



Himley Village, Bicester

Desk Study

Countryside Properties PLC

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EXECUTIVE SUMMARY

<i>SITE INFORMATION AND SETTING</i>	
Objectives	To identify geotechnical and geo-environmental risks on the site and formulate a conceptual site model.
Client	Countryside Properties PLC
Site name and location	Himley Village, Bicester. The site is located off the B4030 to the east of the M40 and to the west of Howes Lane; approximately 2km west of Bicester town centre. The National Grid Reference of the approximate centre of the site is 455855E, 223172N.
Proposed development	The site development proposals are understood to comprise residential dwellings with associated gardens, open space and infrastructure.
<i>PHASE 1 (DESK STUDY AND SITE RECONNIASANCE)</i>	
Ground Model	<p>The site currently comprises and comprises two adjacent arable fields, with a farm track running north to south through the eastern end of the western field. There are trees and hedges forming site and field boundaries, and sporadic vegetation across the site.</p> <p>The site is approximately 28.5 ha in area and slopes down from the north-west to the south-east from approximately 95m to 84m above Ordnance Datum (OD).</p> <p>Review of historical Ordnance Survey mapping indicates very little change in land use from 1876 (the date of earliest mapping) with only footpaths and field boundaries changing. The surrounding area has also remained largely unchanged with the exception of land to the north-east where a lime kiln, quarry and railway appear in 1919 around 1km from the site.</p> <p>By 1981, there are residential properties approximately 500m to the east, with commercial warehouses constructed in 2019/2020 immediately west of these properties.</p> <p>A number of small quarries are also shown in the area on early mapping.</p> <p>A non-specialist UXO assessment indicates a low bomb risk.</p> <p>The geology at the site is recorded by the BGS as Cornbrash Formation overlying the Forest Marble Formation. There are no superficial deposits recorded. However, the Hyder investigation encountered Superficial/Head Deposits across the wider site, typically to 0.90m below ground level (bgl), but to a maximum depth of 1.80m bgl.</p> <p>The Cornbrash Formation and the Forest Marble Formation are both Secondary A aquifers. However, the site is not within a Source Protection Zone and there are no groundwater abstractions within 500m of it.</p> <p>There are a small number springs in the surrounding area possibly suggesting shallow groundwater.</p> <p>There is a pond on the eastern boundary of the site, and the Gagle Brook flows from north-west to south-east approximately 400m south of it.</p> <p>The historical report indicates possible naturally occurring concentrations of arsenic above the Generic Assessment Criteria (GAC) in the area.</p>
<i>ASSESSMENT AND CONCLUSIONS</i>	
Preliminary Geotechnical Hazards	<p>The following plausible geotechnical risks are identified.</p> <ul style="list-style-type: none"> • Low strength, compressible ground – risk of shear failure and excessive settlement of foundations, roads and infrastructure elements (low risk). • Shrinkage/swelling of clay – settlement/heave of foundations, especially where within the influence of trees and vegetation. • Limestone solution features and voids in the overlying deposits. Whilst considered a low risk, such features are possible and should be considered in the investigation and design. • Shallow and changing groundwater levels – potential problems with excavation. • Difficulty excavating through limestone beds.

	<ul style="list-style-type: none"> Potential for unforeseen ground conditions and the risks associated with limited data. 												
Preliminary Geo-environmental Conclusions	<p>Based on historical and current land uses, the overall risk from land contamination at the site is considered to be low currently, and moderate for a developed site, but this would need to be confirmed by appropriate intrusive investigation, testing and assessment of the results of the investigation.</p> <p>It is considered that it is unlikely that the site would be classified as Contaminated Land under Part 2A of the EPA 1990.</p> <p>The possible pollutant linkages on an unremediated site determined by desk study and walk-over are summarised below for risk levels of moderate or greater.</p> <table border="1"> <thead> <tr> <th>Source(s)</th> <th>◀ potential Impact on ▶</th> <th>Receptor(s)</th> </tr> </thead> <tbody> <tr> <td>Pesticides and herbicides from agricultural activities.</td> <td></td> <td>Site users</td> </tr> <tr> <td>Naturally occurring elevated concentrations of arsenic in soils.</td> <td></td> <td>Groundwater via leaching</td> </tr> <tr> <td>Use of waste in construction (asbestos)</td> <td></td> <td>Site users</td> </tr> </tbody> </table>	Source(s)	◀ potential Impact on ▶	Receptor(s)	Pesticides and herbicides from agricultural activities.		Site users	Naturally occurring elevated concentrations of arsenic in soils.		Groundwater via leaching	Use of waste in construction (asbestos)		Site users
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Pesticides and herbicides from agricultural activities.		Site users											
Naturally occurring elevated concentrations of arsenic in soils.		Groundwater via leaching											
Use of waste in construction (asbestos)		Site users											

FUTURE CONSIDERATIONS

Further work	<p>In order to confirm the actual risks to receptors and confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken, which will need to:</p> <ul style="list-style-type: none"> confirm the depth and distribution of strata across the site; determine the soil strength/density profile beneath the site; determine the depth/level of groundwater beneath the site; assess the potential for solution features at the site; determine the ground gas concentrations beneath the site; determine CBRs to assist with pavement design; assess trench stability, over break potential and 'digability'; allow soil infiltration rate testing; allow sampling for chemical and geotechnical laboratory testing; allow soil classification to allow geotechnical characterisation and determine suitability for reuse of soils in earthworks (if required); obtain information in terms of Aggressive Chemical Environment for Concrete Class (ACEC Class). <p>Following investigation, assessment will be required to:</p> <ul style="list-style-type: none"> update the Ground Model; update the Geotechnical Risk Register; provide geotechnical design recommendations; update the preliminary Conceptual Site Model (CSM), including identification of plausible pollution linkages; undertake generic quantitative risk assessment of potential chemical contaminants to establish 'suitability for use' under the current planning regime; discuss potential environmental liabilities associated with land contamination (soil and water); and provide outline mitigation recommendations to ensure the site is 'suitable for use'.
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This Executive Summary forms part of Hydrock Consultants Limited report number 16153-HYD-XX-XX-GE-DS-1001-S2-P01 and should not be used as a separate document.

1. INTRODUCTION

1.1 Terms of reference

In November 2020, Hydrock Consultants Limited (Hydrock) was commissioned by Countryside Properties PLC (the Client) to undertake a desk study at Himley Village, Bicester, off the B4030.

The site is currently grassed fields.

Hydrock understands that the proposed development is to comprise residential dwellings with associated gardens, open space and infrastructure. A proposed development layout (Countryside Properties PLC Drawing HV-01-SK08), is presented in Appendix A

The works have been undertaken in accordance with Hydrock's proposal referenced (C16153-HYD-XX-XX-FP-GE-0005, 28th October 2020) and the Client's instructions to proceed (email dated 28 October 2020).

1.2 Objectives

The works have been commissioned to support the planning application and as part of the due diligence process.

The objective of the Phase 1 Desk Study is to formulate an outline Conceptual Ground Model of the site to identify key geo-environmental and geotechnical risks to the proposed development.

1.3 Scope

The scope of the Phase 1 Desk Study comprises:

- a field reconnaissance (walkover) to determine the nature of the site and its surroundings including current and former land uses, topography and hydrology;
- acquisition and review of:
 - historical Ordnance Survey maps, to identify former potentially contaminative uses shown at the site and immediately surrounding it, and an assessment of the associated contamination risks;
 - a third-party environmental report to identify flooding warning areas, local landfills, pollution incidents, abstractions, environmental permits etc. which may have had the potential to have environmental impact on the site;
 - topographical, geological and hydrogeological maps;
 - British Geological Survey (BGS) archive records;
 - regional UXB risk maps;
- a review of previous investigations carried out at the site;
- development of a preliminary Ground Model representing ground conditions at the site;
- development of an outline Conceptual Model (oCM), including identification of potential pollution linkages;
- a qualitative assessment of any geo-environmental risks identified; and
- identification of plausible geotechnical hazards.

1.4 Available information

The following have been provided to Hydrock by Countryside Properties PLC for use in the preparation of this report:

- Hyder. February 2011. 'NW Bicester Eco Development Geotechnical Interpretative Report - Masterplan Site'. Ref: 2507-UA001881-UP33R-01 (A2 Dominion and P3Eco Ltd.)
- Penoyre & Prasad. 6th March 2020. '592-Himley Village. Land Transfer Plan 02. Ref 592-SK-072 Rev A.
- Alan Baxter. December 2014. 'Himley Village Development Surface Water Drainage Strategy and Flood Risk Assessment'. Unreferenced.

It is understood that the Client has commissioned or obtained assignment of the above documents and Hydrock and Hydrock is entitled to full reliance upon their contents.

1.5 Regulatory context and guidance

The geo-environmental section of this report is written in broad agreement with BS 10175:2011+ A2:2017, 'Land Contamination: Risk Management' (LCRM, 2019) and the AGS (2006) 'Good Practice Guidelines for Site Investigations'. The methods used follow a risk-based approach, with the first stage being a Phase 1 desk study and field reconnaissance (this report), with the potential geo-environmental risk assessed qualitatively in future report(s) using the 'source-pathway-receptor contaminant linkage' concept to assess risk as introduced in the Environmental Protection Act 1990 (EPA, 1990).

The geotechnical section of this report is prepared in general accordance with BS EN 1997 (EC7) and BS 8004:2015. This report forms the Preliminary Sources Study Report (PSSR) as defined by DMRB CD622.

Where relevant the NHBC Standards (2020), have also been applied.

Remaining uncertainties and recommendations for further work are listed in Section 5 and Section 6.

Reference to the technical details of the approach and the methodologies adopted are provided in Appendix G.

2. PHASE 1 STUDY (DESK STUDY AND FIELD RECONNAISSANCE)

2.1 Data

A number of desk study sources have been used to assemble the following information. These are presented in Appendix D and include:

- Third-party environmental report (Groundsure report, reference GS-7327068);
- Historical Ordnance Survey mapping;
- BGS Archive Records; and
- Zetica UXB Risk Maps (<https://zeticauxo.com/downloads-and-resources/risk-maps/>).

As part of the desk study data, a number of previous ground investigations undertaken at the site have been reviewed (see Section 1.4). The Hyder and Alan Baxter reports cover a much wider area than the current site. The Hyder report was prepared as a preliminary assessment only and therefore, there are only four investigation hole locations relevant to the current site. However, no exploratory hole logs or test result sheets have been provided, so conclusions about the ground and groundwater conditions and chemical analysis are based on the report text. Relevant data from the historical reports have been taken into account during the preparation of this report.

2.2 Site referencing

The site is referenced in Table 2.1 and the location is indicated in Figure 2.1 and Figure 2.2.

Table 2.1: Site referencing information

Item	Brief Description
Site name	Himley Village, Bicester
Site address	Off the B4030 at Himley Village, Bicester. The nearest postcode is OX26 1RT.
Site location and grid reference	The site is located off the B4030 to the east of the M40 and to the west of Howes Lane. The site is around 2km west of Bicester centre. The National Grid Reference of the approximate centre of the site is 455855E, 223172N.



Figure 2.1: Site location (Reproduced with permission from Groundsure)



Figure 2.2: Extract from the Ordnance Survey Map. (OS licence 100035207).

A site location plan (Hydrock Drawing 16153-HYD-XX-ZZ-DR-GE-1000) is presented in Appendix A.

2.3 Site description and field reconnaissance survey

A field reconnaissance survey was undertaken on 3rd November 2020 to visually assess potential geotechnical hazards, contaminant sources and receptors. The weather during the field reconnaissance survey was dry.

A basic site description is presented in Table 2.2 and selected photographs are presented in Figure 2.3 to Figure 2.6. Additional photographs are presented in Appendix B.

Table 2.2: Site description

Item	Brief Description
Site area	The site is irregular in shape and has an area of approximately 28.5 ha.
Site access	The western field is accessed from the B4030 through a gated farm track that trends north to south across the eastern section of this field. The eastern field is accessed via a gap in the hedgerow from the B4030 onto the field.
Elevation, topography and any geomorphic features	The site is gently sloping from 95 mOD in the north-west corner to 84 mOD in the south-east. There are no particular topographic features.
Present land use	The current land use is arable farmland, with a track running from north to south across the eastern end of the westernmost field. An overhead electricity cable runs across the north-east corner from north-west to south-east. There are two further overhead cables (thought to be telephone cables) in the western field; the first trends east to west in the southern end of the field; the second trends south-west to north east across the western end of the western field.
Vegetation	Trees and hedges form the field boundaries and are noted sporadically across the site.
General site sensitivity	The site is within a generally a rural area with residential properties and some commercial development, to the east. A small area of fly tipping was found in the south-east corner of the eastern field.
Site boundaries and surrounding land	Most of the site boundaries follow the field boundaries, which are formed of trees and hedge lines. However, most of the southern site boundary is offset to the north of the filed boundary, and therefore undefined, on the ground. The surrounding land is mainly farmland, with a residential property just off site to the south-west. Immediately to the east of the site there are quarrying works probably associated with earthworks as part of ongoing commercial development in the adjacent field.

A site features plan (Hydrock Drawing 16153-HYD-XX-ZZ-DR-GE-1001) is presented in Appendix A.



Figure 2.3: Gated farm track entrance from the B4030.



Figure 2.4: Looking towards the north-east corner of the site and the overhead cable.



Figure 2.5: Looking north from the south-east corner. Flooded ground with the overhead cable beyond.



Figure 2.6: Fly tipping on site.

2.4 Site history

A study of historical Ordnance Survey maps (Appendix C) has been undertaken to identify former land uses at the site and surrounding areas which may have geotechnical or geo-environmental implications for the proposed development. The historical maps show the site has remained as agricultural land since 1876 (the date of earliest mapping), with only footpaths and the field boundaries changing. The surrounding area has also remained largely unchanged until 1981, when residential properties were built 500m to the east. In 2019/2020 commercial warehouses were constructed immediately west of the residential properties.

There are a few small quarries in the surrounding area from 1898, the closest being approximately 500m to the south-east. In 1919 a limekiln, quarry and pumping station are shown on maps, to the north-east around 1km from the site, with a railway just beyond. There is a pond shown immediately to the north-east of the site on the 2010 OS map.

2.5 Geology

The general geology of the site area is shown on the 1:10,000 British Geological Survey (BGS) map extract reproduced as part of the Groundsure report and is summarised in Table 2.3. Extracts from the map are shown in Figure 2.7 and Figure 2.8.

Table 2.3: Geology

Ref. for Figures	Location	Stratigraphic Name	Description
Superficial Deposits (Figure 2.7)			
None recorded.			
Solid Geology (Figure 2.8)			
1 (shown as pink on Figure 2.8)	On site.	Cornbrash Formation	Medium to fine grained limestones with intense bioturbation and poorly bedded. Bluish grey weathering to olive or yellowish brown. Beds of weathered clay encountered in the Hydrock investigation.
2 (shown as dark yellow on Figure 2.8)	On site underlying the Cornbrash Formation. Outcropping, to the south west and north.	Forest Marble Formation	Greenish grey calcareous mudstone with banks and channels infilled with variable cross bedded limestones. Beds of weathered greenish grey clay encountered in the Hydrock investigation.



Figure 2.7: Superficial deposits. (Reproduced with permission from Groundsure)

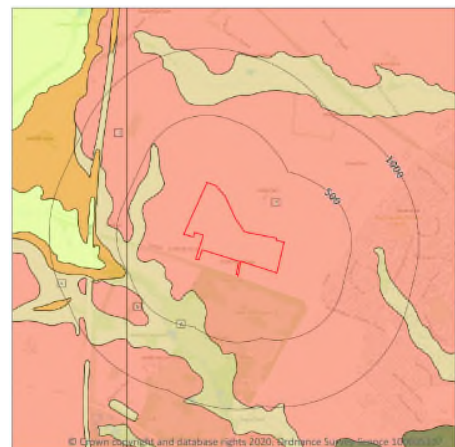


Figure 2.8: Solid geology. (Reproduced with permission from Groundsure)

2.5.1 Ground conditions (wider site area)

The ground conditions proven by historical investigation (Hyder, 2011) for the wider north-west Bicester development site (which includes the current site), comprise:

- Topsoil to 0.30m bgl; overlying
- Superficial/Head deposits to a maximum depth of 1.80m bgl, comprising clayey sandy gravel with cobbles; overlying

- Limestone recovered as yellowish grey sandy gravel progressing into interbedded limestone, clays and mudstones to over 9.00m bgl (recorded by Hyder as Cornbrash Formation but likely to be Cornbrash Formation overlying Forest Marble Formation with the boundary undifferentiated).

As the Hyder report covers a wider site these ground conditions are indicative only. The ground conditions on the site currently being assessed will need to be proven by further site investigation.

2.6 Hydrogeology

2.6.1 Aquifer designations

Based on the geological sequence presented in Section 2.5 and the Environment Agency's interactive aquifer designation map, the aquifer system presented in Table 2.4 applies.

Table 2.4: Aquifer system

Stratum	Aquifer Designation	Comments
Cornbrash Formation	Secondary A	Generally high porosity and high secondary permeability from fracturing. Large water storage capacity due to its high porosity. Some local low permeability due to clay beds.
Forest Marble Formation	Principal Aquifer	Interbedded mudstones (low porosity and permeability) with limestones (high porosity and permeability) with a high secondary permeability from fracturing. Some local low permeability due to clay beds.

2.6.2 Groundwater abstraction

There are no active licensed groundwater abstractions within 500m of the site.

2.6.3 Groundwater source protection zones and groundwater vulnerability

The site is not within a groundwater Source Protection Zone (SPZ).

2.6.4 Groundwater levels, recharge, and flow

Springs to the north of site may be an indication of locally shallow groundwater in the Cornbrash Formation, a deeper groundwater body likely to be found in the Forest Marble Formation. The presence of fracturing in these formations may allow vertical connection between these two potential groundwater bodies. However, this may be inhibited by the clay beds in both deposits.

Experience of this stratum within this part of the UK indicates that the Cornbrash Formation is a seasonal aquifer, which recharges with water during sustained wetter periods of weather and discharges during drier months.

Previous ground investigation (Hyder, 2011) recorded groundwater at around 2.5m bgl in the Limestone.

2.6.5 Groundwater quality

The groundwater body beneath the site (Bicester-Otmoor Cornbrash) is currently (2019 Cycle 2) classified under the Water Framework Directive as 'poor', due to 'chemical drinking water' conditions. The objective is for chemical drinking water protected area to be 'good' by 2015.

2.6.6 Groundwater flooding

The environmental data report indicates a low risk of groundwater flooding.

2.7 Hydrology

2.7.1 Surface water system and drainage

The surface water features in the vicinity of the site are listed in Table 2.5.

Table 2.5: Surface water features

Feature	Location Relative to Site
Pond	Approximately 45m east of eastern boundary.
Spring	Approximately 400m north-north-east of northern boundary.
Gagle Brook	400m south-west

2.7.2 Surface water quality

Reference to the Environment Agency web site shows the site is located within the catchment of the Thames River Basin District, with the specific river water body being the Town Brook at Bicester. The current (2019 cycle 2) overall status under the Water Framework Directive is 'moderate'.

The water body is currently 'moderate' status due to failing the chemical classification and supporting elements being moderate in the ecological classification. The objective is for these classifications to be 'moderate' by 2015 due to 'unfavourable balance of costs and benefits'.

2.7.3 Surface water flooding

The desk study information indicates the proposed development is in Flood Zone 1 (with a low probability of flooding from rivers or the sea).

2.8 Mining and mineral extraction

The site is not within an area of recorded mining. However, limestone quarrying has been recorded in the surrounding area historically and is recorded immediately to the east of the site. However, no quarrying or mining has been recorded on the site itself and mining risk is not considered further in this report.

2.9 Natural ground instability

Trees and hedges are present around the site and field boundaries and sporadically across the site. Cohesive deposits of the Cornbrash Formation or any superficial deposits found may be affected by potential for shrinkage/swelling of clays as a result of changes in moisture content from removal or growth of trees. The Hyder report for the wider site area recorded (based on very limited data) the clays of the Cornbrash Formation to be of medium volume change potential.

2.10 Waste management

There are no current or historical waste management sites recorded within 250m of the site.

2.11 Regulatory consultation

Information in the GroundSure Report (Appendix D), relating to various regulatory controls has been reviewed, with a summary presented below in Table 2.6.

Table 2.6: Regulatory information within 500m of the site

Regulatory Data	Distance from Site	Details	Potential Risk	Comment
Waste exemption	6m north	Himley Barns – Various activities including deposit of waste from dredging of inland waters, deposit of agricultural waste consisting of plant tissue under a Plant Health notice, burning waste in the open and use of waste in construction.	Yes	Due to close proximity to the site boundary.
	12m west			
	94m west	Himley Barns – Various activities including deposit of waste from dredging of inland waters, deposit of agricultural waste consisting of plant tissue under a Plant Health notice, burning waste in the open and use of waste in construction.	No	Likely to be spreading of material on fields/creation of access between fields. Unlikely to be an issue due to distance from the site.
	240m north			
	336m north-west			

2.12 Natural soil chemistry

Information contained within the environmental report (Appendix D) gives indicative (estimated) concentration values for the natural soils at the site for a selection of Contaminants of Potential Concern (CoPC). These have been reproduced in Table 2.7.

Table 2.7: Natural soil chemistry

Element	Arsenic	Cadmium	Chromium	Lead	Nickel
Concentration (mg/kg)	15 - 25	<1.8	60 - 90	<100	30 - 45

2.13 Evidence of historical contamination

A baseline contamination assessment was carried out as part of the Hyder ground investigation, using GAC values for a residential with plant uptake end use. The assessment identified one elevated concentration of arsenic, in natural soils in the wider site area and suggested that there may be naturally occurring arsenic in the soils. No other contamination was identified.

2.14 Radon

The radon risk is reported in the environmental report and indicates that the site is not in a Radon Affected Area and no radon protection measures are required for new properties.

2.15 Unexploded ordnance (UXO)

In general accordance with CIRIA Report C681 (Stone et al 2009) a non-specialist UXO screening exercise has been undertaken for the purposes of ground investigation and is presented in Table 2.8 .

Table 2.8: Non-specialist UXO screening (for the purposes of ground investigation)

Data	Comment	Further Assessment Required
Site history	There is no indication of former military use from the desk study.	No
Post-war development	No evidence of bomb damage from OS mapping.	No
Geology type	The ground conditions comprise Cornbrash Formation with no recorded superficial deposits. It is unlikely UXO would remain undetected.	No
Surface cover during WWI	The surface cover during WWII comprised open fields, however due to there being no recorded superficial deposits it is unlikely UXO would remain undetected.	No
Indicator of aerial delivered UXO	Screening against the bomb risk map for the area (see Appendix D) indicates the site to be in an area where the bomb risk is low.	No

The non-specialist UXO screening exercise has indicated no further assessment is required with regard to UXO in relation to ground investigation. Further assessment may be considered prudent for construction activities.

2.16 Reliability of previous data

Data from the previous ground investigation report listed in Section 1.4 has been included in the preparation of this report where considered to be reliable. The section below provides comment as to the applicability of the various data available.

Geological data

The geological data from previous investigation are consistent with the anticipated ground conditions from BGS sources. However as detailed in Section 2.1, only general descriptions are presented in the report text and the interpretation of the solid geology does not correlate with the current Hydrock interpretation, as it appears the Cornbrash Formation and underlying Forest Marble Formation have not been differentiated. Without the individual exploratory hole logs, reinterpretation of the stratigraphy cannot be undertaken. Therefore, the geological data is used to provide background information only.

Chemical analysis data

The most recent investigation on the site containing soil and groundwater chemical analysis data was conducted in 2011 with very limited data relevant to the site; it is also subject to the limitations in the analytical methodologies of the time. However, the chemical test data does have value as an indicator of expected contamination on site.

There is the potential for changes to the CoC distribution and concentration (dilution, dispersion and degradation), over time in the groundwater. As such, whilst the 2011 groundwater data provides good background information, Hydrock has not used it in the final assessment.

Groundwater data

There is very limited groundwater data available for the site (one water strike in a trial pit, and three post-fieldwork records from one borehole). Whilst providing a useful indication of possible groundwater conditions, the data is over nine years old and therefore has not been relied upon. Groundwater monitoring will be required as part of a site- specific investigation.

Ground gas data

There is limited ground gas data available for the site (three records from one borehole). Whilst providing a useful indication of possible groundwater conditions, the data is over nine years old and therefore has not been relied upon. Gas monitoring will be required as part of a site- specific investigation.

Geotechnical data

Whilst the available geotechnical information pertains to the wider site area (with no tests carried out on samples taken from the site under consideration in this report), it remains relevant as a guide to general physical ground conditions. However, significant supplementary investigations will be required related to the new development proposals.

3. OUTLINE CONCEPTUAL SITE MODEL

3.1 Introduction

The outline Conceptual Model (oCM) incorporates evidence from the site walkover, the Desk Study and previous investigations carried out at the site. The formulation of an outline Conceptual Model is a key component of the LCRM methodology. The oCM incorporates a ground model of the site physical conditions and an exposure model of the possible contaminant linkages; it forms the basis for Generic Quantitative Risk Assessment (GQRA) in accordance with current guidelines.

3.2 Ground model

The preliminary ground model presented in Section 2 provides an understanding of the ground conditions and is the basis for preparing the preliminary geotechnical hazard assessment (Section 3.3) and the preliminary geo-environmental exposure model (Section 3.4).

3.3 Geotechnical hazard identification

3.3.1 Context

The preliminary geotechnical hazard identification has been undertaken in accordance with the general requirements of ICE/DETR Document 'Managing Geotechnical Risk' and the HE documents HD 41/15 and CD 622.

The following section sets out the identified geotechnical hazards and the development elements potentially affected (see Table E.1 in Appendix E for further information).

3.3.2 *Plausible geotechnical hazards*

Plausible geotechnical hazards identified at the site are:

- Soft/loose compressible ground (low strength and high settlement potential).
- Shrinkage/swelling of the clay fraction of soils under the influence of vegetation.
- Lateral and vertical changes in ground conditions.
- Shallow groundwater.
- Changing groundwater conditions.
- Solution features in limestone and resultant cavities in the overlying superficial deposits.
- Difficulty excavating through limestone beds.

3.3.3 *Potential development elements affected*

Development elements potentially affected by geotechnical hazards are:

- Buildings – foundations.
- Buildings – floor Slabs
- Roads and pavements.
- Services.
- Gardens.
- Construction staff, vehicles and plant operators.

- Concrete below ground.

Health and safety risks to site Contractors and maintenance workers have not been assessed during these works and will need to be considered separately during design.

The above plausible geotechnical hazards and development elements affected have been carried forward for assessment.

3.4 Geo-environmental exposure model

3.4.1 Context

The preliminary exposure model is used to identify geo-environmental hazards and to establish potential pollution linkages, based on the source-pathway-receptor (SPR) approach.

A viable pollution linkage requires all the components of an SPR to be present. If only one or two are present, there is no linkage and no further assessment is required.

3.4.2 Potential contaminants

For the purpose of this assessment the potential contaminants have been separated according to whether they are likely to have originated from an on-site or off-site source.

Potential on-site sources of contamination

- Pesticides and herbicides from agricultural practices (S1).
- Hydrocarbon vapours from potential VOC and petroleum hydrocarbon spillages/leaks associate with farm machinery (S2).
- Naturally occurring elevated concentrations of arsenic within soils (S3).
- PAH from on-site burning (identified as an activity undertaken very close to the site, and likely to have occurred on site) (S4).
- Spreading waste on agricultural land (identified as an activity undertaken very close to the site, and likely to have occurred on site) (S5).
- Use of waste in construction: asbestos wastes were historically commonly used to reinforce/repair site entrances (identified as an activity undertaken very close to the site, and likely to have occurred on site) (S6).

Potential off-site sources of contamination

- Pesticides and herbicides from agricultural practices (S7).
- Hydrocarbon vapours from potential VOC and petroleum hydrocarbon spillages/leaks associate with farm machinery (S8).
- PAH from on-site burning (identified as an activity undertaken very close to the site) (S9).
- Spreading waste on agricultural land (identified as an activity undertaken very close to the site) (S10).
- Use of waste in construction (identified as an activity undertaken very close to the site) (S11).

3.4.3 *Potential receptors*

The following potential receptors in relation to the proposed land use have been identified.

- People (site users, neighbours) (R1).
- Development end use (buildings, utilities and landscaping) (R2).
- Groundwater: Secondary A aquifer status of the Cornbrash Formation and Principal aquifer status of the Forest Marble Formation (R3).

The pond 45m to the east is not included as a potential receptor as it is upslope of the site.

3.4.4 *Potential pathways*

The following potential pathways have been identified.

- Ingestion, skin contact, inhalation of dust and outdoor air by people (P1).
- VOC and petroleum hydrocarbon vapour ingress via permeable soils and/or construction gaps (P2).
- VOC, PAH and petroleum hydrocarbon contact with water supply pipes (P3).
- Root uptake by plants (P4).
- Migration of contaminant via leachate migration through the unsaturated zone in the Cornbrash Formation (P5).

Surface water flow to Gagle Brook and base flow from contaminated groundwater are considered unlikely due to the distance to the potential receptor from the site.

Health and safety risks to site development contractors and maintenance workers have not been assessed as part of this study and will need to be considered separately.

The above sources, pathways and receptors have been considered as part of the Preliminary Risk Assessment in accordance with LCRM (2019), are considered to be plausible in the context of this site and have been carried forward for investigation and assessment. An assessment of the Source – Pathway – Receptor linkages is presented in Appendix F (Table F.1).

4. DESK STUDY CONCLUSIONS

4.1 Geotechnical conclusions

The following plausible geotechnical risks are identified.

- Low strength, compressible ground – risk of shear failure and excessive settlement of foundations, roads and infrastructure elements.
- Shrinkage/swelling of clay – settlement/heave of foundations, especially where located within the influence of trees and vegetation.
- Limestone solution features and voids in the overlying deposits – whilst considered a low risk, the site is in an area where solution features may be present, potentially leading to a loss of support of foundations, roads, pavements and gardens.
- Shallow and changing groundwater levels causing problems with excavation.
- Difficulty excavating through limestone beds.
- Potential for unforeseen ground conditions and the risks associated with limited data.

These plausible risks require further investigation and assessment (see Section 6).

4.2 Geo-environmental conclusions

Based on historical and current land uses and in accordance with the processes set out in Appendix G:

- It is considered that it is unlikely that the site would be classified as Contaminated Land under Part 2A of the EPA 1990.
- The overall risk from land contamination at the site is considered to be low for the current development, as it is farmland with little evidence of historical activities that would create contamination on site.

The possible pollutant linkages (for risk levels of moderate or greater) on an unremediated redeveloped site, as determined by the desk study and walk-over, are summarised in Table 4.1:

Table 4.1: Possible Pollutant Linkages (for Risk Levels of Moderate or Greater)

Source(s)	◀ potential Impact on ▶	Receptor(s)
Pesticides and herbicides from agricultural activities.		Site users
Naturally occurring elevated concentrations of arsenic in soils.		Groundwater via leaching
Use of waste in construction (asbestos)		Site users

These possible pollutant linkages will require further investigation and assessment.

5. UNCERTAINTIES AND LIMITATIONS

5.1 General comments

Hydrock Consultants Limited (Hydrock) has prepared this report in accordance with the instructions of Countryside Properties PLC (the Client), by e-mail dated 28 October 2020 under the terms of appointment for Hydrock, for the sole and specific use of the Client and parties commissioned by them to undertake work where reliance is placed on this report. Any third parties who use the information contained herein do so at their own risk. Hydrock shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared or for use of the report by any parties not defined in Hydrock's appointment.

This report details the findings of work carried out in November 2020. The report has been prepared by Hydrock on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, not all potential environmental constraints or liabilities associated with the site may have been revealed.

Groundwater data are only representative of the dates on which they were obtained and both levels and quality may vary.

Information provided by third parties has been used in good faith and is taken at face value; however, Hydrock cannot guarantee its accuracy or completeness.

Where the existing report prepared by others have been provided by the Client, it is assumed that these have been either commissioned by the Client, or can be assigned to the Client, and can be relied upon by Hydrock. Should this not be the case Hydrock should be informed immediately as additional work may be required. Hydrock is not responsible for any factual errors or omissions in the supplied data, or for the opinions and recommendations of others. It is possible that the conditions described may have since changed through natural processes or later activities.

The work has been carried out in general accordance with recognised best practice. The various methodologies used are referenced in Appendix G. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance. Where the phrase 'suitable for use' is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Hydrock.

The non-specialist UXO screening has been undertaken for the purposes of ground investigation only (i.e. low risk activity in accordance with CIRIA Report C681). Further assessment should be undertaken with regards to other higher risk activities e.g. construction.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds, this report does not constitute a formal survey of these potential constraints and specialist advice should be sought.

Any site boundary line depicted on plans does not imply legal ownership of land.

6. RECOMMENDATIONS FOR FURTHER WORK

6.1 Ground investigation objectives

In order to confirm the actual risks to receptors and confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. This investigation will need to:

- confirm the depth and distribution of strata across the site;
- determine the soil strength/density profile beneath the site;
- determine the depth/level of groundwater beneath the site;
- assess the potential for solution features at the site;
- determine the ground gas concentrations beneath the site;
- determine CBRs to assist with pavement design;
- assess trench stability, over break potential and 'digability';
- allow soil infiltration rate testing;
- allow sampling for chemical and geotechnical laboratory testing;
- allow soil classification to allow geotechnical characterisation and determine suitability for reuse of soils within earthworks;
- obtain information in terms of Aggressive Chemical Environment for Concrete Class (ACEC Class).

Following investigation, assessment will be required to:

- update the Ground Model;
- update the Geotechnical Risk Register;
- provide Geotechnical Design recommendations;
- update the Conceptual Site Model (CSM), including identification of plausible pollution linkages;
- undertake generic quantitative risk assessment of potential chemical contaminants to establish 'suitability for use' under the current planning regime;
- discuss potential environmental liabilities associated with land contamination (soil, water and gas); and
- provide outline mitigation recommendations to ensure the site is 'suitable for use'.

6.2 Proposed scope and rationale for investigation works

Based on the current data, site investigation is proposed to comprise:

- the excavation of trial pits across the whole site to allow collection of samples for geotechnical and chemical analysis, to assess trench stability, over break potential and 'digability' and allow soil infiltration rate testing to be undertaken;
- the undertaking of five soil infiltration rate tests across the site;

- eight dynamic sampler/rotary boreholes to allow collection of samples for geotechnical and chemical analysis of deeper soils, and allow *in situ* testing (SPTs) to be undertaken to determine the strength and thicknesses of the limestone, and allow the installation of gas and groundwater monitoring wells;
- gas and groundwater monitoring installations to allow gas concentration and groundwater level monitoring;
- two rounds of gas concentration and groundwater level monitoring (low assessed gas risk) with additional monitoring should elevated concentrations of gas be encountered;
- geotechnical testing of soils and rock; and
- contamination analyses of soil and groundwater.

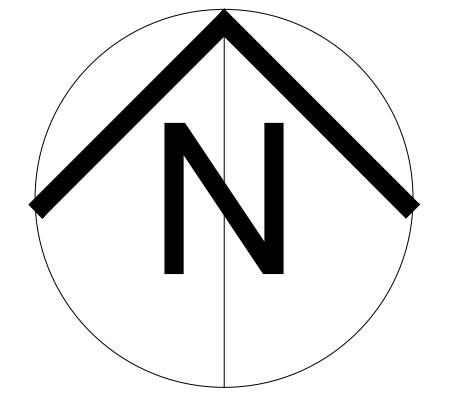
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Appendix A

Drawings

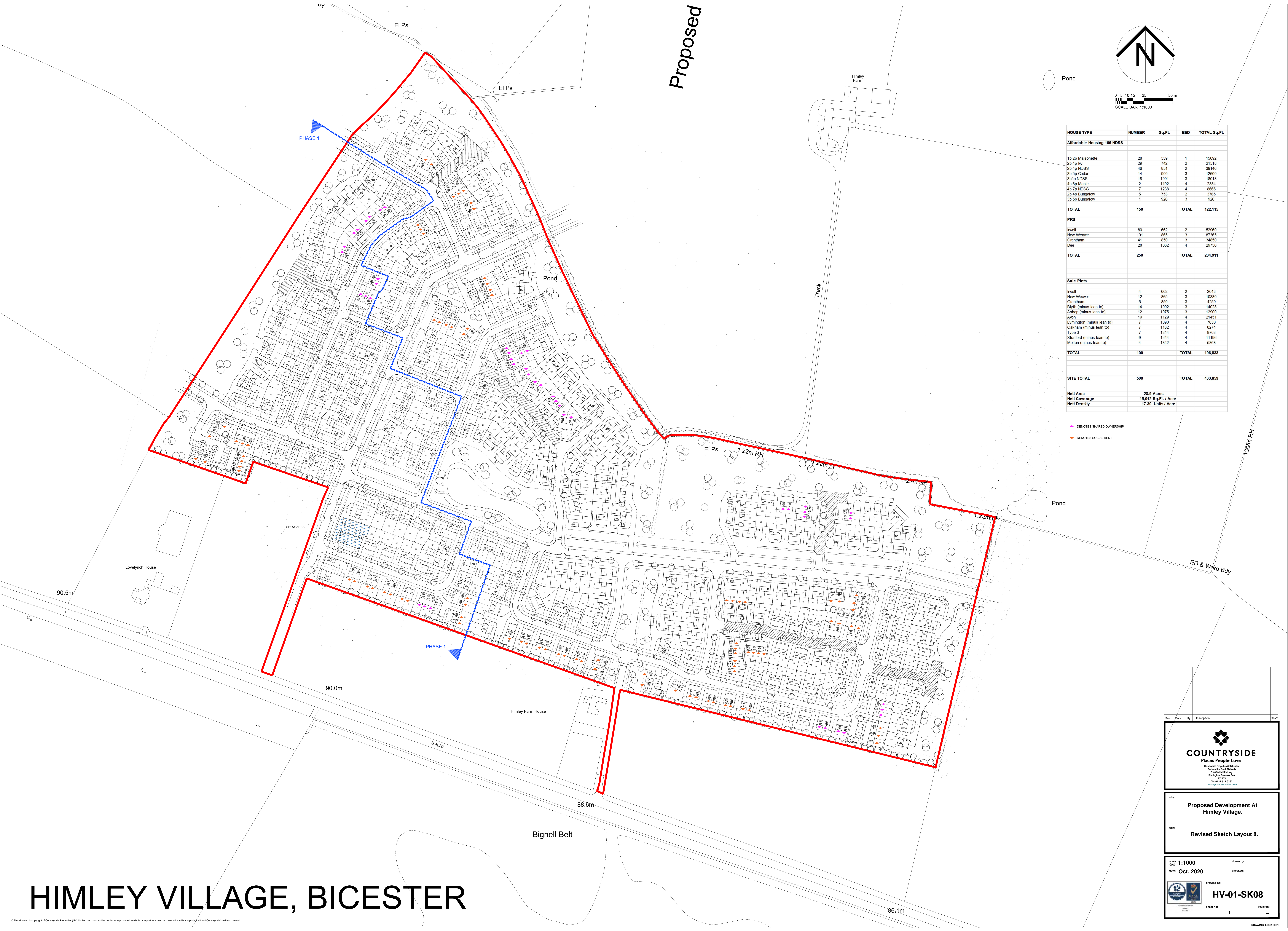
Proposed



0 5 10 15 25 50 m
SCALE BAR 1:1000

HOUSE TYPE	NUMBER	Sq. FL.	BED	TOTAL Sq. FL.
Affordable Housing 106 NDSS				
1b 2p Maisonette	28	539	1	15092
2b 4p Ivy	29	742	2	21518
2b 4p NDSS	46	851	2	39146
3b 5p Cedar	14	900	3	12600
3b 5p NDSS	18	1001	3	18018
4b 5p Maple	2	1192	4	2384
4b 7p NDSS	7	1238	4	8666
2b 4p Bungalow	5	753	2	3765
3b 5p Bungalow	1	926	3	926
TOTAL	150		TOTAL	122,115
PRS				
Inwell	80	662	2	52960
New Weaver	101	865	3	87365
Grantham	41	850	3	34850
Dee	28	1062	4	29736
TOTAL	250		TOTAL	204,911
Sale Plots				
Inwell	4	662	2	2648
New Weaver	12	865	3	10380
Grantham	5	850	3	4250
Blyth (minus lean to)	14	1002	3	14028
Ashop (minus lean to)	12	1076	3	12900
Avon	19	1129	4	21451
Lymington (minus lean to)	7	1080	4	7630
Cakham (minus lean to)	7	1162	4	8274
Type 3	7	1244	4	8708
Stratford (minus lean to)	9	1244	4	11196
Melton (minus lean to)	4	1342	4	5368
TOTAL	100		TOTAL	106,833
SITE TOTAL	500		TOTAL	433,859
Nett Area	28.9 Acre			
Nett Coverage	15,912 Sq. Ft. / Acre			
Nett Density	17.30 Units / Acre			

◆ DENOTES SHARED OWNERSHIP
◆ DENOTES SOCIAL RENT



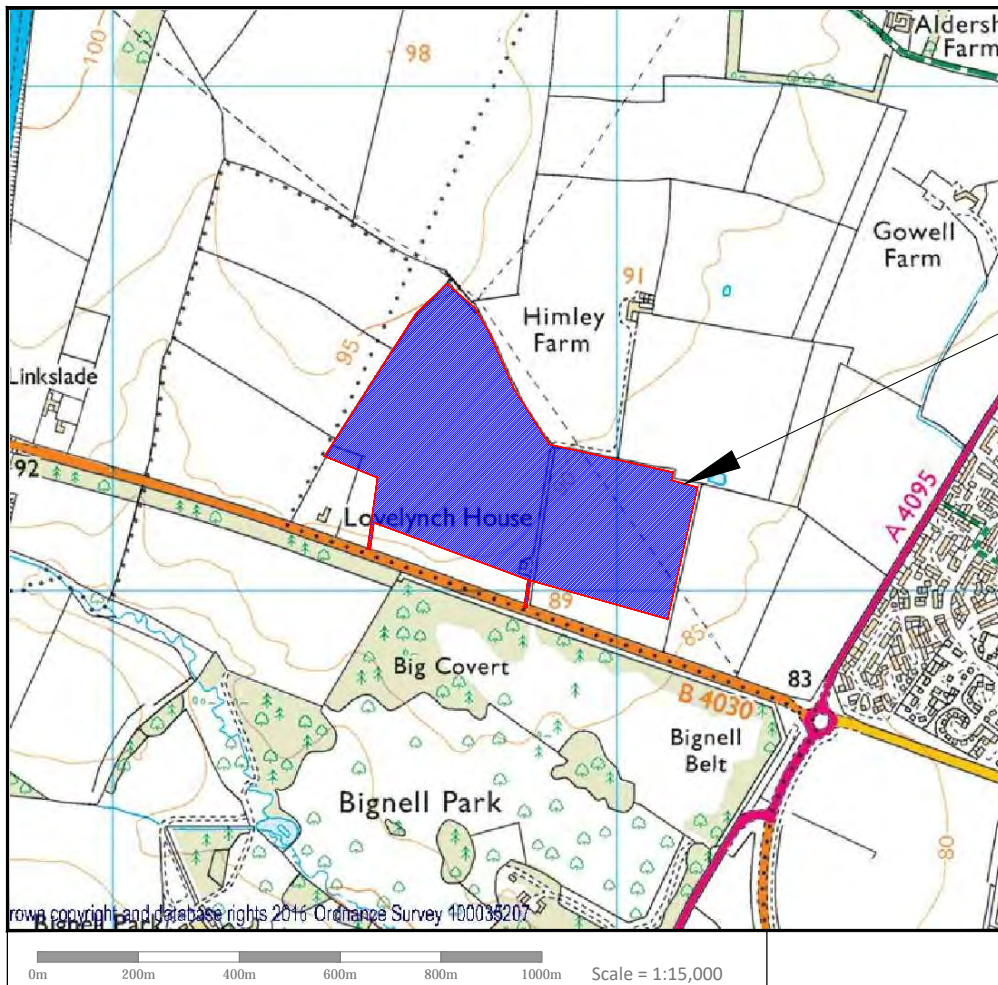
HIMLEY VILLAGE, BICESTER

Rev.	Date	By	Description	CHKD
 COUNTRYSIDE Places People Love Countryside Properties (UK) Limited Pershore Park Station 300 Baldry Parkway Birmingham Business Park Birmingham B37 7YU Tel: 0121 312 3332 countrysideproperties.com				
Site: Proposed Development At Himley Village.				
Title: Revised Sketch Layout 8.				
Scale:	1:1000		Drawn by:	
Date:	Oct. 2020		Checked:	
Drawing no.:	HV-01-SK08		Revision:	
Sheet no.:	1		Revision:	

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THE SITE



THE SITE

FIRST ISSUE						
P01	SD	08/12/20	CA	08/12/20	JC	08/12/20
REVISION NOTES/COMMENTS						
REV.	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
Haselburn Park Holdensby Road Spratton Northampton NN6 8LD TEL: 01604 842 888 E-Mail: northampton@hydrock.com or visit www.hydrock.com						
CLIENT						
Countryside Properties Ltd						
PROJECT						
Himley Village, Bicester						
TITLE						
SITE LOCATION PLAN						
HYDROCK PROJECT NO. C-16153-C			SCALE @ A4 See Drawing			
PURPOSE OF ISSUE SUITABLE FOR INFORMATION					STATUS S2	
DRAWING NO./PROJECT - ORIGINATOR/VOLUME-LEVEL-TYPE-ROLE-NUMBER 16153-HYD-XX-ZZ-DR-GE-1000					REVISION P01	

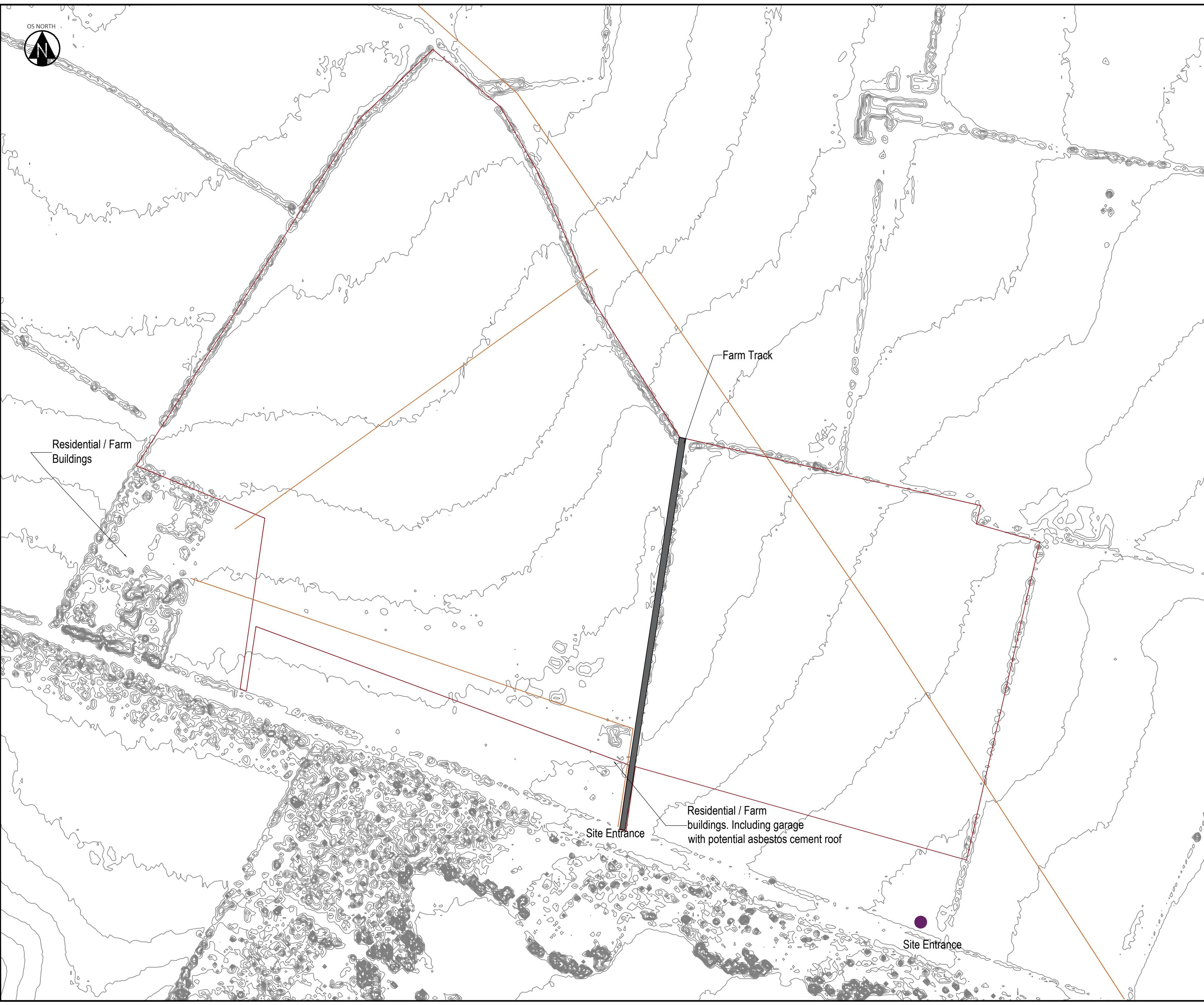


KEY

- Approximate Site Boundary
- Overhead utilities (location approximate)
- Approximate area of fly tipping

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.
3. This drawing has been based on the following drawings and information:
Open Source Lidar data: Contains public sector information under the Open Government License v3.0.



P01	FIRST ISSUE					
	CA	09/12/20	JC	09/12/20	JC	09/12/20

REV.	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

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CLIENT

Countryside Properties Ltd

PROJECT

Himley Village, Bicester

TITLE

Site Features Plan

HYDROCK PROJECT NO. C-16153-C	SCALE @ A2 1:2000
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PURPOSE OF ISSUE SUITABLE FOR INFORMATION	STATUS S2
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DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) 16153-HYD-XX-ZK-SK-GE-1002	REVISION P01
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Appendix B

Field Reconnaissance Photographs

<p>Desk Study Photograph 1</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: Looking south from the southern boundary of the western field.</p>	
<p>Description: Site entrance and farm track.</p>	

<p>Desk Study Photograph 2</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: Looking south west from south of western field</p>	
<p>Description: Adjacent farm property immediately west of the site entrance and farm track.</p>	

<p>Desk Study Photograph 3</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: North west from southern east of western field.</p>	
<p>Description: Garage with a probable asbestos cement roof. Located off site, immediately west.</p>	


<p>Desk Study Photograph 4</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: Facing north from south east end of the western field.</p>	
<p>Description: Farm track and hedgerow of western field trending north south.</p>	

<p>Desk Study Photograph 5</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: North west from south east of western field.</p>	
<p>Description: Agricultural field forming the western field.</p>	

<p>Desk Study Photograph 6</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: Looking east from south western end of the western field.</p>	
<p>Description: Overhead cables in the south of the western field trending east to west.</p>	

<p>Desk Study Photograph 7</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: Facing north from the south west end of the western field.</p>	
<p>Description: Overhead service trending south west to north east.</p>	

<p>Desk Study Photograph 8</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: North from the south east of the eastern field.</p>	
<p>Description: Area of standing surface water in the south east of the eastern field and the site entrance.</p>	

<p>Desk Study Photograph 9</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: North west from the south east of the eastern field.</p>	
<p>Description: Agricultural field forming the eastern field of the site.</p>	

<p>Desk Study Photograph 10</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: Facing south east from the south east corner of the eastern field.</p>	
<p>Description: Site entrance into the eastern field.</p>	

<p>Desk Study Photograph 11</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: East from the south east corner.</p>	
<p>Description: Land immediately east of the site with the quarrying / earthworks.</p>	

<p>Desk Study Photograph 12</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: Facing north from the south east of the eastern field.</p>	
<p>Description: Agricultural field and overhead services trending north west to south east.</p>	

<p>Desk Study Photograph 13</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: n/a.</p>	
<p>Description: Area of fly tipping adjacent to the eastern fields entrance.</p>	

<p>Desk Study Photograph 14</p>	
<p>Date: 03/11/20</p>	
<p>Direction Photograph Taken: South from the north eastern end of the eastern field.</p>	
<p>Description: Agricultural field hedgerow/tree eastern boundary.</p>	