposits are absent. The underlying geology comprises of bedrock deposits of the Cornbash Formation overlying the Forest Marble Formation. A series of boreholes located along the M40 corridor confirm this and generally describe topsoil (average thickness 0.30 m) underlain by weathered limestone or colluvium (average thickness 1.20 m) underlain by interbedded limestone, mudstone and clay of the Cornbash Formation and Forest Marble Formation.
- 11.4.21. Limestone was recorded at the surface during the WSP walkover.
- 11.4.22. Given the history of the Site (with the potential for earthworks and landscaping to form a golf course and artificial ponds), the presence of a former quarry located on the Site's northern boundary and earthworks associated with the M40 along the western boundary, the bedrock is likely to be overlain by Made Ground or reworked natural material and topsoil.
- 11.4.23. The Envirocheck report (**Ref 11.31**) states that on the Site, there is a very low risk of collapsible ground, landslides, and ground dissolution stability hazards, while the risks from compressible ground, running sands and shrinking and swelling clay are classed as 'no hazard'.

### **Hydrogeology**

- 11.4.24. The bedrock deposits of the Cornbash Formation and Forest Marble Formation, part of the larger Great Oolite Group, are classified by the Environment Agency as a Secondary A aquifer. The group consists of a significant limestone aquifer producing large yields. Groundwater is likely to be present within the deposits on-site. However, the Site is not located within a groundwater Source Protection Zone.
- 11.4.25. The Site is located within a High Risk zone for Groundwater Vulnerability. The Environment Agency designates this by determining the vulnerability of groundwater to a pollutant discharged at ground level based on the geological, hydrological, hydrogeological and soil properties of the area. The soils within the area are designated with a High Leaching Potential. The Site is also located within a Soluble Rock Risk zone, as classified by the Environment Agency.



## Hydrology

- 11.4.26. A number of surface water features (ponds) are present on-site (generally located in the northern half of the Site (specifically at the north-western corner and the north-eastern corner) with drains running from west to east (also in the northern half of the Site).
- 11.4.27. The nearest main surface water body is the Gagle Brook (overall Poor classification according to the Environment Agency (**Ref. 11.46**), located approximately 500m north-east of the Site.

## RADON

- 11.4.28. Information from Public Health England (**Ref 11.43**) and the Envirocheck report (**Ref 11.31**) indicates that the Site is located within an Intermediate Probability radon affected area where 1-3% of homes are at or above the Action Level for radon gas and as such no radon protective measures may be required in the construction of new dwellings or extensions.
- 11.4.29. However, it should be noted that in accordance with building regulations, until a building has been constructed and occupied, it is not possible to accurately assess the severity of a radon problem on a Site. Thus, if the development was to include below ground workplaces (e.g. basements), then, further assessments, consultation from a radon risk assessor and/or basic protection measures in accordance with BRE Report BR211 (**Ref 11.44**) may be required.
- 11.4.30. Public Health England (**Ref.11.43**) also recommends radon monitoring should be considered in workplace basements irrespective of the radon affected area status.

## CONTAMINATION

- 11.4.31. **Table 11-6** provides a summary of the potential sources of contamination that may be present on the site as well as the likely nature of such sources.

**Table 11-6 - Potential Sources of Contamination**

Potential Source	Potential Contaminants of Concern	Likely / Anticipated Distribution
<b>ON-SITE</b>		
Made Ground	Range of contaminants including metals, inorganics (e.g. cyanide), petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), ground gas (methane and carbon dioxide) and asbestos.	Site wide due to formation of the golf course, former quarry and former farm and clubhouse buildings
Electrical substation	PCBs and mineral oils	Centre of Site
Material stockpiles	Potential for range of contaminants including metals, inorganics (e.g. cyanide), petroleum hydrocarbons, PAHs, ground gas (methane and carbon dioxide) and asbestos.	South-west and centre of the Site
<b>OFF-SITE</b>		
Made Ground	Range of contaminants including metals, inorganics, petroleum hydrocarbons, PAHs, ground gas (methane and carbon dioxide) and asbestos.	Surrounding the Site, particularly to the north/east

Potential Source	Potential Contaminants of Concern	Likely / Anticipated Distribution
Unmarked tank	Potential for range of contaminants including metals, various organics, inorganics, asbestos, hydrocarbons and solvents.	10 m, north-east of the Site
Coal Yard	Range of petroleum hydrocarbons, PAHs, heavy metals, creosote and asbestos.	90 m, north-east of the Site
W.I.G Engineering and associated bunded fuel tank and rusted steel drums	A range of hydrocarbons including PAHs, BTEXs and petroleum hydrocarbons, heavy metals and solvents.	Adjacent to the Site, south
M40 motorway	Hydrocarbons and heavy metals	Adjacent to the Site, western boundary
Farming industry and allotments	A range of contaminants including various chemicals (e.g. pesticides and herbicides), petroleum hydrocarbons and sewage waste.	Surrounding the Site
Stored chemicals associated with clubhouse	Sodium hypochlorite and fertilisers	Adjacent to the clubhouse and leisure complex structures
Bunded fuel tanks, propane gas tanks and engine oil bottles	A range of hydrocarbons including PAHs, BTEX and TPH. Potential gas explosion risk.	Centre of Site

## FUTURE BASELINE

11.4.32. Should the Site remain in its current use, the Site is considered unlikely to present a notable risk to the identified sensitive receptors. As the Site is currently predominantly a golf course and given that gross widespread contamination is not anticipated to be present on the Site, the degree of risk to the identified receptors is unlikely to increase if the Site use remains unchanged.

## SENSITIVE RECEPTORS

11.4.33. The following are the sensitive receptors which have been assessed:

- Future Site users (high sensitivity);
- Construction workers (medium sensitivity);
- Third party neighbours (medium to high sensitivity);
- Secondary A aquifer (medium sensitivity);
- On-site water features (low sensitivity); and





- Gagle Brook (low sensitivity).

## **11.5. RELEVANT ELEMENTS OF THE PROPOSED DEVELOPMENT AND ESTABLISHING THE PRE-MITIGATION SCENARIO**

### **CONSTRUCTION PHASE**

- 11.5.1. Relevant elements of the Proposed Development in the context of Ground Conditions and identified significant effects during the Construction Phase are:
- The Construction Phase has the potential to result in effects through introducing contamination source to the ground/Controlled Waters<sup>3</sup>/humans and/or creating pathways thought releasing existing ground contamination to Controlled Waters/humans. These works are likely to commence in June 2020 with completion in May 2022and
  - The development of a waterpark, family entertainment centre, hotel, conferencing facilities and restaurants with associated access, parking and landscaping, the construction of which will include excavations, ground works, and the storage and movement of materials around site.
- 11.5.2. Ground investigations will be carried out to identify potential contaminant linkages prior to commencement of the Construction Phase which are also likely to be conditioned as part of the planning permission for the Proposed Development. If the ground investigation identifies contaminant linkages a Remediation Strategy will be produced for the Site to specify protective measures for the construction phase of the development.
- 11.5.3. Prior to works commencing on-site a UXO Risk Management Plan should be produced and site specific UXO awareness briefings provided to all personnel conducting intrusive works.
- 11.5.4. It has been assumed that excavated material from the Site will be appropriately classified and disposed to licenced facilities.

### **OPERATIONAL PHASE**

- 11.5.5. Relevant elements of the Proposed Development in the context of Ground Conditions and identified significant effects during the operational phase are:
- The future users of the Proposed Development represent new receptors to potential contamination sources which include maintenance workers, employees, site users/visitors and third party neighbours; and
  - Development of the waterpark which may impact upon Controlled Waters within the vicinity of the Site.

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<sup>3</sup> Controlled Waters include territorial waters, coastal waters, inland freshwaters and groundwaters.



- 11.6. A verification report would be completed for any remedial works that are required in accordance with best practice guidance and National House Building Council (NHBC) requirements. These works area also anticipated to be required as part of a planning condition for planning permission of the Proposed Development.
- 11.7. It has been assumed that imported materials and reused materials (e.g. topsoil) will be suitable for use.
- 11.8. It has been assumed that the following practice is adhered to as standard good practice during construction:
- Installation of interceptors into surface water drainage to prevent ingress of petroleum hydrocarbons from vehicles using roadways and car parks.

## 11.9. ASSESSMENT OF EFFECTS, MITIGATION AND RESIDUAL EFFECTS

### CONSTRUCTION PHASE

<p><b>Potential effects on human health from exposure to contamination and/or ground gas associated with historical and current land use</b></p>	<p>Construction workers could be exposed to any unexpected contaminants that are present in the Made Ground, or that are present in the ground after migrating from contaminant sources, during any earthworks or Site clearance that includes disturbing or clearing the Made Ground. Third party neighbours could also be exposed to any contaminants that are present in Made Ground during construction works and earth movements. There is potential for exposure to asbestos or other contaminants during any earthworks or site clearance if it is present in the Made Ground. They will be affected by inhalation of dusts, gases or vapours, dermal contact with soil and groundwater; and ingestion of soil and dust. However, the length of direct exposure will be limited to the duration of site works in which they are directly involved, and thus the effect will be short term. Any health effects from the potentially contaminated soil and groundwater could have a medium to long term effect.</p> <p>The sensitivity of construction workers and third party neighbours is medium to high and the magnitude of change, prior to mitigation, is high. Therefore, there is likely to be a direct, permanent, medium to long-term <b>moderate to major adverse</b> effect (<b>significant</b>) on construction workers and third party neighbours prior to the implementation of mitigation measures (see below).</p>
<p><b>Secondary Mitigation</b></p>	<p>The following measures will be incorporated within the final Construction Management Plan, which is likely to be required by a planning condition of a planning permission for the Proposed Development.</p> <p>Assuming the conditions detailed above, construction workers would be required to wear PPE such as gloves and face masks (where appropriate) to prevent dermal contact and inhalation or ingestion. Appropriate site hygiene facilities will be put in place and the presence of contaminants and the associated risks will be explained to ground workers before they begin work.</p> <p>Water can be sprayed onto material being worked to damp down any potentially contaminated dust and prevent it from becoming airborne where it may affect construction workers and third party neighbours. Wheel washing of site vehicles may also be implemented to prevent tracking of contaminated material off-site.</p>

	<p>Fuel storage on-site to be carried out under best practice i.e. integrally banded containers. Plant refuelling to be carried out using best practice techniques and any spills to be controlled with spill kit.</p> <p>Dust suppression measures (e.g. damping down) will be implemented to minimise the potential for dust generation.</p> <p>Wheel washing of site vehicles will be carried out in order to minimise the potential for dust generation.</p> <p>Appropriate covering of onsite stockpiled materials and during transport to/from the Site to prevent dust generation.</p>
<b>Residual Effects</b>	<p>The sensitivity of construction workers and third party neighbours is medium to high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a <b>negligible</b> effect (<b>not significant</b>) on construction workers and third party neighbours following implementation of pre-mitigation measures.</p>

<b>Potential for increased mobilisation of chemical contaminants into surface water and / or groundwater.</b>	<p>Construction work has the potential to increase the rate of infiltration of rainfall and therefore leaching of unexpected contaminants from shallow materials (such as Made Ground) to the Secondary A Aquifers (within the Cornbush Formation and Forest Marble Formation) by decreasing the thickness of the unsaturated zone during any striping of topsoil/grass cover.</p> <p>The use of machinery and plant associated with construction activities (including the establishment of a site construction compound and storage of chemicals or fuels) could give rise to localised contamination that may represent a risk to groundwater through accidental fuel / oil and chemical spills and leaks. There could also be a risk of contaminated runoff, including hydrocarbon contamination, associated with the operation of vehicles. This has the potential to create overland migration pathways to surface water features (on-site ponds and Gagle Brook).</p> <p>The sensitivity of Controlled Waters is considered to be low to medium, and the magnitude of change, prior to mitigation is medium. Therefore, there is likely to be a direct, temporary, long-term <b>minor to moderate adverse</b> effect (<b>significant</b>) on Controlled Waters prior to the implementation of mitigation measures.</p>
<b>Secondary Mitigation</b>	<p>The ground investigation carried out in compliance planning conditions will identify areas of contamination in shallow soils which will be appropriately remediated prior to the construction phase.</p> <p>Fuel storage on-site to be carried out under best practice i.e. integrally banded containers. Plant refuelling to be carried out using best practice techniques and any spills to be controlled with spill kit.</p>
<b>Residual Effects</b>	<p>The sensitivity of Controlled Waters is low to medium and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a direct, temporary, medium to long-term <b>negligible</b> effect (<b>not significant</b>) following the implementation of mitigation measures.</p>

## OPERATIONAL PHASE

<b>Potential effects on human health from exposure to</b>	<p>Future Site users will be exposed to any contaminants that are present in the Made Ground, or that are present in the ground after migrating from</p>
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<p><b>contamination and/or ground gas/vapours associated with historical and current land use</b></p>	<p>contaminant sources. They will be affected through inhalation of dust, dermal contact with soil and groundwater, inhalation of ground gas and vapours, and ingestion of soil and dust.</p> <p>The sensitivity of the future Site users (including maintenance workers) is high and the magnitude of change, prior to mitigation, is high. Therefore, there is likely to be a direct, temporary, medium to long-term effect on future site users of <b>major adverse</b> effect (<b>significant</b>) prior to the implementation of mitigation measures (see below).</p>
<p><b>Secondary Mitigation</b></p>	<p>A pre-construction ground investigation will be carried out to identify potential contaminant linkages. If necessary a Remediation Strategy will be produced for the Site, and remedial works will be appropriately validated.</p> <p>Where the presence of buildings and hardstanding across the site are present, it will limit the potential for dermal contact, ingestion or inhalation of contaminated soil by future users.</p>
<p><b>Residual effects and monitoring</b></p>	<p>The sensitivity of future users is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a <b>negligible</b> effect on future site users (<b>not significant</b>) following the implementation of mitigation measures.</p>

<p><b>Potential for increased mobilisation of chemical contaminants into surface water and / or groundwater</b></p>	<p>There is potential for ingress of surface water infiltration which may be impacted within hydrocarbons from the areas of car parking into groundwater or nearby surface waters. Additionally, the waterpark could potentially discharge water into the underlying aquifers via drainage channels affecting Secondary A Aquifers.</p> <p>The sensitivity of Controlled Waters is considered to be low to medium, and the magnitude of change, prior to mitigation is medium. Therefore, there is likely to be a direct, temporary, long-term <b>minor to moderate adverse</b> effect (<b>significant</b>) on Controlled Waters prior to the implementation of mitigation measures (see below).</p>
<p><b>Secondary Mitigation</b></p>	<p>Installation of interceptors into surface water drainage to prevent ingress to Controlled Waters of petroleum hydrocarbons from vehicles using roadways and car parks.</p> <p>Use of permeable pavements and penstocks and oil interceptors to be used where required.</p> <p>Monitoring of the discharge from site should be carried out at regular intervals to ensure the pre-mitigation measures are effective.</p>
<p><b>Residual effects and monitoring</b></p>	<p>The sensitivity of Controlled Waters is low to medium and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a <b>negligible</b> effect (<b>not significant</b>) following the implementation of mitigation measures.</p>

<p><b>Potential impact to buildings from ground gas</b></p>	<p>Ground gas could infiltrate into enclosed spaces and cause an explosive hazard.</p> <p>The sensitivity of building structures is medium and the magnitude of change, prior to mitigation, is medium. Therefore, there is likely to be a direct, temporary, long-term effect on building structures of <b>moderate</b></p>
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	<b>adverse (significant)</b> prior to the implementation of mitigation measures (see below).
<b>Secondary Mitigation</b>	<p>A ground investigation undertaken prior to construction in compliance with planning conditions will include an assessment of the ground gas regime at the Site in line with best practice (CIRIA C665, <b>Ref. 11.15</b>).</p> <p>Made Ground is also likely to be removed from the building footprints of the other buildings during the construction phase. This is likely to remove the majority of the Made Ground from beneath the proposed buildings which will remove the source of Ground Gas at these locations.</p> <p>Should the ground gas risk assessment indicate that the buildings structures require ground gas mitigation measures (such as a gas resistance membrane) in line with BS8485 then this will be installed during construction of the building. The installation of any gas protection measures should be validated by a competent and qualified person.</p>
<b>Residual effects and monitoring</b>	The sensitivity of building structures is medium and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a <b>negligible</b> effect on building structure ( <b>not significant</b> ) following the implementation of mitigation measures.

<b>Potential degradation/permeation of water supply pipes from contaminants</b>	<p>The water supply pipes on-site could be affected by direct contact with contaminants, or by contaminants migrating into plastic water supply pipes. Some contaminants have the ability to migrate through plastic pipes, and others to degrade plastics.</p> <p>Any contamination of the potable water is likely to be short term as the nature of the water's use means that it will probably be removed from the pipes and replaced in a relatively short time scale.</p> <p>Made Ground is also likely to be removed from the building footprint prior to construction. This is likely to remove the majority of the Made Ground from beneath the proposed buildings in these areas.</p> <p>The sensitivity of potable water supply is high and the magnitude of change, prior to mitigation, is medium. Therefore, there is likely to be a direct, temporary, short-term effect on potable water supply of <b>major adverse (significant)</b> prior to the implementation of mitigation measures (see below).</p>
<b>Secondary Mitigation</b>	Assuming the presence of contaminants capable of attacking or migrating through plastic supply pipes, it is recommended that the guidance detailed in UK Water Industry Research (UKWIR): Risk Assessment for Water Pipes in Land Potentially Affected by Contamination. Contaminated Land Assessment Guidance (2014) ( <b>Ref. 11.48</b> ) should be followed during the redevelopment of the Site. It may also be necessary to backfill trenches with clean imported material.
<b>Residual effects and monitoring</b>	The sensitivity of water supply pipes is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a <b>negligible</b> effect on water supply pipes ( <b>not significant</b> ) following the implementation of mitigation measures.



## 11.10. LIMITATIONS AND ASSUMPTIONS

- 11.11. The work undertaken to provide the basis of this chapter comprised a study of available documented information from a variety of sources and discussions with relevant authorities and other interested parties.
- 11.12. It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following further surveys and physical intrusive investigation of the Site.

## 11.13. SUMMARY

- 11.13.1. The Site is approximately 18.6 hectares in size and comprises 9 of the wider 18-hole golf course associated with Bicester Hotel Golf and Spa. This area includes holes 10 to 18 and comprises grassed areas, interspersed with standing water bodies, drainage ditches, sand bunkers and semi-mature to mature trees. Bands of woodland areas and hedges extend along the boundaries of the Site, with the M40 beyond on the western boundary and the A4095 beyond on the north-eastern boundary.
- 11.13.2. Historical Ordnance Survey maps indicate that the Site was generally open fields since the 1880s. A former quarry was noted in the north-east in the 1920s and appears to be backfilled by the late 1960s. The golf course was noted to be present by the 1980s.
- 11.13.3. Potential contaminative off-site sources included allotments, agricultural and farm land, a pump house, a tank and a coal yard.
- 11.13.4. A preliminary UXO enquiry with Zetica reported that the Site is located within an area with a very low WWII regional bombing density. However, there is record of at least four high explosive bombs to have fallen in the immediate vicinity of the Site. Zetica therefore recommended the need for a further detailed UXO desk study report to further assess the UXO hazard level of the Site.
- 11.13.5. There are no recorded superficial deposits. However, due to the engineered topography of the golf course it is anticipated that Made Ground is present across the Site. Geological mapping indicates the Site is underlain by the Cornbash Formation (limestone with interbeds of calcareous mudstone) overlying the Forest Marble Formation (mudstone with beds of limestone); both are classified by the Environment Agency (EA) as Secondary A Aquifers. The Cornbash Formation and Forest Marble Formation are part of the larger Great Oolite Group, which consists of a significant limestone aquifer producing large yields. Groundwater is likely to be present within these formations beneath the Site. The Site is not located within a groundwater Source Protection Zone and there are no groundwater abstraction wells located within 500m of the Site.
- 11.13.6. There are several water bodies situated within the Site, comprising drainage ditches and engineered ponds, lakes and swamps associated with the golf course.
- 11.13.7. Likely significant receptors identified include:
- Future site users (high sensitivity);
  - Construction workers (medium sensitivity);
  - Third party neighbours (medium to high sensitivity);
  - Secondary A aquifer (medium sensitivity);
  - On-site water features (low sensitivity); and
  - Gagle Brook (low sensitivity).



11.13.1. Proposed mitigation measures during the Construction Phase include (to be implemented through planning conditions):

- Appropriate use of PPE and hygiene regime by construction workers during demolition, construction and maintenance, through the implementation of a CEMP;
- Dust suppression during the construction stage, through the implementation of a CEMP;
- Appropriate fuel storage and good practice during fuelling of Site vehicles during development, through the implementation of a CEMP;
- Appropriate site drainage including use of interceptor systems in areas where motor vehicles are used, through the implementation of a CEMP;
- A ground investigation will be carried out to identify potential contaminant linkages as a condition of planning. If the ground investigation identifies contaminant linkages a Remediation Strategy will be produced for the Site to specify protective measures for the construction stage of the development;
- If potential contaminant linkages are identified following the ground investigation a remediation strategy will be produced in agreement with the Regulators and National House Building Council on that strategy and subsequent verification report requirements (in accordance with CLR 11) as a condition of planning; and
- Chemical validation of imported soils for soft landscaping areas.

11.13.2. The residual effects during construction and operation of the Proposed Development have all been assessed as **not significant**, based upon the above mitigation measures being implemented appropriately. However, a summary of significant effects is provided below in **Table 11-7**.



**Table 11.7 - Summary of Effects Table for Ground Conditions**

Description of Effects	Receptor	Significance and Nature of Effects Prior to Mitigation / Enhancement	Summary of Mitigation / Enhancement	Significance and Nature of Effects Following Mitigation / Enhancement (Residual)
<b>Construction Phase</b>				
Potential effects on human health from exposure to contamination and/or ground gas associated with historical and current land use	Construction workers Third party neighbours	Moderate – major (significant) - / P / D/ MT-LT	<ul style="list-style-type: none"> <li>Requirement to wear PPE.</li> <li>Appropriate hygiene facilities to be provided.</li> <li>Water spray to damp down any potentially contaminated dust.</li> <li>Magnetometer surveys can be carried out in areas at high risk of UXO.</li> </ul>	Negligible (Not Significant) - / T / D/ ST
Potential for increased mobilisation of chemical contaminants into surface water and / or groundwater	Groundwater (Secondary Aquifer) Surface water (on-site water feature. Gagle Brook)	Minor to moderate (significant) - / T / D/ LT	<ul style="list-style-type: none"> <li>Ground investigation pre-construction to identify areas of contamination.</li> </ul>	Negligible (not significant) - / T / D/ MT-LT
<b>Operational Phase</b>				
Potential effects on human health from exposure to contamination and/or ground gas/vapours associated with	Construction workers Third party neighbours	Major (significant) - / T / D/ MT-LT	<ul style="list-style-type: none"> <li>Ground investigation pre-construction to identify areas of contamination.</li> <li>Remediation Strategy and verification of imported soils.</li> </ul>	Negligible (not significant) - / T / D/ MT-LT





Description of Effects	Receptor	Significance and Nature of Effects Prior to Mitigation / Enhancement	Summary of Mitigation / Enhancement	Significance and Nature of Effects Following Mitigation / Enhancement (Residual)
historical and current land use				
Potential for increased mobilisation of chemical contaminants into surface water and / or groundwater	Groundwater (Secondary Aquifer) Surface water (on-site water feature. Gagle Brook)	Minor to moderate (significant) - / T / D / LT	<ul style="list-style-type: none"> <li>Ground investigation post planning to identify areas of contamination.</li> </ul>	Negligible (not significant) - / T / D / MT-LT
Potential impact to buildings from ground gas	Future on-site buildings	Moderate (significant) - / T / D / LT	<ul style="list-style-type: none"> <li>Ground investigation post planning to identify areas of contamination.</li> <li>Appropriate choice of gas mitigation measures, if required.</li> </ul>	Negligible (not significant) - / T / D / MT-LT
Potential degradation/permeation of water supply pipes from contaminants	Future site users	Minor (significant) - / T / D / ST	<ul style="list-style-type: none"> <li>Appropriate choice of pipe material.</li> <li>Backfill trenches with clean imported soil.</li> </ul>	Negligible (not significant) - / T / D / ST

NB: Aspects of the Proposed Development considered as part of the pre-mitigation scenario are summarised above in Section 11.5.

Key to table:

+ / - = Beneficial or Adverse P / T = Permanent or Temporary, D / I = Direct or Indirect, ST / MT / LT = Short Term, Medium Term or Long Term N/A = Not Applicable



## 11.14. REFERENCES

- **Ref. 11.1:** HMSO (1990) Part IIA of the Environmental Protection Act, 1990
- **Ref. 11.2:** HMSO (1995) Environment Act, 1995
- **Ref. 11.3:** HMSO (2002) Control of Substances Hazardous to Human Health Regulations, 2002 (as amended)
- **Ref. 11.4:** HMSO (2012) The Contaminated Land (England) (Amendment) Regulations
- **Ref. 11.5:** HMSO (2012) The Control of Asbestos Regulations
- **Ref. 11.6:** HMSO (2015) Construction (Design & Management) Regulations
- **Ref. 11.7:** HMSO (2015b) The Environmental Damage (Prevention and Remediation) (England) Regulations
- **Ref. 11.8:** (HMSO, 2016) The Environmental Permitting (England and Wales) Regulations (HMSO, 2016)
- **Ref. 11.9:** HMSO (2017) The Water Environment (Water Framework Directive) (England & Wales) Regulations (2000/60/EC)
- **Ref. 11.10:** The Groundwater Directive 2006/1118/EC
- **Ref. 11.11:** Water Resources Act (1991)
- **Ref. 11.12:** National Planning Policy Framework (June 2019)
- **Ref. 11.13:** National Planning Practice Guidance (July 2019)
- **Ref. 11.14:** Cherwell District Council (2016). Cherwell Local Plan 2011-2031. Available at: <https://www.cherwell.gov.uk/info/83/local-plans>, Accessed May 2019
- **Ref. 11.15:** Environment Agency (2004) Model Procedures for the Management of Contaminated Land (CLR11)
- **Ref. 11.16:** CIRIA C552 (2001) Contaminated Land Risk Assessment. A Guide to Good Practice
- **Ref. 11.17:** CIRIA C532: Control of Pollution from Construction Sites (CIRIA, 2001)
- **Ref. 11.18:** CIRIA C665: Assessing Risks Posed by Hazardous Ground Gases to Buildings (CIRIA, 2007)
- **Ref. 11.19:** CIRIA C681: Unexploded Ordnance (UXO) - A Guide for the Construction Industry (CIRIA, 2009)
- **Ref. 11.20:** CIRIA C682: The VOCs Handbook (CIRIA, 2009b)
- **Ref. 11.21:** CIRIA C733: Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks (CIRIA, 2014)
- **Ref. 11.22:** EPA 1990: Part 2A, Contaminated Land Statutory Guidance (HMSO, 2012)
- **Ref. 11.23:** British Standard (BS) 8576:2013 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds (VOCs) (BSI 2013)
- **Ref. 11.24:** National House Building Council (NHBC), EA, Chartered Institute of Environmental Health, Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66: 2008
- **Ref. 11.25:** BS5930: 2015 Code of Practice for ground investigations (BSI 2015)
- **Ref. 11.26:** BS 8485: 2015+A1 Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings (BSI 2019)
- **Ref. 11.27:** BS 10175:2011+A2 Investigation of Potentially Contaminated Sites – Code of Practice (BSI 2017)



- **Ref. 11.28:** EA Groundwater Protection Technical Guidance (2017)
- **Ref. 11.29:** Department for Communities and Local Government (2018) National Planning Policy Framework
- **Ref. 11.30:** Envirocheck reports, dated 25 January 2018, Order Ref: 154470925\_1\_1
- **Ref. 11.31:** Envirocheck reports, dated 28 February 2019, Order Ref: 195713619\_1\_1
- **Ref. 11.32:** EA Long Term Flood Risk Information website, accessed on 6 February 2018
- **Ref. 11.33:** British Geological Society (BGS), Geological map Sheet No.219 Buckingham, 1:50,000, Solid and Drift Edition (2002) (online), accessed on 02 February 2018
- **Ref. 11.34:** Zetica Pre-Desk Study Assessment Unexploded Ordnance (UXO) risk report, dated 8 February 2018
- **Ref. 11.35:** Zetica Pre-Desk Study Assessment UXO risk report, dated 6 March 2019
- **Ref. 11.36:** 1st Line Defence Preliminary UXO Risk Assessment, dated 6 March 2019
- **Ref. 11.37:** 1st Line Defence Detailed UXO Risk Assessment, dated 3 April 2019
- **Ref. 11.38:** British Geological Survey (BGS). Geology of Britain Viewer. British Geological Survey. <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>
- **Ref. 11.39:** BGS. 2017. Geindex Onshore <http://mapapps2.bgs.ac.uk/geindex/home.html>.
- **Ref. 11.40:** BGS  
[http://scans.bgs.ac.uk/sobi\\_scans/boreholes/1063613/images/12528627.html](http://scans.bgs.ac.uk/sobi_scans/boreholes/1063613/images/12528627.html)
- **Ref. 11.41:** BGS GeoRecords Plus+ <http://mapapps.bgs.ac.uk/GeoRecords/GeoRecords.html>
- **Ref. 11.42:** The Coal Authority. Interactive Coal Mining Risk Map  
<http://mapapps2.bgs.ac.uk/coalauthority/home.html>.
- **Ref. 11.43:** Public Health England and BGS. UK Radon Map  
<http://www.ukradon.org/information/ukmaps>.
- **Ref. 11.44:** Building Research Establishment (BRE). Radon: guidance on protective measures for new buildings, originally introduced in 1991 and amended in 1992, 1999 and 2007 covering England and Wales. 2015. BRE 211
- **Ref. 11.45:** CIRIA. C681 Unexploded Ordnance (UXO); A guide for the construction industry. London, 2009
- **Ref. 11.46:** Environment Agency <https://environment.data.gov.uk/catchment-planning/WaterBody/GB106039030140> Accessed 26 June 2019.
- **Ref. 11.47:** [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/539079/PHE-CRCE-028.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/539079/PHE-CRCE-028.pdf) Accessed 26 June 2019.
- **Ref. 11.48:** UK Water Industry Research (UKWIR): Risk Assessment for Water Pipes in Land Potentially Affected by Contamination. Contaminated Land Assessment Guidance (2014)