

APPENDIX 2.1
EIA SCOPING OPINION REQUEST REPORT

Land North West of Bicester

Environmental Impact Assessment Scoping Report

November 2020

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Environmental Impact Assessment Scoping Report

Prepared on behalf of
Firethorn Developments Limited

Project Ref:	31036/A5/EIAScoping		
Status:	Draft	Draft	Final
Issue/Rev:	01	02	03
Date:	September 2020	October 2020	November 2020
Prepared by:	JM/Project Team	JM	MM
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1 INTRODUCTION

- 1.1 This report, prepared by Barton Willmore¹ on behalf of Firethorn Developments Limited (the “Applicant”), accompanies a request for an Environmental Impact Assessment (EIA) Scoping Opinion from Cherwell District Council (CDC) in accordance with Regulation 15 of the *Town and Country Planning (Environmental Impact Assessment) Regulations 2017, as amended*² (the “EIA Regulations”).
- 1.2 In accordance with the EIA Regulations, a person who is minded to make an EIA application may ask the relevant planning authority to state in writing their opinion as to the information to be provided in the Environmental Statement (a “Scoping Opinion”). Regulation 15 (2) states that a scoping request must be accompanied by:
- *A plan sufficient to identify the land;*
 - *A brief description of the nature and purpose of the development, including its location and technical capacity;*
 - *An explanation of the likely significant effects of the development on the environment; and*
 - *Such other information or representations as the person making the request may wish to provide or make.*

The Site

Site Context

- 1.3 The site (as shown at Appendix 1) comprises two parcels of land and is located on the northern edge of Bicester, 2.5km to the north west of Bicester Town Centre. It is approximately 550m to the north of Lords Lane (A4095) and directly to the west of Banbury Road (B4100), with the villages of Bucknell and Caversfield located to the north west and east, respectively. Land adjacent to the site has planning consent for residential development and construction has begun in parts, the planning context for which is discussed below. Land further north of the site comprises open countryside and farm buildings.
- 1.4 The site is bound to the east by Banbury Road (B4100), with the Church of St Laurence Grade II* Listed Building, Caversfield House, which is surrounded by vegetation, and a Public Right of Way (PRoW) beyond that. Home Farmhouse, a Grade II Listed Building, is located approximately 85m to the south east at the closest point to the site. The site does not lie

¹ Institute of Environmental Management and Assessment (IEMA) Quality Mark Members

² SI 2017/571 as amended by SI 2018/695 and 2020/505

within a Conservation Area, the closest is RAF Bicester approximately 480m to the south east. Further to the south east of the site lies the village of Caversfield, a park, and Bicester Airfield. The site is bound to the west by agricultural land, farm buildings, with Bicester Road and the London to Birmingham railway line further to the west and the village of Bucknell approximately 1.2km to the north west. The historic parkland of Bignell Park is located to the south west of Middleton Stoney Road, which is approximately 2.6km to the south west of the site.

Site Description

- 1.5 The site comprises two parcels of land, with a total area of approximately 22 ha. The land is predominantly grassland with fields bounded by hedges with some large trees, woodland and plantation. The land is classified as good to moderate value (primarily Grade 3b) under the Agricultural Land Classification system. The west of the site contains two distinct areas of woodland, and the most northern area of woodland contains a dry pond. A historic hedgerow runs along the north eastern border of the site and a drainage feature runs through the south of the site, which also comprises areas of Flood Zones 2 and 3. The site is relatively flat rising gradually to the north west.

Planning Background

- 1.6 The site forms part of a strategic allocation for 6,000 dwellings at North West Bicester within Policy Bicester 1 of the adopted Cherwell Local Plan 2011-20313. An adopted Supplementary Planning Document⁴ (SPD) defines the extent and type of development proposed across the whole of the North West Bicester area which covers an area of around 400ha and seeks to deliver up to 6,000 'true' zero carbon homes; 4 primary schools and 1 secondary school; Pedestrian and cycle links; new local centres, and new railway links.
- 1.7 The site within this Scoping Report is one of several development parcels being brought forward for development within the North West Bicester SPD area. The land immediately adjacent to the site to the north and east is being developed as an Exemplar scheme for 493 homes along with a primary school, a Local Centre and associated infrastructure. Schemes have also been approved to the south of the Exemplar site (up to 150 dwellings plus access) and at Himley Village to the north of the railway line (for up to 1,700 dwellings, commercial floorspace and a new primary school). Further information is provided in section 12 of this Scoping Report, Cumulative Schemes.

³ <https://www.cherwell.gov.uk/info/83/local-plans/376/adopted-cherwell-local-plan-2011-2031-part-1>

⁴ <https://www.cherwell.gov.uk/downloads/download/281/north-west-bicester-spd-main-document-february-2016>

Proposed Development

- 1.8 The proposed development comprises an outline planning application for up to 550 residential dwellings, open space provision, access, internal estate roads, vehicle and cycle parking, drainage and all associated works and operations including but not limited to demolition, earthworks, and engineering operations.

2 SCOPING

- 2.1 This scoping exercise has been informed by desk-based research, professional judgement and other information available for the site. Table 1 provides a summary of the scoping exercise.

Table 2.1: EIA Scoping Summary

Topics	Potential Construction Phase Effects	Potential Operational Phase Effects	Likely Significant Effects (Pre-Mitigation)	Comments
Transport and Access	✓ - T	✓ - P	✓	Chapter to be prepared.
Air Quality	✓ - T	✓ - P	✓	
Noise & Vibration	✓ - T	✓ - P	✓	
Landscape and Views	✓ - T	✓ - P	✓	
Biodiversity	✓ - T/P	✓ - P	✓	
Built Heritage	✓ - T	✓ - P	✓	
Population and Human Health	✓ - T	✓ - P	✓	
Water Resources and Flood Risk	✓ - T	✓ - P	✓	
Climate Change	✓ - T	✓ - P	✓	
Agriculture and Soils	x	x	x	Topic scoped out of the ES.
Archaeology	x	x	x	
Land Contamination	x	x	x	
Wind Microclimate	x	x	x	
Daylight, Sunlight and Overshadowing	x	x	x	
Lighting	x	x	x	
Waste	x	x	x	
Accidents and Disasters	x	x	x	

Key: ✓ Likely Significant Effect / x No Likely Significant Effect.
T – Temporary Effect / P – Permanent Effect

Environmental Disciplines Scoped Out

- 2.2 Further information on the topics scoped out of the EIA in Table 1 is set out in the following paragraphs.

Agriculture and Soils

- 2.3 Agricultural survey work has already been undertaken on the site as part of the planning application for consented development including the Bicester Exemplar scheme (14/01384/OUT). This work identified that the land within the boundary of the proposed development is classified as good to moderate value (primarily Grades 3b and 4) under the Agricultural Land Classification system. Appendix 2 contains the ES chapter and supporting Figure setting out the ALC classifications on the site and in the wider area. In accordance with this information, given the site does not comprise more than 20 hectares of Best and Most Versatile Land (i.e. Grades 1, 2 and 3a) an assessment of agricultural land will be scoped out of this ES.

Archaeology

- 2.4 Desk-based assessment and field surveys have already been undertaken for the site in support of permitted developments on and adjacent to the Bicester Exemplar Development (ref: 14/01384/OUT). Surviving buried archaeological remains were confirmed in the trial trenching that formed part of these surveys. These remains comprise infilled ditch and pit features indicative of late prehistoric (Iron Age) field systems, lying in the hinterland of settlement. Early medieval artefacts have also been discovered, which are believed to relate to the former settlement lying to north-east, near the church.
- 2.5 These buried archaeological remains are of limited heritage significance and do not warrant retention (preservation in situ). An archaeological mitigation plan has been agreed with CDCs archaeological advisor (Mr. Richard Oram at Oxfordshire CC) for the western part of the site. Further consultation is required to agree the mitigation plan for the eastern part of the site. The mitigation proposals for both parts of the site will involve archaeological excavation of discrete areas in advance of construction.
- 2.6 No further assessment work is required to support the current application. No significant effects are anticipated in regard to buried archaeological remains. Therefore this topic has been scoped out of the ES.

Land Contamination

- 2.7 The site is not located in a groundwater Source Protection Zone, there are historic landfills recorded in the wider area, and historic records of quarrying however no significant contamination is anticipated given the agricultural nature of the land. Appendix 3 contains the ES chapter submitted as part of the 2014 ES (planning ref: 14/01384/OUT) which did not identify significant residual effects therefore this topic has been scoped out of the ES.

Wind Microclimate

- 2.8 Due to the low-rise nature of proposed buildings, likely significant wind effects are not anticipated and this topic has been scoped out of the ES.

Daylight, Sunlight and Overshadowing

- 2.9 The scale and massing of the proposed development will not cause changes to daylight or sunlight availability or cause overshadowing of residents or amenity space. It is therefore proposed to scope this discipline out of the ES.

Lighting

- 2.10 External lighting will be designed carefully with due reference to relevant British Standards, industry best practice and the Institute of Lighting Professionals (ILP) (2020) Guidance Notes for the Reduction of Obtrusive Light⁵. The effect of lighting from the proposed development on biodiversity will be assessed within the Biodiversity chapter of the ES. The effect of lighting from the proposed development in terms of landscape and visual effects, including on the night time scene, will be assessed within the Landscape and Views chapter of the ES. The effect of lighting from the proposed development on the historic environment will be assessed within the Built Heritage chapter of the ES. Therefore, lighting as a standalone chapter has been scoped out of the ES.

Waste

- 2.11 The proposed development is not anticipated to produce significant amounts of waste during the construction works. Any waste generated during the construction of the proposed development would be reused and recycled, where possible. Operational waste is unlikely to be significant or complex and would be disposed of in line with CDC requirements and managed in accordance with all applicable legislation. The proposed development is not likely to produce significant effects relating to waste and therefore this topic has been scoped out of the ES.

Accidents and Disasters

- 2.12 The proposed development will comprise residential dwellings. The site is not located in an area considered to be at risk from major accidents and natural disasters. The Flood Risk Assessment (FRA) and Water Resources and Flood Risk ES chapter will assess and mitigate the risk of flooding, including building in an allowance for climate change. This is the only such hazard considered relevant. No ground stability hazards have been identified on the site and the site is not located in an area at risk from past or present coal extraction. It is considered that ground stability does not pose a significant risk.
- 2.13 During the construction phase for the proposed development, which is considered the only phase which could be considered as hazardous, all applicable health and safety legislation will be complied with in accordance with best practice. This topic has therefore been scoped out of the ES.

⁵ Guidance Notes for the Reduction of Obtrusive Light (Guidance Note 01/20) Institute of Lighting Engineers

Environmental Disciplines Scoped In

- 2.14 For each of the topics scoped into the assessment, further information on the details to be included in the assessment and the methodology to be employed are set out in the following sections.

3 TRANSPORT AND ACCESS

- 3.1 An assessment will be undertaken of the likely significant effects of the proposed development with respect to transport and access.

Baseline

- 3.2 The site is located to the north of Lords Lane (A4095) and adjacent to the west of Banbury Road (B4100). The site access arrangements from the existing adopted highway network, identified as being the B4100 Banbury Road, are identified as being via the existing priority junctions that have been agreed and constructed for the Bicester Eco Town Exemplar Site (Elmsbrook) scheme that was consented on the 10th July 2012 (Planning Reference 10/01780/HYBRID).
- 3.3 The western parcel of land is proposed to be accessed from two priority junctions that will connect directly to the Estate Road at points generally to the north and south of the Bus Only Link that is provided on Charlotte Avenue. The eastern parcel of land is proposed to be accessed from a new priority junction that will connect to the internal road network as permitted for the Elmsbrook scheme.
- 3.4 Links for pedestrians and cyclists from the Development are proposed at a number of locations for both the western and eastern parcels of land, as presented on the location plan contained at Appendix 1 of this EIA Scoping Report. These links will be provided in an appropriate and consistent form to that which has been agreed and provided for the Elmsbrook scheme.
- 3.5 Due to the fact that the internal highway network of the Elmsbrook scheme has yet to be adopted by Oxfordshire County Council (OCC) in their capacity as local highway authority, rights of access for all purposes have been secured with the Developers of the Elmsbrook scheme. As such, a continuous and uninterrupted means of access for all purposes can be achieved to the local highway network whether this includes the internal highway network of the Elmsbrook scheme or not.
- 3.6 As has been identified within this EIA Scoping Report, the site forms part of the strategic allocation for 6,000 dwellings at North West Bicester, which has been the subject of substantial traffic analysis commissioned by OCC. The Bicester SATURN Model was developed in 2007. The current base year for the Bicester SATURN Model is 2012.
- 3.7 Detailed traffic analysis of a more refined area that includes the Site was undertaken by Hyder as part of the Application 1 submission for 2,600 dwellings (Planning Reference 14/01384/OUT). The Transport Assessment that supported the Application 1 proposals is dated July 2014.

- 3.8 A consistent methodology to obtain baseline traffic flows for the local highway network is to be adopted for the planning application. This will include traffic flows at identified links and junctions for a 2012 base year that are to be extracted from the Bicester SATURN Model.

Approach

- 3.9 The traffic and transport impacts of the proposed development will be assessed in line with the IEA Guidelines for the Environmental Assessment of Road Traffic (the IEA Guidelines), utilising the Bicester SATURN Model and informed by scoping discussions with OCC Highways Department and Highways England.

- 3.10 The scope of the highway network assessed will be agreed with OCC and a more refined study area will be identified as the technical analysis work progresses, but is likely to include the following links and junctions:

- Highway Links
 - B4100 Banbury Road
 - A4095
 - A4421
 - Skimmingdish Lane
- Highway Junctions
 - Site Access Junctions
 - Charlotte Avenue / B4100 Banbury Road
 - Braeburn Avenue / B4100 Banbury Road
 - B4100 Banbury Road / A4095
 - A4095 / A4421 / Skimmingdish Lane

- 3.11 Within the IEMA Guidelines, two broad rules are suggested which can be used as a screening process to limit the scale and extent of the assessment which in turn assists in identifying links to be assessed. These comprise:

- **Rule 1:** *include highway links where traffic flows will increase more than 30% (or the number of heavy goods vehicles (HGVs) will increase by more than 30%); and*
- **Rule 2:** *include any other specifically sensitive areas where total traffic flows have increased by 10% or more'.*

- 3.12 Where the predicted increase in traffic flows is lower than the above thresholds, the IEMA Guidelines suggest the significance of the effects can be stated to be negligible and further detailed assessments are not warranted. Furthermore, increases in traffic flows below 10% are generally considered to be insignificant in environmental terms given that daily variations in background traffic flow may vary by this amount.

3.13 The extent of transport impacts will be determined using pre-defined significance criteria for each mode of travel. Those criteria will be based on the net change in journeys as a result of the proposed development at the site and any infrastructure improvements delivered as part of the proposals. The significance criteria will establish the magnitude of any beneficial or adverse effects that the proposed development will have on the transport network.

3.14 The following topics will be assessed for the construction and operational phases:

- Severance;
- Driver delay;
- Pedestrian delay;
- Pedestrian amenity;
- Accidents and safety; and
- Hazardous and dangerous loads.

Summary

3.15 Table 3.1 summarises the transport and access effects identified for inclusion in the assessment.

Table 3.1: Transport and Access Effects

Receptor	Effects	Scoped In
Local Roads	Net change in traffic patterns; peak hour junction capacity; daily link flows; traffic speed; effect on personal injury accidents	✓
Public Transport	Net change in public transport use; duration and frequency of bus services.	✓
Pedestrians and Cyclists	Net change in pedestrian and cycle journeys; on-street cycle facilities; effect on personal injury accidents.	✓

4 AIR QUALITY

- 4.1 An assessment will be undertaken of the likely significant effects of the proposed development on air quality.

Baseline

- 4.2 The site is not located in an Air Quality Management Area (AQMA). The closest AQMA is located in Bicester Town Centre which is declared due to Nitrogen Dioxide (NO₂) levels.

Approach

- 4.3 The Institute of Air Quality Management (IAQM)⁶ guidance states that *'roads which have an additional 500 Average Annual Daily Traffic (AADT) vehicles and/or 100 AADT HGVs flows, associated with a proposed development, would also be required to be included within an air quality assessment'*.
- 4.4 It is proposed that air pollutant concentrations in the area will be assessed to identify current baseline levels and determine any constraints or impacts associated with the proposed development during both the construction and operational phases. It is therefore proposed that the following scope of works will be carried out:
- Detailed consultation with CDC;
 - Identification of sensitive receptors (including ecological receptors);
 - Review of monitoring data (where available) and background pollutant maps;
 - Detailed air quality dispersion modelling using ADMS Roads for traffic related emissions;
 - Assessment of impacts on ecological receptors; and
 - Determination of construction related impacts.
- 4.5 The air quality impact assessment will include an assessment of background and modelled concentrations for NO₂, PM₁₀ and PM_{2.5}, as these are the three pollutants responsible for the declaration of the majority of the AQMAs throughout the country and most closely associated with traffic emissions.
- 4.6 The modelling exercise will be undertaken for three different scenarios, as follows:

⁶ Institute of Air Quality Management, Guidance on Land-use Planning and Development Control: Planning for Air Quality 2017 v1.2

- Baseline year;
 - Opening year without the proposed development; and
 - Opening year with the proposed development.
- 4.7 The modelling exercise will utilise AADT data for all affected roads from the Transport Assessment prepared for the proposed development.
- 4.8 An assessment of the likely significant cumulative effects on the environment with respect to air quality with the identified committed developments would also be undertaken for the construction and operational phases.
- 4.9 The model will predict the annual mean concentration at any proposed sensitive receptors for direct comparison with the UK air quality objectives and the results will be verified using the site-specific NO₂ diffusion tube monitoring data.
- 4.10 During construction, fugitive dust emissions and construction plant and vehicle emissions have the potential to cause adverse air quality impacts in the vicinity of the site. Experience of implementing mitigation measures for construction activities demonstrates that total mitigation is normally possible such that effects from fugitive dust emissions and construction plant and vehicle emissions would not be 'significant'. Mitigation measures would be agreed with CDC and set out within a Construction Environmental Management Plan (CEMP). An assessment of construction dust has therefore been scoped out.

Summary

- 4.11 Table 4.1 summarises the air quality receptors identified for inclusion in the assessment.

Table 4.1: Air Quality Effects

Receptor	Effects	Scoped In
Existing surrounding sensitive receptors including residents, schools, care homes and healthcare institutions	Potential exposure to increased pollution levels during operation.	✓
Ecologically sensitive sites within 2km of the proposed site	Potential exposure to increased pollution levels during operation.	
Future residents and users of the proposed development	Potential exposure to increased pollution levels during operation.	✓
Local pollution level	Potential increase of pollutant levels above national objectives.	✓

5 NOISE AND VIBRATION

5.1 An assessment will be undertaken of the likely significant effects of the proposed development on the environment with respect to noise and vibration. This will include construction phase (temporary) and operational phase (permanent) effects.

Baseline

5.2 The key considerations in relation to the noise and vibration assessment are as follows:

- The existing sensitive receptors, including residential properties;
- The baseline noise and vibration conditions in the study area; and
- Suitability of the site for proposed noise sensitive uses.

5.3 It should be noted that the suitability of the site for residential development is not a direct environmental impact of the development itself; however, the assessment of site suitability for residential development will be considered as part of the ES chapter. The assessment will be undertaken in accordance with the guidance presented within ProPG: Planning and Noise and BS 8233 and will include the identification of mitigation measures to be included as part of the development proposals to reduce the potential adverse effects of noise on the development site.

5.4 A baseline noise monitoring survey was undertaken at nine locations from Wednesday 9th August to Wednesday 16th August 2020. Attended short-term measurements were undertaken at seven locations during day, evening and night-time periods with two additional locations being measured unattended over a 164-hour period. The noise monitoring locations are detailed in Table 5.1 below.

Table 5.1: Noise Monitoring Locations

Ref	Description
LT1	Lay-by off the B4100, north west of the site
LT2	Centre of the site by the currently completed houses along Charlotte Avenue
ST1	Bainton Road by the residents of Bucknell
ST2	In the lay-by off the B4100
ST3	On Braeburn Avenue by the child's playpark
ST4	At the top of the entrance to The Courtyard by the B4100
ST5	Outside Home Farm on the corner of the B4100
ST6	On Charlotte Avenue by the completed buildings on the estate
ST7	On Bicester Road outside the farm buildings

5.5 The ambient noise climate is characterised by road traffic noise along the B4100 and distant traffic noise from the M40. As such, the noise chapter will consider the effects of existing sources of road traffic noise affecting the development site, as well as the potential impact of increased traffic flows on the local road network.

5.6 The nearest sensitive receptors to the site include but are not limited to:

- Residential properties along Braeburn Avenue and Charlotte Avenue located adjacent to the site boundary;
- Gagle Brook Primary School located approximately 100m to the south east of the site;
- Residential properties along the B4100 located adjacent to the site boundary;
- Residential properties along the A4095 located approximately 570m to the south east of the site; and
- Residential properties along the Bucknell Road located approximately 850m to the south east of the site.

Approach

Operational Noise

5.7 The change in noise levels resulting from additional traffic flows associated with the proposed development will be predicted using CadnaA environmental noise modelling software. The magnitude of the impact will then be assessed in accordance with guidance contained in Design Manual for Roads and Bridges Volume 11 Section 3 Part 7 – LA 111 Noise and Vibration for the following scenarios:

- Opening year without the proposed development;
- Opening year with the proposed development;
- Future year (+15 years of opening) without the proposed development; and
- Future year (+15 years of opening) with the proposed development.

5.8 The modelling exercise will utilise 18 hour (daytime) and 8-hour flows (night time) for all affected roads from the Transport Assessment prepared for the proposed development.

Operational Vibration

5.9 The operational development is unlikely to give rise to any vibration that would be measurable beyond the site boundary. Vibration effects from the operation of the proposed development are not expected to be significant and have therefore been scoped out.

Construction Noise and Vibration

- 5.10 The effects on noise and vibration during construction will also be assessed qualitatively in accordance with the British Standard 5228: 2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites.
- 5.11 The focus will be on mitigation measures to be included in a CEMP. In accordance with best practice, a CEMP will be prepared by the principal contractor and submitted to CDC for agreement in writing prior to the start of works which will detail how construction activities will be managed and, where necessary, mitigated.

Assessment Criteria

- 5.12 It is anticipated that the assessment criteria will include the following:
- National Planning Policy Framework 2019;
 - National Planning Practice Guidance 2019;
 - Noise Policy Statement for England March 2010;
 - British Standards BS7445-1:2003, BS 8233:2014 and BS5228-1:2009+ A1 2014;
 - World Health Organisation Guidelines for Community Noise 1999;
 - Professional Practice Guidance on Planning and Noise 2017; and
 - Any local policy specific to CDC.

Summary

- 5.13 Table 5.1 summarises the noise and vibration effects to be included for detailed assessment in the ES.

Table 5.1: Noise and Vibration Effects

Receptor	Effects	Scoped In
Existing residential receptors and community uses	• Temporary noise / vibration effects during construction and need for control/mitigation measures.	✓
	• Noise change due to traffic and operational noise generated by the proposed development.	✓
Proposed residential receptors	• Road traffic noise	✓

6 LANDSCAPE AND VIEWS

- 6.1 An assessment will be undertaken of the likely significant effects of the proposed development on the environment with respect to landscape and visual effects.

Baseline

- 6.2 The site is not located within any statutory or non-statutory (local) landscape designations.
- 6.3 The Oxfordshire County Council Wildlife and Landscape Study (OWLS) places the Site within the 'Wooded Estatelands' landscape character type. This is described as a largely arable landscape with rolling topography and woodland blocks. At the more local level, the site falls within the 'Oxfordshire Estate Farmlands' landscape character type as identified in Cherwell District Landscape Character Assessment. Again, this is described as an arable landscape, with woodlands dividing and enclosing the landscape. There are also long views across rolling open fields where there are substantial breaks in tree cover.
- 6.4 The site (and countryside surrounding the site) is largely consistent with this description of landscape character. The site itself comprises predominantly arable farmland and contains two distinct areas of woodland to the south. However, the site is heavily influenced by the urban area, lying between new housing development and a primary school, which forms the first phase of the North West Bicester eco-town allocation, and in close proximity to the built up area of Bicester.
- 6.5 The site is relatively well contained within the landscape, bound by mature hedgerows and adjoining areas of built development. The western site boundary is open and there is intervisibility between the western part of the site across adjoining arable fields, however, widespread visibility is limited by mature field boundaries and woodland blocks in the surrounding landscape.
- 6.6 An initial Zone of Theoretical Visibility (ZTV) study has been undertaken to inform the assessment of landscape and visual effects. This was based on existing ground levels, existing and permitted built development, and existing woodland (modelled from a LiDAR digital surface model); and proposed development parameters (modelled at between 8.5 and 14m, presenting a range of 2 – 4 storey buildings). It should be noted that the ZTV presents a 'worst case' scenario, based on built development across the site and not taking into account local landscape features such as trees, hedgerows, embankments, landform and / or buildings not within the data sets. As a result, the extent of actual visibility on the ground will be less than suggested by the ZTV study.

- 6.7 The ZTV indicates visibility is relatively limited. There is theoretical visibility for up to around 1km to the north-east / north-west, beyond which woodland generally screens views. There is limited theoretical visibility to the east, with taller elements of proposed development potentially visible along the A4421 corridor. There is theoretical visibility for up to around 750m to the south, beyond which the existing built up area of Bicester (extending up to the A4095 Lords Lane) restricts screens views. There is theoretical visibility for up to around 3km to the south-west, extending across the open countryside up to the B4030. However, it is noted that this area forms part of the wider North West Bicester eco-town allocation and will be developed in the future. There is theoretical visibility for up to around 750m to the west, which is curtailed by a mature tree and hedgerow boundary on the eastern edge of Bucknell.
- 6.8 The ZTV study was subsequently tested in the field. It was determined that that the Zone of Visual Influence (ZVI) - i.e. the area within which the proposed development is most likely to be visible - is much smaller than the ZTV. The ZVI is largely contained to up to 1km to the north-east / north-west, from public footpaths and roads extending through the countryside; up to around 500m to the east, from properties / roads in close proximity to the site; up to 1km to the south, from the existing properties / roads along the existing settlement edge (but accepting much of this area will be developed in the future); and up to 750m to the west, from public footpaths and roads between the site and Bucknell.
- 6.9 Based on the above analysis, a 2km zone is considered appropriate to assess all likely landscape and visual effects resulting from the proposed development and Table 6.1 identifies the proposed Representative Viewpoints.

Table 6.1: Representative Viewpoints

Viewpoint	Location	Receptors
1	View from road between the western and eastern site parcel	Residents of the first phase of North West Bicester eco-town
2	View from PRoW 148/7 to north of Site	Recreational users of footpath
3	View from junction of PRoW 148/8, B4100 and Bainton Road to north of the Site	Recreational users of footpath and motorists
4	View from PRoW 148/7 / B4100 to north-east of Site	Recreational users of footpath and motorists
5	View from St Laurance Church / B4100 to north-east of Site	Visitors to church and motorists
6	View from A4421 to the east of the Site	Residents of Home Farm and motorists
7	View from Caversfield residential area / Fringford Road to east of Site	Residents of Caversfield and motorists
8	Views from A4095 to south of Site	Future residents of Bicester North West and motorists
9	Views from PRoW 148/9 / Bucknell Road to south-west of Site	Future residents of Bicester North West eco town / resident of Bucknell, recreational users and motorists
10	Views from Bainton Road to the north-west of Site	Residents of Bucknell and motorists

Approach

- 6.10 The assessment will be undertaken in accordance with Landscape Institute and Institute of Environmental Management and Assessment, 'Guidelines for Landscape and Visual Impact Assessment' (Third Edition, 2013) and will provide a review of the existing landscape planning policy context, published sources of landscape character and visual appraisal of the study area and an assessment of the potential landscape and visual effects of the proposed development, both at the construction and operational phases.
- 6.11 Baseline information for the study area will be collated, which will include landscape planning policy designations, published sources of landscape character / green infrastructure, mapping of landscape features / topography, photography of the site and from representative viewpoints, and any other relevant information.
- 6.12 The baseline appraisal will be based on the year 2020, with the assessment of effects considered during construction; on completion, including the implemented landscape and green infrastructure strategy; and 15 years thereafter, once any proposed planting has matured. The assessment will also take account of the seasonal variation in visual characteristics.
- 6.13 This assessment will assume that any consented developments within the study area will form part of the baseline environment. The assessment will also assume the area of the North West Bicester eco-town allocation to the south of the site is also part of the baseline environment, and is built out generally in accordance with the parameters established by the North West Bicester SPD.
- 6.14 In accordance with current best practice, this assessment will address landscape and visual effects as separate issues. Landscape effects relate to both the effect on the physical features of the site, and on the landscape character of the site and surrounding area. Visual effects relate to typical views of the proposed development from the surrounding area.
- 6.15 A list of representative viewpoints for assessment is set above and will form the basis of the assessment of visual effects. The exact location of viewpoints will be refined during further desk and field study.
- 6.16 In summary, the assessment will:
- Define the study area for the site, identifying key landscape receptors and separately, key visual receptors and their typical/representative views to be used for the visual impact

assessment;

- Assess the value, susceptibility to change and overall sensitivity of the landscape and visual receptors (the receiving environment);
- Assess the magnitude of landscape and visual effects;
- Assess the significance of landscape and visual effects;
- Identify ways in which adverse effects on landscape and/or visual amenity could be avoided or reduced and consider requirements for any mitigation measures;
- Summarise any residual effects following mitigation; and
- Identify the likely cumulative effects of any known developments.

Summary

6.17 Table 6.1 summarises the landscape and visual receptors identified for inclusion in the assessment.

Table 6.2: Landscape and Views

Receptor	Effects	Scoped In
Typical views from publicly accessible locations, including roads, footpaths and public open spaces (as per the schedule of representative viewpoint in Table 6.1)	Visual effects on users	✓
Landscape features, including existing vegetation	Landscape effects on the landscape resource	✓
Landscape Character	Effects on landscape character areas	✓

7 BIODIVERSITY

- 7.1 An assessment will be undertaken of the likely significant effects of the proposed development on the environment with respect to ecology and nature conservation.

Baseline

- 7.2 There are no European or nationally designated sites on or directly adjacent to the site. The following designated sites are located within the wider area:

- Bure park Local Nature Reserve (LNR), 800m to the south of the site;
- Ardley Cutting and Quarry Site of Special Scientific Interest (SSSI), 1.4km to the west of the site; and
- Stratton Audley Quarries SSSI, 2km to the east of the site.

- 7.3 The majority of the site contains grassland which holds limited potential nature conservation interest. Woodland mapped as UK Priority Habitat, hedgerows, arable land, scrub and a small watercourse also lie within and adjacent to the site boundary. Consideration will be given to the following potential effects:

- Construction
 - Temporary Land-take;
 - Disturbance (visual, noise);
 - Hydrology and pollution (dust generation, pollution of aquatic habitats);
 - Lighting (construction); and
 - Construction site hazards.
- Operation
 - Permanent Land-take;
 - Air Quality / Pollution and Hydrology;
 - Permanent External Lighting; and
 - Visitor pressure (disturbance / trampling) to nearby designed sites.

Approach

- 7.4 A qualitative and quantitative ecological impact assessment will be undertaken, following the principles set out in the CIEEM publication 'Guidelines for Ecological Impact Assessment in the United Kingdom' (2006), and will include an assessment of cumulative effects, details of appropriate mitigation measures and details of any residual effects (should any exist following

mitigation).

Summary

7.5 Table 7.1 provides a summary of the key issues to be considered in relation to Biodiversity.

Table 7.1: Biodiversity Effects

Receptor	Effects	Scoped In
Ecological Designations	<ul style="list-style-type: none"> • Land-take • Disturbance (visual, noise) • Hydrology and pollution (dust generation, pollution of aquatic habitats) 	✓
Habitats	<ul style="list-style-type: none"> • Lighting 	✓
Faunal species	<ul style="list-style-type: none"> • Construction site hazards 	✓

8 BUILT HERITAGE

8.1 An assessment will be undertaken of the likely significant effects of the proposed development on built heritage, i.e. above ground 'heritage assets', the significance of which is derived from their heritage interest, which may be architectural, artistic or historic.

Baseline

8.2 There are no designated heritage assets located within the site. The heritage assets in proximity to the site are:

- Church of St Laurence Grade II* Listed Building, located approximately 40m to the east at the closest point to the site;
- Home Farmhouse Grade II Listed Building, located approximately 85m to the south east at the closest point to the site; and
- Bicester Airfield Conservation Area, located 550m to the south east at the closest point to the site.

Approach

8.3 The ES chapter will contain a description of the national and local heritage planning policy context and the methods used in the assessment. It will describe the baseline historic environment currently existing at the site and in its immediate vicinity; provide a statement of the significance of the heritage assets identified above; assess the magnitude of change (impact) of the proposed development upon the significance of such heritage assets and the resulting environmental effect; identify mitigation measures required to prevent, reduce or off-set any significant adverse environmental effects; and report on residual effects (those that might remain after mitigation has been implemented).

8.4 The assessment would conform entirely to standards set by Historic England and other professional guidance.

8.5 The Plot SGR1, Caversfield planning application was supported by a Built Heritage Assessment (CgMs 2018). This assessment informed the masterplan for the same application and also informed the mitigation proposals that were agreed with CDC. This 2018 assessment and the principles of development agreed as part of the SGR1 application will form a useful baseline.

8.6 Against this baseline, the assessment will:

- Assess development impacts (and operational impacts where appropriate) and hence the significance of environmental effects arising from the proposals;
- Provide recommendations for mitigation that would offset adverse effects;
- Quantify any residual effects (those that might remain after mitigation).

8.7 Since heritage assets are an irreplaceable resource it is generally considered as standard practice within the planning system to implement mitigation measures proportionate to the significance of the asset being affected in order to offset any level of adverse effect on a heritage asset, including minor adverse.

8.8 It is anticipated that the development (during construction and operation) will not result in significant effects on the built heritage. However, this will be fully explored in the ES chapter.

Potential Construction Effects

8.9 The impact on built heritage receptors caused by construction effects are of a temporary nature. The effects caused by the construction phases will relate to the enclosure of the site with hoardings construction traffic, possible temporary impacts on setting through plant, and dust/noise of construction practices. The latter effects are directly related to this assessment because the experience of a built heritage asset (which is influenced by uses or activity) can contribute to setting, and therefore the heritage value.

8.10 This approach is taken from the Historic Environment Good Practice Advice in Planning: 3 (2nd Edition) (2017⁷) (GPA3), which states: "the setting of a heritage asset is the surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral".

Potential Operational Effects

8.11 Any operational effect on built heritage assets will potentially manifest from the presence of new buildings and / or changes in land-use within the setting of designated heritage assets. The potential operational effects of the proposed development, therefore, will relate to how these changes may affect the heritage significance of (and experience of) these assets.

⁷ The Setting of Heritage Assets, Historic Environment Good Practice Advice in Planning: 3 (2nd Edition), 2017, available at: <https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/>

Summary

8.12 Table 8.1 provides a summary of the key issues to be considered in relation to built heritage.

Table 8.1: Historic Environment

Receptor	Effects	Scoped In
Listed Buildings	Built heritage assets: <ul style="list-style-type: none"> • Temporary changes to setting that impact on significance – construction phase; and • Permanent changes to setting that impact on significance – operational phase. 	✓
Conservation Areas		✓

9 POPULATION AND HUMAN HEALTH

- 9.1 An assessment will be undertaken of the likely significant effects of the proposed development on population and human health.

Baseline

- 9.2 The Site comprises greenfield land with no existing residents or employment provision.

Approach

- 9.3 Given the residential-led nature of the proposed development, the assessment will consider the effects of the proposed development on housing delivery, employment generation (during the construction phase only), household expenditure and wider human health. The effects of the additional population created by the proposed development on education (need for early years, primary school and secondary school places), primary healthcare (need for GP and dental places) and open space provision, will also be assessed.
- 9.4 A desktop study will be undertaken to determine the national and local policy context and existing baseline conditions at site, local and borough level. Baseline conditions will focus on: the population profile; housing stock profile; household expenditure, the location and capacity of existing early years/childcare facilities, primary schools, secondary schools, GP surgeries and dental surgeries; existing open/play space; and wider public health profile.
- 9.5 The existing baseline will be established using a combination of data sources including nationally published statistics from the Office for National Statistics (ONS), Experian, Department for Education (DfE), Ofsted, National Health Service (NHS), Ordnance Survey (OS) and CDC where relevant. This includes the Census 2011, Sub National Population Projections (SNPP), Sub National Household Projections (SNHP), Mid-Year Population Estimates (MYPE), Household Expenditure data, GP Workforce Statistics, NHS Choices, Childcare Providers and Inspections, Get Information About Schools and OS Open Green Spaces. Relevant policy and supplementary planning guidance produced by CDC will be consulted.
- 9.6 The assessment will consider the effects of the proposed development during the construction and operational phase within the context of the policy framework and existing/future baseline conditions.

9.7 The assessment will consider the potential impacts and likely effects on the following:

Construction phase effects:

- Employment generation (direct and indirect); and
- Wider human health.

Operational phase effects:

- Delivery of new housing including affordable housing;
- Demand from the new residential population for local community services and infrastructure including:
 - GP places;
 - Dental places;
 - Early/years childcare places;
 - Primary school places;
 - Secondary school places;
 - Open/play space; and
- Additional household expenditure from resident population; and
- Wider human health.

9.8 Assessment of the topics listed above will be made using quantitative and qualitative methods. The number of direct jobs generated during the construction phase will be calculated using the Construction Industry Training Board (CITB), Labour Forecasting Tool (LFT) which is regarded as an industry standard. Indirect employment during the construction phase will give regard to ONS, Type 1 Employment Multipliers. The number of people expected to live in the Development will be calculated using a population factor of 2.5 persons per dwelling as per the 2011 Census for the CDC area. The assessment will assume that all residents of the proposed development will need to register within a local health practitioner. Capacities of existing GP provision will be based on the HUDU standard of 1 GP for 1,800 patients and capacities of existing dentist provision will be based on the availability of new registrations according to NHS Choices. Demand for early years, primary and secondary school places arising from the proposed development will be determined using child yield multipliers adopted by Oxfordshire County Council (the Local Education Authority for the CDC area) and assessed against forecast capacities for the relevant School Planning Areas. Demand for open/play space will be based upon quantity and accessibility standards as detailed in Policy BSC 11 of the adopted Cherwell District Local Plan. Wider human health considerations that fall within the wider scope of the ES will be considered and summarised drawing on the conclusions of other ES Chapters relevant to human health, including air quality, noise and transport.

- 9.9 Effects on housing, GP/dental/early years/primary school/secondary school places and open/play space during the construction phase have been scoped out of the assessment as it is assumed that the construction workforce will not move to the area and therefore place no additional demand on these services.
- 9.10 There are no published assessment guidance and technical significance criteria to assess population and human health effects. Accordingly, the evaluation of effects will be undertaken based on professional experience and judgement, having regard to the existing baseline position.
- 9.11 Mitigation measures will be recommended where any significant adverse effects are assessed to reduce potential adverse effects.
- 9.12 Consideration will be given to inter-project cumulative effects, subject to availability of cumulative scheme information in the public domain.

Summary

- 9.13 Table 9.1 summarises the population and human health effects to be included ('scoped in') for detailed assessment in the ES.

Table 9.1: Population and Human Health Effects

Receptor	Effects	Scoped In
Employment (construction phase only)	Increase in short term construction employment	✓
Housing	Increase in housing stock and contribution towards policy requirements in the operational phase	✓
Household Expenditure	Increase in expenditure from the Development's resident population in the operational phase	✓
Early years/childcare	Increased demand for early years/childcare places in the operational phase	✓
Primary Education	Increased demand for primary school places in the operational phase.	✓
Secondary Education	Increased demand for secondary school places in the operational phase	✓
GP Provision	Increased demand for GP places during the operational phase	✓
Dentist provision	Increased demand for dentist places during the operational phase.	✓
Human Health	Potential effects on human health from the proposed development including noise, air quality and transport.	✓
Open/Play Space	Increased demand on open/play space during the operational phase.	✓

10 WATER RESOURCES AND FLOOD RISK

- 10.1 An assessment will be undertaken of the likely significant effects of the proposed development on water resources and flood risk.
- 10.2 A Flood Risk Assessment (FRA) including a Drainage Strategy will be included as a Technical Appendix to the ES. A Water Resources and Flood Risk Chapter will be included within the ES summarising the findings of the FRA.

Baseline

- 10.3 The majority of the site is located within Flood Zone 1, with some areas in the south and east of the site located in Flood Zones 2 and 3. This is associated with a river (i.e. fluvial) source of flooding. Similar parts of the site are also susceptible to surface water flooding.
- 10.4 There are no significant waterbodies on the site. Drainage features run along the south and eastern borders of the site. A dry pond is located within an area of woodland in the north west of the site.
- 10.5 The site is not located in a groundwater Source Protection Zone.
- 10.6 A Thames Water potable and foul network is present in close proximity to the site serving the Elmsbrook development.

Approach

- 10.7 The ES chapter will identify and assess the effects of the proposed development on flood risk, surface water quantity and quality, wastewater drainage and potable water as a result of the change in land use and regime during the construction and completed development phases.
- 10.8 The assessment of likely significant effects will be based on a review of published data including evidence base documents, site surveys and site visits, online mapping (BGS, EA, Ordnance Survey, etc), and liaison with the EA, and CDC.
- 10.9 The flood risk and drainage assessment would include a NPPF-compliant FRA and accompanying Drainage Strategy. The scope would include the following assessments:
- Flood alleviation measures already in place, their state of maintenance and performance;
 - Potential impacts of flooding to the site and identification of any necessary mitigation

measures;

- Residual risk after the implementation of any necessary mitigation measures, allowing for the future impacts of climate change;
- Sustainable Drainage Systems (SuDS) considered appropriate for inclusion within the scheme, taking into account site specific constraints; and
- Demonstration that the proposed drainage strategy follows the drainage hierarchy, with surface water runoff restricted to as close to the greenfield runoff rate as reasonably practicable and/or infiltrated into the ground.

10.10 An assessment of the existing and proposed wastewater flows generated by the proposed development (including a foul water drainage strategy) as well as the potable water demand required to supply the development will be considered as part of the Utilities Appraisal Report.

Summary

10.11 The assessment will consider the potential effects of fluvial, pluvial, groundwater and artificial sources of flooding upon the development, in line with national and local planning policy. In addition, the management of foul and surface water runoff will also be assessed, so as not to have a detrimental effect on the site or its surroundings.

10.12 Table 10.1 summarises the likely effects on the water environment identified for inclusion in the assessment.

Table 10.1: Water Environment Effects

Receptor	Effects	Scoped In
Flood Risk	Construction and operational phase effects on flood risk from all sources.	✓
Surface Water Drainage	Construction and operational phase effects on surface water quantity and quality.	✓
Wastewater generation	Construction and operational phase effects on the wastewater conveyance and treatment network.	✓
Potable Water Supply	Construction and operational phase effects on the potable water network.	✓

11 CLIMATE CHANGE

- 11.1 An assessment will be undertaken of the likely significant effects of the proposed development on climate change.

Policy

- 11.2 The Climate Change Act (2008), which was updated in May 2019, sets a legally binding target for reducing greenhouse gas (GHG) emissions, in particular carbon dioxide (CO₂), by at least 100% (on 1990 levels) by the year 2050 in the United Kingdom, and a requirement that domestic emissions are reduced by no less than 3% each year.
- 11.3 In October 2017, the UK Government published its Clean Growth Strategy (CGS) setting out ambitious policies and proposals, to 2050, to reduce emissions across the economy and promote clean growth. The Clean Growth Strategy provides a blueprint for Britain's low carbon future, outlining how investment in green energy goes hand-in-hand with economic growth and industrial, commercial and residential strategies. Core to the strategy are actions that will cut emissions, increase efficiency and lower the amount consumers and businesses spend on energy.
- 11.4 On Tuesday 30th July 2019, CDC declared a Climate & Environmental Emergency and committed to a Carbon Net Zero 2030 goal.
- 11.5 The EIA Regulations include a requirement for the assessment of development on the environment with relation to climate change

'The EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the proposed development on... climate.'

'A description of the likely significant effects of the development on the environment resulting from, inter alia: ...(f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change.'

Approach

- 11.6 Following IEMA guidance, there are two main approaches which may be taken to determine a project's climate change impact, which involve identifying:
- a. The vulnerability of the proposed development to climate change (adaptation / resilience); and

- b. The direct and indirect influence of the proposed development on climate change (mitigation).
- 11.7 The vulnerability of the proposed development to climate change considers effects on the proposed development as a receptor (this is referred to in IEMA Guidance as Climate Change Resilience and Adaptation). A high-level climate change risk and resilience assessment will be undertaken to identify the potential risks of climate change on the proposed development and how these risks have been reflected in design measures to increase the resilience of the development to climate hazards such as extreme hot and cold weather, intense rainfall, high winds and storm events. This will draw upon and inform other reports such as the FRA and landscaping strategy.
- 11.8 A quantitative, assumption-based assessment of the embodied carbon associated with the construction of the scheme will be undertaken. Cost plan and information from the design team to estimate material quantities will be used with allowance made for refurbishment and end-of-life emissions associated with the scheme.
- 11.9 A quantitative, assumptions-based assessment of the direct effects of vehicular GHG emissions, in particular CO₂, during operations will be conducted. This will use the trip generation forecast from the traffic model but where detailed information is not available, a qualitative appraisal will be undertaken and recommendations will be made to limit effects associated with the construction and operational phases of the proposed development.
- 11.10 A quantitative, assumptions-based assessment of the projected GHG emissions stemming from operational energy use will be conducted. The outline energy strategy and Building Regulation benchmarks will be used to calculate these emissions.
- 11.11 The Applicant will comply with appropriate legislation and policy requirements including the Building Regulations that are in force at the time to avoid or minimise potential effects from the proposed development on climate and ensure that the proposed development is resilient to the changing climate.

12 CUMULATIVE EFFECTS

- 12.1 The ES will consider the potential for likely significant effects on the environment resulting from committed developments in the area. The EIA Regulations require existing and approved development to be assessed. Planning Practice Guidance identifies that:

'...There are occasions where other existing or approved development may be relevant in determining whether significant effects are likely as a consequence of a proposed development...'

- 12.2 Table 12.1 below details the projects that have been identified for the cumulative assessment. These developments are considered to be a suitable scale and distance from the proposed development to have the potential for likely significant cumulative effects on the environment. In addition to approved developments, one development has been included in the list below which is currently under consideration by CDC as this is likely to be determined in due course.

Table 12.1: Cumulative Schemes

Application Ref	Site	Distance to Site	Description
14/01384/OUT	Bicester Eco Town Exemplar Site Banbury Road B4100 Caversfield	Adjacent	Development comprising redevelopment to provide up to 2600 residential dwellings (Class C3), commercial floorspace (Class A1 - A5, B1 and B2), social and community facilities (Class D1), land to accommodate one energy centre, land to accommodate one new primary school (Up to 2FE) (Class D1) and land to accommodate the extension of the primary school permitted pursuant to application (reference 10/01780/HYBRID). Such development to include provision of strategic landscape, provision of new vehicular, cycle and pedestrian access routes, infrastructure, ancillary engineering and other operations
10/01384/HYBRID	Bicester Eco Town Exemplar Site Caversfield Oxfordshire	Adjacent	Development of Exemplar phase of NW Bicester Eco Town to secure full planning permission for 393 residential units and an energy centre (up to 400 square metres), means of access, car parking, landscape, amenity space and service infrastructure and outline permission for a nursery of up to 350 square metres (use class D2), a community centre of up to 350 square metres (sui generis), 3 retail units of up to 770 square metres (including but not exclusively a convenience store, a post office and a pharmacy (use class A1)), an Eco-Business Centre of up to 1,800 square metres (use class B1), office accommodation of up to 1,100 square metres (use class B1), an Eco-Pub of up to 190 square metres (use class A4), and a primary school site measuring up to 1.34 hectares with access and layout to be

Application Ref	Site	Distance to Site	Description
			determined. 23/12/2010 Application Permitted
18/00484/OUT	Land North And Adjoining Home Farm Banbury Road B4100 Caversfield	Adjacent	Outline planning permission for up to 75 homes, pedestrian and cycle routes, creation of new access point from Charlotte Avenue, provision of open space, play space, allotments, orchard, parking and associated works. Application not yet determined.
14/02121/OUT	Proposed Himley Village North West Bicester Middleton Stoney Road Bicester Oxfordshire	To the south of the site	OUTLINE - Development to provide up to 1,700 residential dwellings (Class C3), a retirement village (Class C2), flexible commercial floorspace (Classes A1, A2, A3, A4, A5, B1, C1 and D1), social and community facilities (Class D1), land to accommodate one energy centre and land to accommodate one new primary school (up to 2FE) (Class D1). Such development to include provision of strategic landscape, provision of new vehicular, cycle and pedestrian access routes, infrastructure and other operations (including demolition of farm buildings on Middleton Stoney Road)
15/00760/F Permitted	North and South Arcade At Bicester Eco Town Exemplar Site Charlotte Avenue Bicester	Approximately 200m south at the closest point to the site.	Development of a new Local Centre comprising a Convenience Store (use class A1), Retail Units (flexible use class A1/A3/A5), Pub (use class A4), Community Hall (use class D1), Nursery (use class D1), Commercial Units (flexible use class A2/B1/D1) with associated Access, Servicing, Landscaping and Parking with a total GEA of 3,617 sqm
17/01090/OUT Permitted	Adjoining and North East Of A4095 And Adjoining And South West Of Howes Lane Bicester	Approximately 1.9km south east at the closest point to the site.	Development of B1, B2 and B8 (Use Classes) employment buildings, including landscaping; parking and service areas; balancing ponds and swales; and associated utilities and infrastructure. Construction of a new access off Middleton Stoney Road (B4030); temporary access off Howes Lane; internal roads, footways and cycleways.
19/01036/HYBRID Under Consultation Validated 04/06/2019	Bicester Eco Town Exemplar Site Phase 2 Charlotte Avenue Bicester	Approximately 200m south at the closest point to the site.	Full permission is sought for Local Centre Community Floorspace (Use Class D1 with ancillary A1/A3), with a total GIA of 552 sqm, and 16 residential units (Use Class C3) with associated access, servicing, landscaping and parking. Outline consent is sought for Local Centre Retail, Community or Commercial Floorspace (flexible Use Class A1/A2/A3/A4/A5/B1/D1).

12.3 Confirmation of these schemes for cumulative assessment is sought from CDC as part of the EIA Scoping Opinion.

13 ENVIRONMENTAL STATEMENT STRUCTURE

13.1 The ES will contain three main volumes as set out in Table 13.1 below.

Table 13.1: Environmental Statement Structure

Volume 1: ES Main Text and Figures		
Chapter No.	Chapter Title	Description
1	Introduction	Introduction to the ES, EIA requirements, details of project team, ES organisation and availability.
2	EIA Methodology	Methods used to prepare each chapter, description of ES structure and content, generic significance criteria, scoping and consultation.
3	Site and Development Description	Site description and details of the proposed development plus qualitative, high level consideration of climate change mitigation and adaptation.
4	Alternatives and Design Evolution	Outline of the main alternatives considered by the Applicant.
5	Construction Methodology and Phasing	Outline of the anticipated construction methodology and programme.
6	Transport and Access	Effects from the proposed development relating to transport and access.
7	Air Quality	Effects from the proposed development relating to air quality.
8	Noise and Vibration	Assessment of the effects from the proposed development relating to noise and vibration.
9	Landscape and Views	Assessment of the effects from the proposed development relating to landscape and views.
10	Biodiversity	Assessment of the effects of the proposed development on ecology and nature conservation.
11	Built Heritage	Assessment of the effects from the proposed development relating to built heritage.
12	Population and Human Health	Effects from the proposed development relating to population and human health.
14	Water Resources and Flood Risk	Assessment of the effects from the proposed development relating to water resources and flood risk.
15	Climate Change	Assessment of the effects of the development on climate change.
16	Summary and Residual Effects	Summary of the residual and interactive effects of the proposed development.
Volume 2		
	Technical Appendices	Technical data and reports to support the chapters in Volume 1.
Standalone Document		
	Non-Technical Summary	Summary of the ES in non-technical language.

13.2 The first five chapters of the ES would be introductory and provide essential information for the subsequent technical chapters. Further information on these chapters is set out below.

Introduction

- 13.3 This chapter will provide background to the EIA, describe the structure of the ES and identify the project team.

EIA Methodology

- 13.4 This chapter will set out the methodology used in the EIA, state the assumptions applicable to all disciplines, summarise the EIA Scoping process undertaken and summarise the public consultation process. Bespoke methodologies, limitations and assumptions will be contained in the technical chapters of the ES where required.
- 13.5 The significance of an environmental effect is determined by the interaction of magnitude and sensitivity, whereby the effects can be positive or negative. Generic criteria to be used in carrying out this process are detailed below. Some technical chapters will use discipline-specific criteria with their own terms for magnitude, sensitivity and significance. This will be explained in the relevant chapter.

Prediction of Impact Magnitude

- 13.6 The methodology for determining the scale or magnitude of impact is set out in Table 13.2 below.

Table 13.2: Methodology for Assessing Magnitude

Magnitude of Impact	Criteria for assessing impact
Major	Total loss or major/substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post development character/composition/attributes will be fundamentally changed.
Moderate	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of the baseline will be materially changed.
Minor	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-development circumstances/situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

- 13.7 The sensitivity of a receptor is based on the relative importance of the receptor using the scale set out in Table 13.3 below.

Table 13.3: Methodology for Determining Sensitivity

Sensitivity	Examples of Receptor
High	The receptor/resource has little ability to absorb change without fundamentally altering its present character, or is of international or national importance.
Moderate	The receptor/resource has moderate capacity to absorb change without significantly altering its present character, or is of high importance.
Low	The receptor/resource is tolerant of change without detriment to its character, is of low or local importance.

Assessment of Effect Significance

13.8 Effect significance will be calculated using the matrix in Table 13.4. This illustrates the interaction between impact magnitude and receptor sensitivity.

Table 13.4: Effect Significance Matrix

Magnitude	Sensitivity		
	High	Moderate	Low
Major	Major Adverse/Beneficial	Major - Moderate Adverse/Beneficial	Moderate - Minor Adverse/Beneficial
Moderate	Major - Moderate Adverse/Beneficial	Moderate - Minor Adverse/Beneficial	Minor Adverse/Beneficial
Minor	Moderate - Minor Adverse/Beneficial	Minor Adverse/Beneficial	Minor Adverse/Beneficial - Negligible
Negligible	Negligible	Negligible	Negligible

Statutory Consultation

13.9 The following statutory and other consultees will be consulted through the EIA process:

- Highways England;
- Environment Agency;
- Natural England;
- Historic England;
- CDC (various departments); and
- Any other stakeholder that CDC nominates.

Site and Development Description

13.10 This chapter will describe the setting of the site and the existing conditions on the site, as well as explaining the proposed development and setting out the proposed development parameters. The parameter plans will be included as figures to the chapter.

Alternatives

13.11 This chapter would describe the evolution of the proposed development based on environmental constraints.

Technical Assessments

13.12 Each ES chapter will follow the headings set out below to ensure the final document is transparent, consistent and accessible.

- Introduction;
- Planning Policy Context;
- Assessment Methodology;
- Baseline Conditions;
- Likely Significant Effects;
- Mitigation Measures;
- Residual Effects;
- Cumulative Effects; and
- Summary.

13.13 Each chapter sub-heading is explained in further detail in Table 13.5 below.

Table 13.5: Technical Chapter Format and Content

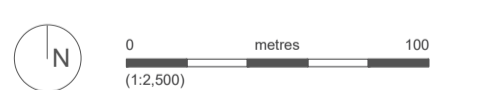
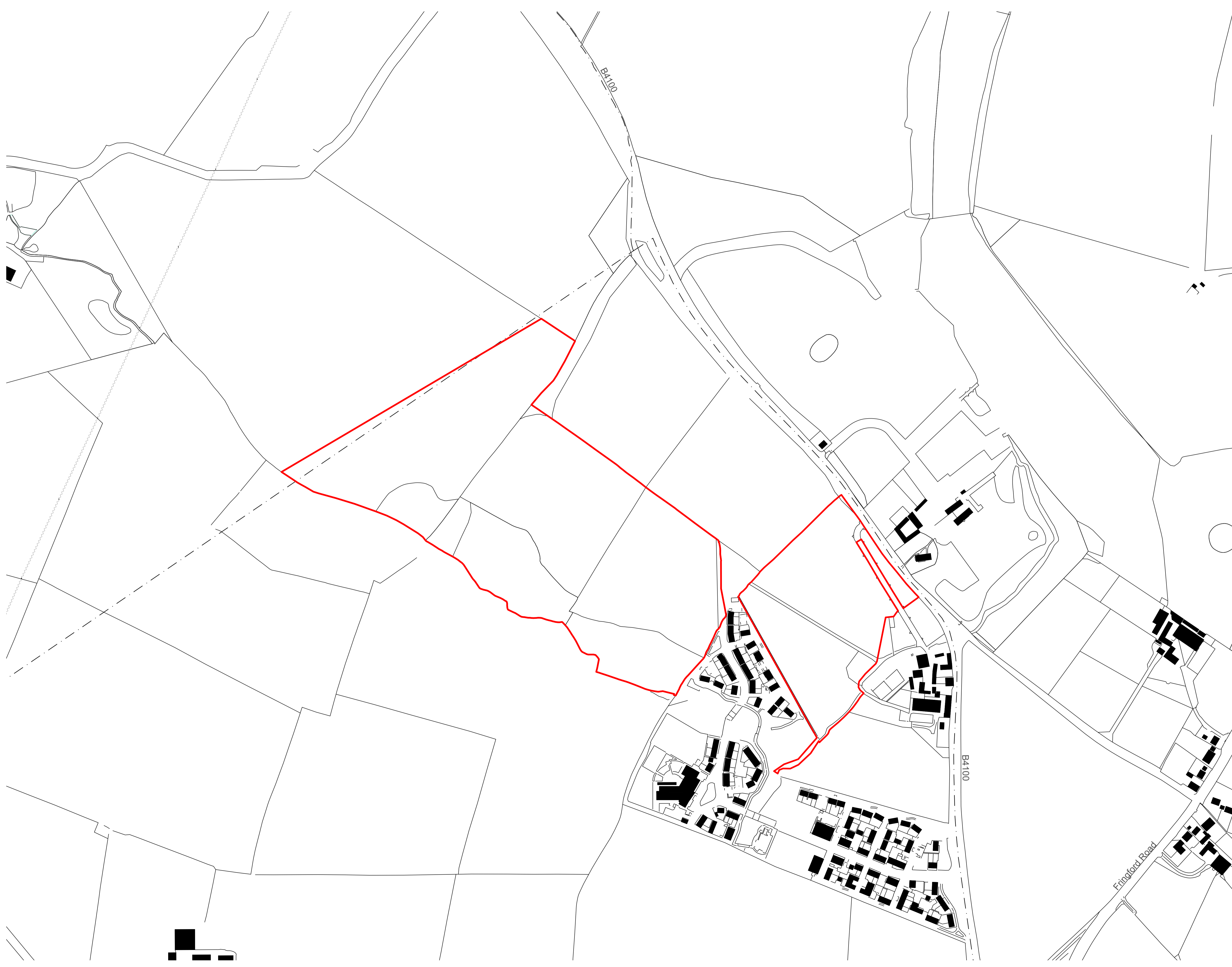
Sub-Heading	Content
Introduction	<ul style="list-style-type: none"> • This section will introduce the assessment discipline and the purpose for which it is being undertaken.
Planning Policy Context	<ul style="list-style-type: none"> • This section will include a summary of national, regional and local policies of relevance to the environmental discipline and assessment. Where applicable, relevant legislation will also be summarised.
Assessment Methodology	<ul style="list-style-type: none"> • This section will provide an explanation of methods used in undertaking the technical study with reference to published standards, guidelines and best practice. The application of significance criteria will also be discussed. • It will also outline any difficulties encountered in compiling the required information.
Baseline Conditions	<ul style="list-style-type: none"> • This will include a description of the environment as it is currently (2020) and as it is expected to change given the project were not to proceed (i.e. 'do-nothing' scenario). The method used to obtain baseline information will be clearly identified. Baseline data will be collected in such a way that the importance of the particular subject area to be affected can be placed in its context and surroundings so that the effects of the proposed changes can be predicted.
Likely Significant Effects	<ul style="list-style-type: none"> • This section will identify the likely significant effects on the environment resulting from the proposed development.
Mitigation Measures	<ul style="list-style-type: none"> • Adverse effects will be considered for mitigation and specific mitigation measures put forward, where practicable. Mitigation measures considered may include modification of the project, compensation and the provision of alternative solutions (including alternative technology) as well as pollution control, where appropriate.

Sub-Heading	Content
	<ul style="list-style-type: none"> • The extent of the mitigation measures and how these will be effective will be discussed. Where the effectiveness is uncertain or depends upon assumptions about operating procedures, data will be introduced to justify the acceptance of these assumptions. • Clear details of when and how the mitigation measures will be carried out will be given. When certainty of impact magnitude and/or effectiveness of mitigation over time exists, monitoring programmes will be proposed to enable subsequent adjustment of mitigation measures, as necessary. • The opportunity for enhancement measures will also be considered, where appropriate. • Information will be included on the mechanism by which the mitigation will be secured (e.g. by planning condition) with outline arrangements for monitoring and responsibilities for doing so, where necessary.
Residual Effects	<ul style="list-style-type: none"> • The residual effects, i.e. the effects of the proposed development assuming implementation of proposed mitigation, will be determined. The residual effects represent the overall likely significant effect of the proposed development on the environment having taken account of practicable/available mitigation measures.
Cumulative Effects	<ul style="list-style-type: none"> • The cumulative effects of the proposed development and the identified committed developments will be assessed.
Summary	<ul style="list-style-type: none"> • A summary of the assessment and conclusions will be provided at the end of each technical chapter.

Summary and Residual Effects

13.14 The residual effects of the proposed development will be summarised in one table at the end of the ES, setting out the overall beneficial and adverse effects of the proposed development.

APPENDIX 1
SITE LOCATION PLAN



— Site boundary 22.31ha

Project
Land at North West Bicester

Drawing Title
Location Plan

Date	Scale	Drawn by	Check by
10/11/2020	1:2,500 at A1	ML	LA
Project No	Drawing No	Revision	
1192	001	C	

APPENDIX 2

AGRICULTURAL LAND ASSESSMENT

12 Agriculture and Land Use

12.1 Introduction

- 12.1.1.1 This assessment reviews the information currently available in relation to agriculture, soils and land use (including the infrastructure utilised for agricultural purposes and the structure of the businesses engaged in farming and related activities) in relation to the proposals. The methodology used to identify the key receptors is described, followed by details of these receptors.
- 12.1.1.2 Both the construction phase and operational phase impacts of the proposals are identified with detailed measures presented to mitigate these impacts, such that the residual effects of the proposals would not be significant.
- 12.1.1.3 The baseline against which the likely significant effects have been assessed are the environmental conditions at, and surrounding, the Site in July 2014.
- 12.1.1.4 This Chapter has been prepared by Dr Bruce Lascelles, employed by Hyder Consulting. Dr Lascelles is a Chartered Environmentalist and full member of the Institute of Professional Soil Scientists (IPSS) and meets the requirements of the IPSS Professional Competency Scheme for Agricultural Land Classification (ALC: see IPSS PCSS Document 2 'Agricultural Land Classification of England and Wales', given as Appendix 12-A). The IPSS Professional Competency Scheme is endorsed, amongst others, by the Department for Environment, Food and Rural Affairs (Defra), Natural England, the Science Council, and the Institute of Environmental Assessment and Management (IEMA).
- 12.1.1.5 This assessment is based upon a study of published information on climate, geology and soil in combination with a soil investigation carried out in accordance with current guidelines (see Methodology section below).

12.2 Regulatory and Policy Framework

- 12.2.1.1 This impact assessment has been undertaken in accordance with current national legislation, and national, regional and local plans and policies relating to agriculture and land use in the context of the Development. A summary of the relevant legislation and policies, the requirements of these policies and the Development response has been provided in Table 12-1 below.

Table 12-1 Agriculture and Land Use Regulatory and Policy Framework

Policy/Legislation	Summary of Requirements	Development Response
A Strategy for England; Safeguarding Our Soils (Ref 12-1)	The Strategy for England sets out the Government's aims in relation to protecting agricultural soils and in relation to protecting the soil resource during construction and development. This includes a requirement that planning decisions take sufficient account of soil quality, particularly where significant areas of the BMV (best and most versatile) agricultural land are involved.	An assessment has been made of the agricultural land grade and the potential impacts on this resource. Recommendations have been provided detailing appropriate soil handling methodologies in line with the Defra Code of Practice.

	<p>The presence of BMV agricultural land is stated to be a material consideration in planning decisions, but has to be taken into account alongside other sustainability considerations including: biodiversity, the quality and character of the landscape, accessibility to infrastructure, workforce and markets and maintaining viable communities.</p> <p>Within the Strategy there is an aim of encouraging better management of soils during the construction process. Linked to this is the Construction Code of Practice for the sustainable re-use of soils on construction sites, also published by Defra (Ref 12-2) to protect soil resources disturbed on construction sites. Whilst the Code is not legislatively binding, the wider benefits of following the guidance (in terms of sustainability, cost savings and waste controls) are clearly set out.</p>	
<p>National Planning Policy Framework (NPPF; Ref 12-3)</p>	<p>The NPPF sets out the Government's planning policies for England and how these are expected to be applied. The NPPF provides a framework within which local and neighbourhood plans can be produced. Planning law requires that applications for planning permission must be determined in accordance with the development plan. The NPPF must be taken into account in the preparation of local and neighbourhood plans, and is a material consideration on planning decisions.</p> <p>Section 11 of the NPPF deals with conserving and enhancing the natural environment. This includes a requirement that the <i>'local planning authorities should take into account the economic and other benefits of the best and most versatile agricultural land. Where significant development of agricultural land is demonstrated to be necessary, local planning authorities should seek to use areas of poorer quality land in preference to that of a higher quality.'</i></p> <p>The local planning authority should also 'put in place policies to ensure ...(safeguarding the long term potential of best and most versatile agricultural land and conserving soil resources) ...'</p> <p>The NPPF also has, as one of its core planning principles, the promotion of "mixed use developments, and encourage multiple benefits from the use of land in urban and</p>	<p>An assessment has been made of the agricultural land grade and the potential impacts on this resource.</p>

	<p>rural areas, recognising that some open land can perform many functions (such as for wildlife, recreation, flood risk mitigation, carbon storage, or food production)". The sustainable re-use of soil materials would support this objective.</p>	
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12.3 Methodology

12.3.1 General Approach

- 12.3.1.1 The principal agricultural and related resources are the quality of the agricultural land and items of fixed farm and farm-related capital, as well as other items of capital associated with diversified activities on farms. Soil and ALC surveys have been undertaken in accordance with published guidelines (MAFF 1988; Ref 12-5).
- 12.3.1.2 The ALC system provides a framework for classifying land according to the extent to which its physical or chemical characteristics impose long-term limitations on agricultural use. The ALC system divides agricultural land into five grades (Grade 1 'Excellent' to Grade 5 'Very Poor'), with Grade 3 subdivided into Subgrade 3a 'Good' and Subgrade 3b 'Moderate'. Agricultural land classified as Grade 1, 2 and Subgrade 3a falls in the 'best and most versatile' category as set out in the NPPF (see Table 1-1 above). Further details of the ALC system and national planning policy implications are set out by Natural England in its Technical Information Note 049 (see Appendix 12-B).
- 12.3.1.3 There are no legislative requirements governing the assessment of agricultural matters, and the framework of any assessment is derived from a combination of EU and national agricultural and land use policies and measures, combined with expert judgement.

12.3.2 Consultation

- 12.3.2.1 As very limited detailed published Agricultural Land Classification (ALC) information was available for the Site (in particular information which separates Grade 3 land into Subgrades 3a and 3b) Natural England was consulted on the requirements for further surveys. Their response stated that:
- 12.3.2.2 "An agricultural land classification and soil survey of the land should be undertaken at a detailed level, e.g. 1 auger boring per hectare, supported by pits dug in each main soil type to confirm the soil physical characteristics of the full depth of soil resource, to determine the impact of the development on 'best and most versatile' agricultural land and on soil resources."
- 12.3.2.3 In addition, the landowners were interviewed (as detailed below) to gather information on the existing farm business.

12.3.3 The Study Area

12.3.3.1 The Study Area for the Development includes the land within the red line boundary (Drawing 12-1), as well as adjacent land under the same ownership, such that a full assessment of the potential impact on farm viability could be undertaken.

12.3.4 Methodology for Establishing Baseline Conditions

Establishing the Existing Baseline

12.3.4.1 The baseline conditions comprise an assessment of the quality of the agricultural land, items of fixed farm and farm-related capital, as well as the agricultural practices used on the land.

12.3.4.2 A range of published information has been reviewed in order to assess the character of the Site in terms of land use and soils. This has included:

- Published soil maps (Ref 12-6)
- Published ALC maps and more detailed survey information held by Natural England (accessed on Nature on the Map website www.natureonthemap.naturalengland.org.uk)
- LandIS Soils Site Report (Ref 12-7)
- Climate data (purchased from the National Soil Resources Institute (NSRI))

12.3.4.3 In addition, surveys have been undertaken, as required by the consultation response received from Natural England. A detailed ALC survey of the Site was undertaken, in accordance with MAFF (1988), over a range of dates (September 2010, April/May 2011 and June/July 2014).

12.3.4.4 The detailed survey involved examination of the soil's physical properties at approximately 140 locations on approximately a 100 m by 100 m grid (due to the presence of a standing crop in some locations it was not always possible to follow a regular grid pattern).

12.3.4.5 The soil profile was examined at each location to the full depth of the soil profile up to a maximum depth of approximately 1.2 m using a 5 cm diameter Dutch (Edleman) soil auger. A number of soil pits were excavated at selected locations with a spade in order to confirm soil characteristics. The soil profile at each location was described using the Soil Survey Field Handbook: Describing and Sampling Soil Profiles (Ref 12-8). Based on these data each sample location was given an ALC grade following the published guidelines.

12.3.4.6 In addition, the landowners were interviewed in April 2011 where contact details were available and permission had been granted.

Forecasting the Future Baseline (“Without Development” Scenario)

12.3.4.7 The ALC grade is based on an assessment of the soil physical properties, and it is considered unlikely that these would change significantly over time, and thus the future baseline in terms of ALC grades would remain unchanged.

12.3.4.8 In relation to the farm businesses, the interviews held with the landowners attempted to gain an understanding of potential future developments to their businesses. The assessment of the future baseline also takes into account other consented developments which may have an influence on farming practices.

Defining the importance/sensitivity of resource

12.3.4.9 Current best practice and professional judgement are used to define significance criteria in relation to both agricultural land and to farming businesses.

12.3.4.10 The relative importance or sensitivity of the agricultural land that would be affected by the development can be based on the ALC grades, as set out in Table 12-2 below.

Table 12-2 Determining the Importance / Sensitivity of the agricultural land resource based on ALC Grade

Importance/sensitivity of resource or receptor	Criteria
High	Grades 1, 2 and 3a
Medium	Grade 3b
Low	Grades 4 and 5

Source: This is based on professional judgement

12.3.4.11 There is no standardised method for determining the effects of development proposals on agricultural businesses, and thus professional judgement, having regard to relevant legislation and advice, has been used for the assessment of the impact to agricultural business, as detailed below.

12.3.5 Methodology for Assessing Impacts

12.3.5.1 An assessment has been carried out of the likely effects of the proposals, both during the construction phase and in the longer-term. Where required, effects have been quantified and assessed in the wider context to evaluate the degree to which they may be considered significant. Effects have been based on the assumption that agricultural circumstances prevailing in July 2014 would continue to prevail.

12.3.5.2 The magnitude of impacts in relation to agricultural land is assessed using the criteria provided in Table 12-3, based on the extent of land take.

Table 12-3 Assessing Magnitude of Impact

Magnitude of impact*	Agricultural land take (ha)
High	>20
Medium	5-20
Low	<5

Source: This is based on professional judgement

12.3.5.3 The significance of impacts on agricultural land is then determined using the matrix presented below in Table 12-4.

Table 12-4 Significance criteria for assessing the effect of the proposals on the National Agricultural Resource

Sensitivity	Magnitude		
	High	Medium	Low
High	Major	Moderate	Minor
Medium	Moderate	Minor	Negligible
Low	Minor	Negligible	Negligible

12.3.5.4 The criteria for assessing the impact on the farm businesses have been assessed in accordance with Table 12-5 below.

Table 12-5 Significance Criteria for Assessing the Effect of the Scheme on Farm Viability

Magnitude of Impact	Farm Businesses
Major adverse	Renders an existing full-time farm business (including any diversification enterprises) unviable.
Moderate adverse	A significant effect on the workability of a full time farm business (including any diversification enterprises) but where the continued viability is not prejudiced.
Minor adverse	Limited effects on workability and the economic performance of a farm unit (including any diversification enterprises) or the loss or a significant effect on the viability of a part-time farm business.
Neutral	Where there would be no negative impact on the farm business (including any diversification enterprises).

12.3.6 Limitations and Assumptions

12.3.6.1 A small proportion of the Site was not surveyed, due to either crop or livestock restrictions. However, this area is small, equating to just 1.33% of the Site and thus it is not considered that this would adversely affect the assessment.

12.4 Description of the Baseline Conditions

12.4.1 Existing Baseline

12.4.1.1 This section of the report sets out the findings of the ALC assessment and review of the farm businesses within the Site.

Agricultural Land Classification

12.4.1.2 The ALC assessment is based on a desktop study of relevant published information on climate, topography, geology, and soil in conjunction with a soil survey carried out across the Site.

12.4.1.3 As described in the ALC Guidelines, the main physical factors influencing agricultural land quality are:

- Climate;
- Site;
- Soil; and
- Interactive Limitations.

12.4.1.4 These factors are considered in turn below.

Climate

12.4.1.5 Interpolated climate data relevant to the determination of the ALC grade is given in Table 12-6 below.

Table 12-6 Interpolated climate data

Climate Parameter	Data
Average Altitude (m)	93
Accumulated Temperature above 0°C (Jan – June)	1397
Average Annual Rainfall (mm)	687
Field Capacity Days (FCD)	148
Moisture Deficit (mm) Wheat	101
Moisture Deficit (mm) Potatoes	92

12.4.1.6 With reference to Figure 1 'Grade according to climate' on page 6 of the ALC Guidelines (Ref 12-5), the quality of agricultural land at the Site is not limited by overall climate and so could potentially be Grade 1 land in the absence of any other limiting factor.

Site

12.4.1.7 At the time of the ALC survey, the Site was under a combination of arable and pasture.

12.4.1.8 With regard to the ALC Guidelines, agricultural land quality can be limited by one or more of three main site factors as follows:

- Gradient;
- Micro-relief (i.e. complex change in slope angle over short distances); and
- Risk of flooding.

12.4.1.9 The topography across the Site is generally low, with slope angles of less than 1°. Slope angles increase in proximity to the drainage lines through the Site,

with angles of up to 3° to the south-east of Home Farm. These gradients are not considered to be a limiting factor to agricultural land quality. In addition, micro-relief (i.e. complex changes in slope angle and direction over short distances), does not limit the agricultural grading across the.

12.4.1.10 From the EA Flood Map³ it is apparent that a very limited area of the Site is considered at risk of fluvial flooding. This is restricted to a narrow corridor along the stream flowing to the south-east from Home Farm. Therefore, for the majority of the Site, the risk of flooding is not limiting to agricultural land quality. For the narrow corridor potentially at risk from flooding there would be a minor limitation to agricultural land quality, limiting these areas to Grade 2 in the absence of any other limitation.

Soil

12.4.1.11 British Geological Survey (BGS) information available online⁴ shows that the majority of the Site is underlain by bedrock geology described as the Cornbrash Formation. This is described as medium- to fine-grained poorly bedded limestone. Thin argillaceous (clay) partings or interbeds of calcareous mudstone may also be present.

12.4.1.12 The mapping also shows that interbedded mudstone and limestone are present in limited areas. The alignment of these deposits is followed by the drainage network across the Site.

12.4.1.13 The superficial mapping available from the BGS shows superficial deposits of clay, silt, sand and gravel associated with the drainage network, limited to a narrow corridor along these drainage lines.

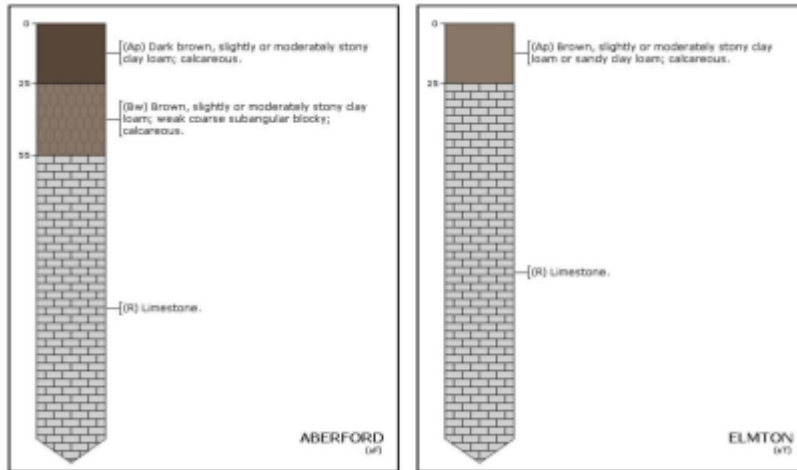
12.4.1.14 A Soils Site Report has been obtained for a 4km x 4km study area centred on the Site (NGR SP563066 24621; included as Appendix 12-C). The soils across the whole Site are mapped as belonging to the Aberford Series. These are described as shallow, locally brashy well drained calcareous fine loamy soils over limestone. These soils are relatively freely draining, but are identified as having a high leaching potential and thus little ability to retain non-adsorbed pesticides, which may therefore leach out of the soils and into surface or groundwater.

12.4.1.15 The Figure below shows two typical component profiles of the Aberford Series (taken from the Soil Site Report).

³ See <http://maps.environment-agency.gov.uk/wiyby/wiybyController?value=TF11+8RN&submit.x=0&submit.y=0&submit=Search%09&lang=e&ep=map&topic=floodmap&layerGroups=default&scale=9&textonly=off#x=457638&y=224748&lg=1,&scale=11>

⁴ <http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html>

Figure 12-1 Aberford Component Soil Profiles



12.4.1.16 These diagrams clearly show the potentially shallow nature of these soils, lying directly over the solid parent material (limestone).

12.4.1.17 The detailed soil survey undertaken has confirmed that soils as described above are present across the majority of the Site. Typically the soil profile consists of a brown (Munsell colour 7.5YR 4/4), calcareous, slightly to very stony(10->50%) medium silty clay loam overlying a strong brown (Munsell colour 7.5YR 5/8), calcareous, moderately to very stony heavy silty clay loam. The topsoil and subsoil horizons typically give a soil profile depth of 30cm or less, below which lies the parent material (generally recorded as fractured limestone).

12.4.1.18 Typical profiles are show in the figure below

Figure 12-2 Typical shallow and deeper soil profiles overlying fractured limestone

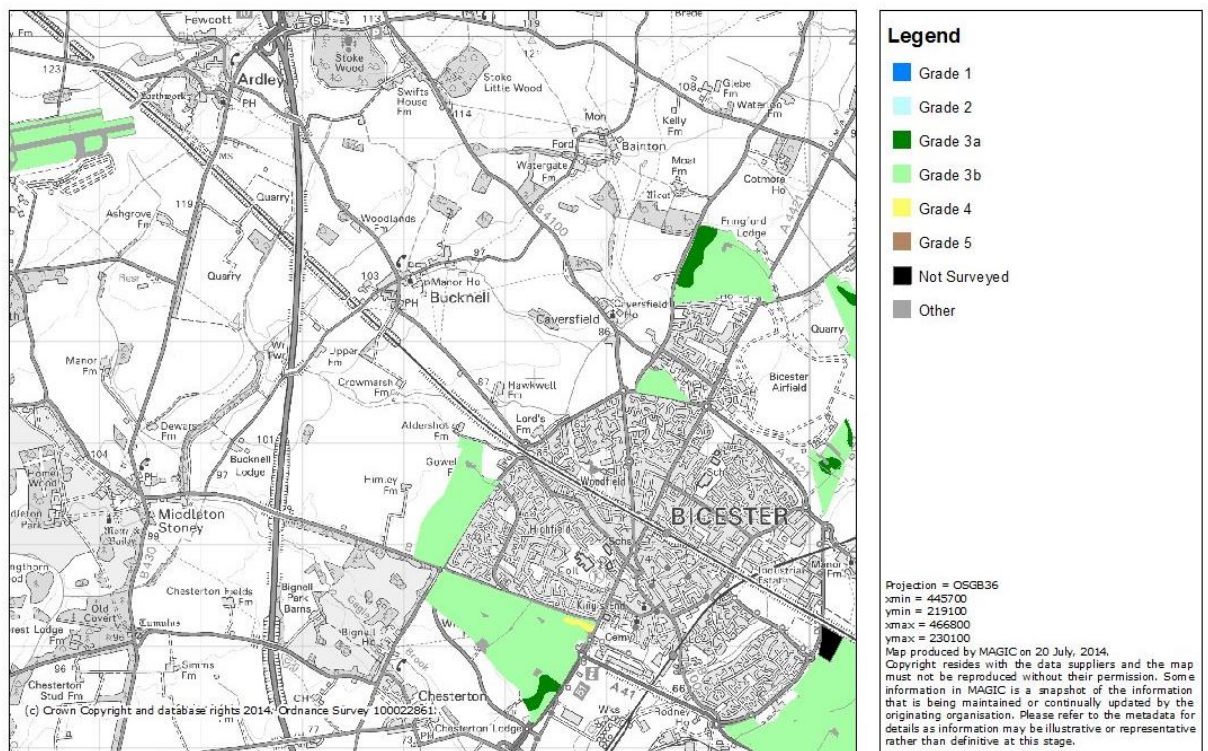


12.4.1.19 The exceptions to this are in narrow corridors along drainage lines, where the soils are developed in alluvial deposits. Here the soils are deeper, in some places in excess of 1.2m. Typical profiles consist of a brown (Munsell colour 7.5YR 4/4), calcareous, very slightly stony medium silty clay loam overlying a pale grey to white (Munsell colour 2.5YR8/1), calcareous clay or sandy clay, often mottled from approximately 25 – 30cm depth below ground surface. The signs of gleying at these depths indicates restricted drainage for at least parts of the year.

Agricultural Land Classification

12.4.1.20 The land is shown as all falling within Grade 3 from available provisional published maps. Limited more detailed published information, which shows the distinction between the Subgrades 3a and 3b, is available for the wider area, but none is available for the Site. Figure 12-3 shows the detailed mapping available, and that generally the land is graded as 3b, with only small areas of Grade 3a present.

Figure 12-3 Available detailed ALC mapping (from MAGIC)



12.4.1.21 From the published and detailed soil survey information, there are a number of key limitations on land grade across the Site: total soil depth; stone content; and soil wetness.

12.4.1.22 Soil depth is an important factor in determining the available water capacity of a soil, and can influence the range and type of cultivations which can be carried

out. The current guidelines specify minimum soil depth requirements for the grades and subgrades, as detailed below.

Table 12-7 Grade according to soil depth

Grade / Subgrade	Depth limits (cm)
1	60
2	45
3a	30
3b	20
4	15
5	<15

12.4.1.23 As the majority of the soil profiles had a recorded depth of <30cm, this limits the land grade to no higher than 3b across much of the Site. In places, depths of <20cm were recorded, limiting some areas to no higher than Grade 4. The deeper soils developed in alluvium have the potential to be of a higher grade in the absence of any other limiting factor.

12.4.1.24 Stone contents in many sample locations were high, and this presents another limitation as high stone contents act as an impediment to cultivation, harvesting and crop growth, and cause a reduction in the available water capacity of the soil. Figure 12-4 below shows the high content typically visible at the soil surface.

Figure 12-4 Typical stony soil surface



12.4.1.25 Generally where the stone content in the upper 25cm was high the soil was shallow, and so already limited in terms of the maximum grade achievable.

- 12.4.1.26 From the ALC Guidelines, a soil wetness limitation exists where ‘the soil water regime adversely affects plant growth or imposes restrictions on cultivations or grazing by livestock’. Agricultural land quality is limited by soil wetness as set out in the guidelines. This is of relevance where the soils exhibit signs of waterlogging (i.e. mottling) within the profile, and this has been taken into account when determining the land grade. This is relevant to the majority of the deeper soils developed in alluvium, where soil texture (clay-rich) and landform (i.e. low lying areas) has resulted in restricted drainage.
- 12.4.1.27 The detailed ALC grading based on the above is shown in Drawing 12-1. The area and proportion of agricultural land in each ALC grade has been measured from Figure 12-5 and are presented in Table 12-8 below.

Table 12-8 Areas and proportions of each ALC Grade

Grade / Subgrade	Area (%)
1	0
2	0
3a	4.7 (3.13)
3b	111.6 (74.35)
4	29.4 (19.59)
5	0
Non agricultural	2.4 (1.60)
Not surveyed	2.0 (1.33)
TOTAL	150.1 (100)

Agricultural Businesses

- 12.4.1.28 The land within the Site falls under three separate ownerships, although the majority of the Site is split between just two ownerships.
- 12.4.1.29 The largest landowner within this Site runs a mixed dairy and arable farm, which included land both owned and tenanted outside the Site boundary. In total 700 cattle are held across the whole farm, with this Site supporting 550 of these. Beef and dairy cattle and kept in over winter and turned out at the end of March. The arable land is used to grow barley which is recycled back as feed for the beef cattle, with additional feed stock brought in as required. There are water troughs in each field and the herd has been closed for over 45 years.
- 12.4.1.30 There is a borehole near Lord’s Farm which supplies the farm, including some of the domestic supply. This is a 120 ft, 16 inch diameter, artesian well licensed for abstraction of 48 000 litres/day. This results in a major financial saving. There are also significant fixed assets (which include the industrial units at Lord’s Farm which lie outside the red line boundary).
- 12.4.1.31 The business of the second main landowner is centred on beef suckler cows, with some cereal crop grown on rotation with the field then returned to grass to generate big bale silage. In addition to the land within the Site boundary

additional land is owned (currently proposed for the Exemplar Site development) with one field rented immediately to the east on the opposite side of the B4100 (this additional field has not been used for grazing as it has been considered not possible to move the herd safely across the road and has instead been used for cereal production).

12.4.1.32 The herd is currently disease free. The cows and calves are turned out in March, and they are generally visited daily by the farmer. There is a water pipe running from the farm buildings along the farm track which supplies drinking troughs which have been set to allow access to livestock from both sides of the hedgerow. There are a number of farm buildings used by the business; however, none of these would be affected by the proposals.

12.4.1.33 Land under the third ownership comprises two small portions of land on the northern boundary, currently under arable production.

12.4.2 Future Baseline

12.4.2.1 As noted above, the ALC grade is assessed from various soil physical characteristics, and across the Site is limited to a large degree by soil depth. These characteristics are unlikely to change over time, and as such the current ALC grades also represent the future baseline, in the absence of any development.

12.4.2.2 Of the two main farm businesses, one is already having to change as a result of the development of the Exemplar Site, which is taking a large proportion of the grazing land used by this business. In the absence of this development, it is assumed that the remaining land would continue to be grazed as part of their business.

12.4.2.3 In the absence of the development the main landowner on this Site would continue to operate in a similar manner, although some changes/upgrades to fixed assets would be undertaken, most notable being the development of a new parlour.

12.5 Design and Mitigation

12.5.1 Construction Approach and Mitigation of Short-Term Construction Effects

12.5.1.1 The sustainable re-use of the soil resource affected by the proposals would be undertaken in line with the Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (Ref 12-2). This would be achieved by the development of a Soil Resources Plan (SRP) identifying the soils present, proposed storage locations, handling methods and locations for re-use where possible. Measures which would be implemented include (but are not limited to):

- Completion of a Soil Resources Survey and incorporate results into a SRP
- Link SRP to the Site Waste Management Plan (SWMP)

- Ensure soils are stripped and handled in the driest condition possible
 - Confine vehicle movements to defined haul routes until all the soil resource has been stripped
 - Protect stockpiles from erosion and tracking over
 - Ensure physical condition of the entire replaced soil profile is sufficient for the vegetation requirements
- 12.5.1.2 Approximately 46% (68.01 ha) would be set aside as open space (to include SUDS, hedgerows, a village green, allotments, community garden and green link). Implementation of appropriate soil handling and re-use measures would ensure that the soils used across the Site in these areas would be of the required characteristics and in the required condition to support a variety of specified activities. For example, surplus nutrient-poor soils (topsoils or subsoils) would be re-used in areas of habitat creation (to enable to development and sustainability of species-rich habitats) whilst surplus nutrient-rich soils would be prioritised for areas designated for food production or in areas of landscape planting. This would ensure that the retained soils can continue to provide a range of valuable ecosystem services.
- 12.5.1.3 A limitation of these soils, identified above, is that they have little ability to retain non-adsorbed pesticides, and thus may also have a limited ability to retain other pollutants. This is, in part, due to the shallow nature of these soils and thus this would be taken into account in the creation of soil profiles within the SUDS to ensure they can provide the required functions.
- 12.5.1.4 The phasing of the development would take into account how each business operates, ensuring that the phasing does not, for example, lead to the severance of parts of an enterprise from the rest of the holding or lead to the undeveloped part of the enterprise becoming unviable for the period until it is brought into the development.
- 12.5.1.5 A considerate construction approach would be used to minimise potential impacts on the agricultural enterprises during the construction phase. The potential impacts on the farm business, in particular the risks of disturbance to livestock and the risks of livestock getting out into adjacent areas, would be clearly highlighted to all construction staff during Toolbox Talks provided by the Environmental Coordinator or their recognised deputy. If there are likely to be periods of significant construction activity close to the boundary with the undeveloped fields, the option to use temporary screening would be reviewed.
- 12.5.1.6 All fencing around the Development would be sufficient to resist damage by livestock, and would be regularly checked and maintained in a suitable condition. Any damage to boundary fencing would be repaired immediately.
- 12.5.1.7 During construction the provision of water supplies to undeveloped fields would be maintained at all times. Should pipework become damaged it would be repaired immediately to ensure no disruption to drinking water supplies for livestock.
- 12.5.1.8 The protection of the water supply from the borehole close to Lord's Farm is dealt with in Chapter 7 Contaminated Land.

12.5.2 Scheme Design and Mitigation of Permanent Operational Effects

- 12.5.2.1 There is provision, within the Development, for local food production from allotments, and additional potential for local food production from private or commercial gardens (within the 46% of the development which would be set aside as open space). The use of appropriate construction techniques outlined above in relation to soil handling during the construction phase would ensure that the soils in those areas set aside for food production would be in a suitable condition to support this activity. It is also proposed that there would be advice provided locally to individuals or firms on soil management in order to maximise both productivity and sustainability.

12.6 Construction Impacts

- 12.6.1.1 The proposals for this Site would result in the loss of up to approximately 147.7 ha of agricultural land from primary agricultural productivity. However, of this only 4.7 ha is BMV land. It is considered that these proposals would have a **permanent minor adverse** impact on agricultural land on that basis that the focus of relevant policy is on the protection of BMV land.
- 12.6.1.2 During construction, there would be impacts on the agricultural enterprises. Land would be lost to the businesses as each field was brought into the Development, reducing the area available for grazing or arable production. The measures outlined above would minimise disruption to ongoing activities and minimise disturbance to remaining livestock. These should limit the likelihood of any of the enterprises becoming unviable. It is assumed that the phasing, and notice periods provided, would allow the enterprises to adapt or move such that the economic performance of the business remains unaffected, and as such it is considered that there would be no more than a **short-term minor adverse** impact on farm viability as they adapt through the changes required. This would be confirmed through further discussions with the landowners once more information on the phasing of the development is available.

12.6.2 Overview

- 12.6.2.1 Overall, there would be a **permanent minor adverse** impact on agricultural land. Assuming the successful implementation of notice periods and phasing there would be only **short-term, slight adverse** impacts on farm businesses.

12.7 Permanent Operational Impacts

- 12.7.1.1 There would be no additional impacts on the soil resource during the operational phase.
- 12.7.1.2 It is considered that, once construction is complete, the farm enterprises would have relocated totally and thus there would be no further impacts on these businesses. However, during operation there is the potential for impacts associated with disturbance and vandalism to occur outside the red line boundary (as in effect the Development brings urban boundary closer to new

areas). This is considered to be a minor issue currently, and thus it is assumed that at this level during the operational phase this would result in a **permanent minor adverse** impact on those enterprises now adjacent or in closer proximity to the Development.

12.8 Cumulative Impacts

- 12.8.1.1 A number of other developments are proposed in the vicinity of Bicester which have the potential to impact on agricultural land (Table 17-1 and Table 17-2). Some of these are at a significant scale, such as the South West Bicester development which reports a total loss of approximately 60 ha of agricultural land. However, the majority of this land has been assessed as being Grade 3b, with only a small amount of Grade 3a land (area not provided but likely to be <10% of the total area). The Bicester Business Park development states that the land to be lost is Grade 4. Provisional ALC mapping shows that the land surrounding Bicester is classed as Grade 3 or 4. Where more detailed mapping is available areas of Grade 3a land are limited in extent.
- 12.8.1.2 As such, it is considered that the potential for cumulative impacts on best and most versatile land is limited, and unlikely to be more than **permanent moderate adverse**, assuming all other developments follow current policy and guidance.

12.9 Summary

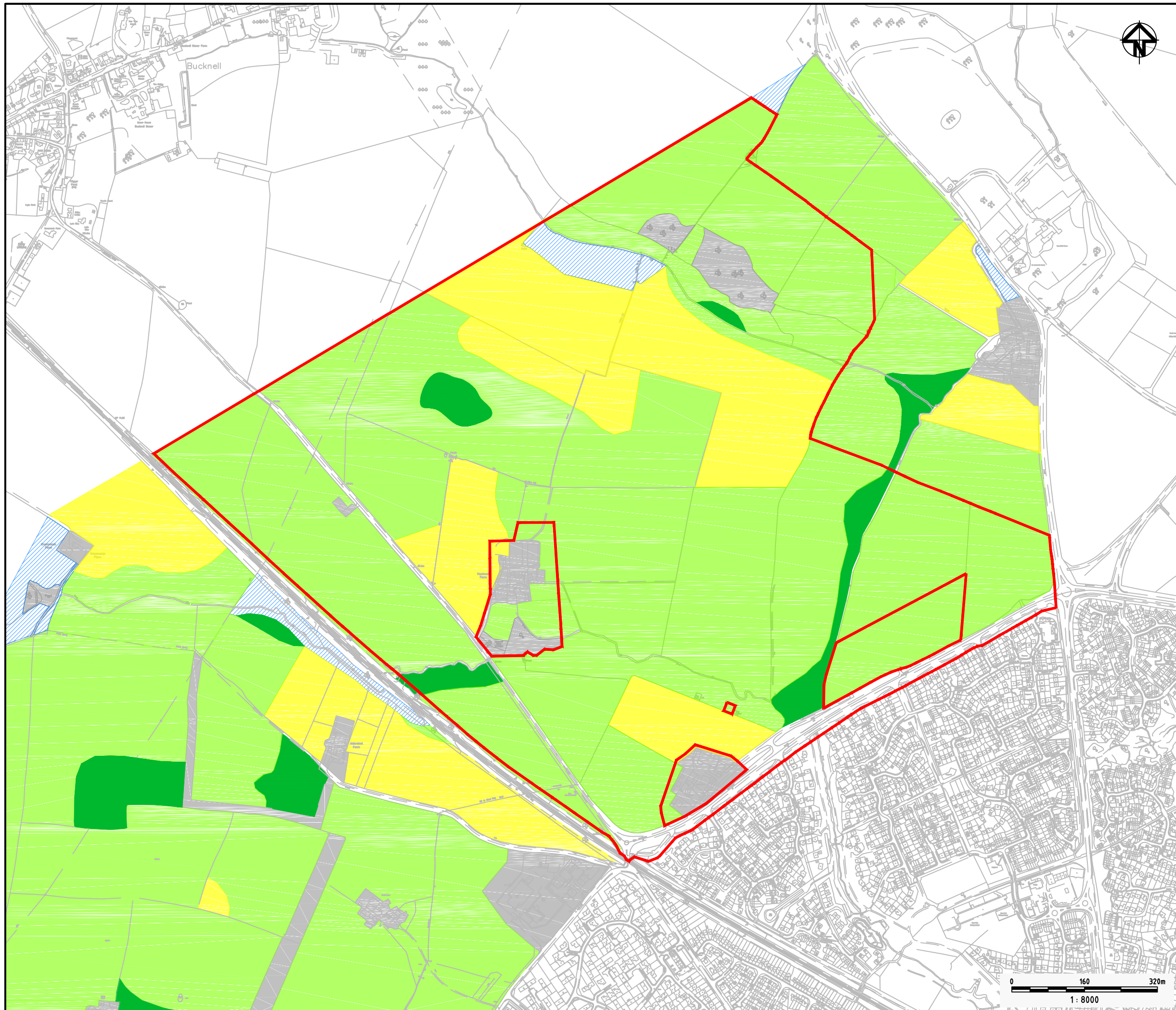
- 12.9.1.1 An assessment has been undertaken in relation to agriculture, soils and land use in relation to the Development. The assessment has been undertaken in accordance with current national legislation and national, regional and local plans and policies.
- 12.9.1.2 The soils across the Site are fairly uniform, with only approximately 3% classed as Grade 3a (i.e. best and most versatile land). The main limitations on land productivity relate to soil depth, stone content and poor drainage, and it is only in the deeper, more freely drained soils that land falls within the Grade 3a. Given the small area (approx 4.7 ha) of BMV land affected, it is considered that the proposals would have a **permanent minor adverse** impact on agricultural land.
- 12.9.1.3 During construction, appropriate soil handling methodologies would be used, in line with current guidance, to ensure the sustainable re-use of soils and maximise the value of the retained soil resource within the proposed design. This would ensure that soils with the optimum characteristics are allocated for the given end use, such as food production, habitat creation or SuDS.
- 12.9.1.4 Assuming that the phasing of construction and the notice periods provided would allow the agricultural enterprises present to adapt or move such that the economic performance of the business remains unaffected, it is considered that there would be no more than a **short-term slight adverse** impact on farm viability as they adapt through the changes required.

12.9.1.5 In addition, a considerate construction approach would be used to minimise potential impacts on the agricultural enterprises, which would focus on limiting disturbance to livestock, ease of access etc.

12.9.1.6 As the land around Bicester is likely to predominantly be Grade 3b or lower (i.e. not BMV) the potential for cumulative impacts is limited.

Table 12-9 Agriculture and Land Use Impact Summary Table

Impact description	Temporary/Permanent	Significance rating
Loss of best and most versatile agricultural land	Permanent	Minor adverse
Effects on agricultural businesses during construction	Short-term	Minor adverse
Effects on agricultural businesses during operation	Permanent	Minor adverse
Cummulative impact in relation to best and most versatile agricultural land	Permanent	Moderate adverse



KEY

- SITE BOUNDARY
- ALC GRADES**
- GRADE 3a
- GRADE 3b
- GRADE 4
- NON AGRICULTURAL
- NOT SURVEYED


MAPPED LAND AREA BY GRADE
(IN RED LINE BOUNDARY)

GRADE	AREA (Ha)
3a	4.7
3b	111.6
4	29.4
NON AGRICULTURAL	2.4
NOT SURVEYED	2.0

Issue	Description	Date
Status	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION	
Scales	1:8000	Current Issue Signatures
Original Size	A3	Author H.TRACEY
Height Datum	OS	Checker B.LASCCELLES
Grid	OS	Approver B.LASCCELLES
© Copyright reserved		

File name: 02-UA001881-STD-02-ALCGRAD-APP1.DWG

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Project

**NW BICESTER
APPLICATION 1
(NORTH OF RAILWAY)**

Title

**AGRICULTURAL LAND
CLASSIFICATION GRADES**

Drawing No.	Project No.	Issue
12-1	UA005241	01

APPENDIX 3

LAND CONTAMINATION ASSESSMENT

11 Contaminated Land

11.1 Introduction

11.1.1.1 This chapter relates to the Development within the site boundary for Application 1 – North of Railway of the NW Bicester development. It considers aspects relating to the chemical quality of the land and the potential associated risks to identified receptors such as human health and controlled waters that the Development may represent. This chapter describes:

- The current baseline conditions at the Site (North of Railway)
- Potential impacts and the mitigation measures required to prevent, reduce or offset any potentially significant adverse effects
- The likely cumulative effects after the mitigation measures have been implemented

11.1.1.2 To assist the understanding of the principles of this subject and their particular application within the context of the Development, it is recommended that the reader refers to the associated Hyder Consulting (UK) Limited Reports (Ref 11-1, 11-2 and 11-3), which have provided information for this chapter and copies of which are included in Appendix 11A, 11B and 11C. Reference should also be made to Chapter 15 which discusses waste such as excavated and construction waste.

11.2 Regulatory and Policy Framework

11.2.1.1 This impact assessment has been undertaken in accordance with current international and national legislation, and national, regional and local plans and policies relating to nature conservation in the context of the Development. A summary of the relevant legislation and policies, the requirements of these policies and the Development response has been provided in Table 11-1 below.

Table 11-1 Contaminated Land Regulatory and Policy Framework

Policy/Legislation	Summary of Requirements	Development Response
Environmental Protection Act (1990)	Government policy in relation to land contamination is outlined in DEFRA Circular 01/2006 'Contaminated Land'. The policy aims to both prevent new contamination and to address the inherited legacy of contaminated land. The primary legislation that covers historic land contamination is Part 2A of the Environmental Protection Act 1990, which was inserted by section 57 of the Environment Act 1995. Part 2A provides a definition of contaminated land, focussing on risks in the context of the current use and circumstances of the land. It places specific duties on local authorities to inspect their areas to identify land falling within this definition and, where they do,	Local authorities are the main regulator and are required to publish a strategy for inspecting their areas. The Environment Agency is responsible for dealing with defined 'special sites' and monitoring and reporting on progress made. Both local authorities and the Environment Agency record certain prescribed information about their regulatory actions on a public register and local

Policy/Legislation	Summary of Requirements	Development Response
	<p>to require its remediation in line with the 'suitable for use' approach.</p> <p>Part 2A of the Environmental Protection Act 1990 defines contaminated land as 'Any land which appears to be in such a condition, by reason of substances in, on or under the land that: Significant Harm is being caused or there is a Significant Possibility of such harm being caused; or Pollution of Controlled Water is being, or is likely to be, caused'.</p> <p>The identification of contaminated land on the basis that there is a significant possibility of significant harm (SPOSH) being caused is set out in DEFRA Circular 01/2006.</p> <p>The identification of contaminated land, as defined in Part 2A of the Environmental Protection Act 1990, comprises a risk-based approach. For harm to the non-aquatic environment or pollution of controlled waters to occur, there must be a 'pollutant linkage'. This linkage is based on the following being present:</p> <ul style="list-style-type: none"> ▪ Source of contamination (hazard); ▪ Pathway for the contaminant to move from source to receptor; ▪ Receptor (target), which is affected by the contaminant. This includes humans, ecosystems, controlled waters, physical systems and built structures, which could be affected by the hazard. 	<p>authorities maintain databases about potentially contaminated sites within their area.</p> <p>Development will follow principles of suitable for use criteria based upon a source-pathway-receptor risk assessment approach.</p>
<p>National Planning Policy Framework 2012</p>	<p>The National Planning Policy Framework (NPPF) was introduced in March 2012 to simplify planning and was written to help achieve sustainable development. Whilst containing only limited guidance on land affected by contamination the document does states that:</p> <p><i>"To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner."</i></p>	<p>Consideration has been given to the potential risks from pollution within the study area.</p>

Policy/Legislation	Summary of Requirements	Development Response
Waste Regulations	<p>The Waste (England and Wales) Regulations 2011 states that excavated material generated by the development of land maybe subject to waste regulatory controls to ensure that waste does not harm human health or the environment.</p> <p>Waste disposal, deposit, recovery & recycling in England, Wales and Scotland is regulated primarily through Part 2 of the Environmental Protection Act and the Environmental Permitting Regulations. Under the legislation all controlled waste must be deposited, disposed of, recycled or recovered at a suitably licensed site, or a site that is registered as exempt from waste management licensing. In addition, controlled waste must be transported to a licensed (or exempt) site by an authorised waste carrier. It is an offence to deposit waste on land that does not have a waste management licence (or exemption) in force.</p>	<p>Licensing of waste disposal and treatment facilities, waste carriers and brokers and the monitoring of waste management activities is the responsibility of the Environment Agency in England and Wales.</p> <p>When dealing with waste the developemtn will apply the required waste regulations.</p>
CL:AIRE The Definition of Waste: Development Industry Code of Practice	<p>This Code of Practice (CoP) provides best practice for the development industry to use when assessing if materials are classified as waste, or not, and determining when treated waste can cease to be waste for a particular use. The CoP provides engineers, contractors, consultants and developers a basis upon which to demonstrate to the Environment Agency that they are following best practice with respect to the use and reuse of materials. It provides an auditable system to demonstrate that the CoP has been adhered to on a site by site basis. The development and use of the CoP is seen as a Better Regulation Approach by the EA.</p> <p>The CoP requires a normal risk assessment based approach (see CLR 11 above) to prove that materials are “suitable for use”. Where materials are not considered to be waste the Environmental Permitting Regulations (2010) need not be applied. Soils requiring treatment to allow their re-use are considered to be waste. Such treatment processes must be undertaken under an appropriate Mobile Treatment Permit. The CoP allows the user to demonstrate when wastes have been fully recovered, via treatment, and hence cease to be waste.</p> <p>The CoP requires regulatory agreement for each stage of the works. This is best achieved via a formal planning consent with appropriate</p>	<p>Due consideration to this guidance has been made.</p> <p>When re-use of material is appropriate a suitable for use approach as set out within CL:AIRE CoP will be applied.</p>

Policy/Legislation	Summary of Requirements	Development Response
	<p>conditions attached to the investigation, assessment and remediation. Approval is effectively obtained by discharge of the planning conditions that require regulatory agreement of:</p> <ul style="list-style-type: none"> ▪ Remediation Strategy. ▪ Remediation Method Statement. ▪ Verification Report. 	
<p>The Environment Agency's Model Procedures for the Management of Land Contamination (Contaminated Land Report 11)</p>	<p>Contaminated Land Report 11 (CLR 11) has been developed to provide the technical framework for applying a risk management process when dealing with land affected by contamination. The process involves identifying, making decisions on, and taking appropriate action to deal with land contamination in a way that is consistent with government policies and legislation within the UK. The document is consistent with the approach presented within the "Guidelines for Environmental Risk Assessment and Management" published by the Department of the Environment, Transport and the Regions, the Environment Agency and the Institute for Environment and Health (2000).</p>	<p>Assessment has been undertaken with due consideration to this guidance.</p>
<p>Water Resources Act 1991</p>	<p>The Water Resources Act 1991 provides regulation of contamination potentially impacting controlled waters and is enforced by the Environment Agency. This provides regulation separate from that within the planning framework.</p>	<p>Controlled Waters Risk Assessment (CWRA) has been undertaken and the potential impacts on water are included.</p>
<p>Control of Substances Hazardous to Health 2002</p>	<p>The Control of Substances Hazardous to Health (COSHH) Regulations, 2002, and subsequent amendments and the Construction and Design Management (CDM) Regulations, 2007, require the developer to ensure that risks to the public and site workers, in relation to the likely presence of contaminated land, are minimised.</p> <p>Additional guidance is provided by DEFRA in their series of Contaminated Land Reports (CLR 1-CLR 11).</p>	<p>Human Health Risk Assessment has been undertaken.</p>
<p>Environment Agency Pollution Prevention Guidance Notes</p>	<p>The Environment Agency has produced a range of Pollution Prevention Guidance Notes (PPGs) to provide advice on the laws and good environmental practice relevant to a number of industrial sectors and activities. These include</p>	<p>Best practice as set out in these PPGs will be implemented during the works.</p>

Policy/Legislation	Summary of Requirements	Development Response
	<p>the following:</p> <ul style="list-style-type: none"> ▪ PPG1 – General guide to the prevention of pollution ▪ PPG2 – Above ground oil storage tanks ▪ PPG5 – Works and maintenance in or near water ▪ PPG6 – Working at construction and demolition sites ▪ PPG8 – Safe storage and disposal of used oil ▪ PPG13 – Vehicle washing and cleaning ▪ PPG21 – Pollution incident response planning 	

11.3 Methodology

11.3.1 General Approach

11.3.1.1 The assessment of the potential for adverse environmental impact that could be associated with chemical contamination has been undertaken in accordance with The Statutory Guidance on Part IIA of the Environmental Protection Act 1990 (EPA 1990) as set out in Defra Circular 2012 (Ref 11-4); The Environment Agency's Model Procedures for the Management of Land Contamination (Contaminated Land Report (CLR) 11) (Ref 11-5) and other relevant supporting guidance.

11.3.1.2 The DEFRA statutory guidance for contaminated land uses the concept of a 'contaminant linkage', whereby for land to be contaminated, each of the following has to be identified:

- a contaminant (source)
- a relevant receptor
- a pathway by means of which either:
 - that contaminant is causing significant harm to that receptor, or
 - there is a significant possibility of such harm being caused by that contaminant to that receptor.

11.3.1.3 If one or more of the source, pathway or receptor is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

11.3.1.4 Although the presence of contaminants may result in contamination of the ground, land will only be designated as statutory Contaminated Land when the requirements of the strict definition of EPA 1990 Part IIA are met.

- 11.3.1.5 For definition of the terms 'Contaminated Land', 'contaminant', 'harm' and 'risk' and further details on the concept of a 'contaminant linkage' reference should be made to Part IIA of the EPA 1990.
- 11.3.1.6 As this is a development led project, consideration has been given to the NPPF. The principles for assessing if the site is "suitable for the proposed use" are based on the contaminant linkage methodology as detailed above. As a minimum the development should be considered safe and should not be able to be determined as statutory Contaminated Land under Part IIA.
- 11.3.1.7 Receptors identified as part of this study are:
- Human health (construction workers, site end users)
 - Controlled waters (groundwater and surface water)
 - Buildings and services

11.3.2 Consultation

- 11.3.2.1 Cherwell District Council and the Environment Agency (EA) were consulted during the preparation of the contaminated land assessment and relevant information is included within the baseline conditions below.

11.3.3 The Study Area

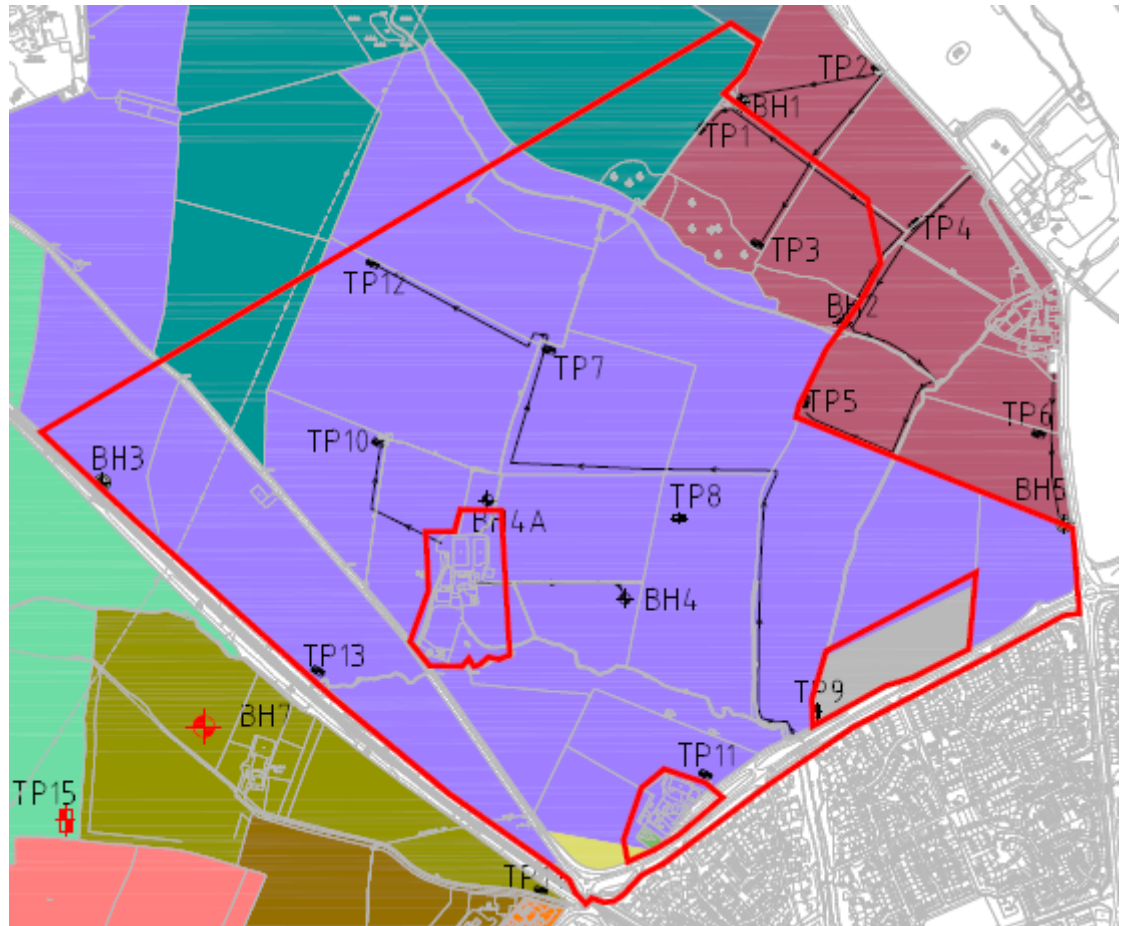
- 11.3.3.1 The study area for the contaminated land assessment is defined by the red line boundary for Application 1, as shown on Figure 11-1, however consideration is also given to activities within 500m of the boundary, e.g. landfill site, which may have an ability to cause impact on the Development.

11.3.4 Methodology for Establishing Baseline Conditions

Establishing the Existing Baseline

- 11.3.4.1 The baseline conditions for Application 1 have been determined from the following:
- Data presented in the Hyder Phase 1 Desk Study Report (Appendix 11A). This includes a review of available published and internet based information sources such as the Environment Agency (EA) database, historical maps and British Geological Survey (BGS). This report also includes a Tier 1 hydrological risk assessment report for land being considered for development as a new cemetery within the Application 1 boundary.
 - Information obtained during a preliminary intrusive ground investigation undertaken by Hyder in August 2010 (Appendix 11B). This includes details of ground conditions encountered and chemical quality of soils and groundwater sampled. This investigation covered a larger area as shown on Figure 11-1 below, than the Application 1 area considered within this chapter. Only information relevant to the Site Area is included within this chapter.

Figure 11-1 Plan showing the Hyder Site Investigation Area

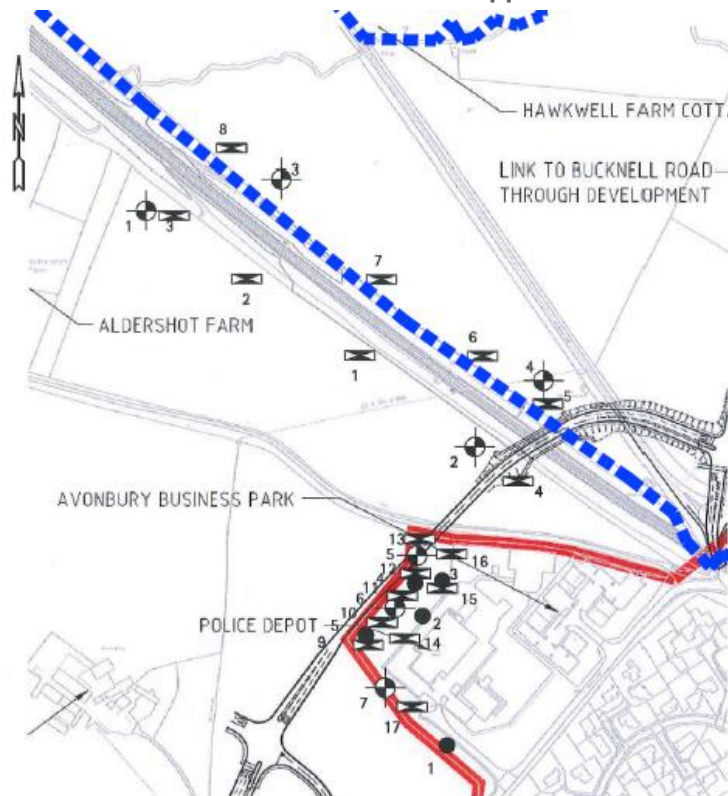


- Details have been taken from the Groundwater Supply: Feasibility Study (Appendix 11C).
- A desk study and intrusive site investigation (March 2014) was undertaken by ST Consult (Ref 11-6) on land within the southern part of the Application 1 boundary and on the other side of the railway lines shown in Figure 11-2 below (the blue dashed line indicates the Application 1 boundary). This was to provide information for the proposed road underpass in this location and investigated the landfill site present at Gowell Farm which is part of the Avonbury Business Park to the south of the Application 1 boundary. Whilst the majority of the work was undertaken on the opposite side of the railway and hence outside the Application 1 site boundary, six sample locations are within the Application 1 boundary and relevant information has been taken from this document which is appended within Appendix 11D.

Figure 11-2 Plan showing the investigation area of ST Consult
Key

Red line = ST Consult boundary

Blue dashed line = Application 1 boundary



Forecasting the Future Baseline (“Without Development” Scenario)

- 11.3.4.2 The existing ‘interpretative’ baseline conditions and risk assessment process (human health, controlled waters and buildings/structures) is carried out on the assumption that the Development and/or future land-users is/are in place.
- 11.3.4.3 The future baseline (‘without development’ scenario) will therefore be forecast by qualitatively assessing the potential baseline conditions and risks to human health, controlled waters and buildings and structures from existing sources of contamination.
- 11.3.4.4 It is not possible to predict future changes to regulatory policy and frameworks so the future baseline will be forecast assuming no significant change from current methodology. We do not envisage that any changes would materially affect the assessments made herein.

Defining the importance/sensitivity of resource

- 11.3.4.5 The significance criteria for contaminated land are based on the criteria set out in the Design Manual for Roads and Bridges (DMRB) (Ref 11-7). The significance of the identified impacts would be based on the sensitivity of the receptor taking into account the magnitude of the potential impact.
- 11.3.4.6 The assessment process comprises a number of stages. The first stage involves assigning the importance or sensitivity of each resource / receptor as assessed using the criteria provided in Table 11-2 below.

Table 11-2 Determining the Importance / Sensitivity of Resource

Importance / sensitivity of resource or receptor	Receptor: Human Health * (Soils)	Receptor: Human Health/Buildings ** (Ground Gas)	Receptor: Controlled Waters
Very High	Future users of residential properties with private gardens.	Low rise residential properties.	<p>High water quality and rare resource. Important at a regional or national scale, with limited potential for substitution, e.g.</p> <ul style="list-style-type: none"> ▪ Supply of high quality potable water to a large population <p><u>Groundwater:</u></p> <ul style="list-style-type: none"> ▪ Principal aquifer ▪ Within SPZ 1 or 2 <p><u>Surface water:</u></p> <ul style="list-style-type: none"> ▪ Supply of high quality potable water to a large population ▪ Classified as “high” water quality under the TAGWFD guidance with no EQS exceedances ▪ EC designated Salmond fishery ▪ Main Rivers ▪ Flood Zone 3b (functional floodplain)
High	Future users of allotments. Construction Workers^.	Residential properties other than low rise.	<p>High water quality and rare resource. Important at a local scale with limited potential for substitution, e.g.</p> <ul style="list-style-type: none"> ▪ Supply of a small volume of potable water for local use <p><u>Groundwater:</u></p> <ul style="list-style-type: none"> ▪ Secondary A aquifer ▪ Within SPZ 3 <p><u>Surface water:</u></p> <ul style="list-style-type: none"> ▪ Classified as “high” water quality under the TAGWFD guidance with no EQS exceedances ▪ EC designated Cyprinid fishery ▪ Some potential to supply a small volume for potable use ▪ Local drainage networks ▪ Flood Zone 3
Medium	Future users of residential properties	Public building e.g. managed apartments,	Moderate water quality and low rarity. Important at a local scale

Importance / sensitivity of resource or receptor	Receptor: Human Health * (Soils)	Receptor: Human Health/Buildings ** (Ground Gas)	Receptor: Controlled Waters
	without private gardens.	schools and hospitals.	<p>e.g.</p> <ul style="list-style-type: none"> ▪ Supply of a small volume of water for agricultural or industrial use or limited potential for potable supply <p><u>Groundwater:</u></p> <ul style="list-style-type: none"> ▪ Secondary B aquifer ▪ Not within SPZ <p><u>Surface water:</u></p> <ul style="list-style-type: none"> ▪ Classified as “good” water quality under the TAGWFD guidance with minor EQS exceedances or classified as “high” with moderate EQS exceedances ▪ Provision of water for agricultural or industrial purposes, no or limited potential to be used for potable supply ▪ Flood Zone 2 ▪ Overland / surface water flow routes
Low	Future users of public open space.	Commercial buildings.	<p>Poor water quality and low rarity e.g.</p> <ul style="list-style-type: none"> ▪ Limited potential to supply a small volume of water for agricultural or industrial use. No or limited potential for potable supply <p><u>Groundwater:</u></p> <ul style="list-style-type: none"> ▪ Secondary B aquifer ▪ Not within SPZ <p><u>Surface water:</u></p> <ul style="list-style-type: none"> ▪ Classified as “moderate” water quality under the TAGWFD guidance with minor EQS exceedances or classified as “good” water quality under the TAGWFD guidance, with moderate EQS exceedances ▪ Limited potential to supply a small volume of water for industrial or agricultural purposes. No, or limited

Importance / sensitivity of resource or receptor	Receptor: Human Health * (Soils)	Receptor: Human Health/Buildings ** (Ground Gas)	Receptor: Controlled Waters
			potential, to be used for potable supply <ul style="list-style-type: none"> ▪ Flood Zone 1
Negligible	Future users of commercial/ industrial properties.	Industrial buildings (where open and well ventilated; office pods might require separate assessment as classified as commercial).	Irreparably poor or bad water quality and low rarity. Important at a local scale e.g. <ul style="list-style-type: none"> ▪ No or very limited potential to supply water for agricultural or industrial use <u>Groundwater:</u> <ul style="list-style-type: none"> ▪ Non designated aquifer or unproductive strata ▪ Not within SPZ <u>Surface water:</u> <ul style="list-style-type: none"> ▪ Classified as “poor” water quality under the TAGWFD guidance, or any other classifications, with high EQS exceedances ▪ No potential to be used for industrial, agricultural or potable supply ▪ Flood Zone 1

* Duration of exposure to contamination and number of pathways of exposure to contamination increases from commercial/industrial (minimum) to residential with private garden (maximum) land uses. Therefore future users of industrial sites are considered to be of negligible importance as they will have minimal contact with underlying soils, whilst residential ends users are likely to be in contact with underlying soils on a more regular basis and are therefore of very high importance.

** Duration of occupancy and perception of risk increases from industrial buildings (minimum) to low rise residential properties (maximum). Amount of ventilation and management increases from low rise residential properties (minimum) to industrial buildings (maximum).

^Construction workers will only be exposed to contamination for a short duration, however, they may enter enclosed spaces and will be directly handling the soils.

Source: Professional judgement.

11.3.5 Methodology for Assessing Impacts

Introduction

11.3.5.1 The assessment of impacts to human health and controlled waters has followed the Environment Agency’s Model Procedures for the Management of Land Contamination (Contaminated Land Report 11, CLR 11) guidance. The assessment was based on the identification of ‘contaminant linkages’, i.e. source-pathway-receptor relationships. This approach accords with the guidance that accompanies Part IIA of the Environmental Protection Act of 1990 (as amended).

Conceptual Site Model

11.3.5.2 The Conceptual Site Model (CSM) links the identified potential previous and existing site sources of contamination capable of causing harm via pathways to identified receptors.

11.3.5.3 The Conceptual Site Model was characterised by identification of the following:

- On-site sources which may impact on-site receptors via plausible pathways;
- On-site source which may impact off-site receptors via plausible pathway; and
- Off-site sources which may impact on-site receptors via plausible pathways.

Human Health Risk Assessment

11.3.5.4 The Human Health Risk Assessment (HHRA) has been undertaken in accordance with the current guidance such as Contaminated Land Report 11 (CLR 11). When quantitative data exists, a tiered risk – based approach has been adopted, comprising the following:

- Tier 1 Assessment: Comparison of site contaminant concentrations against generic exposure scenarios and associated compliance criteria including an assessment of risk using a source-pathway-receptor model
- Tier 2 Assessment: Derivation of site-specific risk assessment criteria and calculation of site specific clean-up goals, if the Tier 2 assessments deem clean-ups to be necessary

11.3.5.5 The assessment has therefore been undertaken in a phased approach, focussing initially on the Tier 1 Assessment. The Tier 1 assessment includes the following stages, which were completed where applicable:

- Zoning of data/site averaging areas;
- Maximum Concentration Assessment - comparison of maximum detected concentrations against relevant Generic Assessment Criteria (GAC);
- Mean and Maximum Value Statistical Analysis – consideration of statistical outliers and 95% Upper Confidence Levels (UCLs) against relevant GAC;
- Risk Evaluation/Assessment of Significant Results; and
- Identification of the need for Tier 2 Assessment and derivation of Site Specific Assessment Criteria (SSAC).

11.3.5.6 The current philosophy in the assessment and remediation of contaminated land in the UK is to adopt an ‘end use’ risk based “suitable for use” approach whereby the significance of contamination at a site is evaluated according to either the existing use or to a proposed developments end use.

Zoning of Data/Site Averaging Areas

11.3.5.7 The development is expected to comprise predominantly residential properties, therefore the site has been considered to comprise one zone and averaging area for the purposes of this assessment.

Tier 1 Assessment

- 11.3.5.8 To identify the contaminants of potential concern (COPC), the laboratory testing results have been compared with the respective SGVs/GAC. The results and respective screening criteria are presented in the associated interpretative report, a copy of which is included within Appendix 11B.
- 11.3.5.9 For the Tier 1 Assessment, Environment Agency published generic Soil Guideline Values (SGVs) derived using the Agency's CLEA model (Ref 11-8), were used. Where these are not available, GAC published by LQM/CIEH (Ref 11-9) were utilised.
- 11.3.5.10 The assessment criteria relevant to the standard sensitive receptor setting within the CLEA model has been used i.e. a female receptor aged 1 to 6 years, a residential building (small terraced house) and a sandy loam soil with a pH7 and SOM 1%. Given the proposed site end use, the stringent "residential with plant uptake" land use scenario has been adopted.
- 11.3.5.11 Any contaminants that exceed the SGVs/GAC are considered to be COPC. Those that do not exceed the respective SGVs/GAC are not considered to be COPC and do not require further assessment in relation to the Development.

Ground Gas Risk Assessment

- 11.3.5.12 It should be noted that, in accordance with current best practice and guidance, the number and frequency of ground gas monitoring rounds required is dependent on the sensitivity of the development and the generation potential of any ground gas source. In this case, the ground gas monitoring programme has been devised in order to establish a preliminary indication of the ground gas regime at the site.
- 11.3.5.13 Preliminary monitoring of the ground gas regime was undertaken by Hyder between August and November 2010. Further monitoring was undertaken by ST Consult in 2014.
- 11.3.5.14 The results of monitoring have been assessed using the current guidance document: CIRIA C665 "Assessing Risks Posed by Hazardous Ground Gases to Buildings" (Ref 11-10) and BS8485:2007 "Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments" (Ref 11-11).

Controlled Waters Risk Assessment

- 11.3.5.15 The Controlled Waters Risk Assessment (CWRA) has been undertaken in accordance with the guidance suggested in the CLR 11 and comprised a staged approach (referred to as 'Levels'). A Level 2 Assessment has been undertaken for the purposes of this CWRA. For information, all Levels (1 to 4) are summarised in Table 11-3 below.

Table 11-3 Quantitative Risk Assessment Levels

	Soil	Groundwater
1	Pore water contamination compared directly to receptor target concentration	Not applicable
2	Attenuation in unsaturated zone and dilution at the water table	Groundwater below source - groundwater data is compared directly to target concentrations
3	Attenuation in the aquifer	Attenuation and down gradient receptor or compliance point – groundwater concentration at the receptor/compliance point is predicted using numerical modelling
4	Attenuation and dilution in the receptor	Dilution in the receptor - dilution in a receiving watercourse or pumping abstraction borehole (only with approval of EA)

11.3.5.16 The basis for the screening criteria is to ensure that the selected screening values are protective of the identified receptor. For groundwater the general approach is to use an environmental standard as experience shows that remediation of contaminated groundwater to background quality is not achievable. The standard should be relevant to the current and future receptors and the standards compliance criteria should be considered.

11.3.5.17 Standards that are applicable to this study are:

- UK Environmental Quality Standards (EQS) for the protection of aquatic life (in both freshwater and saline environments);
- UK Water Supply (Water Quality) Regulations, 2000 and 1989.

11.3.5.18 The groundwater beneath the site is considered to be the receptor in the first instance and therefore the UK Drinking Water Standards (UKDWS) have been selected as the appropriate screening criteria for the Level 2 Assessment. The results and respective screening criteria are presented in the associated interpretative report (Appendix 11B).

Assessment Criteria

11.3.5.19 The magnitude of each impact is assessed using the criteria provided in Table 11-4 below. This assessment, in the context of this chapter, is essentially quantifying the potential outcome of complete ‘pollutant linkages’ impacting the identified receptor.

Table 11-4 Assessing Magnitude of Impact

Magnitude of Impact	Human Health	Building/Structure	Groundwater*
Major	Chronic risk to human health likely to result in	Catastrophic damage to buildings/property.	Loss in water body or permanent significant detrimental impact on

Magnitude of Impact	Human Health	Building/Structure	Groundwater*
	'significant harm' as defined by the Environmental Protection Act 1990, Part IIA.	e.g. explosion resulting in building collapse.	water quality which permanently affects its use to or potential to supply water.
Moderate	Chronic damage to human health (significant harm as defined in Statutory Guidance.	Significant damage to buildings, structures and services.	Temporary loss of water body. Significant temporary detrimental impact on water quality but does not affect its use or moderate temporary detrimental impact on water quality, which does affect its use for supply purposes.
Minor	Significant chronic harm but to less sensitive receptors.	Damage to sensitive buildings, structures, services or the environment.	Moderate temporary detrimental impact on water quality, which does not affect its use for supply purposes.
Negligible	Non permanent health effects to human health (easily prevented by means such as personal protective clothing).	Easily repairable effects of damage to buildings, structures and services.	Minor temporary detrimental impact on water quality.
No Change	No discernable impact	No discernable impact	No discernable impact

*Source: Adapted from Department of Transport's Transport Analysis Guidance: The Water Environment Sub-Objective, 2003 based on methodology set out in DMRB with professional judgement added to relate to contaminated land. *Magnitude of impacts can be positive or negative

11.3.5.20 Using these definitions, a combined assessment of sensitivity and magnitude can then be undertaken to determine how significant an effect is, as demonstrated in Table 11-5 below.

Table 11-5 Assessing Magnitude of Impact

		Magnitude of Impact				
		No Change	Negligible	Minor	Moderate	Major
Value of Receptor	Very High	Neutral	Slight	Moderate/Large	Large or Very Large	Very Large
	High	Neutral	Slight	Moderate/Slight	Moderate/Large	Large/Very Large
	Medium	Neutral	Neutral/Slight	Slight	Moderate	Moderate/Large
	Low	Neutral	Neutral/Slight	Neutral/Slight	Slight	Slight/Moderate
	Negligible	Neutral	Neutral	Neutral/Slight	Neutral/Slight	Slight

11.3.6 Limitations and Assumptions

- 11.3.6.1 Subsurface ground conditions are by their nature hidden from view, and on this basis actual ground conditions at the Site have the potential to be at variance to those being reported and inferences drawn.
- 11.3.6.2 The intrusive investigation undertaken by Hyder was designed to provide a preliminary inspection to help inform a baseline of the ground conditions to facilitate the Outline Planning Application. Further recommended work would be controlled by relevant planning conditions(s). Further detailed investigation / assessments would be required to provide a higher density sampling plan reduce uncertainties and thereby to refine the Site characterisation between sampling points where previously no investigation has been undertaken.
- 11.3.6.3 This document has been prepared using factual information contained in maps and documents prepared by others. Where this is the case, no responsibility can be accepted for the accuracy of such information.

11.4 Description of the Baseline Conditions

11.4.1 Existing Baseline

Site History

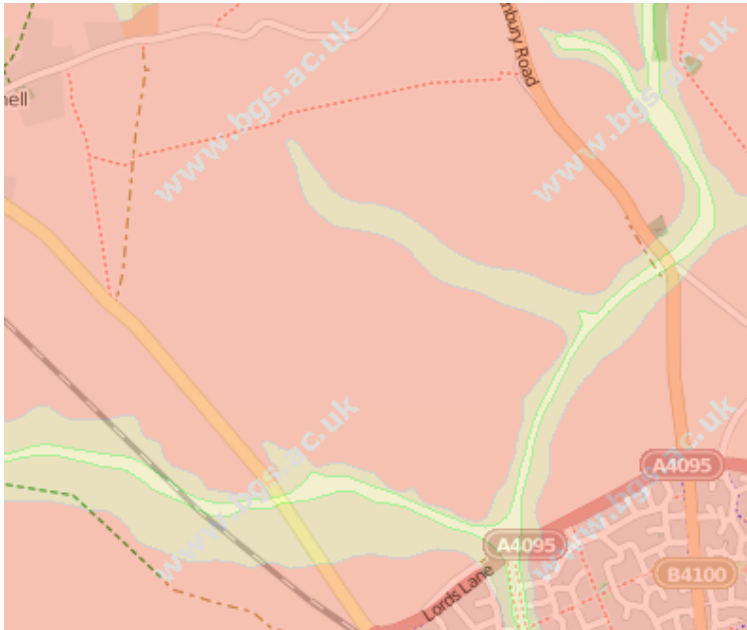
- 11.4.1.1 Since the earliest available historical map of 1881 to the present day, the site has been dominated by agricultural activity. A quarry is located on the southern side of Bucknell Road. On the 1922 edition, the Great Western Railway is present defining the southern boundary. In 1923 limekilns, quarry and pumping station are shown on southern side of railway line. These are no longer present in 1970 and are the location of the landfill site which is later developed into Avonbury Business Park.

Geology

Published Geology

- 11.4.1.2 From published BGS geological maps (Sheet 219, Scale 1:50,000) (Ref 11-12), the geology across the site is underlain by a thin cover of superficial deposits (alluvium) which follows the lines of the watercourses within the locality. The solid geology, is represented by the Combrash Formation, which primarily comprises bioclastic limestone. This is underlain by the Forest Marble Formation, which comprises grey calcareous mudstone with lenticular beds of bioclastic limestone. Further detailed information is included within the desk study report in Appendix 11A and Figure 11-4 below illustrates the drift and solid geology at the site.

Figure 11-4 Solid and Drift geology (Taken from BGS website)



Key

Superficial deposits

- ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
- HEAD - CLAY, SILT, SAND AND GRAVEL

Bedrock geology

- BLADON MEMBER - MUDSTONE AND LIMESTONE, INTERBEDDED
- CORNBRASH FORMATION - LIMESTONE
- FOREST MARBLE FORMATION - LIMESTONE
- FOREST MARBLE FORMATION - LIMESTONE AND MUDSTONE, INTERBEDDED
- WHITE LIMESTONE FORMATION - LIMESTONE

Source: C09/013-CCSL British Geological Survey. ©NERC. All rights reserved. Reproduced from Online Viewer by permission of the British Geological Survey. ©NERC. All rights reserved.

Encountered Geology from Preliminary Investigation

11.4.1.3 The geological sequence is generally confirmed by the two ground investigations undertaken across the site with the strata encountered as follows:

- 0-0.2m thickness of Topsoil;
- 0.2-0.6m (up to 0.8m deep in places) of Subsoil, comprising an orange/brown gravelly/sandy Clay or sandy clayey Gravel;
- 0.6m to 1.9m (up to 2.9m deep in places) of yellow sandy Gravel and in places yellow/grey Clay, grading to completely weathered Limestone (Cornbrash Formation);
- From 1.9 to 7m depth, alternating Limestone and Clay bands of the Cornbrash Formation are represented.

Hydrogeology

- 11.4.1.4 The solid geology is designated as Secondary A aquifer. These are aquifers which are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flows to rivers. The superficial deposits are not designated.
- 11.4.1.5 The site is not located within a Source Protection Zone (SPZ) and no major potable water supplies are present within 5km of the Site.
- 11.4.1.6 There are three groundwater abstractions recorded within the site boundary. All are registered to boreholes at Lord's Farm for general farming and domestic purposes. Two further abstractions are shown on the map at Hawkwell Farm in the centre of the Site, but these are not recorded in the EA database (from Envirocheck).
- 11.4.1.7 From the borehole log available of the BGS website, the following information is available regarding the one for the abstraction wells at Lords Farm:
- 11.4.1.8 An 80 m deep borehole at Lords Farm (SP52/18 at SP 5746 2424), drilled in 1941, was drilled through a similar sequence and terminated in the Lias. It struck water in the Cornbrash Formation, which was cased out, and at two levels below the White Limestone Formation. The rest water level was at 11m below ground level (about 68m AOD) and it yielded 1.7 l/s. Other records of water levels at Lords Farm (SP52/17A, B and C at about SP 569 245) show that the water level was at approximately 3.6m of ground level (about 76m AOD).
- 11.4.1.9 One historical well is located within the Site Area under consideration, with two further historic wells located to the south west on the opposite side of the railway line. Plans showing the locations of the wells are included in the Hydrogeological report in Appendix 11C.
- 11.4.1.10 During the Hyder site investigation (Appendix 11B) groundwater was encountered between 0.6 to 2.6 m in trial pits TP7, TP8, TP9 TP10 and TP13 (location plan in Hyder report Appendix 11B). The remaining trial pits were dry during the short time they were left open. Trial pits TP7 to TP10 and TP13 were carried out after a period of heavy rain. Groundwater monitoring, following completion of the ground investigation at the Masterplan site suggested that excavations for shallow foundations may encounter some groundwater flow in some areas, particularly after heavy rain. The groundwater strikes within the trial pits generally coincide with the top of the limestone (Cornbrash Limestone).
- 11.4.1.11 During the ST Consult investigation (Appendix 11D) groundwater was encountered in BH3 and BH4 at 4.85m and 5.40m respectively. In BH3 the groundwater rose to ground level in 3 minutes which indicated an artesian flow following a fissure strike. This location was abandoned and grouted with a bentonite seal.

Hydrology

- 11.4.1.12 There are three main watercourses on Site, as shown on Figure 7-1; one flowing in a north-westerly to south-easterly direction from the railway line across the site, another which flows from the north-north-west and joins with the

third watercourse which flows in a north-easterly to south-westerly direction. The two main streams converge and discharge into the River Bure in the centre and north-east of the Site area. The River Bure flows off-Site in a roughly north-easterly to south-westerly direction.

Landfill Sites

- 11.4.1.13 A historic landfill is recorded as present on the Site at Gowell Farm approximately 100m to the south of the Site boundary. This is currently part of Avonbury Business Park. Records suggest that this location may have been previously quarried for limestone. Local Authority records contained within the Envirocheck Report state the deposited waste as being “ash, glass, brick, pottery”, which was likely used as fill for the old quarry on Site.
- 11.4.1.14 The ST Consult investigation (Appendix 11D) included drilling in the landfill area which is outside the Application 1 boundary. Made Ground was encountered to a maximum depth of 3m (WSL3) in the area of the infilled Lime Kiln. This comprised of clinker based fill including black and brown mottling and abundant glass sharps but no visual or olfactory signs of significant contamination.
- 11.4.1.15 A plan showing the features detailed above are included within the Phase 1 desk study report (Appendix 11A) and Hydrogeological Report (Appendix 11C).

Tier 1 Hydrological Risk Assessment

- 11.4.1.16 This was undertaken to assess the suitability of land within the Application 1 boundary for the development of a cemetery. The key issues are detailed below with further information on the assessment within the report included within Appendix G of the Hyder desk study report (Appendix 11A).
- 11.4.1.17 Within the assessment a site vulnerability is determined which is based on the geology, hydrogeology and other baseline factors. The vulnerability ranking assigned to land within the Application 1 boundary is Moderate and when the number of anticipated annual burials are considered the risk rating is increased to High.
- 11.4.1.18 The site characteristics that have caused the raised vulnerability score were absence of superficial deposits and high water table.
- 11.4.1.19 The report states that subject to appropriate site investigation and agreement with the EA, it may be possible to either adjust the risk rating of the site or to design measures, such as drainage or specifications for burials, to mitigate risk to groundwater.

Contamination Status

Human Health Risk Assessment

- 11.4.1.20 During the investigation undertaken by Hyder, soil samples were taken from the Application 1 area and analysed for a suite of metal and organic contaminants. From the assessment only one soil sample of 23 samples from TP13 at 0.6m depth had a concentration slightly above the respective SGVs/GAC for Arsenic. The concentration recorded was 36.2mg/kg which is marginally above the SGV of 32mg/kg for a residential with plant uptake scenario. On review of the log for

TP13, this slightly elevated result was encountered within natural soils (very clayey sandy gravel) and therefore it is likely that the Arsenic is from natural sources. From BGS data the background concentrations in this area are around 25mg/kg which is a similar order as the concentration encountered. Due to the depth that it has been encountered, residents are unlikely to come into day to day contact with this material and therefore the risk from this slightly elevated concentration would be minimal. This assumes that the site levels remain the same.

- 11.4.1.21 All other samples analysed contained contaminants which were below the SGVs/GAC for a residential with plant uptake scenario.
- 11.4.1.22 As only one sample of the 23 samples tested returned contaminant values greater than the respective SGVs/GAC, the soil that has been tested is deemed suitable for use in gardens (including growing edible plants) without the need for treatment or other remedial action. It should however be noted that samples have been taken from depths ranging from 0.2m to 1.2m below ground level. There has therefore been limited testing of shallow soils and very limited testing (if any) of topsoil across the site.
- 11.4.1.23 The investigation undertaken in the southern portion of the Application 1 site (on northern side of the railway line) by ST Consult included analytical testing of soil samples for a suite of inorganic and organic contaminants. The results were compared to SSVs for a commercial end use and no exceedances were recorded. On review of the results, the concentrations from the locations on the northern side of the railway line (i.e. within the Site boundary) all the results were below the SSVs for a residential with plant uptake scenario.
- 11.4.1.24 All the samples from the ST Consult investigation and two from the Hyder investigation were screened for Asbestos. No fibres or asbestos containing materials (ACM) were recorded.
- 11.4.1.25 Based on the information available to date, the risks posed to human health (i.e. site end users) are considered to be low.
- 11.4.1.26 It should be noted that the investigation undertaken to date, only provides limited spatial coverage due to access constraints at the time of the works.
- 11.4.1.27 During site construction works, site workers should remain vigilant to the possible risk of encountering localised “unforeseen” areas of contaminated soils. Should potentially contaminated soil be encountered, further testing would be required to assess the risks to the health and safety of site workers, site end users and other sensitive receptors. All persons engaged in site construction works should be made aware of the findings of the intrusive investigation and the hazards associated with handling potentially contaminated materials. It is recommended that all works are conducted in accordance with the Health and Safety Executive publication entitled “Protection of Workers and the General Public during the Development of Contaminated Land” (Ref 11-13).

Gas Risk Assessment

- 11.4.1.28 Gas monitoring was undertaken during the Hyder (3 rounds) and ST Consult investigations (3 rounds).

- 11.4.1.29 From the Hyder investigation, two boreholes BH3 and BH5 are considered. BH3 is located on the northern side of the railway line at the southern boundary of the site. BH5 is located within an area known as the Exemplar site but is located adjacent to the northern boundary and therefore the data from this borehole has also been considered within this assessment.
- 11.4.1.30 From the ST Consult investigation, one monitoring well BH4 is located within the Site area, however all the results are considered as monitoring is undertaken with landfill material located to the south of the site. This could pose a risk to end users within the Application 1 site area from migration of gases on to site.
- 11.4.1.31 In line with current guidance, Gas Screening Values (GSV) for methane and carbon dioxide have been calculated.
- 11.4.1.32 Based on the concentrations recorded during the monitoring undertaken by Hyder the highest GSV are; Methane 0.0003l/h (BH5) and Carbon Dioxide 0.011l/h (BH5).
- 11.4.1.33 From the ST Consult information, the gas concentrations and flow rate recorded in BH4 (on site) are below the limit of detection (<0.1% v). BH1 and BH2 which are located on the opposite side of the railway line recorded below limit of detection with regards to methane, however carbon dioxide with a maximum of 2% v was recorded in BH2. This indicates that some gas may be migrating from the landfill site towards the Site Area. When considering all the gas monitoring undertaken including the wells within the landfill material, the worst case GSV for carbon dioxide is 0.12l/h (WSL4 within fill material).
- 11.4.1.34 The results of the gas monitoring indicate a NHBC Green Scenario (low risk) in relation of ground gases for the Development.
- 11.4.1.35 Further monitoring across the site may be required to ensure that there is no variation across the Development.
- 11.4.1.36 With regards to radon, a detailed BR 211 Radon Report was obtained from the British Geological Survey (BGS) as part of the Desk Study (Appendix 11A) and states that the estimated probability of a property being above the Action Level for radon is 3-5% and therefore basic radon protection measures are required in the construction of new properties for the site.

Controlled Water Risk Assessment

- 11.4.1.37 During the Hyder investigation, three water samples taken from the boreholes (BH1, BH3 and BH5) across the Site Area or in close proximity were analysed predominantly for metal contaminants. All the results were below the Water Quality Standards (WQS) values. Further information on the WQS values used can be found in the Hyder interpretative report (Appendix 11B).
- 11.4.1.38 Groundwater was taken from seven wells during the ST Consult investigation and screened for inorganic and organic contaminants. Generally the results were below the appropriate WQS, however slight exceedances were encountered for some metal contaminants against the screening values. For example BH4 which is located within the Site indicated slightly elevated

selenium and lead, but only a natural sequence was observed during drilling. This may indicate naturally higher concentrations or that there is impact on an off-site location.

11.4.1.39 Whilst some slight exceedances have been recorded, it is unlikely that remedial action with regards to groundwater would be required.

11.4.2 Future Baseline

11.4.2.1 In the absence of the Development, the future use of the Site is likely to stay in agricultural use. Based upon this assumption, it is considered that existing ground conditions, and low levels of contamination would remain at the Site.

11.4.2.2 The low levels of contamination encountered on the site are likely to be from natural sources and therefore the land quality is not likely to deteriorate if no development was constructed.

11.5 Design and Mitigation

11.5.1 Construction Approach and Mitigation of Short-Term Construction Effects

11.5.1.1 The remedial works required for the mitigation of impacts to the proposed future Site users and controlled waters would be completed during the construction phase of the Development. The main potential contamination impacts relating to the construction phase are considered to be:

- Impacts to construction workers;
- Impacts to the environment from the construction works;
- Impacts to adjacent people, properties and roads from the remedial and construction works.

11.5.1.2 The necessary mitigation measures to be incorporated within the construction phase are outlined below.

Mitigation of Contamination Impacts to Construction Workers

11.5.1.3 The potential impacts to construction workers from contaminants in soils and groundwater would be mitigated through the adoption of appropriate health and safety practices, as outlined in the Code of Construction Practice (CoCP). This would be set out in the CEMP.

11.5.1.4 All persons engaged in Site construction works would be made aware of the findings of the intrusive investigations and the hazards associated with handling potentially contaminated materials. All works would be conducted in accordance with the Health and Safety Executive publication entitled "Protection of Workers and the General Public during the Development of Contaminated Land", 1991.

11.5.1.5 Whilst no asbestos has been encountered, the procedures relating to asbestos outlined within the CoCP would be adhered to by construction workers with regard to the potential presence of asbestos within excavated earthworks

materials. Suitable Personal Protective Equipment (PPE) including Respiratory Protective Equipment (RPE) if necessary would be made available for use if suspected asbestos contaminating materials are encountered during the Site works.

- 11.5.1.6 Where any hazardous chemicals are used in the construction works, risk assessments would be made under The Control of Substances Hazardous to Health Regulations (as amended) (Ref 11-14).
- 11.5.1.7 The procedures relating to the monitoring of excavation works and the identification of any suspected further contamination defined within the CoCP would be adhered to. Site workers would remain vigilant to the possible risk of encountering isolated areas of contaminated material, particularly if unusual visual changes, or odours are encountered.
- 11.5.1.8 The main contractor would be required to develop contingency plans in the Construction and Environmental Plan (CEMP) to minimise accidental exposure to human and environmental receptors from unexpected hazards.
- 11.5.1.9 A Materials Management Plan would be produced detailing the strategy for re-use of soils within the Development. This would follow the approach within the CL:AIRE Development Industry Code of Practice (Ref 11-15).
- 11.5.1.10 An experienced environmental engineer would be available to attend site and undertake inspection and supervision of contingency events and subsequent actions. This would allow quick identification of potential hazards, direction of quarantine and call-off actions and sampling and testing of potentially hazardous materials. Specialist services would be called upon for further investigation and remedial actions, as necessary.

Mitigation of Contamination Impacts to the Environment, Adjacent People and Properties from the Construction Works

- 11.5.1.11 Suitable measures to mitigate the contamination impacts during the construction works are outlined below. The mitigation of construction related impacts to surface water are detailed in Chapter 7 of this ES. The following mitigation methods would be employed:
 - Prevention of water entering excavations, where possible;
 - Planned and phased topsoil stripping, excavation and stockpiling operations to ensure minimal disturbance;
 - Use of measures such as cut off ditches, silt fences or impermeable membranes to prevent uncontrolled release of runoff from excavations or exposed ground;
 - Appropriate disposal of waste from the Site;
 - Appropriate storage of potentially polluting materials and chemicals in accordance with the Control of Pollution (Oil Storage) Regulations (England) 2001 (Ref 11-16);
 - Adequate supervision of all deliveries and refuelling involving potentially polluting substances;

- Delivery and refuelling areas to be located away from surface water bodies with adequate measures in place to contain spillages at these locations;
- Leaks or spillages of potentially polluting substances to be contained, collected then removed from Site in an appropriate manner e.g. use of absorbent material, bunding or booms. An emergency action plan would be formulated which all Site personnel would have read and understood;
- Storage of machinery and equipment to be located away from surface water bodies. Drip trays to be placed underneath any parts where oil/fuel may be found;
- Use of adequate wheel wash facilities to contain and dispose of potentially polluted runoff;
- Regular washing of machinery and access roads and dampening to reduce dust emissions with appropriate collection and disposal of runoff;
- Use of pre-mixed concrete from an off-site source or limiting mixing and handling of wet concrete to a designated area away from surface water bodies and with controlled runoff for appropriate disposal;
- Should areas of contamination be identified measures would be taken to ensure that contaminated material is isolated. All equipment utilised within the contaminated area would be thoroughly cleaned before it is used outside the contaminated area;
- Special measures would be adopted during drilling of boreholes and during piling to ensure that preferential pathways are not created;
- All construction works would be carried out in accordance with PPG 6 'Working at Construction and Demolition Sites' (Ref 11-17) and other relevant PPG documents (Refs 11-18 to 11-25);
- Secure access to the Site for construction personnel only to prevent vandalism

11.5.2 Scheme Design and Mitigation of Permanent Operational Effects

Future Site Users

- 11.5.2.1 The impacts to future Site users would be mitigated by the remedial measures (if deemed necessary) that are implemented.
- 11.5.2.2 The impacts to future Site users within buildings would be mitigated by the incorporation of appropriate ground gas protection measures (if required beyond those to mitigate the risk from Radon gas) within the building design and construction, in accordance with CIRIA C665 and BS8485.
- 11.5.2.3 As part of the further detailed contaminated land investigations and assessments to be completed ahead of each development phase, installation of additional ground gas monitoring locations and further ground gas monitoring would be completed. This would provide an acceptable ground gas dataset to allow a comprehensive ground gas risk assessment to be completed. The findings of this assessment would confirm the suitability of the above listed

measures. The assessment and remedial measures would be controlled by relevant planning condition(s).

Controlled Waters

- 11.5.2.4 The impacts to controlled waters would be mitigated by the remedial measures (if deemed necessary) that are implemented.
- 11.5.2.5 Within the land proposed to be a cemetery, measures such as drainage design or specification for burials would be implemented to ensure that the risk to groundwater is mitigated. Prior to the design of the cemetery, further detailed ground investigations would be undertaken to determine the depth of groundwater (including seasonal variations) in this locality and discussions with the EA would be undertaken to ensure all requirements are met.

Buildings and Services

- 11.5.2.6 As methane concentrations within the explosive range (5-15% v/v in air) have not been detected during the ground gas monitoring completed to date, explosive ground gas is unlikely to impact upon the proposed buildings. Notwithstanding this, the impact from ground gas to proposed buildings would be mitigated by the incorporation of appropriate ground gas protection measures (if required) within the building design and construction to protect future Site users, subject to further monitoring and assessment.
- 11.5.2.7 As part of the further detailed contaminated land investigations and assessments to be completed ahead of each development phase, installation of additional ground gas monitoring locations and further ground gas monitoring would be completed to provide an acceptable ground gas dataset. This would allow a comprehensive ground gas risk assessment to be completed. The findings of this assessment would confirm whether proposed buildings require gas mitigation measures.
- 11.5.2.8 Appropriate assessment of potential risks to new water supply pipes would be completed to ensure appropriate pipe material is used within the Development. This would be controlled by relevant planning condition(s).

11.6 Construction Impacts

- 11.6.1.1 Provided that the mitigation measures outlined above and in the remedial strategy documents are followed, the likely construction impacts are detailed below.
- 11.6.1.2 The impacts on construction workers include potential chronic damage via dermal, ingestion and inhalation exposure to contamination. Construction workers are considered to be of high importance and assuming the mitigation measures are adopted, it is considered that this would result in a negligible adverse change to human health. The impact significance has been assessed as **temporary slight adverse**.
- 11.6.1.3 The impacts to adjacent site users include potential chronic damage to contamination via ingestion and inhalation of air-borne dust exposure. This could be through site activities and transportation of material off site. The main

adjacent site users are considered to be residential receptors which are considered to have a very high importance. Assuming the mitigation measures are adopted it is considered that this would result in a negligible adverse changes to human health. The impact significance has been assessed as **temporary slight adverse**.

- 11.6.1.4 Whilst low levels of contamination have been encountered on site, construction activities could result in the mobilisation of contaminants within the soil and create pathways for contaminants to migrate into the underlying groundwater or surface water. These receptors would also be at risk from general construction activities such as re-fuelling of vehicles, use of chemicals and hydrocarbons on site, stockpiling and excavation of soils. The groundwater is designated a Secondary A aquifer and is given a high importance. Assuming the mitigation measures are implemented, it is considered that this could result in a negligible adverse change in water quality. The impact significance has been assessed as **temporary slight adverse**.

11.6.2 Overview

- 11.6.2.1 As detailed above assuming that the mitigation measures are adopted during the construction phase, the impact significance has been assessed as **temporary slight adverse** for identified receptors.

11.7 Permanent Operational Impacts

- 11.7.1.1 The development mainly comprises of residential housing and therefore once developed the site end users (i.e. residents) would come into contact with soils and therefore there is the potential for chronic damage via exposure to contamination via accidental ingestion, dermal contact or inhalation of dust. Based on the information to date, low levels of contaminants have been encountered on site and if contamination was encountered in other previously uninvestigated area remedial measures would be implemented.
- 11.7.1.2 Residents are considered to have very high importance and assuming mitigation measures are adopted this would results in a negligible adverse change to human health. The impact significance has been assessed as **permanent slight adverse**.
- 11.7.1.3 Based on the gas monitoring information to date, there is the potential for low levels of gases in particular carbon dioxide to migrate from the landfill site to the south of Application 1. Site end users could be at risk from gases migrating on to site and accumulating within confined spaces in properties leading to asphyxiation. Site end users (residents) are considered to have a very high importance and assuming that appropriate mitigation measures are implemented (ie installation of suitable gas protection measures) this would result in a negligible adverse change to human health. The impact significance has been assessed as **permanent slight adverse**.
- 11.7.1.4 A small proportion of the site is likely to be developed for retail / leisure activities. During operation, there is the potential risk from accidental spillages of contaminating materials such as fuel, oil and chemicals. These areas are likely to be covered by hardstanding with appropriate drainage which would

protect the underlying soils and water receptors. Groundwater is considered to be of high importance and assuming design and mitigation measures are adopted this would result in a negligible adverse change to water quality. The impact significance has been assessed as **permanent slight adverse**.

- 11.7.1.5 A small area within the Application 1 boundary is proposed to be a cemetery. During the operation of this, there is a risk that contaminants (associated with decomposition of bodies) would enter the underlying groundwater. Based on the information to date a high vulnerability risk rating has been determined. The groundwater in the area is considered to be of high importance and assuming design and mitigation measures are adopted this would result in a negligible adverse change to water quality. The impact significance has been assessed as **permanent slight adverse**.

11.8 Cumulative Impacts

- 11.8.1.1 Off-site impacts would be limited through the mitigation described above and disposal of contaminated and uncontaminated soils to landfill would be avoided by the proposed remedial works or materials management plans. Therefore, provided that the requirements of the relevant policy and legislation relating to land contamination and remediation are adopted in design and appropriate mitigation measures are applied, it is considered that there would be no significant cumulative impacts.

11.9 Summary

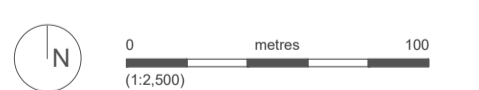
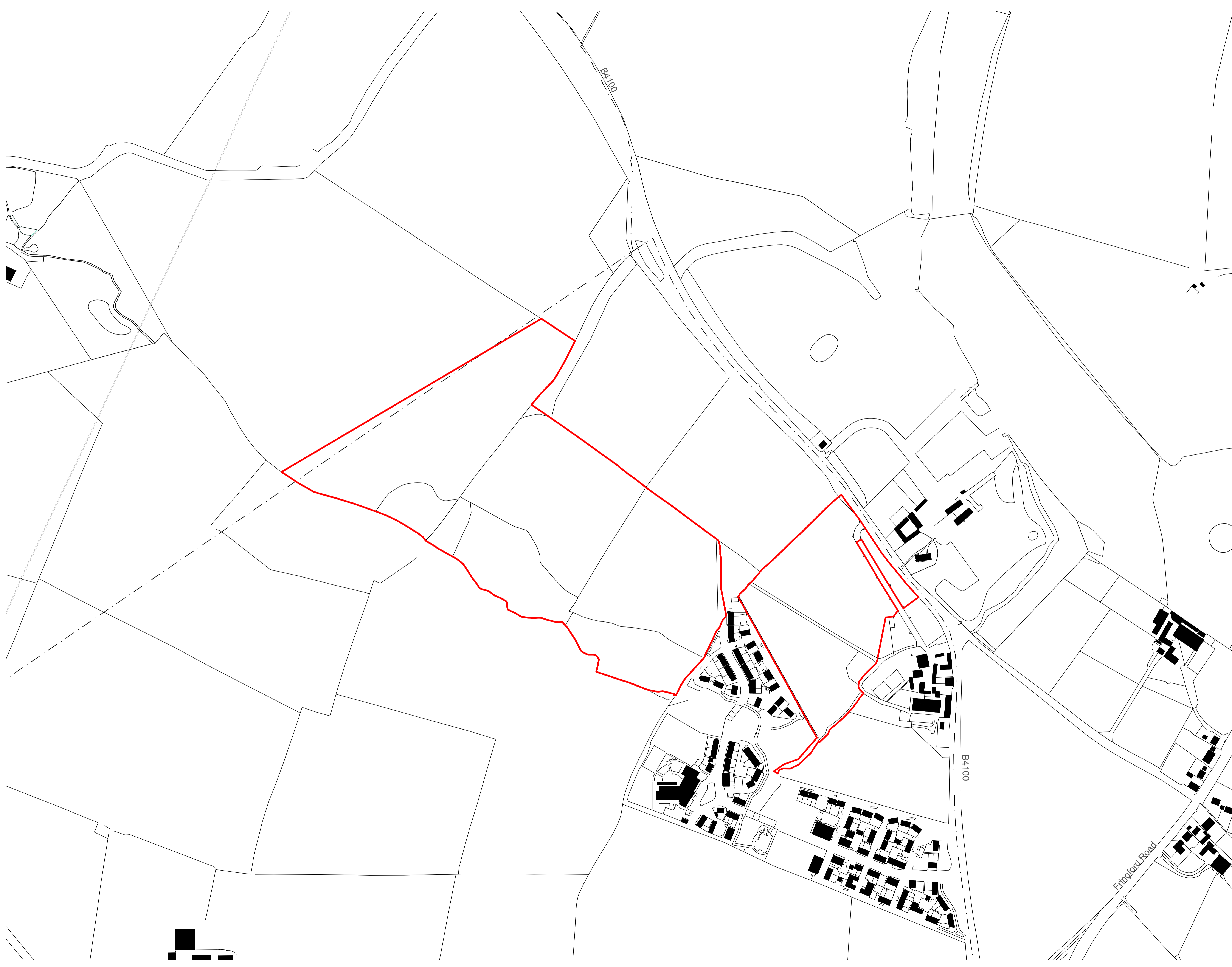
- 11.9.1.1 The study area for the contaminated land assessment is defined by the red line boundary for Application 1, however consideration is given to activities within 500m of the boundary e.g. landfill site which may have an impact on the Development.
- 11.9.1.2 The assessment of the potential for adverse environmental impact that could be associated with chemical contamination has been undertaken in accordance with The Statutory Guidance on Part IIA of the Environmental Protection Act 1990 (EPA 1990) as set out in Defra Circular 2012; The Environment Agency's Model Procedures for the Management of Land Contamination (Contaminated Land Report (CLR) 11) and other relevant supporting guidance.
- 11.9.1.3 Receptors identified as part of this study are:
- Human health (construction workers, site end users)
 - Controlled waters (groundwater and surface water)
 - Buildings and services
- 11.9.1.4 Since the earliest available historical map of 1881 to the present day, the site has been dominated by agricultural activity. A quarry is located on the southern side of Bucknell Road. On the 1922 edition, the Great Western Railway is present defining the southern boundary. In 1923 limekilns, quarry and pumping station are shown on southern side of railway line. These are no longer present in 1970 and are later developed into Avonbury Business Park.

- 11.9.1.5 From published BGS geological maps, the geology across the site is underlain by a thin cover of superficial deposits over Combrash Formation and Forest Marble Formation. This sequence was generally confirmed by the investigation work undertaken by Hyder and ST Consult.
- 11.9.1.6 The solid geology is designated as Secondary A aquifer, whilst the superficial deposits are not designated. The site is not located within a Source Protection Zone (SPZ).
- 11.9.1.7 A historic landfill is recorded as present on the Site at Gowell Farm approximately 100m to the south of the site boundary. This is currently part of Avonbury Business Park. The ST Consult investigation included drilling in the landfill area where Made Ground was encountered to a maximum depth of 3m (WSL3) in the area of the infilled Lime Kiln.
- 11.9.1.8 During the investigations undertaken by Hyder and ST Consult, soil samples were taken and analysed for a suite of contaminants. There was only one Arsenic which was slightly above the guideline value for a residential end use.
- 11.9.1.9 The results of the preliminary gas monitoring indicate a NHBC Green Scenario (low risk) in relation of ground gases for the Development.
- 11.9.1.10 Generally the groundwater results were below the appropriate WQS, however slight exceedances were encountered for some metal (selenium, lead) contaminants against the screening values. Whilst some slight exceedances have been recorded, it is unlikely that remedial action with regards to groundwater would be required.
- 11.9.1.11 Assuming that the proposed mitigation measures are adopted during the construction phase, the impact significance has been assessed as **temporary slight adverse** for identified receptors.
- 11.9.1.12 Assuming that the proposed mitigation measures are adopted during the operational phase, the impact significance has been assessed as **permanent slight adverse** for identified receptors.

Table 11-6 Contaminated Land Impact Summary Table

Impact description	Temporary/Permanent	Significance rating
Damage to health of construction workers through dermal / ingestion and inhalation exposure to contamination during construction	Temporary	Slight Adverse
Damage to health of adjacent and new site users through ingestion of dust and inhalation exposure to contamination during construction.	Temporary	Slight Adverse
Potential mobilisation of	Temporary	Slight Adverse

contamination into groundwater during construction via excavation, spillages etc		
Damage to health of new site users through demal / ingestion and inhalation exposure to contamination	Permanent	Slight Adverse
Damage to health of new site users from ground gases.	Permanent	Slight Adverse
Accidental Spillages during use of retail activities	Permanent	Slight Adverse
Contaminants entering the groundwater from the use as a cemetery	Permanent	Slight Adverse



— Site boundary 22.31ha

Project
Land at North West Bicester

Drawing Title
Location Plan

Date	Scale	Drawn by	Check by
10/11/2020	1:2,500 at A1	ML	LA
Project No	Drawing No	Revision	
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a2dominion

Bicester Eco Development

Application 1 (North of Railway)

Cultural Heritage Desk-Based Assessment



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a2dominion

Bicester Eco Development

Application 1 (North of Railway)

Cultural Heritage Desk-Based Assessment

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Report No

Date July 2014

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1 SUMMARY

- 1.1.1 There are two heritage assets recorded on the Oxfordshire HER within the Site. In addition there are a further thirteen heritage assets within the 500m study area and four of these are listed buildings. The assets within the Site comprise a crop mark (2) and geophysical anomalies (4) representing various enclosures and are likely to indicate late prehistoric or Roman settlement. This is supported by archaeological evaluation which provided dating evidence for these features, dating them to the Roman period.
- 1.1.2 In addition to this further archaeological work indicated various concentrations of archaeological features within the Site. There is an area of possible Bronze Age ritual activity in the eastern part of the Site, three small areas of early – middle Iron Age activity, probably indicating dispersed use of the landscape in the form of small farmsteads, and another small area of Roman activity, probably indicating a small outlying farmstead.
- 1.1.3 In addition to this evidence of medieval and post medieval agriculture, in the form of ridge and furrow field systems and field boundaries was recorded by further work within the Site. These indicate the longevity of arable agriculture within the Site and there are likely to be further buried features relating to this activity. The disturbance of the subsurface caused by arable agriculture over an extended period of time may have truncated or completely removed some evidence of preceding archaeological features.
- 1.1.4 The listed buildings are located in Bucknell and Caversfield. Those in Bucknell would not be impacted by the Development but the Development would have a negative impact on the settings of the buildings in Caversfield, although it would not have any physical impact on them.

2 Introduction

2.1 Background

- 2.1.1 Hyder Consulting (UK) Limited has been commissioned by A2Dominion to produce an Environmental Impact Assessment, of which this Cultural Heritage Desk-Based Assessment forms part, for the proposed North West Bicester Eco Development. The Masterplan Development Area covers an area of 406 hectares (ha) to the north west of Bicester and will be subject to three separate planning applications.
- 2.1.2 This Desk-Based Assessment has been produced in support of the planning application and Environmental Impact Assessment for Application 1 (North of Railway). This Desk-based Assessment will also form a technical appendix of the Environmental Statement produced as part of the Environmental Impact Assessment.
- 2.1.3 The other two applications will be for areas known as Application 2 (South of Railway) and A4095 NW Strategic Link Road. These will be subject to separate Desk-Based Assessments and planning applications (Hyder Consulting Ltd 2014a; 2014b). A separate planning application and Environmental Statement, including a Desk-Based Assessment (Hyder Consulting Ltd 2010a; 2010b), and associated archaeological fieldwork (Air Photo Services 2010b; Oxford Archaeology 2010) was submitted in 2010 for the Exemplar Site, located in the north eastern corner of the North West Bicester development.
- 2.1.4 Figure 1 shows the location of the North West Bicester development and the application boundaries for the Exemplar Site, Application 1 (North of Railway), Application 2 (South of Railway) and A4095 NW Strategic Link Road.
- 2.1.5 The details of the development at Application 1 (North of Railway) at the time of the production of this Desk-Based Assessment comprise development of some 155ha of land to the north west of Bicester to provide for residential led development. This would comprise approximately 2600 residential dwellings, commercial floor space, leisure, social and community facilities, a primary school, extra care housing, water treatment plant and energy centre, amenity space and service infrastructure.

2.2 The Site Location and Land Use

- 2.2.1 The Site is located on the north west edge of Bicester, bounded to the south west by the railway line and to the south east by the A4095, Howes Lane. To the north west of the site are open fields and the village of Bucknell and to the north east of the site is the village of Caversfield. The Site is irregular in plan and covers an area of approximately 155ha centred upon NGR 457200 224800. At present the Site comprises open fields, small areas of woodland and two farm complexes, Hawkwell Farm and Lord's Farm.

2.3 Geology and Topography

- 2.3.1 The Site is underlain by various formations and members of the Great Oolite Group, of Mid-Jurassic age, which are dominated by limestones with subordinate mudstone beds. The majority of the Site is covered by the Cornbrash Formation which forms a broad south-east sloping plateau. It comprises about 3m thick grey to brown bioclastic shelly rubbly-bedded limestone with thin subordinate beds of grey mudstone (British Geological Survey Online Map Viewer, accessed June 2014).

- 2.3.2 There is a narrow outcrop of Forest Marble Formation, which forms a narrow outcrop on the flank of several small stream valleys, across the southern, eastern and northern sections of the Site. This is a greenish grey silicate mudstone (*ibid.*).
- 2.3.3 The streams in the southern and eastern areas of the Site are flanked by a narrow tract of alluvium of late Quaternary age, comprising sandy silty calcareous clay overlying gravelly sandy silty clay, with limestone clasts. The alluvial deposits are generally between 1 – 2m in thickness (rarely exceeding 3m in thickness). They may locally include highly compressible, organic-rich (peaty) layers (*ibid.*).
- 2.3.4 The topography of the Site is generally flat with heights ranging between 80 and 95m OD.

2.4 Aims and Objectives

- 2.4.1 The aim of this Desk-Based Assessment is to assess the archaeological and built heritage resource within a pre-defined study area centred on the Site. This was achieved through the collation and analysis of available written, cartographic, photographic and electronic information within the public domain.
- 2.4.2 The assessment objectives were:
- To identify known designated and undesignated heritage assets within the Site and surrounding study area
 - To assess the significance of those identified heritage assets (including archaeological remains and built heritage)
 - To determine the potential impact of the Development upon the significance of those identified heritage assets
 - To identify the potential for unknown and buried archaeological remains, their likely significance and the possible impact of the Development upon them
 - To assess the impact of any previous intrusive activities within the Site upon the known and potential heritage resource
 - To determine the necessity for any further investigative works and implement a programme of appropriate fieldwork in response to this
 - To formulate a mitigation strategy, if appropriate.

3 Methodology

3.1 Study Area

- 3.1.1 For the purpose of this assessment a study area extending up to and including 500m from the Site boundary has been defined. This was set out in the scoping report (500) and was based on a search of the Oxfordshire Historic Environment Record (HER), the National Monuments Record (NMR) and a selection of historic maps and unpublished sources. Where specific heritage assets have been identified outside of these study areas but consultation or other research have demonstrated that they are relevant they have been included in this assessment (Figure 1 and 2).

3.2 Consultation

The Planning Archaeologist for Oxfordshire County Council, Richard Oram, has been consulted at all stages of this project starting in 2010. He issued briefs for geophysical survey and archaeological evaluation and conducted monitoring visits during the evaluation phase. Consultation was also carried out prior to the production of this desk-based assessment in 2014 and it was advised that an updated search of the HER should be undertaken.

The Conservation Officer at Cherwell District Council has also been consulted regarding the built heritage. In discussion relating to the Exemplar Site they had no concerns with any undesignated built heritage and confirmed that including the listed buildings in the assessment would be sufficient. No specific comment was received from the Conservation Officer in relation to this application so the comments on the Exemplar Site have been taken as an example of their opinion.

English Heritage only require that they are consulted when a development affects the setting of a Grade I or Grade II* listed building, a Grade I or II* registered park or garden or the site of a scheduled monument (<https://www.english-heritage.org.uk/professional/advice/our-planning-role/consent/planning-permission/>). Due to the lack of registered parks and gardens, scheduled monuments and Grade I listed buildings English Heritage were not consulted during the production of this desk-based assessment.

3.3 The Site Walkover

- 3.3.1 A site visit was undertaken on 2nd September 2010 in addition further visits were made to the site during the archaeological evaluation carried out between August and October 2013. The objectives of the site visit were to:
- Assess and describe the current ground conditions within the Site
 - Identify evidence and / or potential for the survival of buried archaeological remains within the Site
 - Confirm the presence, location and condition of known above ground remains
 - Identify any unknown above ground heritage assets not recorded elsewhere
 - Identify any areas where previous modern activities may already have impacted upon known and / or potential heritage assets
 - Consider the potential impact of the Development upon built and buried heritage assets within the study area

3.4 Sources

3.4.1 A variety of sources were consulted to obtain information for analysis during the preparation of this assessment. They included:

- The Oxfordshire HER for sites and events data (July 2010 and March 2014)
- The NMR for information on listed buildings and additional heritage assets (July 2010)
- The English Heritage National Heritage List, for current information on designated sites within the study area (May 2014)
- The English Heritage Archive (EHA), for additional sites and events data (May 2014)
- Landmark Information Group®, for historic OS mapping (July 2010)
- The British Geological Survey website, for information on the prevailing geological conditions within the vicinity of the Site (May 2014)
- Oxfordshire Record Office, for supplementary information on the known archaeological and historical background of the study areas, historic mapping (including tithe and enclosure maps), and any other useful information (grey literature etc.) relating to the historic environment in these areas (September 2010)
- Oxfordshire County Council and Cherwell District Council websites, for planning policy information (May 2014)

3.4.2 All identified assets within the masterplan area have been numbered sequentially and are referenced in bold type within the text. All identified assets within the Site and study area for Application 1 (North of Railway) are presented in a gazetteer within Appendix 1 and displayed on Figure 2. Where designated assets – scheduled monuments and listed buildings – are present they are prefixed by **SM** and **LB** respectively. Undesignated heritage assets are not prefixed.

4 Regulation and Policy

- 4.1.1 This assessment has been undertaken in accordance with current legislation, national and local plans and policies. Relevant legislation, policy and guidance are outlined below.

4.2 Legislation

- 4.2.1 The relevant parliamentary act which provides the legislative framework for development and archaeology is the Town and Country Planning Act 1990. This assessment has also taken into account the Planning (Listed Buildings and Conservation Areas) Act 1990 and the Ancient Monuments and Archaeological Areas Act 1979.
- 4.2.2 National policy relating to the archaeological resource is outlined in the National Planning Policy Framework (NPPF) which was enacted in 2012.

Planning (Listed Buildings and Conservation Areas) Act 1990

- 4.2.3 The Planning (Listed Buildings and Conservation Areas) Act 1990 applies special protection to buildings and areas of special architectural or historic interest.
- 4.2.4 Section 66 (1) of the act states that “*In considering whether to grant planning permission for development which affects a listed building or its setting, the local planning authority or, as the case may be, the Secretary of State shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses*”.

Ancient Monuments and Archaeological Areas Act 1979

- 4.2.5 The Ancient Monuments and Archaeological Areas Act 1979 gives statutory protection to any structure, building or work which is considered to be of particular historic or archaeological interest and regulates any activities which may affect such areas. Under the Act any work that is carried out on a Scheduled Ancient Monument must first obtain Scheduled Monument consent.
- 4.2.6 Scheduled Ancient Monuments and their setting are a material consideration in the NPPF.

4.3 Policy

National Planning Policy Framework (NPPF)

- 4.3.1 The NPPF sets out Government planning policies for England and how these are expected to be applied. The NPPF provides a framework within which local and neighbourhood plans can be produced. Planning law requires that applications for planning permission must be determined in accordance with the development plan. The NPPF must be taken into account in the preparation of local and neighbourhood plans, and is a material consideration in planning decisions.
- 4.3.2 Section 12 of the NPPF ‘Conserving and Enhancing the Historic Environment’ contains the government’s policies relating to the historic environment.
- 4.3.3 Paragraph 126 states that local planning authorities should set out in their Local Plan a positive strategy for the conservation and enjoyment of the historic environment. In doing so they should

recognise that heritage assets are an irreplaceable resource and conserve them in a manner appropriate to their significance.

- 4.3.4 Paragraph 128 states that in determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum the relevant historic environment record should have been consulted and the heritage assets assessed using appropriate expertise where necessary. Where a site on which development is proposed includes or has the potential to include heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate Desk-Based Assessment and, where necessary, a field evaluation.
- 4.3.5 Paragraph 129 states that local planning authorities should identify and assess the particular significance of any heritage asset that may be affected by a proposal (including development affecting the setting of a heritage asset). They should take this assessment into account when considering the impact of a proposal on a heritage asset, to avoid or minimise conflict between the heritage asset's conservation and any aspect of the proposal.
- 4.3.6 Paragraph 135 states that the effect of an application on the significance of an undesignated heritage asset should be taken into account in determining the application. In weighing applications that affect directly or indirectly undesignated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.
- 4.3.7 Paragraph 136 states that local planning authorities should not permit the loss of the whole or part of a heritage asset, without taking all reasonable steps to ensure that the new development will proceed after the loss has occurred.
- 4.3.8 Paragraph 139 states that undesignated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments are to be considered subject to the same policies as designated heritage assets.
- 4.3.9 Paragraph 141 states, in part, that local planning authorities should require developers to record and advance understanding of the significance of any heritage assets to be lost, whether wholly or in part in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible, in the relevant HER or local museum.

Planning Policy Statement: Eco-towns

- 4.3.10 Planning Policy Statements (PPS) set out the Government's national policies on different aspects of spatial planning in England, although most of these have now been replaced by the NPPF. The PPS on eco-towns, formerly a supplement of PPS1, has not been replaced and is therefore still applicable to this assessment.
- 4.3.11 The PPS sets out a range of Eco-town targets. ET15 deals with landscape and historic environment. It states:
- 4.3.12 *"Planning applications for eco-towns should demonstrate that they have adequately considered the implications for the local landscape and historic environment. This evidence, in particular that gained from landscape character assessments and historic landscape characterisation should be used to ensure that development complements and enhances the existing landscape character. Furthermore, evidence contained in relevant Historic Environment Records, should be used to assess the extent, significance and condition of known heritage assets (and the potential for the discovery of unknown heritage assets) and the contribution that they may make*

to the eco-town and surrounding area. Eco-town proposals should set out measures to conserve and, where appropriate, enhance heritage both assets and their settings through the proposed development.”

Cherwell Local Plan

- 4.3.13 Current planning policy from Cherwell District Council comprises the Cherwell Adopted Local Plan 1996 and the Non-Statutory Cherwell Local Plan 2011. This latter document was in preparation when work was discontinued due to changes to the national planning system, but it has been approved as interim planning policy for development control purposes. Both of these documents are due to be replaced by the new Cherwell Local Plan (2006-2031). Both the saved policies of the Cherwell Adopted Local Plan 1996 and the Non-Statutory Cherwell Local Plan 2011 contain policies which are relevant to this assessment.
- 4.3.14 From the Cherwell Adopted Local Plan policy C20 states that *“special care will be taken to ensure that development which is situated within the setting of a listed building respects the architectural and historic character of the building and its setting”*.
- 4.3.15 Policy C25 states *“in considering proposals for development which would affect the site or setting of a Scheduled Ancient Monument, other nationally important archaeological sites and monuments of special local importance, the council will have regard to the desirability of maintaining its overall historic character, including its protection, enhancement and preservation where appropriate”*.
- 4.3.16 Paragraph 9.56 goes on to say that it must be acknowledged that the character and setting of an archaeological site or monument, which may include historic landscapes, parks and gardens, may be damaged or even destroyed by certain forms of development and in such cases policy C25 will apply.
- 4.3.17 From the Non-Statutory Cherwell Local Plan there are two policies of particular relevance. ENV47 states that *“the council will promote sustainability of the historic environment through conservation, protection and enhancement of the archaeological heritage and its interpretation and presentation to the public”*. It goes on to add that scheduled monuments and sites of national and regional importance and their settings will be preserved; sites, buildings, landscapes and their settings of archaeological interest will require assessment through a desk-top study and possibly field evaluation; and that development that would adversely affect archaeological remains must either preserve them in situ or provide other suitable mitigation.
- 4.3.18 Policy ENV44 states that *“special care will be taken to ensure that development that is situated within the setting of a listed building respects the architectural and historic character of the building and its setting”*.

4.4 Guidance

- 4.4.1 This Desk-Based Assessment was undertaken with regard to all relevant industry guidance, principally the ‘Code of Conduct’ and ‘Standards and Guidance for Archaeological Desk-Based Assessments’ (Institute for Archaeologists 2013; 2012) and *The Setting of Heritage Assets* (English Heritage 2011).

5 Walkover Survey

5.1 Introduction

- 5.1.1 A site walkover survey of the whole masterplan area for the North West Bicester Development was carried out on the 2nd September 2010 (Figure 5). This walkover survey included the Application 1 Site.
- 5.1.2 The Application 1 Site occupies an area of approximately 155ha, comprises several different farms and land use was split between arable and pasture. Across the Site it was observed that the topography was generally flat with the exception of a small hill in the fields in the north eastern part of the Site. As well as farmland the Site contains two complexes of farm buildings, Hawkwell Farm and Lord's Farm, in the centre and south east of the Site respectively. A railway line borders the Site to the south west and the Bicester to Bucknell road crosses the Site.
- 5.1.3 In order to facilitate ease of discussion for the purposes of the site visit the whole Masterplan Area has been divided into eight areas labelled A-H (Figure 5). Areas G and H are within the Application 1 Site and areas E and F border the Site. Only these areas will be discussed in this report as these are the area that are relevant to this report.

5.2 Area E

- 5.2.1 This area comprises Aldershot Farm to the south west of the Site, on the opposite side of the railway line. The farm is accessed via a long gravel drive leading from the A4095 adjacent to the railway line. The north eastern boundary of this area is formed by the railway line which is on an embankment. There is a bridle way which runs through this area along the drive, through one of the fields and into the adjacent farm.
- 5.2.2 Aldershot Farm is currently under pasture with horses being kept in all the fields. The topography of the area was generally flat and the fields were bounded by mature hedgerows (Plate 1). The farm buildings were located at the end of the drive, roughly in the centre of the farm and consisted of the main farmhouse and a complex of out buildings and stables surrounded by a paved yard. The farm buildings were separated from the surrounding fields by fences and hedges. No evidence for any archaeological remains was observed during the walkover and no activity which could impact any potential below ground remains was evident in any of the fields in this area.

5.3 Area F

- 5.3.1 This area is adjacent to Area E and borders the Site to the south west on the other side of the railway line. It comprises part of Crowmarsh Farm. The farm buildings themselves are located outside the Masterplan Area to the north west. For the purposes of the site walkover this area was accessed via the bridleway leading from Area E but there is also an access track leading from the north to the farm buildings.
- 5.3.2 At the time of the site visit the fields were under arable cultivation and were in the process of being harvested. Therefore the walkover was confined to the bridle way and farm access track for safety reasons. All of the fields in this area were relatively flat and there was no evidence of any archaeological activity or any modern disturbance which may have impacted upon any possible below ground archaeological remains.



Plate 1: Example field at Aldershot Farm in Area E

5.4 Area G

- 5.4.1 Area G comprises the majority of the Site and includes Lord's Farm, Hawkwell Farm and a small light industrial unit. The light industrial unit is located adjacent to the farm buildings of Lord's Farm, is accessed from the A4095 and comprises some modern metal agricultural buildings set within a concrete yard. In addition to the light industrial unit there are two complexes of farm buildings in this area, Lord's Farm which is immediately adjacent to the A4095 and Hawkwell Farm which is accessed via a track leading off the road from Bicester to Bucknell. The rest of this area is farm land with a mix of arable and pasture land (Plate 2).



Plate 2: Example field at Hawkwell Farm in Area G

5.5 Area H

- 5.5.1 Area H comprises two separate fields on the northern boundary of the Site. One of the fields is triangular in shape and is located adjacent to Bucknell Road. The other field is located adjacent to the Exemplar Site. It was not possible to access either of these fields for the purposes of the walkover. Therefore the field adjacent to Bucknell Road was viewed from a gateway. The field adjacent to the Exemplar Site was viewed from Area G. Both fields were under crop at the time of the walkover and no evidence of any archaeological activity or modern disturbance was observed.

6 Archaeological, Historical and Historic Landscape Background

- 6.1.1 The following presents information about the known designated and undesignated heritage assets within the study area. All heritage assets within the study area are listed in Appendix 1 and the assets discussed are shown on Figure 2.

6.2 Designated Assets

- 6.2.1 There are no scheduled monuments, world heritage sites, registered parks and gardens or registered battlefields within the study area. There are four listed buildings, two in Caversfield and two in Bucknell, located to the north east and north west of the Site respectively. They are discussed in detail in the built heritage section below.

6.3 Prehistoric Period (30,000 BC – AD 43)

- 6.3.1 The earliest archaeological evidence within the study area is a Mesolithic (c. 9600 – 4000 BC) gully with possible post holes and associated artefacts (6). This was recovered from the area of the former Slade Farm to the south east of the Site. The next clear evidence for human activity dates to the Iron Age (c. 800 BC – AD 43) and comprises a settlement consisting of a ring ditch, boundary ditch, oven and pit (13). This is also located in the area of the former Slade Farm. The only recorded assets within Site itself are also prehistoric. In the centre of the Site are anomalies identified by geophysical survey (4). The anomalies are sub-rectangular and sub-circular ditched enclosures, curvilinear ditches and pits that are likely to date to the later prehistoric or Roman periods. This survey also identified a trackway or driveway of uncertain date. In addition in the same area a crop mark of a rectilinear enclosure (2) was recorded. It is likely that this feature was also one of the anomalies recorded by the geophysical survey.
- 6.3.2 There is a possible ring ditch (16) located east of Caversfield of unknown date. However, features of this type are most likely to date to the Bronze or Iron Ages (c. 2200 BC – AD 43). A ring ditch could indicate a round barrow, a funerary monument that were usually constructed over an inhumation burial or cremation, or a round house depending on the size but as these details were not available for this asset it is not possible to be more specific.
- 6.3.3 These assets indicate primarily later prehistoric activity in the study area, with an area of more intensive activity in the centre of the Site indicated by the geophysical anomalies.

6.4 Roman Period (AD 43 – AD 410)

- 6.4.1 There is one heritage asset dating to the Roman period in the study area. This is located south east of the Site, south west of South Farm, and comprises enclosures, including a rectangular enclosure, and associated finds (11). This is likely to be associated with a Romano-British settlement and may indicate either settlement or agricultural activity.
- 6.4.2 There was a more substantial Roman settlement approximately 1 mile to the south of the centre of modern Bicester. The town, Alchester, was occupied from AD 43 to the 5th century when the site became increasingly waterlogged and was eventually abandoned. There was initially a Marching Camp surrounded by a defensive ditch and whilst the fort was in operation a civilian settlement grew up outside it. The fort was abandoned in the mid A.D. 60's but the settlement continued to expand as an administrative and market focus in the area. Temples and several

stone buildings have been identified within the town and a stone town wall was built in the 2nd century (www.blhs.org.uk).

- 6.4.3 This indicates evidence for Roman activity within the study area. The presence of a settlement in close proximity to the Site indicates there is potential for unknown Roman archaeology to be present.

6.5 Early Medieval Period (AD 410 – 1066)

- 6.5.1 There are no recorded heritage assets dating to the early medieval period within the study area.
- 6.5.2 The Site lies within the civil parishes of Bucknell and Bicester. There is evidence of a Saxon settlement at Bicester and it is recorded in the Domesday Book. The Saxon settlement is thought to have been located to the north of the Roman town and adjacent to the Roman road. The name Bicester is thought to originate from Bernecestre which can be interpreted as meaning 'the fort of the warriors' or 'of Beorna', possibly a notable person in the area in the Anglo Saxon period (Lobel 1959). Bucknell village lies to the north of the Site, just beyond the boundary of the study area and is mentioned in the Domesday Book as Buchelle.
- 6.5.3 It is likely that during the early medieval period the Site formed part of the hinterland of the settlements of Bicester and Bucknell. Any activity on the Site at this time is likely to have agricultural in nature.

6.6 Medieval Period (AD 1066 – 1540)

- 6.6.1 Two of the listed buildings date to the medieval period, the Church of St Lawrence (**LB2**) in Caversfield and a church yard cross (**LB5**) in Bucknell.
- 6.6.2 There is further evidence for medieval activity within the study area at Caversfield in the form of a deserted medieval village (**7**), located north east of the church, and a fishpond (**9**), located north of Caversfield House. Deserted medieval villages indicate the abandonment or contraction of settlements and are fairly common in the later medieval period. In this case the village never expanded again but the continued use of the church indicates that there must have been occupation in the area, possibly comprised of scattered farms rather than a nucleated settlement.
- 6.6.3 The town of Bicester developed further in the medieval period and was granted a market in 1239. The early town developed at King's End and Market End, linked by a causeway across the Bure stream. Evidence of the medieval town can be observed in the 10th century houses in Priory Lane and Manorsfield Road and the present property boundaries in the town centre which reflect the medieval burgage plots. Medieval Bicester expanded further once Bicester Priory was founded in 1182 A.D. Excavations in the 1960s revealed a religious complex containing a large church, which housed the shrine of St Edburg, and other associated monastic buildings, including a hospital (www.blhs.org.uk).
- 6.6.4 During the medieval period the site would have formed part of the hinterland of the settlements of Bucknell, Caversfield and Bicester and the most likely activity within the site at this time would have been agricultural in nature.

6.7 Post-medieval Period (AD 1540 – 1914)

- 6.7.1 Two of the listed buildings date to the post medieval period, the Manor House (**LB4**) in Bucknell and Home Farm (**LB3**) in Caversfield. In addition, in Caversfield there is also the unlisted Caversfield House (**17**) and fishponds (**8**) located close to this. This may indicate a slight

increase in activity in this settlement or Caversfield House may have replaced an earlier dwelling.

- 6.7.2 There are geophysical anomalies, probably representing ditches (5), at South Lodge Stables on the south east edge of Caversfield. It is possible that these may indicate former field boundaries or field drainage and if so are likely to date to this period.
- 6.7.3 There has been no Historic Landscape Characterisation produced for Oxfordshire but the Cherwell District Landscape Assessment, undertaken in 1995, provides some useful information for determining the historic value and time depth of the landscape. In addition cartographic analysis indicates changes that have occurred within the landscape.
- 6.7.4 The cartographic sequence for the Site, discussed in more detail below, demonstrates that much of the area was farmed in an open field system until the late 18th century when enclosure awards were passed and the landscape began to be divided into smaller fields with individual owners. The sequence of Ordnance Survey maps, which began in the later 19th century, records the same field boundaries within the Site that are present today. As enclosure maps were not available for this area it is not possible to determine if these boundaries date to the initial period of enclosure or are a slightly later development. The villages of Bucknell and Caversfield are largely unchanged throughout the map sequence. The key change in the area is the expansion of Bicester and therefore increasing urbanisation in the area bordering the Site. Within the wider landscape surrounding the Site there has been a slight reduction in the amount of field boundaries.
- 6.7.5 The Cherwell and District Landscape Assessment (1995) describes the landscape within which the Site lies as the Oxfordshire Estate Farmlands character area. This area runs from Bletchington in the south, around the north of Bicester and up to the county boundary with Northamptonshire and is characterised by a rolling landform and a pattern of woodland and mixed farmland. Much of the landscape in this character area is associated with estates linked to the extensive areas of remaining 18th century parkland and this is one of the special features of the character area. The closest evidence for parkland is at Bignell Park to the south of the Site, although this dates to the later 19th century and so is not classed as part of the 18th century parkland. The Landscape Assessment characterises the local landscape within and around the Site as large scale open farmland or large scale undulating farmland; the former has a weak field patterns while the latter has strong field patterns, which are given definition by well-maintained hedges.
- 6.7.6 The Landscape Assessment draws out some of the key landscape elements of the area surrounding the Site but does not designate it as an area of high landscape value. As with other parts of Cherwell the area to the north of Bicester has been considerably affected by military development. Military airfields such as RAF Bicester are dominant features in the landscape when they occur.
- 6.7.7 Other key features in the landscape of the Cherwell district are small settlements. Many of these date to the early medieval and medieval periods and a significant number of these settlements experienced abandonment or shrinkage as a result of social and economic change in the late medieval or post-medieval period. The two closest villages to the Site, Caversfield and Bucknell, have a church which dates to the Anglo Saxon period and medieval or earlier origins respectively. Both the villages experienced shrinkage in the post- medieval period with little remaining of Caversfield except for the church and the manor house. The predominant architecture in these settlements is of the vernacular style which is typical for the district.
- 6.7.8 Overall the historic landscape which the Site is located within can be described as typical for the area. It is of a predominantly rural nature characterised by late 18th and early 19th century arable fields. Any activity within the site in the post-medieval period is most likely to be in line

with this use of the landscape and any features that may be present would be agricultural in nature.

6.8 Modern Period (AD 1914 – Present)

6.8.1 There are no recorded heritage assets dating to the modern period.

7 Built Heritage

7.1 Listed Buildings

7.1.1 There are four listed buildings within the study area for the Site. Three of them are Grade II listed and one is Grade II* listed. They are all located within settlements; two each in Bucknell and Caversfield.

7.2 Church of St Lawrence (LB2)

7.2.1 This is a Grade II* listed church in the village of Caversfield. The earliest elements are believed to date to the 10th or 11th centuries, with further additions in the late 12th and 13 centuries. The church was restored and partially rebuilt in 1874. It is constructed of coursed and random limestone rubble with ashlar dressings and the roof is Stonesfield-slate and concrete plain tiles. It is located east of the B4100 and adjacent to Caversfield House.

7.2.2 It has national significance as a listed building and historical significance because it demonstrates the duration of continuous settlement in this location. Its setting is informed by the deserted village to the east of it and the existing buildings in the village of Caversfield. In addition the historic parish of Caversfield informs its setting. The Development would change the nature of this wider parish setting by introducing an urban area into this well established agricultural landscape, which could have a negative impact on the setting of this asset. However, it would not prevent an understanding of the relationship between the church and the wider area.

7.3 Home Farmhouse (LB3)

7.3.1 This is a Grade II listed farmhouse dating to the early to mid 17th century and was extended in the 18th and 19th centuries. It is constructed of coursed squared limestone with ashlar dressings and has an old plain tile roof with rebuilt brick gable stacks. It is located in Caversfield, to the west of the B4100 and south of St Lawrence Church.

7.3.2 It has national significance as a listed building and historical significance as it demonstrates the agricultural nature of this area since the post medieval period. Its setting is informed by the agricultural buildings that surround it and the agricultural land that is managed from it. The Development would change the nature of part of this agricultural land, which would change the relationship between the building and its landscape. Therefore the Development would have a slight negative impact on the setting of this asset.

7.4 Bucknell Manor House (LB4)

7.4.1 This is an early 17th century Grade II listed manor house. It possibly has some surviving earlier elements as it was altered and partially rebuilt around 1700, it was also further altered in the late 19th century and the late 20th century. It is constructed of coursed limestone rubble with ashlar dressings and has Stonesfield-slate, Welsh-slate, plain tile and artificial stone-slate roofs. The stacks are stone and brick and it is H-shaped in plan. It is located on the southern edge of the village of Bucknell.

7.4.2 It has national significance as a listed buildings and historical significance as an indication of the development, nature and status of the settlement of Bucknell. Its setting is primarily informed by

the gardens surrounding it and the village of which it forms part. The Development would not affect either of these aspects of setting or the relationship between the buildings and its setting. It would introduce a new urban element into the surrounding agricultural land but this would be separated from the building by a buffer of unchanged agricultural land. Therefore the Development would not physically impact this asset and it would also not impact its setting.

7.5 Churchyard Cross (LB5)

7.5.1 This is a 13th-14th century Grade II listed cross, constructed from limestone. It was restored in c. 1929 and is a tapering octagonal shaft rising from a square medieval base, with a chamfered octagonal top and corner spurs. The head is 20th century and is carved with the Crucifixion and the Virgin and Child on its gabled ends with shields on the lesser sides. It is located approximately 10m south of the Church of St Peter in the village of Bucknell.

7.5.2 It has national significance as a listed building and historical significance due to its age and its relationship with the associated church. Its setting is directly informed by the church and church yard and also informed to a lesser extent by the village of Bucknell, which forms the congregation of the church. The Development would not affect any of these relationships and therefore would have no impact on the setting of this asset.

8 Cartographic Analysis

- 8.1.1 The following presents an analysis of the cartographic sequence from the 1753 map of the manors of Market End and King's End to the 2010 Ordnance Survey (OS) map.
- 8.1.2 Much of the Site lies within the area covered by Williams' 1753 map of Bicester, showing the manors of Market End and King's End. This map shows that at this time a large proportion of the land in this area was farmed in furlongs, long narrow divisions that were developed due to the difficulty of turning earlier ploughs. These were usually found within an open field system.
- 8.1.3 In 1780 an enclosure award was granted for the manor of Bucknell, unfortunately the accompanying map no longer survives. Enclosure awards for the areas of Market End and King's End were awarded in 1757 and 1793 respectively. The presence of the enclosure awards demonstrates that the land within the Site is likely to have been open fields until the late 18th century.
- 8.1.4 The 1851 Caversfield tithe map shows the northern area of the Site under either arable or grassland with a small coppice in the south west corner. The field boundaries are the same as the modern boundaries. There are some fieldnames recorded on the tithe award which indicate former activity within the site. For example, the field to the north east of the area of woodland is named 'The Limekiln Ground' which may indicate there once was a limekiln in the vicinity. The small narrow field to the east of the woodland is named 'Stone Pit Pieces' which could suggest quarrying activity in the area. No tithe map was available for Bucknell. It is assumed that this map if it did exist would have shown the rest of the Site area.
- 8.1.5 The 1884-6 1:10,560 scale OS map shows that the field boundaries within the Site have already achieved their present layout by this time. Home Farm, Lords Farm, Hawkwells Farm, Crowmarsh Farm, Himley Farm, Aldershot Farm and Gowell Farm are present. There is also a barn labelled Parkers Barn one field to the south east of Himley Farm. The road to the north of the Site is present and the main road network to the east of the Site has achieved its current layout. Beyond the north eastern edge of the study area St Lawrence's Church and Caversfield House are recorded. To the north west the village of Bucknell is recorded as a small nucleated settlement centred around the Manor House and the church with a small cluster of buildings located to the east of the main area of settlement, separated by two small fields. The village had achieved its current road pattern by this time. To the south east of the Site Bicester is considerably smaller than in the present day. The Bicester Union Workhouse lies in open countryside approximately halfway between the Site and the town along Bucknell Road. Slade Farm is also marked to the east of the Site. Beyond the southern edge of the study area is a large house labelled Bignell House which is surrounded by fairly extensive grounds.
- 8.1.6 The 1900 1:10,560 scale OS map shows no change within the Site or in Bicester or the surrounding villages. To the south of the Site the grounds of Bignell House have expanded to abut the B4030 to the south of the Site and are now labelled Bignell Park. A significant number of trees have been planted within the park including a wide bank of trees, labelled as Bignell Belt, along the northern boundary of the park, which is adjacent to the road.
- 8.1.7 On the 1923 1:10,560 scale edition the only change in the area to the north east of the Site is the addition of a filter bed in the field immediately to the west of Home Farm. The most important change on this map is the introduction of the railway line which borders the south western edge of the Site. A pumping station, a tower, a quarry and a lime kiln are recorded south of the Site, where the Avonbury Business Park is now located.
- 8.1.8 The 1938-1952 1:10,560 scale OS map shows there has been no change within the Site. A small building has been constructed adjacent to the B4030, to the south of the Site. It is likely

that this building is the one labelled 'Lovelynych House' on modern maps. By the time of the 1952 map this building has been enclosed within its own plot. There has been little change to Bucknell and no change to Caversfield. Bignell House and Bignell Park to the south of the Site are also unchanged. Outside the Site there has been a probable residential development next to the former Bicester Union Workhouse, which at this time was used as a home for poor boys. On the 1952 map this residential area is labelled 'Highfield' and the former workhouse is called Market End House. This map also shows the gradual northward expansion of Bicester and Bicester Airfield is recorded to the north of the town.

- 8.1.9 There are only minor changes recorded on the 1955 1:10,000 scale OS map. The filter beds close to Home Farm, north east of the Site, and the pumping station to the south of the Site are no longer marked.
- 8.1.10 There is no change recorded on the 1966 1:10,000 scale OS map.
- 8.1.11 The 1970 1:10,000 scale OS maps show little change. The building adjacent to the B4030 is labelled Himley Farm and another small building has also been constructed towards the southern end of the track which links the original farm buildings at Himley farm with the B4030. The map also records that the development of buildings to the west of Bicester Airfield. Bicester has expanded further to the north and north west into the areas of Highfield and Woodfield. The areas around Slade Farm and King's End Farm remain undeveloped.
- 8.1.12 The 1982-1988 1:10,000 scale edition shows that the plot of the new Himley Farm building has increased in size to its present day extent. Parkers Barn is no longer recorded. The field pattern within the Site remains unchanged. A small depot is marked to the south of the Site, in the area now occupied by Avonbury Business Park. Outside of the Site boundary there has been further development to the north east around Brashfield House. To the north west Bucknell remains relatively unchanged. By the time of the 1988 map Bicester has expanded even further with the north western limit of the town abutting the A4095 south of the Site, now covering the area where King's End Farm stood.
- 8.1.13 The 1996 1:10,000 scale map shows no change within the Site. The depot in the location of Avonbury Business Park has expanded slightly and is labelled as a Police HQ. The map also shows that Bicester has almost reached its current extent by this time, with expansion to the north, and the A4095 has been constructed. Slade Farm is no longer recorded but the area around it remains undeveloped.
- 8.1.14 By the time of the 1999 1:10,000 scale OS map there has been no change within the Site. Two small strips of plantation have been planted between Gowell Farm and Himley Farm and one of the fields in Himley Farm is now labelled as a piggery. The building on the B4030 at Himley Farm is now called 'Lovelynych House' and the small building adjacent to the access track for Himley Farm is now 'Himley Farmhouse'. Bucknell has achieved its modern day layout, as has the village of Caversfield with the two separate areas of development along Hemmingford Lane and around Brashfield House joined together.
- 8.1.15 The 2006 1:10,000 scale OS map shows no change to the Site. The piggeries at Himley Farm have moved one field to the west. There has been further development at the Avonbury Business Park. The map also shows that the area around Slade Farm, abutting the south east boundary of the Site, has been developed and Bicester is shown at its current extent. The 2010 1:10,000 scale map shows that there has been a small amount of development at Lords Farm, within the Site, but shows no other changes.

9 Archaeological Investigations

9.1.1 Between 2010 and 2013, three phases of archaeological investigation were undertaken over the whole of the North west Bicester development. These comprised aerial photograph analysis (Air Photo Services 2010a), geophysical survey (Northamptonshire Archaeology 2012) and evaluation (Oxford Archaeology 2014). In this section the archaeological features identified within the Application 1 Site will be discussed (Figure 3).

9.2 Aerial Photograph Analysis

9.2.1 The aerial photograph analysis within the North West Bicester development identified various areas of crop marks indicating buried archaeological features. In many areas these were underlain by extensive geological features, which were also visible as crop marks. In most cases these two types of feature could be distinguished but where this was not possible they were recorded as possible archaeological features (Air Photo Services 2010a, Plan 4). The aerial photograph analysis identified crop marks across the Application 1 Site area. The location of all the crop marks identified within the Site are shown on Figure 3.

9.2.2 In the centre of the Site is a complex and extensive area of buried ditches, pits, probable tracks and enclosures (AP3). They show as distinctive crop marks at Hawkwell Farm, which are partially masked but not confused with geological features. It is likely that these crop marks represent prehistoric or Romano-British settlement, based on their form.

9.2.3 To the east of Hawkwell Farm is an unusual curvilinear feature (AP4), which was only recorded on one occasion and is not consistent with any previously recorded archaeological feature. It is a possible feature that may result from an agricultural process. To the south east of Hawkwell Farm are slight ridges (AP5) on the flood plain of a small watercourse. These may indicate former water meadows or medieval cultivation or drainage. In the north east of the Site and just outside the boundary there are crop marks of fragmentary ditches and possible ditched enclosures (AP6), but they are heavily masked by geological features. The focus of these features appears to be a buried ditched sub-rectangular enclosure, adjoining the small area of woodland in the north of the Site. There is also a smaller sub-rectangular area of deeper soil which may indicate local stone quarrying that was subsequently filled in when it had been worked out.

9.2.4 There is one further area of crop marks, in the west of the Site, indicating medieval ridge and furrow cultivation and an unidentified cut feature (AP8). The unidentified feature is an oddly shaped cut feature, which has been infilled. As most small quarries in this area are sub-rectangular or square, and this feature has a number of projections, it seems unlikely to result from this activity. Given the proximity of a World War 2 airbase at Bicester, this could be a bombing decoy, but it is not visible on photographs taken in 1946 and so its origin is uncertain.

9.3 Geophysical Survey

9.3.1 A 50% sample magnetometer survey was undertaken between December 2011 and January 2012 across the North West Bicester development. This identified a large number of magnetic anomalies with the Application 1 Site representing subsurface features and confirmed and expanded upon the crop marks identified by the aerial photograph analysis. The locations of all the anomalies identified within the Site are shown on Figure 3

9.3.2 In the north of the Site there is a large sub-rectangular ditched enclosure that is orientated east – west and has an entrance on the eastern edge. A second ditch was located parallel to the northern edge of this. Within the western half of the enclosure there are up to four curving

ditches and two pits and within the eastern half one curving ditch and four pits arranged in a loose square. This later ditch appears to form part of a long ovoid feature composed of interrupted lengths of ditch. Two additional ditched enclosures are located north and north east of the sub-rectangular enclosure and to the north west is a linear ditch, aligned north west – south east, with a line of small pits extending south from this. Four similar pits were situated to the west of this. There is a large irregular semi-circular ditch to the east of the sub-rectangular enclosure and to the south an area of ferrous responses probably indicating a dump of iron-based debris (Northamptonshire Archaeology 2012, 3-4).

- 9.3.3 On the eastern edge of the site there is a conjoined pair of circular ditches, possibly indicating roundhouses with a probable pit in the centre of the southern one. In the east of the Site there is a north east – south west aligned ferrous pipeline, a short linear ditch aligned north west – south east and an east – west aligned linear ditch with a group of four possible pits at the western end. The pits were surrounded by curving ditches to the north and south and to the north of these were a roughly square arrangement of four pits with a north east – south west aligned ditch to the west of them. To the west of this group of features there are several linear ditches and two right-angled ditches. It appears that one of the right angled ditches and one of the linear ditches may form three side of a sub-rectangular enclosure. In addition to this there are a number of possible pits; some in isolation, but four of them were located south of the possible enclosure. There is also a reverse 'c' shaped ditch in this area that may continue to form an entire enclosure in the unsurveyed area. To the west of these previous features there are six possible pits, five short sections of linear ditch aligned north east – south west and two gently curving ditches to the south of this. To the north of these features there is a long linear ditch aligned north west – south east, further short linear ditches and a 'u' shaped ditch, possibly representing the southern part of an enclosure. Slightly north of this the northern ditch of a probable enclosure, a curving ditch of another probable enclosure and a pair of north west – south east curving ditches were identified (ibid. 4-5).
- 9.3.4 In the centre of the site is a concentration of anomalies representing linear and curvilinear ditches some of which form curved and rectilinear enclosures and many of these coincided with the location of crop marks at AP3, . Many pits of varying diameters were also detected. A large, c. 70m x 70m, sub-rectangular enclosure containing sub-dividing ditches and numerous pits was detected in the east of this area. Outside this dense area of features to the west there is a linear ditch that is aligned east – west, a pair of ditches, a group of pits, two parallel ditches, a group of five ditches on varying alignments and a probable ceramic drain. There is also an area of ridge and furrow on a north – south alignment. To the south of the dense area of features there is an area with six short ditches, four of these are aligned north west – south east, one north east – south west and one north – south. In the western area of the Site ferrous features were detected, along with a linear anomaly indicating a probable historic boundary on a north – south alignment. There were also linear ditches, two in a 'y' shaped arrangement, small enclosures and pits (ibid. 5-6).
- 9.3.5 In the south of the Site there are several areas of ridge and furrow, some aligned approximately north – south and some aligned east – west. In the centre of this area there are three short sections of ditch and a semi-circular ditch. To the east of this are two sinuous ditches and sections of a single ditch, all on a north west – south east alignment. A pair of adjacent pits was located to the west of the ditches. In the most southerly part of the Site there are ditches possibly representing several enclosures (ibid. 6).

9.4 Evaluation

- 9.4.1 An evaluation was carried out over the whole North West Bicester development. In total this was designed to provide a 2% sample of the Masterplan Area, excluding areas of existing woodland, hedgerows and buildings. It was proposed to excavate 541 trenches, each 50m

long, but a number could not be excavated largely due to ecological constraints. In total 529 trenches were excavated and 130 of these contained features of archaeological origin, including 26 that had only furrows or modern features. These were located to investigate geophysical anomalies, crop marks and areas where these were not recorded (Oxford Archaeology 2014, 10-12).

- 9.4.2 Within the Application 1 Site there 47 trenches contained archaeological features. There is one area of possible Bronze Age activity, in the eastern part of the Site, and three small areas of Early – Middle Iron Age activity, on the northern, eastern and western edges of the Site. A significant area of roman activity is located in the centre of the Site, which was also identified by crop marks and geophysical anomalies, and a smaller area of roman activity on the western edge of the Site.
- 9.4.3 The possible Bronze Age activity consists of two possible burnt mounds, located in a shallow valley of an existing stream, and possibly associated with a cluster of four pits and a sinuous ditch. Burnt mounds are not common in Oxfordshire but in areas where they have been excavated their purpose has been suggested as connected with saunas or specialised sites for cooking food. The evidence for Iron Age activity appears to indicate dispersed utilisation of the landscape, which is reasonably unusual for this period and may indicate that more substantial settlement exists outside the Site. The exception to this may be a large enclosure in the north of the Site that was identified from crop marks and geophysical survey and from which pottery of this date was recovered (ibid. 30-31).
- 9.4.4 The small area of Roman activity on the western edge of the Site contained a limited number of features but produced a substantial amount of early Roman pottery. It may represent a small scale domestic settlement, possibly an outlying farmstead. The significant area of Roman activity in the centre of the site consists of linear ditches and probably indicates an agricultural settlement of relatively low status that was in use throughout the period. This continuity of settlement is perhaps unusual. Isolated finds of human remains may indicate the potential for further burials to be found in the area (ibid. 32).
- 9.4.5 In addition to this there were frequent examples of ridge and furrow and remnants of field boundary ditches and drainage ditches that indicate that much of the Site was under arable cultivation since at least the medieval period (ibid. 33).

10 Discussion and Conclusions

- 10.1.1 There are two heritage assets recorded on the Oxfordshire HER within the Site. These comprise a crop mark (2) and geophysical anomalies (4) representing various enclosures and are likely to indicate late prehistoric or Roman settlement. This is supported by the further archaeological work as evaluation provided dating evidence for these features, dating them to the Roman period.
- 10.1.2 In addition to this the further archaeological work indicated an area of possible Bronze Age ritual activity in the eastern part of the Site, three small areas of early – middle Iron Age activity, probably indicating dispersed use of the landscape in the form of small farmsteads, and another small area of Roman activity, probably indicating a small outlying farmstead.
- 10.1.3 In addition to this evidence of medieval and post medieval agriculture, in the form of ridge and furrow field systems and field boundaries was recorded. These indicate the longevity of arable agriculture within the Site and there are likely to be further buried features relating to this activity. The disturbance of the subsurface caused by arable agriculture over an extended period of time may have truncated or completely removed some evidence of preceding archaeological features.
- 10.1.4 The two listed buildings in Bucknell, the Manor House (LB4) and churchyard cross (LB5), would not be physically impacted by the Development and their settings would also remain unchanged. The two listed buildings in Caversfield, the Church (LB2) and Home Farmhouse (LB3), would not be physically impacted by the development. However, the setting of Home Farmhouse (LB3) would be negatively impacted by the Development as there would be a marked change in use of the surrounding land with which it is associated. The Development would cause a large change to the setting of the church but it would not prevent understanding of the relationship between the church and its parish.

11 Recommendations

- 11.1.1 There has already been extensive pre-application investigation of the potential archaeological resource within the Site and large parts of the study area through aerial photograph analysis, geophysical survey and evaluation. This has significantly increased the knowledge of the archaeological potential of this area and the significance of the archaeological resource within the Site. A archaeological mitigation strategy based on this understand of the significance of the resource will be produced as part of an Environmental Statement for this Development.

12 Bibliography

- Air Photo Services 2010a. *Bicester Eco Town, Oxfordshire. Part 1: The Entire Site: Interpretation of Aerial Photographs for Archaeology.*
- Air Photo Services 2010b. *Bicester Eco Town, Oxfordshire. Part 2: The Exemplar Site: Interpretation of Aerial Photographs for Archaeology*
- English Heritage, 2011. *The setting of Heritage Assets*
- Hyder Consulting Ltd 2010a. *Bicester Eco Town – Exemplar Site. Desk-Based Assessment*
- Hyder Consulting Ltd 2010b. *An Application for the Exemplar Phase of the NW Bicester Eco Development proposals submitted by P3Eco (Bicester) Limited and A2Dominion Group. Environmental Statement Volume 1: Main Text*
- Hyder Consulting Ltd 2014a. *Bicester Eco Development - Application 2 (South of Railway): Cultural Heritage Desk-Based Assessment*
- Hyder Consulting Ltd 2014b. *Bicester Eco Development – A4095 NW Strategic Link Road: Cultural Heritage Desk-Based Assessment*
- Institute for Archaeologists 2012. *Standard and Guidance for Historic Environment Desk- Based Assessment*
- Institute for Archaeologists 2013. *Code of Conduct*
- Lobel, M D 1959. *A History of the County Of Oxfordshire Vol 6.* Victoria County History, 14-56
- Northamptonshire Archaeology 2012. *Archaeological Geophysical Survey for the Proposed Bicester Eco Development, Oxfordshire, December 2011 – February 2012*
- Oxford Archaeology 2010. *Bicester Eco Town Exemplar Site, Caversfield, Oxon. Archaeological Evaluation Report*
- Oxford Archaeology 2014. *Bicester Eco Development, Bicester, Oxfordshire. Archaeological Evaluation Report Volume 1 – 3*
- Cobham Resource Consultants 1995. *Cherwell District Landscape Assessment for Cherwell District Council*
- Bicester Local History Society www.blhs.org.uk (accessed 23/06/2014)

Appendix 1: Gazetteer of Heritage Assets

Hyder No.	HER/NMR No.	Easting	Northing	Period	Site Type	Description
LB2	5106/ 1046533	458063	225202	MEDIEVAL	CHURCH	CHURCH OF ST LAWRENCE, GRADE II*
LB3	17289/ 1200170	458070	224974	POST MEDIEVAL	FARMHOUSE	HOME FARMHOUSE, GRADE II
LB4	1046889	456120	225540	POST MEDIEVAL	MANOR HOUSE	BUCKNELL MANOR HOUSE, GRADE II
LB5	338850	456070	225580	MEDIEVAL	CROSS	13TH-14TH CENTURY CHURCHYARD CROSS, GRADE II
2	15958	457300	224800	PREHISTORIC	ENCLOSURE	CROP MARK OF RECTILINEAR ENCLOSURE
4	27989	457195	224750	LATER PREHISTORIC - ROMAN	GEOPHYSICAL ANOMALIES	LATE PREHISTORIC OR ROMAN FEATURES INCLUDING DITCH, ENCLOSURE, PIT AND TRACKWAY
5	28204	458370	225030	UNKNOWN	GEOPHYSICAL ANOMALIES	LINEAR FEATURES, POSSIBLY DITCHES, AT SOUTH LODGE STABLES
6	16026	458120	223800	MESOLITHIC	GULLY, POST HOLE, FIND SPOT	GULLY WITH POSSIBLE POST HOLES AND ARTEFACTS AT SLADE FARM
7	1016	458400	225400	MEDIEVAL	DESERTED SETTLEMENT	CAVERSFIELD DESERTED MEDIEVAL VILLAGE
8	5107	458200	225200	POST MEDIEVAL	FISHPOND	FISHPOND,CAVERSFIELD
9	13743	458140	225420	MEDIEVAL	FISHPOND	FISHPOND, NE OF CAVERSFIELD HOUSE
11	9984	458440	223930	ROMAN	FINDSPOT, ENCLOSURE	RECTANGULAR ENCLOSURES AND FINDS, SW OF SOUTH FARM
13	16025	458100	224000	IRON AGE	SETTLEMENT	SETTLEMENT INCLUDING RING DITCH, BOUNDARY DITCH, OVEN AND PIT, SLADE FARM
16	17461	458580	225230	UNKNOWN	RING DITCH	POSSIBLE RING DITCH E OF CAVERSFIELD
17	515026	458200	225300	POST MEDIEVAL	HOUSE	CAVERSFIELD HOUSE

11 Contaminated Land

11.1 Introduction

11.1.1.1 This chapter relates to the Development within the site boundary for Application 1 – North of Railway of the NW Bicester development. It considers aspects relating to the chemical quality of the land and the potential associated risks to identified receptors such as human health and controlled waters that the Development may represent. This chapter describes:

- The current baseline conditions at the Site (North of Railway)
- Potential impacts and the mitigation measures required to prevent, reduce or offset any potentially significant adverse effects
- The likely cumulative effects after the mitigation measures have been implemented

11.1.1.2 To assist the understanding of the principles of this subject and their particular application within the context of the Development, it is recommended that the reader refers to the associated Hyder Consulting (UK) Limited Reports (Ref 11-1, 11-2 and 11-3), which have provided information for this chapter and copies of which are included in Appendix 11A, 11B and 11C. Reference should also be made to Chapter 15 which discusses waste such as excavated and construction waste.

11.2 Regulatory and Policy Framework

11.2.1.1 This impact assessment has been undertaken in accordance with current international and national legislation, and national, regional and local plans and policies relating to nature conservation in the context of the Development. A summary of the relevant legislation and policies, the requirements of these policies and the Development response has been provided in Table 11-1 below.

Table 11-1 Contaminated Land Regulatory and Policy Framework

Policy/Legislation	Summary of Requirements	Development Response
Environmental Protection Act (1990)	Government policy in relation to land contamination is outlined in DEFRA Circular 01/2006 'Contaminated Land'. The policy aims to both prevent new contamination and to address the inherited legacy of contaminated land. The primary legislation that covers historic land contamination is Part 2A of the Environmental Protection Act 1990, which was inserted by section 57 of the Environment Act 1995. Part 2A provides a definition of contaminated land, focussing on risks in the context of the current use and circumstances of the land. It places specific duties on local authorities to inspect their areas to identify land falling within this definition and, where they do,	Local authorities are the main regulator and are required to publish a strategy for inspecting their areas. The Environment Agency is responsible for dealing with defined 'special sites' and monitoring and reporting on progress made. Both local authorities and the Environment Agency record certain prescribed information about their regulatory actions on a public register and local

Policy/Legislation	Summary of Requirements	Development Response
	<p>to require its remediation in line with the 'suitable for use' approach.</p> <p>Part 2A of the Environmental Protection Act 1990 defines contaminated land as 'Any land which appears to be in such a condition, by reason of substances in, on or under the land that: Significant Harm is being caused or there is a Significant Possibility of such harm being caused; or Pollution of Controlled Water is being, or is likely to be, caused'.</p> <p>The identification of contaminated land on the basis that there is a significant possibility of significant harm (SPOSH) being caused is set out in DEFRA Circular 01/2006.</p> <p>The identification of contaminated land, as defined in Part 2A of the Environmental Protection Act 1990, comprises a risk-based approach. For harm to the non-aquatic environment or pollution of controlled waters to occur, there must be a 'pollutant linkage'. This linkage is based on the following being present:</p> <ul style="list-style-type: none"> ▪ Source of contamination (hazard); ▪ Pathway for the contaminant to move from source to receptor; ▪ Receptor (target), which is affected by the contaminant. This includes humans, ecosystems, controlled waters, physical systems and built structures, which could be affected by the hazard. 	<p>authorities maintain databases about potentially contaminated sites within their area.</p> <p>Development will follow principles of suitable for use criteria based upon a source-pathway-receptor risk assessment approach.</p>
<p>National Planning Policy Framework 2012</p>	<p>The National Planning Policy Framework (NPPF) was introduced in March 2012 to simplify planning and was written to help achieve sustainable development. Whilst containing only limited guidance on land affected by contamination the document does states that:</p> <p><i>"To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner."</i></p>	<p>Consideration has been given to the potential risks from pollution within the study area.</p>

Policy/Legislation	Summary of Requirements	Development Response
Waste Regulations	<p>The Waste (England and Wales) Regulations 2011 states that excavated material generated by the development of land maybe subject to waste regulatory controls to ensure that waste does not harm human health or the environment.</p> <p>Waste disposal, deposit, recovery & recycling in England, Wales and Scotland is regulated primarily through Part 2 of the Environmental Protection Act and the Environmental Permitting Regulations. Under the legislation all controlled waste must be deposited, disposed of, recycled or recovered at a suitably licensed site, or a site that is registered as exempt from waste management licensing. In addition, controlled waste must be transported to a licensed (or exempt) site by an authorised waste carrier. It is an offence to deposit waste on land that does not have a waste management licence (or exemption) in force.</p>	<p>Licensing of waste disposal and treatment facilities, waste carriers and brokers and the monitoring of waste management activities is the responsibility of the Environment Agency in England and Wales.</p> <p>When dealing with waste the developemtn will apply the required waste regulations.</p>
CL:AIRE The Definition of Waste: Development Industry Code of Practice	<p>This Code of Practice (CoP) provides best practice for the development industry to use when assessing if materials are classified as waste, or not, and determining when treated waste can cease to be waste for a particular use. The CoP provides engineers, contractors, consultants and developers a basis upon which to demonstrate to the Environment Agency that they are following best practice with respect to the use and reuse of materials. It provides an auditable system to demonstrate that the CoP has been adhered to on a site by site basis. The development and use of the CoP is seen as a Better Regulation Approach by the EA.</p> <p>The CoP requires a normal risk assessment based approach (see CLR 11 above) to prove that materials are “suitable for use”. Where materials are not considered to be waste the Environmental Permitting Regulations (2010) need not be applied. Soils requiring treatment to allow their re-use are considered to be waste. Such treatment processes must be undertaken under an appropriate Mobile Treatment Permit. The CoP allows the user to demonstrate when wastes have been fully recovered, via treatment, and hence cease to be waste.</p> <p>The CoP requires regulatory agreement for each stage of the works. This is best achieved via a formal planning consent with appropriate</p>	<p>Due consideration to this guidance has been made.</p> <p>When re-use of material is appropriate a suitable for use approach as set out within CL:AIRE CoP will be applied.</p>

Policy/Legislation	Summary of Requirements	Development Response
	<p>conditions attached to the investigation, assessment and remediation. Approval is effectively obtained by discharge of the planning conditions that require regulatory agreement of:</p> <ul style="list-style-type: none"> ▪ Remediation Strategy. ▪ Remediation Method Statement. ▪ Verification Report. 	
<p>The Environment Agency's Model Procedures for the Management of Land Contamination (Contaminated Land Report 11)</p>	<p>Contaminated Land Report 11 (CLR 11) has been developed to provide the technical framework for applying a risk management process when dealing with land affected by contamination. The process involves identifying, making decisions on, and taking appropriate action to deal with land contamination in a way that is consistent with government policies and legislation within the UK. The document is consistent with the approach presented within the "Guidelines for Environmental Risk Assessment and Management" published by the Department of the Environment, Transport and the Regions, the Environment Agency and the Institute for Environment and Health (2000).</p>	<p>Assessment has been undertaken with due consideration to this guidance.</p>
<p>Water Resources Act 1991</p>	<p>The Water Resources Act 1991 provides regulation of contamination potentially impacting controlled waters and is enforced by the Environment Agency. This provides regulation separate from that within the planning framework.</p>	<p>Controlled Waters Risk Assessment (CWRA) has been undertaken and the potential impacts on water are included.</p>
<p>Control of Substances Hazardous to Health 2002</p>	<p>The Control of Substances Hazardous to Health (COSHH) Regulations, 2002, and subsequent amendments and the Construction and Design Management (CDM) Regulations, 2007, require the developer to ensure that risks to the public and site workers, in relation to the likely presence of contaminated land, are minimised.</p> <p>Additional guidance is provided by DEFRA in their series of Contaminated Land Reports (CLR 1-CLR 11).</p>	<p>Human Health Risk Assessment has been undertaken.</p>
<p>Environment Agency Pollution Prevention Guidance Notes</p>	<p>The Environment Agency has produced a range of Pollution Prevention Guidance Notes (PPGs) to provide advice on the laws and good environmental practice relevant to a number of industrial sectors and activities. These include</p>	<p>Best practice as set out in these PPGs will be implemented during the works.</p>

Policy/Legislation	Summary of Requirements	Development Response
	<p>the following:</p> <ul style="list-style-type: none"> ▪ PPG1 – General guide to the prevention of pollution ▪ PPG2 – Above ground oil storage tanks ▪ PPG5 – Works and maintenance in or near water ▪ PPG6 – Working at construction and demolition sites ▪ PPG8 – Safe storage and disposal of used oil ▪ PPG13 – Vehicle washing and cleaning ▪ PPG21 – Pollution incident response planning 	

11.3 Methodology

11.3.1 General Approach

11.3.1.1 The assessment of the potential for adverse environmental impact that could be associated with chemical contamination has been undertaken in accordance with The Statutory Guidance on Part IIA of the Environmental Protection Act 1990 (EPA 1990) as set out in Defra Circular 2012 (Ref 11-4); The Environment Agency's Model Procedures for the Management of Land Contamination (Contaminated Land Report (CLR) 11) (Ref 11-5) and other relevant supporting guidance.

11.3.1.2 The DEFRA statutory guidance for contaminated land uses the concept of a 'contaminant linkage', whereby for land to be contaminated, each of the following has to be identified:

- a contaminant (source)
- a relevant receptor
- a pathway by means of which either:
 - that contaminant is causing significant harm to that receptor, or
 - there is a significant possibility of such harm being caused by that contaminant to that receptor.

11.3.1.3 If one or more of the source, pathway or receptor is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

11.3.1.4 Although the presence of contaminants may result in contamination of the ground, land will only be designated as statutory Contaminated Land when the requirements of the strict definition of EPA 1990 Part IIA are met.

- 11.3.1.5 For definition of the terms 'Contaminated Land', 'contaminant', 'harm' and 'risk' and further details on the concept of a 'contaminant linkage' reference should be made to Part IIA of the EPA 1990.
- 11.3.1.6 As this is a development led project, consideration has been given to the NPPF. The principles for assessing if the site is "suitable for the proposed use" are based on the contaminant linkage methodology as detailed above. As a minimum the development should be considered safe and should not be able to be determined as statutory Contaminated Land under Part IIA.
- 11.3.1.7 Receptors identified as part of this study are:
- Human health (construction workers, site end users)
 - Controlled waters (groundwater and surface water)
 - Buildings and services

11.3.2 Consultation

- 11.3.2.1 Cherwell District Council and the Environment Agency (EA) were consulted during the preparation of the contaminated land assessment and relevant information is included within the baseline conditions below.

11.3.3 The Study Area

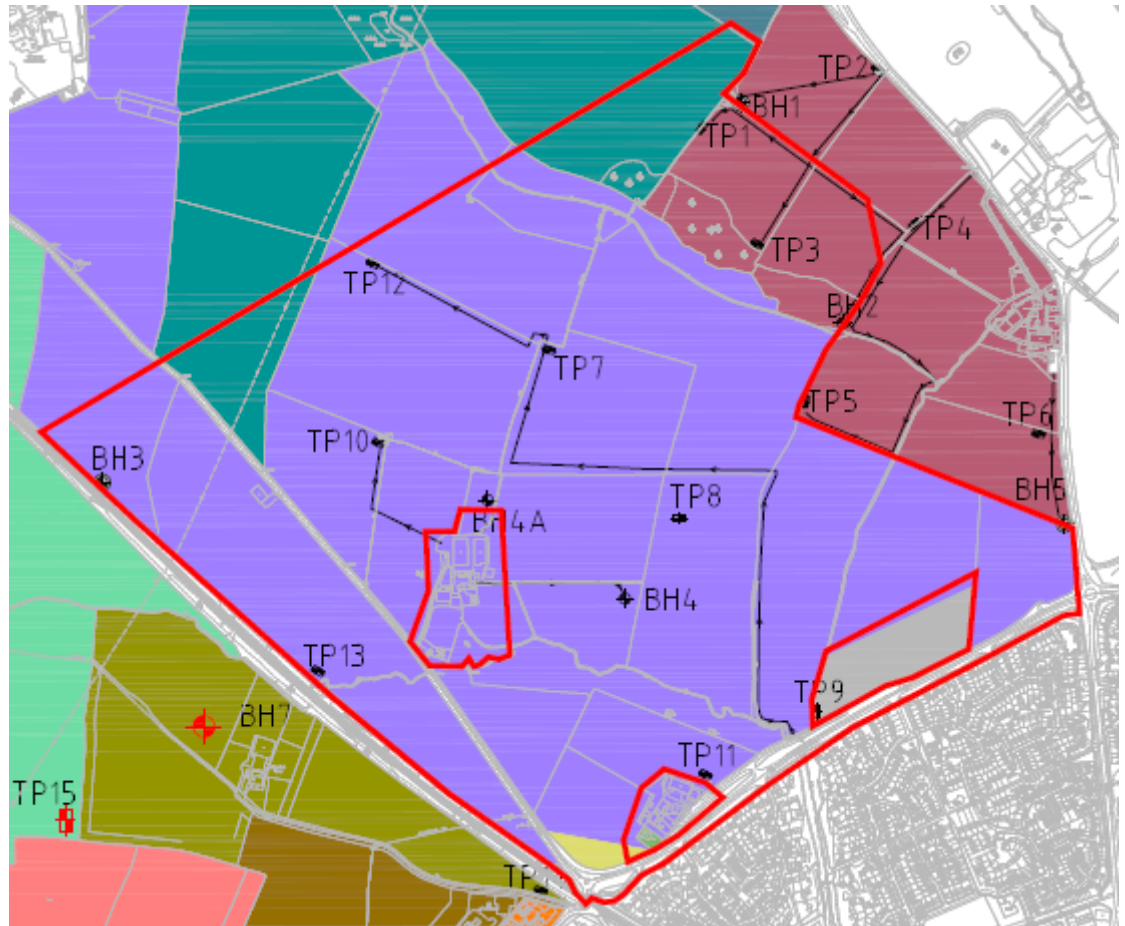
- 11.3.3.1 The study area for the contaminated land assessment is defined by the red line boundary for Application 1, as shown on Figure 11-1, however consideration is also given to activities within 500m of the boundary, e.g. landfill site, which may have an ability to cause impact on the Development.

11.3.4 Methodology for Establishing Baseline Conditions

Establishing the Existing Baseline

- 11.3.4.1 The baseline conditions for Application 1 have been determined from the following:
- Data presented in the Hyder Phase 1 Desk Study Report (Appendix 11A). This includes a review of available published and internet based information sources such as the Environment Agency (EA) database, historical maps and British Geological Survey (BGS). This report also includes a Tier 1 hydrological risk assessment report for land being considered for development as a new cemetery within the Application 1 boundary.
 - Information obtained during a preliminary intrusive ground investigation undertaken by Hyder in August 2010 (Appendix 11B). This includes details of ground conditions encountered and chemical quality of soils and groundwater sampled. This investigation covered a larger area as shown on Figure 11-1 below, than the Application 1 area considered within this chapter. Only information relevant to the Site Area is included within this chapter.

Figure 11-1 Plan showing the Hyder Site Investigation Area

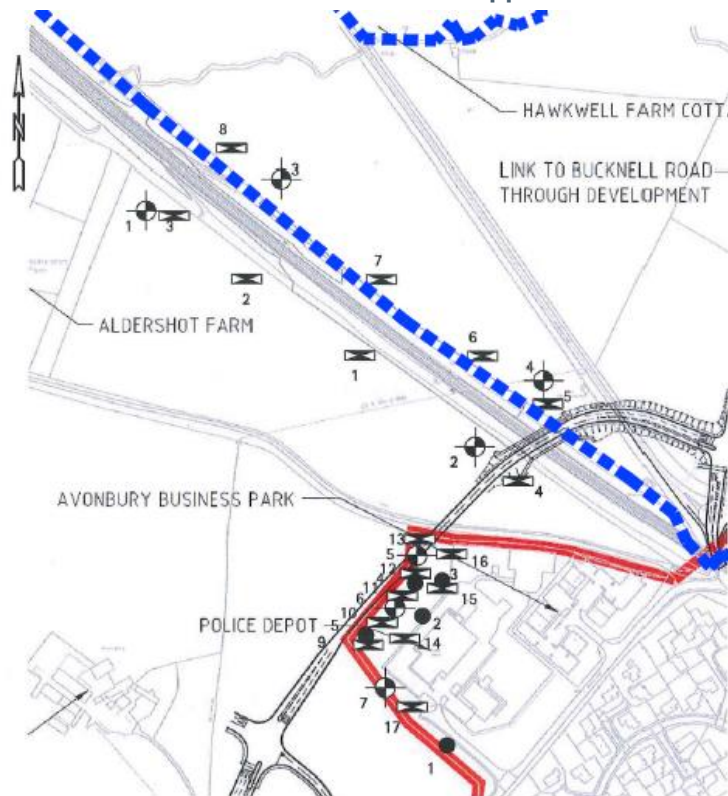


- Details have been taken from the Groundwater Supply: Feasibility Study (Appendix 11C).
- A desk study and intrusive site investigation (March 2014) was undertaken by ST Consult (Ref 11-6) on land within the southern part of the Application 1 boundary and on the other side of the railway lines shown in Figure 11-2 below (the blue dashed line indicates the Application 1 boundary). This was to provide information for the proposed road underpass in this location and investigated the landfill site present at Gowell Farm which is part of the Avonbury Business Park to the south of the Application 1 boundary. Whilst the majority of the work was undertaken on the opposite side of the railway and hence outside the Application 1 site boundary, six sample locations are within the Application 1 boundary and relevant information has been taken from this document which is appended within Appendix 11D.

Figure 11-2 Plan showing the investigation area of ST Consult
Key

Red line = ST Consult boundary

Blue dashed line = Application 1 boundary



Forecasting the Future Baseline (“Without Development” Scenario)

- 11.3.4.2 The existing ‘interpretative’ baseline conditions and risk assessment process (human health, controlled waters and buildings/structures) is carried out on the assumption that the Development and/or future land-users is/are in place.
- 11.3.4.3 The future baseline (‘without development’ scenario) will therefore be forecast by qualitatively assessing the potential baseline conditions and risks to human health, controlled waters and buildings and structures from existing sources of contamination.
- 11.3.4.4 It is not possible to predict future changes to regulatory policy and frameworks so the future baseline will be forecast assuming no significant change from current methodology. We do not envisage that any changes would materially affect the assessments made herein.

Defining the importance/sensitivity of resource

- 11.3.4.5 The significance criteria for contaminated land are based on the criteria set out in the Design Manual for Roads and Bridges (DMRB) (Ref 11-7). The significance of the identified impacts would be based on the sensitivity of the receptor taking into account the magnitude of the potential impact.
- 11.3.4.6 The assessment process comprises a number of stages. The first stage involves assigning the importance or sensitivity of each resource / receptor as assessed using the criteria provided in Table 11-2 below.

Table 11-2 Determining the Importance / Sensitivity of Resource

Importance / sensitivity of resource or receptor	Receptor: Human Health * (Soils)	Receptor: Human Health/Buildings ** (Ground Gas)	Receptor: Controlled Waters
Very High	Future users of residential properties with private gardens.	Low rise residential properties.	<p>High water quality and rare resource. Important at a regional or national scale, with limited potential for substitution, e.g.</p> <ul style="list-style-type: none"> ▪ Supply of high quality potable water to a large population <p><u>Groundwater:</u></p> <ul style="list-style-type: none"> ▪ Principal aquifer ▪ Within SPZ 1 or 2 <p><u>Surface water:</u></p> <ul style="list-style-type: none"> ▪ Supply of high quality potable water to a large population ▪ Classified as “high” water quality under the TAGWFD guidance with no EQS exceedances ▪ EC designated Salmond fishery ▪ Main Rivers ▪ Flood Zone 3b (functional floodplain)
High	Future users of allotments. Construction Workers^.	Residential properties other than low rise.	<p>High water quality and rare resource. Important at a local scale with limited potential for substitution, e.g.</p> <ul style="list-style-type: none"> ▪ Supply of a small volume of potable water for local use <p><u>Groundwater:</u></p> <ul style="list-style-type: none"> ▪ Secondary A aquifer ▪ Within SPZ 3 <p><u>Surface water:</u></p> <ul style="list-style-type: none"> ▪ Classified as “high” water quality under the TAGWFD guidance with no EQS exceedances ▪ EC designated Cyprinid fishery ▪ Some potential to supply a small volume for potable use ▪ Local drainage networks ▪ Flood Zone 3
Medium	Future users of residential properties	Public building e.g. managed apartments,	Moderate water quality and low rarity. Important at a local scale

Importance / sensitivity of resource or receptor	Receptor: Human Health * (Soils)	Receptor: Human Health/Buildings ** (Ground Gas)	Receptor: Controlled Waters
	without private gardens.	schools and hospitals.	<p>e.g.</p> <ul style="list-style-type: none"> ▪ Supply of a small volume of water for agricultural or industrial use or limited potential for potable supply <p><u>Groundwater:</u></p> <ul style="list-style-type: none"> ▪ Secondary B aquifer ▪ Not within SPZ <p><u>Surface water:</u></p> <ul style="list-style-type: none"> ▪ Classified as “good” water quality under the TAGWFD guidance with minor EQS exceedances or classified as “high” with moderate EQS exceedances ▪ Provision of water for agricultural or industrial purposes, no or limited potential to be used for potable supply ▪ Flood Zone 2 ▪ Overland / surface water flow routes
Low	Future users of public open space.	Commercial buildings.	<p>Poor water quality and low rarity e.g.</p> <ul style="list-style-type: none"> ▪ Limited potential to supply a small volume of water for agricultural or industrial use. No or limited potential for potable supply <p><u>Groundwater:</u></p> <ul style="list-style-type: none"> ▪ Secondary B aquifer ▪ Not within SPZ <p><u>Surface water:</u></p> <ul style="list-style-type: none"> ▪ Classified as “moderate” water quality under the TAGWFD guidance with minor EQS exceedances or classified as “good” water quality under the TAGWFD guidance, with moderate EQS exceedances ▪ Limited potential to supply a small volume of water for industrial or agricultural purposes. No, or limited

Importance / sensitivity of resource or receptor	Receptor: Human Health * (Soils)	Receptor: Human Health/Buildings ** (Ground Gas)	Receptor: Controlled Waters
			potential, to be used for potable supply <ul style="list-style-type: none"> ▪ Flood Zone 1
Negligible	Future users of commercial/ industrial properties.	Industrial buildings (where open and well ventilated; office pods might require separate assessment as classified as commercial).	Irreparably poor or bad water quality and low rarity. Important at a local scale e.g. <ul style="list-style-type: none"> ▪ No or very limited potential to supply water for agricultural or industrial use <u>Groundwater:</u> <ul style="list-style-type: none"> ▪ Non designated aquifer or unproductive strata ▪ Not within SPZ <u>Surface water:</u> <ul style="list-style-type: none"> ▪ Classified as “poor” water quality under the TAGWFD guidance, or any other classifications, with high EQS exceedances ▪ No potential to be used for industrial, agricultural or potable supply ▪ Flood Zone 1

* Duration of exposure to contamination and number of pathways of exposure to contamination increases from commercial/industrial (minimum) to residential with private garden (maximum) land uses. Therefore future users of industrial sites are considered to be of negligible importance as they will have minimal contact with underlying soils, whilst residential ends users are likely to be in contact with underlying soils on a more regular basis and are therefore of very high importance.

** Duration of occupancy and perception of risk increases from industrial buildings (minimum) to low rise residential properties (maximum). Amount of ventilation and management increases from low rise residential properties (minimum) to industrial buildings (maximum).

^Construction workers will only be exposed to contamination for a short duration, however, they may enter enclosed spaces and will be directly handling the soils.

Source: Professional judgement.

11.3.5 Methodology for Assessing Impacts

Introduction

11.3.5.1 The assessment of impacts to human health and controlled waters has followed the Environment Agency’s Model Procedures for the Management of Land Contamination (Contaminated Land Report 11, CLR 11) guidance. The assessment was based on the identification of ‘contaminant linkages’, i.e. source-pathway-receptor relationships. This approach accords with the guidance that accompanies Part IIA of the Environmental Protection Act of 1990 (as amended).

Conceptual Site Model

11.3.5.2 The Conceptual Site Model (CSM) links the identified potential previous and existing site sources of contamination capable of causing harm via pathways to identified receptors.

11.3.5.3 The Conceptual Site Model was characterised by identification of the following:

- On-site sources which may impact on-site receptors via plausible pathways;
- On-site source which may impact off-site receptors via plausible pathway; and
- Off-site sources which may impact on-site receptors via plausible pathways.

Human Health Risk Assessment

11.3.5.4 The Human Health Risk Assessment (HHRA) has been undertaken in accordance with the current guidance such as Contaminated Land Report 11 (CLR 11). When quantitative data exists, a tiered risk – based approach has been adopted, comprising the following:

- Tier 1 Assessment: Comparison of site contaminant concentrations against generic exposure scenarios and associated compliance criteria including an assessment of risk using a source-pathway-receptor model
- Tier 2 Assessment: Derivation of site-specific risk assessment criteria and calculation of site specific clean-up goals, if the Tier 2 assessments deem clean-ups to be necessary

11.3.5.5 The assessment has therefore been undertaken in a phased approach, focussing initially on the Tier 1 Assessment. The Tier 1 assessment includes the following stages, which were completed where applicable:

- Zoning of data/site averaging areas;
- Maximum Concentration Assessment - comparison of maximum detected concentrations against relevant Generic Assessment Criteria (GAC);
- Mean and Maximum Value Statistical Analysis – consideration of statistical outliers and 95% Upper Confidence Levels (UCLs) against relevant GAC;
- Risk Evaluation/Assessment of Significant Results; and
- Identification of the need for Tier 2 Assessment and derivation of Site Specific Assessment Criteria (SSAC).

11.3.5.6 The current philosophy in the assessment and remediation of contaminated land in the UK is to adopt an ‘end use’ risk based “suitable for use” approach whereby the significance of contamination at a site is evaluated according to either the existing use or to a proposed developments end use.

Zoning of Data/Site Averaging Areas

11.3.5.7 The development is expected to comprise predominantly residential properties, therefore the site has been considered to comprise one zone and averaging area for the purposes of this assessment.

Tier 1 Assessment

- 11.3.5.8 To identify the contaminants of potential concern (COPC), the laboratory testing results have been compared with the respective SGVs/GAC. The results and respective screening criteria are presented in the associated interpretative report, a copy of which is included within Appendix 11B.
- 11.3.5.9 For the Tier 1 Assessment, Environment Agency published generic Soil Guideline Values (SGVs) derived using the Agency's CLEA model (Ref 11-8), were used. Where these are not available, GAC published by LQM/CIEH (Ref 11-9) were utilised.
- 11.3.5.10 The assessment criteria relevant to the standard sensitive receptor setting within the CLEA model has been used i.e. a female receptor aged 1 to 6 years, a residential building (small terraced house) and a sandy loam soil with a pH7 and SOM 1%. Given the proposed site end use, the stringent "residential with plant uptake" land use scenario has been adopted.
- 11.3.5.11 Any contaminants that exceed the SGVs/GAC are considered to be COPC. Those that do not exceed the respective SGVs/GAC are not considered to be COPC and do not require further assessment in relation to the Development.

Ground Gas Risk Assessment

- 11.3.5.12 It should be noted that, in accordance with current best practice and guidance, the number and frequency of ground gas monitoring rounds required is dependent on the sensitivity of the development and the generation potential of any ground gas source. In this case, the ground gas monitoring programme has been devised in order to establish a preliminary indication of the ground gas regime at the site.
- 11.3.5.13 Preliminary monitoring of the ground gas regime was undertaken by Hyder between August and November 2010. Further monitoring was undertaken by ST Consult in 2014.
- 11.3.5.14 The results of monitoring have been assessed using the current guidance document: CIRIA C665 "Assessing Risks Posed by Hazardous Ground Gases to Buildings" (Ref 11-10) and BS8485:2007 "Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments" (Ref 11-11).

Controlled Waters Risk Assessment

- 11.3.5.15 The Controlled Waters Risk Assessment (CWRA) has been undertaken in accordance with the guidance suggested in the CLR 11 and comprised a staged approach (referred to as 'Levels'). A Level 2 Assessment has been undertaken for the purposes of this CWRA. For information, all Levels (1 to 4) are summarised in Table 11-3 below.

Table 11-3 Quantitative Risk Assessment Levels

	Soil	Groundwater
1	Pore water contamination compared directly to receptor target concentration	Not applicable
2	Attenuation in unsaturated zone and dilution at the water table	Groundwater below source - groundwater data is compared directly to target concentrations
3	Attenuation in the aquifer	Attenuation and down gradient receptor or compliance point – groundwater concentration at the receptor/compliance point is predicted using numerical modelling
4	Attenuation and dilution in the receptor	Dilution in the receptor - dilution in a receiving watercourse or pumping abstraction borehole (only with approval of EA)

11.3.5.16 The basis for the screening criteria is to ensure that the selected screening values are protective of the identified receptor. For groundwater the general approach is to use an environmental standard as experience shows that remediation of contaminated groundwater to background quality is not achievable. The standard should be relevant to the current and future receptors and the standards compliance criteria should be considered.

11.3.5.17 Standards that are applicable to this study are:

- UK Environmental Quality Standards (EQS) for the protection of aquatic life (in both freshwater and saline environments);
- UK Water Supply (Water Quality) Regulations, 2000 and 1989.

11.3.5.18 The groundwater beneath the site is considered to be the receptor in the first instance and therefore the UK Drinking Water Standards (UKDWS) have been selected as the appropriate screening criteria for the Level 2 Assessment. The results and respective screening criteria are presented in the associated interpretative report (Appendix 11B).

Assessment Criteria

11.3.5.19 The magnitude of each impact is assessed using the criteria provided in Table 11-4 below. This assessment, in the context of this chapter, is essentially quantifying the potential outcome of complete ‘pollutant linkages’ impacting the identified receptor.

Table 11-4 Assessing Magnitude of Impact

Magnitude of Impact	Human Health	Building/Structure	Groundwater*
Major	Chronic risk to human health likely to result in	Catastrophic damage to buildings/property.	Loss in water body or permanent significant detrimental impact on

Magnitude of Impact	Human Health	Building/Structure	Groundwater*
	'significant harm' as defined by the Environmental Protection Act 1990, Part IIA.	e.g. explosion resulting in building collapse.	water quality which permanently affects its use to or potential to supply water.
Moderate	Chronic damage to human health (significant harm as defined in Statutory Guidance.	Significant damage to buildings, structures and services.	Temporary loss of water body. Significant temporary detrimental impact on water quality but does not affect its use or moderate temporary detrimental impact on water quality, which does affect its use for supply purposes.
Minor	Significant chronic harm but to less sensitive receptors.	Damage to sensitive buildings, structures, services or the environment.	Moderate temporary detrimental impact on water quality, which does not affect its use for supply purposes.
Negligible	Non permanent health effects to human health (easily prevented by means such as personal protective clothing).	Easily repairable effects of damage to buildings, structures and services.	Minor temporary detrimental impact on water quality.
No Change	No discernable impact	No discernable impact	No discernable impact

*Source: Adapted from Department of Transport's Transport Analysis Guidance: The Water Environment Sub-Objective, 2003 based on methodology set out in DMRB with professional judgement added to relate to contaminated land. *Magnitude of impacts can be positive or negative

11.3.5.20 Using these definitions, a combined assessment of sensitivity and magnitude can then be undertaken to determine how significant an effect is, as demonstrated in Table 11-5 below.

Table 11-5 Assessing Magnitude of Impact

		Magnitude of Impact				
		No Change	Negligible	Minor	Moderate	Major
Value of Receptor	Very High	Neutral	Slight	Moderate/Large	Large or Very Large	Very Large
	High	Neutral	Slight	Moderate/Slight	Moderate/Large	Large/Very Large
	Medium	Neutral	Neutral/Slight	Slight	Moderate	Moderate/Large
	Low	Neutral	Neutral/Slight	Neutral/Slight	Slight	Slight/Moderate
	Negligible	Neutral	Neutral	Neutral/Slight	Neutral/Slight	Slight

11.3.6 Limitations and Assumptions

- 11.3.6.1 Subsurface ground conditions are by their nature hidden from view, and on this basis actual ground conditions at the Site have the potential to be at variance to those being reported and inferences drawn.
- 11.3.6.2 The intrusive investigation undertaken by Hyder was designed to provide a preliminary inspection to help inform a baseline of the ground conditions to facilitate the Outline Planning Application. Further recommended work would be controlled by relevant planning conditions(s). Further detailed investigation / assessments would be required to provide a higher density sampling plan reduce uncertainties and thereby to refine the Site characterisation between sampling points where previously no investigation has been undertaken.
- 11.3.6.3 This document has been prepared using factual information contained in maps and documents prepared by others. Where this is the case, no responsibility can be accepted for the accuracy of such information.

11.4 Description of the Baseline Conditions

11.4.1 Existing Baseline

Site History

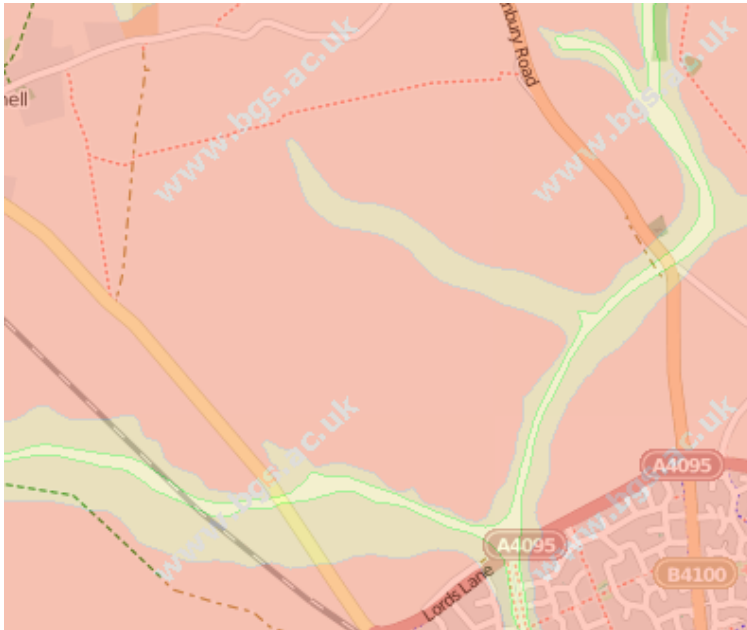
- 11.4.1.1 Since the earliest available historical map of 1881 to the present day, the site has been dominated by agricultural activity. A quarry is located on the southern side of Bucknell Road. On the 1922 edition, the Great Western Railway is present defining the southern boundary. In 1923 limekilns, quarry and pumping station are shown on southern side of railway line. These are no longer present in 1970 and are the location of the landfill site which is later developed into Avonbury Business Park.

Geology

Published Geology

- 11.4.1.2 From published BGS geological maps (Sheet 219, Scale 1:50,000) (Ref 11-12), the geology across the site is underlain by a thin cover of superficial deposits (alluvium) which follows the lines of the watercourses within the locality. The solid geology, is represented by the Combrash Formation, which primarily comprises bioclastic limestone. This is underlain by the Forest Marble Formation, which comprises grey calcareous mudstone with lenticular beds of bioclastic limestone. Further detailed information is included within the desk study report in Appendix 11A and Figure 11-4 below illustrates the drift and solid geology at the site.

Figure 11-4 Solid and Drift geology (Taken from BGS website)



Key

Superficial deposits

- ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
- HEAD - CLAY, SILT, SAND AND GRAVEL

Bedrock geology

- BLADON MEMBER - MUDSTONE AND LIMESTONE, INTERBEDDED
- CORNBRASH FORMATION - LIMESTONE
- FOREST MARBLE FORMATION - LIMESTONE
- FOREST MARBLE FORMATION - LIMESTONE AND MUDSTONE, INTERBEDDED
- WHITE LIMESTONE FORMATION - LIMESTONE

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Encountered Geology from Preliminary Investigation

11.4.1.3 The geological sequence is generally confirmed by the two ground investigations undertaken across the site with the strata encountered as follows:

- 0-0.2m thickness of Topsoil;
- 0.2-0.6m (up to 0.8m deep in places) of Subsoil, comprising an orange/brown gravelly/sandy Clay or sandy clayey Gravel;
- 0.6m to 1.9m (up to 2.9m deep in places) of yellow sandy Gravel and in places yellow/grey Clay, grading to completely weathered Limestone (Cornbrash Formation);
- From 1.9 to 7m depth, alternating Limestone and Clay bands of the Cornbrash Formation are represented.

Hydrogeology

- 11.4.1.4 The solid geology is designated as Secondary A aquifer. These are aquifers which are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flows to rivers. The superficial deposits are not designated.
- 11.4.1.5 The site is not located within a Source Protection Zone (SPZ) and no major potable water supplies are present within 5km of the Site.
- 11.4.1.6 There are three groundwater abstractions recorded within the site boundary. All are registered to boreholes at Lord's Farm for general farming and domestic purposes. Two further abstractions are shown on the map at Hawkwell Farm in the centre of the Site, but these are not recorded in the EA database (from Envirocheck).
- 11.4.1.7 From the borehole log available of the BGS website, the following information is available regarding the one for the abstraction wells at Lords Farm:
- 11.4.1.8 An 80 m deep borehole at Lords Farm (SP52/18 at SP 5746 2424), drilled in 1941, was drilled through a similar sequence and terminated in the Lias. It struck water in the Cornbrash Formation, which was cased out, and at two levels below the White Limestone Formation. The rest water level was at 11m below ground level (about 68m AOD) and it yielded 1.7 l/s. Other records of water levels at Lords Farm (SP52/17A, B and C at about SP 569 245) show that the water level was at approximately 3.6m of ground level (about 76m AOD).
- 11.4.1.9 One historical well is located within the Site Area under consideration, with two further historic wells located to the south west on the opposite side of the railway line. Plans showing the locations of the wells are included in the Hydrogeological report in Appendix 11C.
- 11.4.1.10 During the Hyder site investigation (Appendix 11B) groundwater was encountered between 0.6 to 2.6 m in trial pits TP7, TP8, TP9 TP10 and TP13 (location plan in Hyder report Appendix 11B). The remaining trial pits were dry during the short time they were left open. Trial pits TP7 to TP10 and TP13 were carried out after a period of heavy rain. Groundwater monitoring, following completion of the ground investigation at the Masterplan site suggested that excavations for shallow foundations may encounter some groundwater flow in some areas, particularly after heavy rain. The groundwater strikes within the trial pits generally coincide with the top of the limestone (Cornbrash Limestone).
- 11.4.1.11 During the ST Consult investigation (Appendix 11D) groundwater was encountered in BH3 and BH4 at 4.85m and 5.40m respectively. In BH3 the groundwater rose to ground level in 3 minutes which indicated an artesian flow following a fissure strike. This location was abandoned and grouted with a bentonite seal.

Hydrology

- 11.4.1.12 There are three main watercourses on Site, as shown on Figure 7-1; one flowing in a north-westerly to south-easterly direction from the railway line across the site, another which flows from the north-north-west and joins with the

third watercourse which flows in a north-easterly to south-westerly direction. The two main streams converge and discharge into the River Bure in the centre and north-east of the Site area. The River Bure flows off-Site in a roughly north-easterly to south-westerly direction.

Landfill Sites

- 11.4.1.13 A historic landfill is recorded as present on the Site at Gowell Farm approximately 100m to the south of the Site boundary. This is currently part of Avonbury Business Park. Records suggest that this location may have been previously quarried for limestone. Local Authority records contained within the Envirocheck Report state the deposited waste as being “ash, glass, brick, pottery”, which was likely used as fill for the old quarry on Site.
- 11.4.1.14 The ST Consult investigation (Appendix 11D) included drilling in the landfill area which is outside the Application 1 boundary. Made Ground was encountered to a maximum depth of 3m (WSL3) in the area of the infilled Lime Kiln. This comprised of clinker based fill including black and brown mottling and abundant glass sharps but no visual or olfactory signs of significant contamination.
- 11.4.1.15 A plan showing the features detailed above are included within the Phase 1 desk study report (Appendix 11A) and Hydrogeological Report (Appendix 11C).

Tier 1 Hydrological Risk Assessment

- 11.4.1.16 This was undertaken to assess the suitability of land within the Application 1 boundary for the development of a cemetery. The key issues are detailed below with further information on the assessment within the report included within Appendix G of the Hyder desk study report (Appendix 11A).
- 11.4.1.17 Within the assessment a site vulnerability is determined which is based on the geology, hydrogeology and other baseline factors. The vulnerability ranking assigned to land within the Application 1 boundary is Moderate and when the number of anticipated annual burials are considered the risk rating is increased to High.
- 11.4.1.18 The site characteristics that have caused the raised vulnerability score were absence of superficial deposits and high water table.
- 11.4.1.19 The report states that subject to appropriate site investigation and agreement with the EA, it may be possible to either adjust the risk rating of the site or to design measures, such as drainage or specifications for burials, to mitigate risk to groundwater.

Contamination Status

Human Health Risk Assessment

- 11.4.1.20 During the investigation undertaken by Hyder, soil samples were taken from the Application 1 area and analysed for a suite of metal and organic contaminants. From the assessment only one soil sample of 23 samples from TP13 at 0.6m depth had a concentration slightly above the respective SGVs/GAC for Arsenic. The concentration recorded was 36.2mg/kg which is marginally above the SGV of 32mg/kg for a residential with plant uptake scenario. On review of the log for

TP13, this slightly elevated result was encountered within natural soils (very clayey sandy gravel) and therefore it is likely that the Arsenic is from natural sources. From BGS data the background concentrations in this area are around 25mg/kg which is a similar order as the concentration encountered. Due to the depth that it has been encountered, residents are unlikely to come into day to day contact with this material and therefore the risk from this slightly elevated concentration would be minimal. This assumes that the site levels remain the same.

- 11.4.1.21 All other samples analysed contained contaminants which were below the SGVs/GAC for a residential with plant uptake scenario.
- 11.4.1.22 As only one sample of the 23 samples tested returned contaminant values greater than the respective SGVs/GAC, the soil that has been tested is deemed suitable for use in gardens (including growing edible plants) without the need for treatment or other remedial action. It should however be noted that samples have been taken from depths ranging from 0.2m to 1.2m below ground level. There has therefore been limited testing of shallow soils and very limited testing (if any) of topsoil across the site.
- 11.4.1.23 The investigation undertaken in the southern portion of the Application 1 site (on northern side of the railway line) by ST Consult included analytical testing of soil samples for a suite of inorganic and organic contaminants. The results were compared to SSVs for a commercial end use and no exceedances were recorded. On review of the results, the concentrations from the locations on the northern side of the railway line (i.e. within the Site boundary) all the results were below the SSVs for a residential with plant uptake scenario.
- 11.4.1.24 All the samples from the ST Consult investigation and two from the Hyder investigation were screened for Asbestos. No fibres or asbestos containing materials (ACM) were recorded.
- 11.4.1.25 Based on the information available to date, the risks posed to human health (i.e. site end users) are considered to be low.
- 11.4.1.26 It should be noted that the investigation undertaken to date, only provides limited spatial coverage due to access constraints at the time of the works.
- 11.4.1.27 During site construction works, site workers should remain vigilant to the possible risk of encountering localised “unforeseen” areas of contaminated soils. Should potentially contaminated soil be encountered, further testing would be required to assess the risks to the health and safety of site workers, site end users and other sensitive receptors. All persons engaged in site construction works should be made aware of the findings of the intrusive investigation and the hazards associated with handling potentially contaminated materials. It is recommended that all works are conducted in accordance with the Health and Safety Executive publication entitled “Protection of Workers and the General Public during the Development of Contaminated Land” (Ref 11-13).

Gas Risk Assessment

- 11.4.1.28 Gas monitoring was undertaken during the Hyder (3 rounds) and ST Consult investigations (3 rounds).

- 11.4.1.29 From the Hyder investigation, two boreholes BH3 and BH5 are considered. BH3 is located on the northern side of the railway line at the southern boundary of the site. BH5 is located within an area known as the Exemplar site but is located adjacent to the northern boundary and therefore the data from this borehole has also been considered within this assessment.
- 11.4.1.30 From the ST Consult investigation, one monitoring well BH4 is located within the Site area, however all the results are considered as monitoring is undertaken with landfill material located to the south of the site. This could pose a risk to end users within the Application 1 site area from migration of gases on to site.
- 11.4.1.31 In line with current guidance, Gas Screening Values (GSV) for methane and carbon dioxide have been calculated.
- 11.4.1.32 Based on the concentrations recorded during the monitoring undertaken by Hyder the highest GSV are; Methane 0.0003l/h (BH5) and Carbon Dioxide 0.011l/h (BH5).
- 11.4.1.33 From the ST Consult information, the gas concentrations and flow rate recorded in BH4 (on site) are below the limit of detection (<0.1% v). BH1 and BH2 which are located on the opposite side of the railway line recorded below limit of detection with regards to methane, however carbon dioxide with a maximum of 2% v was recorded in BH2. This indicates that some gas may be migrating from the landfill site towards the Site Area. When considering all the gas monitoring undertaken including the wells within the landfill material, the worst case GSV for carbon dioxide is 0.12l/h (WSL4 within fill material).
- 11.4.1.34 The results of the gas monitoring indicate a NHBC Green Scenario (low risk) in relation of ground gases for the Development.
- 11.4.1.35 Further monitoring across the site may be required to ensure that there is no variation across the Development.
- 11.4.1.36 With regards to radon, a detailed BR 211 Radon Report was obtained from the British Geological Survey (BGS) as part of the Desk Study (Appendix 11A) and states that the estimated probability of a property being above the Action Level for radon is 3-5% and therefore basic radon protection measures are required in the construction of new properties for the site.

Controlled Water Risk Assessment

- 11.4.1.37 During the Hyder investigation, three water samples taken from the boreholes (BH1, BH3 and BH5) across the Site Area or in close proximity were analysed predominantly for metal contaminants. All the results were below the Water Quality Standards (WQS) values. Further information on the WQS values used can be found in the Hyder interpretative report (Appendix 11B).
- 11.4.1.38 Groundwater was taken from seven wells during the ST Consult investigation and screened for inorganic and organic contaminants. Generally the results were below the appropriate WQS, however slight exceedances were encountered for some metal contaminants against the screening values. For example BH4 which is located within the Site indicated slightly elevated

selenium and lead, but only a natural sequence was observed during drilling. This may indicate naturally higher concentrations or that there is impact on an off-site location.

11.4.1.39 Whilst some slight exceedances have been recorded, it is unlikely that remedial action with regards to groundwater would be required.

11.4.2 Future Baseline

11.4.2.1 In the absence of the Development, the future use of the Site is likely to stay in agricultural use. Based upon this assumption, it is considered that existing ground conditions, and low levels of contamination would remain at the Site.

11.4.2.2 The low levels of contamination encountered on the site are likely to be from natural sources and therefore the land quality is not likely to deteriorate if no development was constructed.

11.5 Design and Mitigation

11.5.1 Construction Approach and Mitigation of Short-Term Construction Effects

11.5.1.1 The remedial works required for the mitigation of impacts to the proposed future Site users and controlled waters would be completed during the construction phase of the Development. The main potential contamination impacts relating to the construction phase are considered to be:

- Impacts to construction workers;
- Impacts to the environment from the construction works;
- Impacts to adjacent people, properties and roads from the remedial and construction works.

11.5.1.2 The necessary mitigation measures to be incorporated within the construction phase are outlined below.

Mitigation of Contamination Impacts to Construction Workers

11.5.1.3 The potential impacts to construction workers from contaminants in soils and groundwater would be mitigated through the adoption of appropriate health and safety practices, as outlined in the Code of Construction Practice (CoCP). This would be set out in the CEMP.

11.5.1.4 All persons engaged in Site construction works would be made aware of the findings of the intrusive investigations and the hazards associated with handling potentially contaminated materials. All works would be conducted in accordance with the Health and Safety Executive publication entitled "Protection of Workers and the General Public during the Development of Contaminated Land", 1991.

11.5.1.5 Whilst no asbestos has been encountered, the procedures relating to asbestos outlined within the CoCP would be adhered to by construction workers with regard to the potential presence of asbestos within excavated earthworks

materials. Suitable Personal Protective Equipment (PPE) including Respiratory Protective Equipment (RPE) if necessary would be made available for use if suspected asbestos contaminating materials are encountered during the Site works.

- 11.5.1.6 Where any hazardous chemicals are used in the construction works, risk assessments would be made under The Control of Substances Hazardous to Health Regulations (as amended) (Ref 11-14).
- 11.5.1.7 The procedures relating to the monitoring of excavation works and the identification of any suspected further contamination defined within the CoCP would be adhered to. Site workers would remain vigilant to the possible risk of encountering isolated areas of contaminated material, particularly if unusual visual changes, or odours are encountered.
- 11.5.1.8 The main contractor would be required to develop contingency plans in the Construction and Environmental Plan (CEMP) to minimise accidental exposure to human and environmental receptors from unexpected hazards.
- 11.5.1.9 A Materials Management Plan would be produced detailing the strategy for re-use of soils within the Development. This would follow the approach within the CL:AIRE Development Industry Code of Practice (Ref 11-15).
- 11.5.1.10 An experienced environmental engineer would be available to attend site and undertake inspection and supervision of contingency events and subsequent actions. This would allow quick identification of potential hazards, direction of quarantine and call-off actions and sampling and testing of potentially hazardous materials. Specialist services would be called upon for further investigation and remedial actions, as necessary.

Mitigation of Contamination Impacts to the Environment, Adjacent People and Properties from the Construction Works

- 11.5.1.11 Suitable measures to mitigate the contamination impacts during the construction works are outlined below. The mitigation of construction related impacts to surface water are detailed in Chapter 7 of this ES. The following mitigation methods would be employed:
 - Prevention of water entering excavations, where possible;
 - Planned and phased topsoil stripping, excavation and stockpiling operations to ensure minimal disturbance;
 - Use of measures such as cut off ditches, silt fences or impermeable membranes to prevent uncontrolled release of runoff from excavations or exposed ground;
 - Appropriate disposal of waste from the Site;
 - Appropriate storage of potentially polluting materials and chemicals in accordance with the Control of Pollution (Oil Storage) Regulations (England) 2001 (Ref 11-16);
 - Adequate supervision of all deliveries and refuelling involving potentially polluting substances;

- Delivery and refuelling areas to be located away from surface water bodies with adequate measures in place to contain spillages at these locations;
- Leaks or spillages of potentially polluting substances to be contained, collected then removed from Site in an appropriate manner e.g. use of absorbent material, bunding or booms. An emergency action plan would be formulated which all Site personnel would have read and understood;
- Storage of machinery and equipment to be located away from surface water bodies. Drip trays to be placed underneath any parts where oil/fuel may be found;
- Use of adequate wheel wash facilities to contain and dispose of potentially polluted runoff;
- Regular washing of machinery and access roads and dampening to reduce dust emissions with appropriate collection and disposal of runoff;
- Use of pre-mixed concrete from an off-site source or limiting mixing and handling of wet concrete to a designated area away from surface water bodies and with controlled runoff for appropriate disposal;
- Should areas of contamination be identified measures would be taken to ensure that contaminated material is isolated. All equipment utilised within the contaminated area would be thoroughly cleaned before it is used outside the contaminated area;
- Special measures would be adopted during drilling of boreholes and during piling to ensure that preferential pathways are not created;
- All construction works would be carried out in accordance with PPG 6 'Working at Construction and Demolition Sites' (Ref 11-17) and other relevant PPG documents (Refs 11-18 to 11-25);
- Secure access to the Site for construction personnel only to prevent vandalism

11.5.2 Scheme Design and Mitigation of Permanent Operational Effects

Future Site Users

- 11.5.2.1 The impacts to future Site users would be mitigated by the remedial measures (if deemed necessary) that are implemented.
- 11.5.2.2 The impacts to future Site users within buildings would be mitigated by the incorporation of appropriate ground gas protection measures (if required beyond those to mitigate the risk from Radon gas) within the building design and construction, in accordance with CIRIA C665 and BS8485.
- 11.5.2.3 As part of the further detailed contaminated land investigations and assessments to be completed ahead of each development phase, installation of additional ground gas monitoring locations and further ground gas monitoring would be completed. This would provide an acceptable ground gas dataset to allow a comprehensive ground gas risk assessment to be completed. The findings of this assessment would confirm the suitability of the above listed

measures. The assessment and remedial measures would be controlled by relevant planning condition(s).

Controlled Waters

- 11.5.2.4 The impacts to controlled waters would be mitigated by the remedial measures (if deemed necessary) that are implemented.
- 11.5.2.5 Within the land proposed to be a cemetery, measures such as drainage design or specification for burials would be implemented to ensure that the risk to groundwater is mitigated. Prior to the design of the cemetery, further detailed ground investigations would be undertaken to determine the depth of groundwater (including seasonal variations) in this locality and discussions with the EA would be undertaken to ensure all requirements are met.

Buildings and Services

- 11.5.2.6 As methane concentrations within the explosive range (5-15% v/v in air) have not been detected during the ground gas monitoring completed to date, explosive ground gas is unlikely to impact upon the proposed buildings. Notwithstanding this, the impact from ground gas to proposed buildings would be mitigated by the incorporation of appropriate ground gas protection measures (if required) within the building design and construction to protect future Site users, subject to further monitoring and assessment.
- 11.5.2.7 As part of the further detailed contaminated land investigations and assessments to be completed ahead of each development phase, installation of additional ground gas monitoring locations and further ground gas monitoring would be completed to provide an acceptable ground gas dataset. This would allow a comprehensive ground gas risk assessment to be completed. The findings of this assessment would confirm whether proposed buildings require gas mitigation measures.
- 11.5.2.8 Appropriate assessment of potential risks to new water supply pipes would be completed to ensure appropriate pipe material is used within the Development. This would be controlled by relevant planning condition(s).

11.6 Construction Impacts

- 11.6.1.1 Provided that the mitigation measures outlined above and in the remedial strategy documents are followed, the likely construction impacts are detailed below.
- 11.6.1.2 The impacts on construction workers include potential chronic damage via dermal, ingestion and inhalation exposure to contamination. Construction workers are considered to be of high importance and assuming the mitigation measures are adopted, it is considered that this would result in a negligible adverse change to human health. The impact significance has been assessed as **temporary slight adverse**.
- 11.6.1.3 The impacts to adjacent site users include potential chronic damage to contamination via ingestion and inhalation of air-borne dust exposure. This could be through site activities and transportation of material off site. The main

adjacent site users are considered to be residential receptors which are considered to have a very high importance. Assuming the mitigation measures are adopted it is considered that this would result in a negligible adverse changes to human health. The impact significance has been assessed as **temporary slight adverse**.

- 11.6.1.4 Whilst low levels of contamination have been encountered on site, construction activities could result in the mobilisation of contaminants within the soil and create pathways for contaminants to migrate into the underlying groundwater or surface water. These receptors would also be at risk from general construction activities such as re-fuelling of vehicles, use of chemicals and hydrocarbons on site, stockpiling and excavation of soils. The groundwater is designated a Secondary A aquifer and is given a high importance. Assuming the mitigation measures are implemented, it is considered that this could result in a negligible adverse change in water quality. The impact significance has been assessed as **temporary slight adverse**.

11.6.2 Overview

- 11.6.2.1 As detailed above assuming that the mitigation measures are adopted during the construction phase, the impact significance has been assessed as **temporary slight adverse** for identified receptors.

11.7 Permanent Operational Impacts

- 11.7.1.1 The development mainly comprises of residential housing and therefore once developed the site end users (i.e. residents) would come into contact with soils and therefore there is the potential for chronic damage via exposure to contamination via accidental ingestion, dermal contact or inhalation of dust. Based on the information to date, low levels of contaminants have been encountered on site and if contamination was encountered in other previously uninvestigated area remedial measures would be implemented.
- 11.7.1.2 Residents are considered to have very high importance and assuming mitigation measures are adopted this would results in a negligible adverse change to human health. The impact significance has been assessed as **permanent slight adverse**.
- 11.7.1.3 Based on the gas monitoring information to date, there is the potential for low levels of gases in particular carbon dioxide to migrate from the landfill site to the south of Application 1. Site end users could be at risk from gases migrating on to site and accumulating within confined spaces in properties leading to asphyxiation. Site end users (residents) are considered to have a very high importance and assuming that appropriate mitigation measures are implemented (ie installation of suitable gas protection measures) this would result in a negligible adverse change to human health. The impact significance has been assessed as **permanent slight adverse**.
- 11.7.1.4 A small proportion of the site is likely to be developed for retail / leisure activities. During operation, there is the potential risk from accidental spillages of contaminating materials such as fuel, oil and chemicals. These areas are likely to be covered by hardstanding with appropriate drainage which would

protect the underlying soils and water receptors. Groundwater is considered to be of high importance and assuming design and mitigation measures are adopted this would result in a negligible adverse change to water quality. The impact significance has been assessed as **permanent slight adverse**.

- 11.7.1.5 A small area within the Application 1 boundary is proposed to be a cemetery. During the operation of this, there is a risk that contaminants (associated with decomposition of bodies) would enter the underlying groundwater. Based on the information to date a high vulnerability risk rating has been determined. The groundwater in the area is considered to be of high importance and assuming design and mitigation measures are adopted this would result in a negligible adverse change to water quality. The impact significance has been assessed as **permanent slight adverse**.

11.8 Cumulative Impacts

- 11.8.1.1 Off-site impacts would be limited through the mitigation described above and disposal of contaminated and uncontaminated soils to landfill would be avoided by the proposed remedial works or materials management plans. Therefore, provided that the requirements of the relevant policy and legislation relating to land contamination and remediation are adopted in design and appropriate mitigation measures are applied, it is considered that there would be no significant cumulative impacts.

11.9 Summary

- 11.9.1.1 The study area for the contaminated land assessment is defined by the red line boundary for Application 1, however consideration is given to activities within 500m of the boundary e.g. landfill site which may have an impact on the Development.
- 11.9.1.2 The assessment of the potential for adverse environmental impact that could be associated with chemical contamination has been undertaken in accordance with The Statutory Guidance on Part IIA of the Environmental Protection Act 1990 (EPA 1990) as set out in Defra Circular 2012; The Environment Agency's Model Procedures for the Management of Land Contamination (Contaminated Land Report (CLR) 11) and other relevant supporting guidance.
- 11.9.1.3 Receptors identified as part of this study are:
- Human health (construction workers, site end users)
 - Controlled waters (groundwater and surface water)
 - Buildings and services
- 11.9.1.4 Since the earliest available historical map of 1881 to the present day, the site has been dominated by agricultural activity. A quarry is located on the southern side of Bucknell Road. On the 1922 edition, the Great Western Railway is present defining the southern boundary. In 1923 limekilns, quarry and pumping station are shown on southern side of railway line. These are no longer present in 1970 and are later developed into Avonbury Business Park.

- 11.9.1.5 From published BGS geological maps, the geology across the site is underlain by a thin cover of superficial deposits over Combrash Formation and Forest Marble Formation. This sequence was generally confirmed by the investigation work undertaken by Hyder and ST Consult.
- 11.9.1.6 The solid geology is designated as Secondary A aquifer, whilst the superficial deposits are not designated. The site is not located within a Source Protection Zone (SPZ).
- 11.9.1.7 A historic landfill is recorded as present on the Site at Gowell Farm approximately 100m to the south of the site boundary. This is currently part of Avonbury Business Park. The ST Consult investigation included drilling in the landfill area where Made Ground was encountered to a maximum depth of 3m (WSL3) in the area of the infilled Lime Kiln.
- 11.9.1.8 During the investigations undertaken by Hyder and ST Consult, soil samples were taken and analysed for a suite of contaminants. There was only one Arsenic which was slightly above the guideline value for a residential end use.
- 11.9.1.9 The results of the preliminary gas monitoring indicate a NHBC Green Scenario (low risk) in relation of ground gases for the Development.
- 11.9.1.10 Generally the groundwater results were below the appropriate WQS, however slight exceedances were encountered for some metal (selenium, lead) contaminants against the screening values. Whilst some slight exceedances have been recorded, it is unlikely that remedial action with regards to groundwater would be required.
- 11.9.1.11 Assuming that the proposed mitigation measures are adopted during the construction phase, the impact significance has been assessed as **temporary slight adverse** for identified receptors.
- 11.9.1.12 Assuming that the proposed mitigation measures are adopted during the operational phase, the impact significance has been assessed as **permanent slight adverse** for identified receptors.

Table 11-6 Contaminated Land Impact Summary Table

Impact description	Temporary/Permanent	Significance rating
Damage to health of construction workers through dermal / ingestion and inhalation exposure to contamination during construction	Temporary	Slight Adverse
Damage to health of adjacent and new site users through ingestion of dust and inhalation exposure to contamination during construction.	Temporary	Slight Adverse
Potential mobilisation of	Temporary	Slight Adverse

contamination into groundwater during construction via excavation, spillages etc		
Damage to health of new site users through demal / ingestion and inhalation exposure to contamination	Permanent	Slight Adverse
Damage to health of new site users from ground gases.	Permanent	Slight Adverse
Accidental Spillages during use of retail activities	Permanent	Slight Adverse
Contaminants entering the groundwater from the use as a cemetery	Permanent	Slight Adverse