Table of Results

Solid Samples

Job No: 07-00723

Site: Bicester, Whitlelands Farm (off B4030)

WSP Environmental Laboratories

			Lab No.	7668	7669	7670	7671	7672	7673	7674	7675	7676
			Sample Ref	TP55-E4	TP55 - E6	TP56-E2	TP56-E3	TP56-E6	TP61-E2	TP61-E4	TP61 - E7	TP65-E2
			Depth	0.3 - 0.5	0.5 - 0.8	0.1 - 0.2	0.2-0.5	0.6 - 1.1	0.1 - 0.25	0.25 - 0.75	1.5 - 2.0	0.1-0.2
Determination	LOD	Units	Method									
Benzo(k)fluoranthene	0.3	mg/kg	206b M*	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	1.7	< 0.3	< 0.3	< 0.3
Benzo(b)fluoranthene	0.3	mg/kg	206b M*	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	1.7	0.4	< 0.3	< 0.3
Benzo(a)pyrene	0.3	mg/kg	206b M*	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	1.7	< 0.3	< 0.3	< 0.3
Indeno[1,2,3-cd]pyrene	0.3	mg/kg	206b M*	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	1.2	< 0.3	< 0.3	< 0.3
Dibenzo(a,h)anthracene	0.3	mg/kg	206b M*	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Benzo[ghi]perylene	0.3	mg/kg	206b M*	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	1.3	< 0.3	< 0.3	< 0.3
PAH Total (EPA 16)	3	mg/kg	206b M*	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	19.7	< 3.0	< 3.0	< 3.0
Phenol	0.5	mg/kg	218 *	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4-Nitrophenol	0.5	mg/kg	218 M*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2,4-Dinitrophenol	0.5	mg/kg	218 M*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2-Chlorophenol	0.5	mg/kg	218 M*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2-Nitrophenol	0.5	mg/kg	218 M*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2,4-Dimethylphenol	0.5	mg/kg	218 *	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2,4,6-Trichlorophenol	0.5	mg/kg	218 M*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4-Chloro-3-methylphenol	0.5	mg/kg	218 M*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2,4-Dichlorophenol	0.5	mg/kg	218 M*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2-Methyl-4,6-Dinitrophenol	0.5	mg/kg	218 M*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Pentachlorophenol	0.5	mg/kg	218 M*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Phenols Total	1	mg/kg	218 M*	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Table of Results

Water Samples

Job No: 07-00723

Site: Bicester, Whitlelands Farm (off B4030)

WSP Environmental Laboratories

			Lab No.	7790	7791	7792	7793	7794	7795	7796	7797	7798	7799
			Sample Ref	TP02-W8	TP04-W8	TP11-W10	TP16-W7	TP20-W8	TP25	TP29	TP33-GW8	TP48-W9	TP54-W1
			Depth	1.5	1.5	2.0	1.95	1.5	1.25	1.6	1.1	1.35	1.3
Determination	LOD	Units	Method										
Arsenic	10	µg/l	303 *	< 10.0	---	< 10.0	---	---	---	---	---	< 10.0	---
Cadmium	5	µg/l	303 *	< 5.0	---	< 5.0	---	---	---	---	---	< 5.0	---
Chromium	5	µg/l	303 *	< 5.0	---	< 5.0	---	---	---	---	---	< 5.0	---
Copper	5	µg/l	303 *	< 5.0	---	< 5.0	---	---	---	---	---	< 5.0	---
Nickel	5	µg/l	303 *	< 5.0	---	< 5.0	---	---	---	---	---	< 5.0	---
Lead	10	µg/l	303 *	< 10.0	---	< 10.0	---	---	---	---	---	< 10.0	---
Zinc	7	µg/l	303 *	< 7.0	---	< 7.0	---	---	---	---	---	< 7.0	---
Free Cyanide	40	µg/l	315	< 40.0	---	< 40.0	---	---	---	---	---	< 40.0	---
pH		pH units	312	< 1.0	8.1	8.0	8.1	7.9	8.0	7.8	7.9	8.6	7.8
Sulphate	20	mg/l	303	28.4	24.3	33.0	30.3	31.2	33.6	36.2	56.3	52.7	66.9
Chloride	20	mg/l	320	< 50.0	---	< 50.0	---	---	---	---	---	< 50.0	---
Ammonium	0.5	mg/l	324	< 1.3	---	< 1.3	---	---	---	---	---	< 1.3	---
Chemical Oxygen Demand (CO	20	mg/l	337	< 20.0	---	< 20.0	---	---	---	---	---	< 20.0	---

Table of Results

Water Samples

Job No: 07-00723

Site: Bicester, Whitlelands Farm (off B4030)

			Lab No.	7800	7801	7940
			Sample Ref	TP56-1.6	TP65-W1	TP27
			Depth	1.6	1.2	
Determination	LOD	Units	Method			
Arsenic	10	µg/l	303 *	---	< 10.0	---
Cadmium	5	µg/l	303 *	---	< 5.0	---
Chromium	5	µg/l	303 *	---	< 5.0	---
Copper	5	µg/l	303 *	---	< 5.0	---
Nickel	5	µg/l	303 *	---	< 5.0	---
Lead	10	µg/l	303 *	---	< 10.0	---
Zinc	7	µg/l	303 *	---	8.7	---
Free Cyanide	40	µg/l	315	---	< 40.0	---
pH		pH units	312	7.8	8.1	---
Sulphate	20	mg/l	303	43.8	67.3	---
Chloride	20	mg/l	320	---	< 50.0	---
Ammonium	0.5	mg/l	324	---	< 1.3	---
Chemical Oxygen Demand (CO	20	mg/l	337	---	< 20.0	< 20.0

Appendix I - Limitations

Notes on Limitations

General

WSP Environmental Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from WSP Environmental Limited; a charge may be levied against such approval.

WSP Environmental Limited accepts no responsibility or liability for:

a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and

b) this document to any third party with whom an agreement has not been executed.

Phase I Environmental Audits

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, WSP Environmental Limited reserves the right to review such information and, if warranted, to modify the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, and ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, the environment (including adjacent land), and to surface and groundwater.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues may need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as tentative only and must, in any event, be confirmed by a qualified quantity surveyor.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" of contamination where concentrations may be significantly higher than those actually encountered.

The risk assessment and opinions provided, inter alia, take in to consideration currently available guidance values relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Geo-environmental Investigations

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environmental risks together with engineering and development implications.

If costs have been included in relation to site remediation these must be confirmed by a qualified quantity surveyor.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site of each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects.

The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

The risk assessment and opinions provided, inter alia, take in to consideration currently available guidance values relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

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Date: 03 May 2022

Tony Pinchess
RPS
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London
EC4A 4AB

Dear Tony,

KINGSMERE, BICESTER

1 INTRODUCTION AND BACKGROUND

RPS has been commissioned to undertake a Due Diligence Assessment in support of a land bid concerning the above site.

The site comprises land parcel R1 which we understand is to be purchased as a serviced plot with road connections and service connections, delivered as part of the larger residential development. A site boundary plan is detailed upon the drawing presented within *Appendix A*. This area is herein referred to as the 'Assessment Site'.

The following two geo-environmental assessments have already been undertaken for the wider site which include the Assessment Site and these have been reviewed as part of this assessment:

- WSP Environmental, Kingsmere Phase 2, Bicester. Combined Phase I and Phase II Geo-Environmental Assessment Report for Countryside Properties (Bicester) Ltd, 14/02/2013 (herein termed WSP 2013); and
- RSK, Land South of Middleton Stoney Road, Bicester – Kingsmere, South West Bicester, Geo-environmental site assessment (29286 R01 (00), November 2017 (herein termed RSK 2017).

The site boundaries (with exploratory hole locations) applicable to the two reports are shown on the drawings in *Appendix B*.

It is understood that the above assessments have been accepted by the regulators as sufficient to address contaminated land planning conditions for the wider development. This should be confirmed with the vendor.

2 SCOPE

The following issues have been considered in relation to ground conditions in the context of the proposed redevelopment of the Assessment Site for a residential end use:

- Ground/groundwater remediation;
- Gas protection measures;
- Hazardous waste / material reuse;

- Chemical attack of water supply pipes;
- Phytotoxicity of topsoil;
- Concrete classification;
- Foundations and floor slabs;
- Pavements; and
- Dewatering.

The report does not consider the suitability of the topsoil with respects to nutrient / organic content levels or its physical characteristics with respects to BS38220.

The remainder of this letter report discusses each development constraint in turn based on the available information (*Section 3*) and identifies potential data gaps / key uncertainties (*Section 4*).

3 CONSTRAINTS ASSESSMENT

3.1 Ground/Groundwater Remediation

3.1.1 Summary of Identified Ground Conditions/Environmental Setting

The wider site is understood to primarily comprise open fields, farmland and residential properties with historical uses reported as including an old windmill and quarry (historical mapping not available for review though it is indicated the mill and quarry are not located within the Assessment Site).

The stratigraphic sequence encountered across the wider site generally comprised the following:

- Cultivated topsoil/subsoil – typically dark brown slightly sandy slightly gravelly silty clay with frequent rootlets. Fine to medium gravel of limestone.
- Cornbrash Formation – orange brown clayey to very clayey sandy fine to coarse limestone gravel. Locally stiff to very stiff orange brown slightly sandy gravelly to very gravelly clay. Fine to medium limestone gravel and lithorelics.
- Forest Marble Formation – Alternating horizon of clay / mudstone and limestone. Clay horizons generally very stiff to hard dark blue / green grey silty clay. Limestone horizons generally strong to strong light grey fine grained limestone.

Made Ground was not encountered during the previous investigations.

Water seepages were generally encountered at shallow depth with groundwater generally encountered at depths of between 5 and 8 metres below ground level (m bgl). Groundwater within boreholes located south of the Assessment Site were observed to be under artesian pressure within the Forest Marble Formation. Subsequent groundwater monitoring recorded groundwater between 0.5 and 3.0 m bgl.

A single trial pit (TP704, WSP 2013) is indicated to be excavated on the Assessment Site with two additional exploratory holes located adjacent to the Assessment Site (TP5 to the west, RSK 2017 and WS706 to the north, WSP 2013). The ground conditions encountered within these locations are summarised within Table 1 and details provided on the extracted exploratory hole logs presented in *Appendix C*.

Table 1: Summary of Ground Conditions

Strata	Depth range to top of stratum (m bgl)	Depth range to bottom of stratum (m bgl)	Description
TP704			
Topsoil	Ground Level	0.20	Orange brown slightly sandy clay with frequent rootlets.
Cornbrash Formation	0.20	>3.00	Firm orange brown gravelly clay with abundant limestone cobbles becoming firm to stiff grey blue slightly sandy slightly gravelly clay. Fine to medium limestone gravel.
WS706			
Topsoil	Ground Level	0.40	Brown slightly gravelly clay with rare rootlets.

Strata	Depth range to top of stratum (m bgl)	Depth range to bottom of stratum (m bgl)	Description
Cornbrash Formation	0.40	>2.00	Very soft / soft orange brown slightly sandy clay with rare gravel. Locally slightly sandy gravelly, gravel of fine to coarse limestone. Becoming stiff to hard fissured grey clay with rare fine to coarse limestone gravel.
TP5			
Topsoil	Ground Level	0.30	Dark brown slightly organic sandy slightly gravelly clay with occasional rootlets. Gravel of flint, limestone and rare brick fragments.
Cornbrash Formation	0.30	1.00	Yellow /orange brown clayey sandy gravel with high cobble content. Gravel and cobbles of limestone.
Forest Marble Formation	1.00	>2.90	Very stiff fissured green brown slightly sandy slightly gravelly clay with interbedded laminations and nodules of calcite / weathered limestone.

Groundwater was encountered within all three locations during advancement of the investigation locations as summarised within Table 2. Subsequent groundwater level monitoring was not undertaken at these locations.

Table 2: Summary of Groundwater Encountered During Ground Investigations

Exploratory Hole	Strata	Groundwater
TP704	Cornbrash Formation	Seepage at 1.20 m bgl
WS706	Cornbrash Formation	Water strike at 0.60 m bgl.
TP5	Cornbrash Formation	Seepage at 1.0 m bgl (Fast ingress)

3.1.2 Summary of Previous Risk Assessment – Human Health

Results of laboratory chemical analysis of selected soil samples for the wider site identified one exceedance of generic assessment criteria (GAC) for a residential with home grown produce land use scenario; with a single exceedance for arsenic within natural soils encountered south of the Assessment Site within the wider site (WSP 2013). A capping layer of clean topsoil was recommended should this area be developed for residential gardens.

Neither investigation identified visual evidence of asbestos containing materials nor were asbestos fibres detected from laboratory analysis of selected soil samples.

3.1.3 Summary of Previous Risk Assessment – Groundwater

Slightly elevated concentrations of heavy end petroleum hydrocarbons were reported within groundwater mainly north of the Assessment Site (WSP 2013). This groundwater impaction was considered localised. Comparison was also made with a groundwater remedial target derived for an adjacent site for which reported concentrations were an order of magnitude below. On this basis the risk to controlled waters was assessed as low. Groundwater analysis from an additional borehole located south of the Assessment Site within the wider site (RSK 2017) recorded concentrations of petroleum hydrocarbons to be below the laboratory detection limits.

3.1.4 Summary Conclusions – Remediation

Whilst previous investigation of the wider site has identified limited requirements for remediation (targeted capping of isolated areas) it is noted that there is limited coverage of the Assessment Site. Notwithstanding this and based on the available information and the understanding that the areas of quarrying and the mill are outside of the Assessment Site, it is considered that the available investigation information is likely to be reflective of the contamination status of the Assessment Site. It is recommended that limited further investigation is undertaken to confirm this.

3.2 Gas Protection Measures

A potential source of ground gas was identified from possible historical backfilling of a quarry to the northwest of the wider site. The distance from the Assessment Site is currently unknown.

Ground gas monitoring during both investigations indicate that no specific ground gas protection measures are required. It was noted that a number of boreholes were unsuitable for ground gas monitoring due to groundwater saturation of the response zones.

The general absence of Made Ground, low generation potential of the underlying natural materials, cohesive nature of the underlying strata and low monitored ground gas concentrations would indicate a low level of risk from ground gas.

Whilst it is considered unlikely the development will require specific gas protection measures this position should be confirmed through further ground investigation. Where the backfilled quarry is at distance from the Assessment Site this can comprise trial pits to characterise ground conditions at the Assessment Site. Where the backfilled quarry is in close proximity to the Assessment Site, boreholes and gas monitoring may be required.

3.3 Hazardous Waste

A preliminary Hazardous waste assessment was undertaken on available laboratory chemical results of topsoil materials (RSK 2017). The samples were classified as non hazardous. This exercise has not confirmed the classification of the underlying materials.

We would recommend that the data from the further proposed investigation is assessed to determine the classification of the underlying superficial and bedrock deposits. It is anticipated that this will demonstrate that these materials are also classified as non hazardous.

3.4 Water Supply Pipes

Both previous assessments considered normal plastic pipes would be suitable for potable water supply.

Confirmatory preliminary screening of available laboratory chemical results relevant to the Assessment Site (TP704 and WS706) in relation to UKWIR Standards[1] has been undertaken.

The results are presented within the Table 3.

Table 3: Potable Water Supply Materials Assessment

Group	Parameter	Pipe Material					
		PE	PVC	Barrier Pipe	Wrapped Steel	Wrapped Ductile Iron	Copper
Group 1	Total VOCs	N/A	N/A	Pass	Pass	Pass	Pass
Group 1A	BTEX and MTBE	N/A	N/A	Pass	Pass	Pass	Pass
Group 2	Total SVOCs	N/A	N/A	Pass	Pass	Pass	Pass
Group 2E	Phenols	N/A	N/A	Pass	Pass	Pass	Pass
Group 2F	Cresols	N/A	N/A	Pass	Pass	Pass	Pass
Group 3	Mineral Oils C11 to C20	✓	Pass	Pass	Pass	Pass	Pass
Group 4	Mineral Oils C21 to C40	✓	Pass	Pass	Pass	Pass	Pass
Group 5	Corrosive (conductivity, redox and pH)	Pass	Pass	Pass	✓	✓	× (TP704, WS706)
Pipes that pass chemical thresholds		✓	✓	✓	✓	✓	×

Note: Site-specific suite (comprising ethers, nitrobenzene, ketones, aldehydes and amines) not considered relevant to this site.

N/A: Testing for Group 1 and Group 2 parameters were not undertaken as these chemical compounds were not anticipated to be present at the site.

MTBE and BTEX were carried out on selected samples only (not carried out for the Assessment Site) as these chemical compounds were not anticipated to be present at the site.

[1] UKWIR, Guidance for the selection of water supply pipes to be used in brownfield site, 2010.

pH only was tested of the Group 5 parameters.

The above preliminary assessment confirms the likely suitability of plastic pipes.

3.5 Phytotoxicity

A previous assessment (RSK 2017) indicated two topsoil samples were not compliant with respect to British Standard BS3882 2015: Specification for Topsoil with respects to phytoxicity.

There are no available laboratory chemical results for topsoil within the Assessment Site.

3.6 Concrete Classification – Anthropogenic Material

Both previous assessments established a Design Sulphate (DS) Class and Aggressive Chemical Environment Class (ACEC) in accordance with BRE Special Digest 1 of DS-1 and AC-1. This should be confirmed by the project design team.

Phenols at high levels have the potential to cause chemical attack of concrete. Phenol concentrations within soils across the wider site have been reported at less than the laboratory limit of detection and the risk is therefore considered low.

3.7 Foundations

Previous assessments considered the Cornbrash Formation a suitable stratum to allow the use of traditional strip or trench fill foundations. In addition as the cohesive Cornbrash Formation are indicated to be of medium volume change potential a minimum foundation depth of 0.9 m bgl is to be adopted in residential properties and a suspended ground floor slab with a minimum of 250 mm void installed as a precaution against heave.

The RSK 2017 assessment indicates the Assessment Site is on the edge of a conjectured area of low strength soils where foundation will need to be extended to approximately 1.5 to 2.0 m bgl.

A summary of geotechnical parameters extracted from the previous investigation data relevant to the Assessment Site are provided in Table 4.

Table 4: Summary of Geotechnical Parameters

Soil Parameter	Value	Strata
Liquid limit (%)	44 and 50	Cornbrash Formation
Plastic limit (%)	14 and 15	Cornbrash Formation
Plasticity index (%)	30 and 35	Cornbrash Formation
Plasticity term	Intermediate	Cornbrash Formation
Moisture content	19 and 25	Cornbrash Formation
Liquid limit (%)	47 and 48	Forest Marble Formation
Plastic limit (%)	23 and 26	Forest Marble Formation
Plasticity index (%)	22 and 24	Forest Marble Formation
Plasticity term	Intermediate	Forest Marble Formation
Moisture content	22 and 26	Forest Marble Formation
SPT ‘N’ values	15 and 52	Cornbrash Formation
Undrained shear strength (kN/m^2) from shear vane testing	86	Forest Marble Formation
Maximum dry density (2.5 kg hammer compaction (mg/m^3))	2.06	Cornbrash Formation

The above parameters together with the strata descriptions provided in the exploratory hole logs for the Assessment Site indicate foundation options would be consistent with those previously assessed with the potential for variable ground conditions comprising both cohesive and granular deposits as well as low strength soils, the latter potentially necessitating deep trench fill foundations. Whilst this is the case the available logs do identify variability of conditions within and adjacent to the Assessment Site. As the cohesive Cornbrash Formation is indicated to be of medium volume change potential, design should be in

accordance with NHBC Standards 2022 – Building near trees Limited further investigation should be undertaken to confirm the specific site conditions and the competence of the underlying materials.

3.8 Dewatering

Perched groundwater at relatively shallow depths has been encountered at the Assessment Site and therefore dewatering of excavations is likely to be required. It is considered this may be adequately controlled with the use of simple sump pumps.

3.9 Pavement

A CBR value of 3% for the preliminary design road pavements on cohesive Cornbrash Formation strata and a CBR value of 4% for road pavements on granular strata was previously recommended (WSP 2013). CBRs of this value will generate the requirement for capping and / or increased sub base thicknesses.

3.1 Slopes

The Assessment Site and immediate surrounds is indicated to be relatively flat and therefore slopes are considered a low risk to development.

3.1 Reuse of Excavated Soils

Given the present Assessment Site topography, significant re-profiling is not anticipated. We are not aware of any embankments or retaining structures.

No assessment of the reuse of excavated soils has been undertaken within the previous reports however based on the majority of Particle Size Distribution test results for samples of the Cornbrash Formation (WSP 2013), this material may be classified as being Class 1A/B or 2A/2B in accordance with the MCHW Specification of Highways Works Series 600 clauses, subject to the moisture content of the materials.

Careful consideration of the intermediate plasticity of both Cornbrash Formation and the Forest Marble Formation should be given if it is to be reused as a structural fill.

4 DATA GAPS AND RECOMMENDATIONS

The above review has identified data gaps in the geo-environmental information which leads to uncertainty regarding the ground conditions of the site. These are outlined below:

1. The reports do not include historical plans allowing the location of the quarry and former mill to be identified.
2. The number of intrusive ground investigation locations within the Assessment Site is very limited and as a result there is limited confidence regarding the physical ground conditions at the Assessment Site and the likely low levels of contamination cannot be confirmed.
3. The ground investigation and assessment to date does not fully characterise the risk from ground gas where the quarry is close to the Assessment Site.
4. The status of the reports under planning is unknown with respects to their acceptability.

A supplementary ground investigation is recommended comprising the following scope to address the data gaps identified.

- Excavation of 7 trial pits.
- In situ geotechnical testing.
- Laboratory geotechnical testing
- Analysis of soil samples for a standard suite of chemical testing.
- Completion of an updated ground conditions appraisal.

Our ref: JER9501

A risk register based on the currently available data is presented within *Appendix D*.

Yours sincerely,
for RPS Consulting Services Ltd

Liz Williams
Principal Consultant
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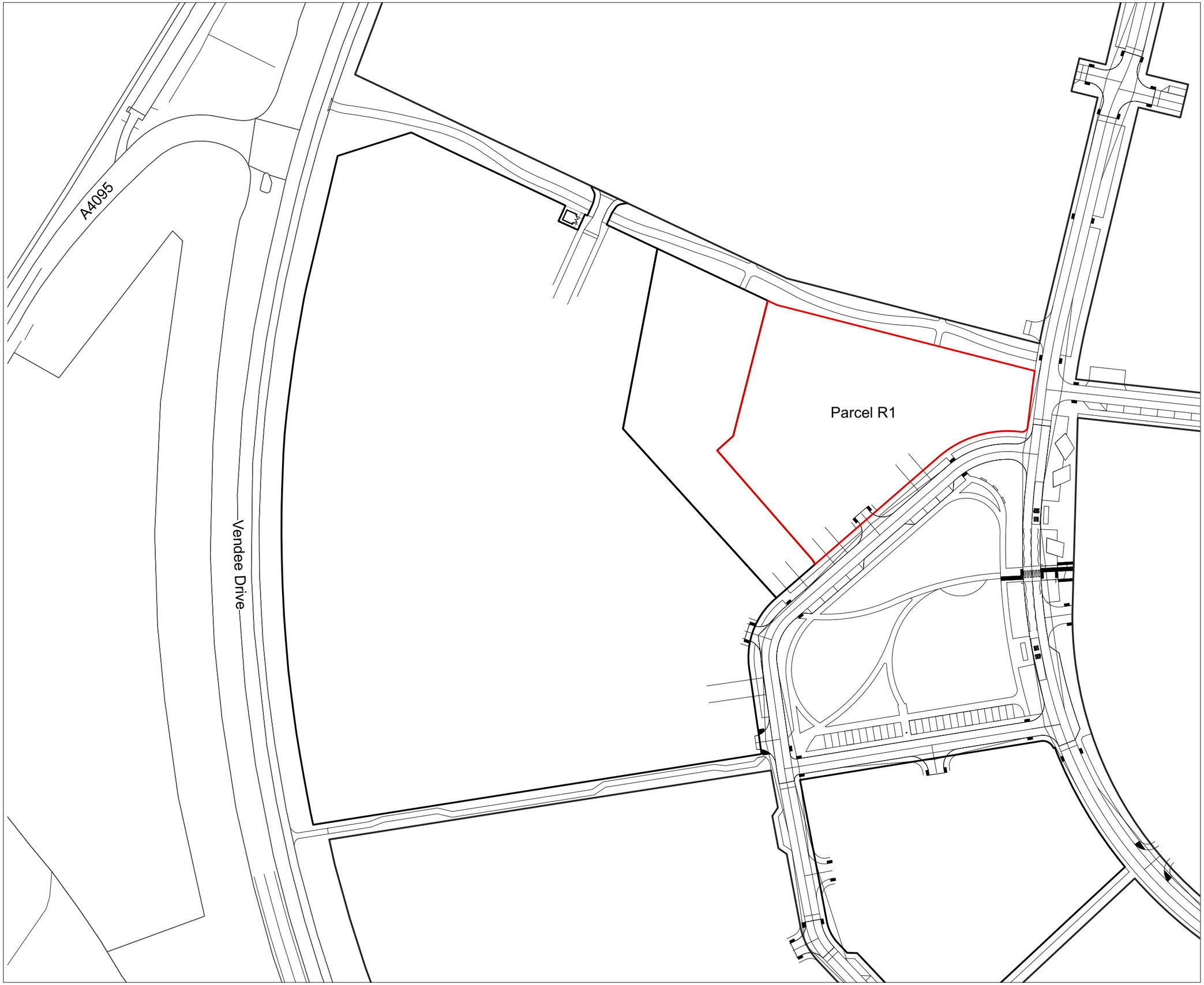
APPENDICES

Appendix A **Assessment Site Plan**
Appendix B **Previous Assessment Site Boundaries**
Appendix C **Previous Exploratory Hole Logs**
Appendix D **Preliminary Risk Register**

Appendix A

Assessment Site Plan



Key

Parcel Boundary

Notes/Revisions

A 18/05/2021 Parcel R2 reverted to follow resolved boundary for Parcel J NOT land registry data SL

Parcel split:
Bicester Proposed Site Layout1. A2-SUBURBAN-1.25-Site Layout. Corstorphine and Wright
Highways: Parcel J Secondary Street 15/March/2019 Create Consulting Engineers Ltd

Kingsmere Phase 2

Countryside Properties (Bicester) LTD

0 50m

N

Parcel R1 Boundary

Status:	Drawn by:	Checked by:
	SL	MA
Project Number:	**Scale:**	**Date created:**
180601U	Scale 1:1250@A3	17/05/2021
Drawing Number:		**Revision:**
TOR-4-LEG-098		A

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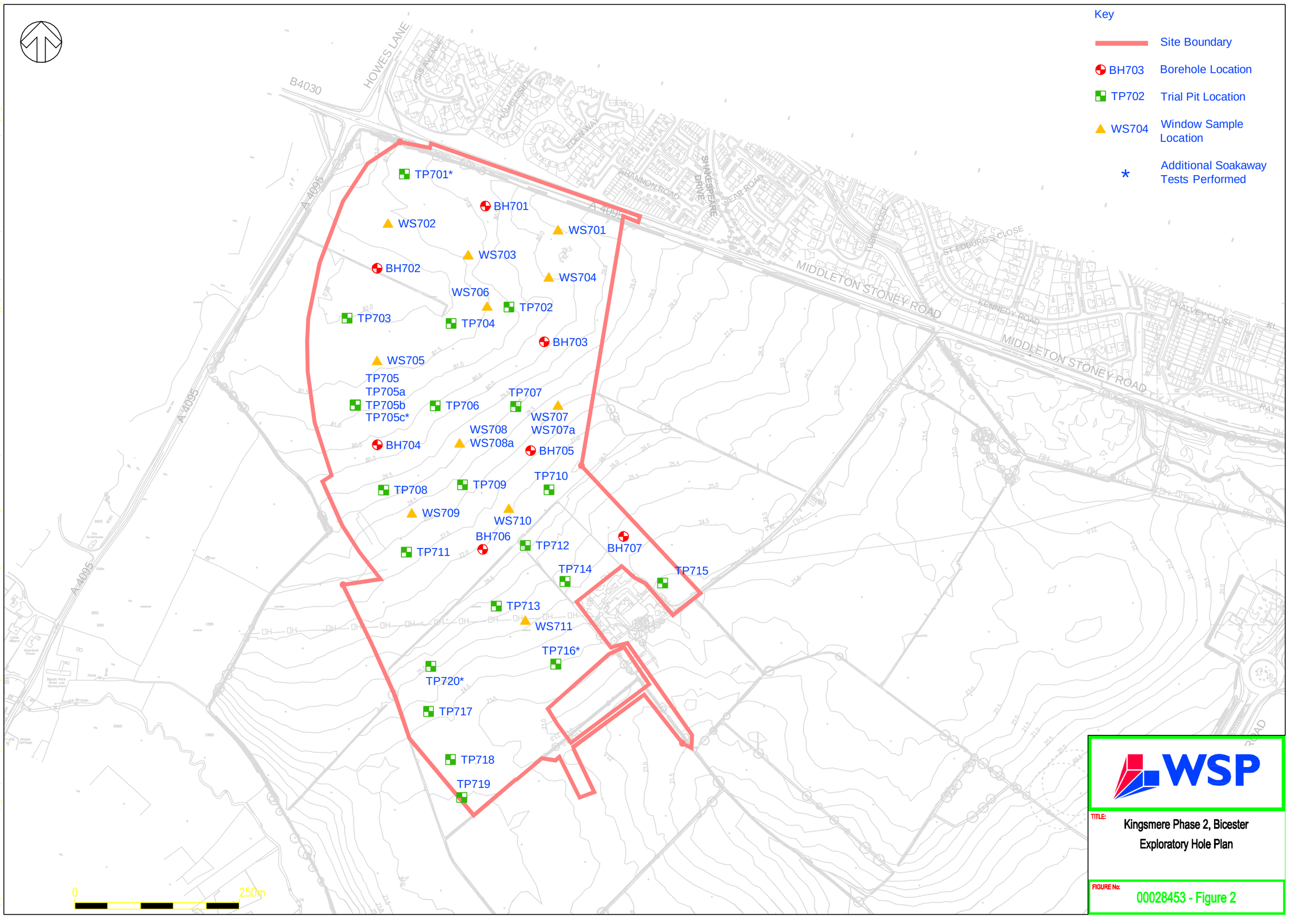
Appendix B

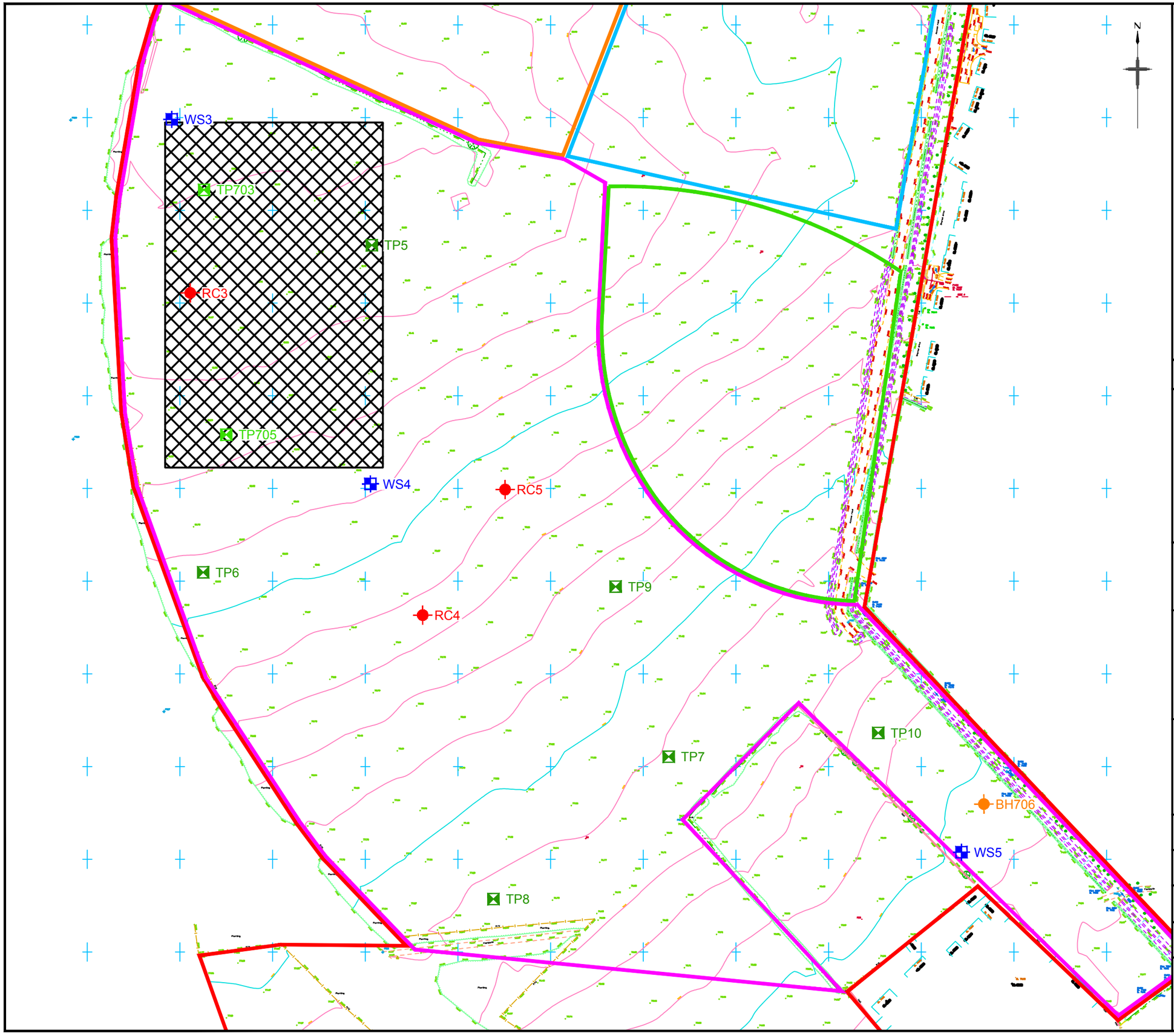
Previous Assessment Site Boundaries



WSP

TITLE:
Kingsmere Phase 2, Bicester
Exploratory Hole Plan

FIGURE No:
00028453 - Figure 2



LEGEND

- Site Boundary
- School Site Boundary
- Parcel H Boundary
- Parcel I Boundary
- Full Site Boundary
- Conjectured Area of Low Strength Soils
- Rotary Location
- Window Sample Location
- Trial Pit Location
- Borehole Location (WSP)
- Trial Pit Location (WSP)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

RSK

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Client
COUNTRYSIDE PROPERTIES (BICESTER) LTD

Project Title
LAND SOUTH OF MIDDLETON STONEY ROAD, BICESTER - KINGSMERE

Drawing Title
EXPLORATORY HOLE LOCATION PLAN

Drawn	Date	Checked	Date	Approved	Date
ASC	11.10.17	JT	11.10.17	JT	11.10.17

Scale	Orig Size	Dimensions
1:2000	A3	m

Project No.	Drawing File
29286 - R01 (00)	29286 (R01-00) Fig 2.dwg

Drawing No.	Rev.
FIGURE 2	P1

Scale 1 : 2,000
0 20 40 60 80 100m

Appendix C

Previous Investigation Exploratory Hole Logs

WSP Environmental Limited
Mountbatten House
RG21 4HJ
Telephone: 01256 318800
Fax: 01256 318700

TRIAL PIT LOG

Hole No. **TP704**

Project: Kingsmere Bicester Phase 2

Sheet: 1 of 1

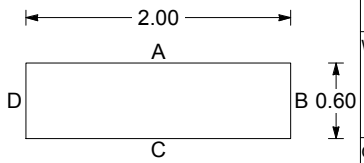
Job No: 00028453/001

Client: Countryside Properties Ltd

Date: 01-10-12
01-10-12

Contractor / Driller	Method/Plant Used	Logged By	Co-Ordinates (NGR)	Ground Level (m AOD)
	JCB 3CX	HG	E 456521.546 N 222453.904	81.887

SAMPLES & TESTS						STRATA					Install / Backfill
Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	Description	Legend	Geology	
						81.69	0.20	Orangish brown slightly sandy CLAY with frequent rootlets. (TOPSOIL)		TS	
0.80	ES						(1.20)	Firm orangish brown gravelly CLAY with abundant cobbles. Cobbles are angular, tabular limestone. (WEATHERED CORNBRASH FORMATION)		CB	
1.00	B										
1.00	D				1						
						80.49	1.40				
2.00	B						(1.60)	Firm to stiff light grey to greyish blue mottled orange slightly sandy slightly gravelly CLAY. Gravel is subangular, fine to medium limestone. (WEATHERED CORNBRASH FORMATION)		CB	
2.00	D										
						78.89	3.00				
										END	



Length: 2.00m

Width: 0.60m

Orientation: degrees from north

Shoring/Support: None

Stability: Stable

Water Strikes

Date	Time	Strike	Minutes	Standing	Remarks
01-10-12	11.21	1.20			Seepage.

General Remarks
End of trial pit at 3.00m bgl - Terminated on hard strata.

Scale 1:31.25

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.

WSP Environmental Limited
Mountbatten House
RG21 4HJ
Telephone: 01256 318800
Fax: 01256 318700

WINDOW SAMPLE LOG

Hole No. **WS706**

Project: Kingsmere Bicester Phase 2

Sheet: 1 of 1

Job No: 00028453/001

Client: Countryside Properties Ltd

Date: 03-10-12
03-10-12

Contractor / Driller	Method/Plant Used	Logged By	Co-Ordinates (NGR)	Ground Level (m AOD)
C.J. Associates	Competitor 130	JEM	E 456576.200 N 222478.100	81.000

SAMPLES & TESTS							STRATA						Install / Backfill
Depth	Type	Test Result	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	Description	Legend	Geology		Dia. mm
							80.60	(0.40) 0.40	Brown slightly gravelly CLAY with rare rootlets (TOPSOIL).		TS		
0.40	ES	.				1	80.45	0.55	Very soft to soft, dark orange to brown slightly sandy CLAY with rare fine gravel. (WEATHERED CORNBRASH FORMATION)		CB		
0.60-1.00	ES	.						(0.55)	Light grey mottled orangish brown slightly sandy gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse subangular of limestone. (WEATHERED CORNBRASH FORMATION)		CB		
1.00	D (S)	3,3,3 3,4,5 N=15.					79.90	1.10					
							79.60	(0.30) 1.40	Very soft, brown sandy CLAY with rare fine gravel. (WEATHERED CORNBRASH FORMATION)		CB		
								(0.60)	Stiff to hard fissured grey mottled orangish brown CLAY with rare gravel. Gravel is fine to coarse subrounded to subangular limestone. Sand is fine to coarse. (WEATHERED CORNBRASH FORMATION)		CB		
2.00	D (S)	2,2,4 8,12,28 N=52/ 0.265.					79.00	2.00			END		

Hole Diameter			Recovery			Water Strikes					
Depth	Diameter (mm)	Remarks	Core Top (m)	Core Base (m)	% Recovery	Date	Time	Strike	Minutes	Standing	Casing
						03-10-12		0.60			

General Remarks
Terminated on hard strata.
Borehole coordinates and elevation estimated from topographical survey.

Scale 1:37.5

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.

08 WSP WINDOW SAMPLE LOG 00028453 KINGSMERE BICESTER.GPJ WSPETEMPLATE1.03.GDT 12/12/12

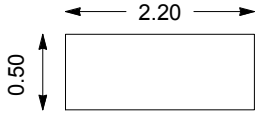
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	TP5

Contract Ref:	Start: 12.09.17	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: 12.09.17	81.72	E:456453.8 N:222431.4	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.10		PID	<0.1ppm			CULTIVATED TOPSOIL: Wheat grass over dark brown slightly organic sandy slightly gravelly CLAY with occasional rootlets. Gravel is subrounded fine to medium flint and subangular fine to coarse tabular limestone with rare gravel sized brick fragments.	(0.30)	
0.20	1	ES					0.30	
0.70	2	D		≈		Yellowish brown to orange brown clayey sandy GRAVEL with a high cobble content. Gravel is subangular fine to coarse limestone. Cobbles are subangular tabular limestone.	(0.70)	
1.00							1.00	
1.20	3	D				Very stiff pale brown to greenish brown with orange brown oxidation fissured slightly sandy slightly gravelly CLAY with interbedded orange brown sandy laminations and nodules of calcite/weathered limestone. Gravel is subangular fine to coarse limestone.		
1.20		V	c_u=86			. . . from 1.00m to 1.40m heavily fissured and weathered.	(0.70)	
1.50	4	D						
1.60	5	D					1.70	
1.80	6	D				Very stiff fissured dark greenish brown slightly sandy CLAY with occasional relict roots and rare fossilised wood 20mm to 500mm long.	(1.20)	
							2.90	
						Trial pit terminated at 2.90m depth due to refusal.		

Plan (Not to Scale)



General Remarks

1. Trial pit remained stable during excavation.
2. Ease of trial pit excavation: difficult
3. On completion, trial pit backfilled with arisings.
4. Trial pit refused at 2.9m depth.
5. Groundwater seepage was noted at 1.0m bgl, fast ingress
6. No visual or olfactory evidence of contamination was identified

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	JCB-3CX	JTownsend	

Appendix D

Preliminary Risk Register

Preliminary Risk Register

Risk Number	Description	Likelihood	Effect of Risk	Actions to quantify / Mitigate
1	Backfilled quarry is on the Assessment Site	Uncertain (indication is unlikely)	Significant additional structural costs and potential remedial requirements (including gas protection measures)	Obtain historical plans
2	Former Mill is on the Assessment Site	Uncertain (indication is unlikely)	Significant additional structural costs and potential remedial requirements	Obtain historical plans
3	Sequence of natural deposits at the site are poorly characterised and may be variable	Likely	Significant additional structural costs	Undertake limited further site specific ground investigation.
4	Materials at the site are geotechnically unsuitable for reuse	Unlikely	Materials may require removal from site or conditioning / stabilisation	Undertake limited further site specific ground investigation.
5	Presence of trees and shrinkable swelling ground	Unknown	Deepened foundations	Request a copy of tree survey and assess following limited further ground investigation.
6	Contamination levels in natural soils are high	Unlikely	Remediation / upgraded water supply pipes / increased waste disposal costs / higher class concrete	Assess following limited further ground investigation.
7	Excess of topsoil / unsuitable topsoil	Likely	Materials will require removal from site	Assess following limited further ground investigation. Undertake a cut and fill appraisal as part of preliminary design
8	Slopes	Unlikely	Requirement for slopes to be battered back to a safe slope angle or restrained by full-face support	Assess following limited further ground investigation.
9	Reports are not considered suitable to address planning	Unknown	Further investigations and assessments required	Request confirmation of acceptance or otherwise of the reports in relation to the current outline consent and regulatory correspondence.

Countryside Properties (Bicester) Limited

Land South of Middleton Stoney Road, Bicester – Kingsmere, South West Bicester

Geo-environmental site assessment

29286 R01 (00)

NOVEMBER 2017

RSK GENERAL NOTES

Project No.: 29286 R01 (00)

Title: Geo-environmental site assessment: Land south of Middleton Stoney Road, Bicester – Kingsmere, South West Bicester

Client: Countryside Properties (Bicester) Limited

Date: November 2017

Office: RSK, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT, UK

Status: Final

Author	Jack Townsend	**Technical reviewer**	Dave Anchor & John Pulsford
Signature		Signature	
Date:	16 November 2017	Date:	16 November 2017
Project manager	Ziaul Hoque	**Quality reviewer**	Thomas Payne
Signature		Signature	
Date:	16 November 2017	Date:	16 November 2017

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

On the instruction of Countryside Properties (Bicester) Limited (the 'Client'), RSK Environment Limited (RSK) has carried out a geo-environmental site assessment of the land south of Middleton Stoney Road, Bicester, hereafter referred to as 'the site'.

The project was commissioned to supplement a previous investigation undertaken by others and provide supplementary information on the ground conditions in relation to the construction of residential dwellings.

The investigation relates to a wider mixed-use development scheme referred to as 'South West Bicester (Kingsmere)'. The entire development area was granted outline planning permission in June 2008 for the erection of dwellings, office buildings, educational facilities, health village and supporting infrastructure. The residential element of the development has been split into smaller parcels of land.

The subject site under investigation is undeveloped having previously been farmland associated with Whitelands Farm and is identified for development with between 338 and 435 units.

The South West Bicester site has been divided into 'character areas', this report relates to Land Parcels J, M & L which are situated in the central parts of the site and O, N and P which are situated in the southeast. A proposed development plan is presented as **Figure 3**.

This report is subject to the RSK service constraints given in **Appendix A**.

1.1 Project brief

The scope of the investigation and layout of this report has been designed with consideration of CLR11 (Environment Agency, 2014) and BS 10175: 2013 (BSI, 2013) and guidance on land contamination reports issued by the Environment Agency (EA) (2010a).

The project was carried out to an agreed brief as set out in RSK's proposal (ref 29286 T01-(02), Rev 03 dated 15 August 2017). The scope of work for the assessment included:

- A review of previous preliminary risk assessment (PRA) information specific to the site contained within the previous WSP report (ref. 00028542, dated May 2013);
- An intrusive investigation consisting of 2No rotary-cored boreholes, 2No drive-in sampler boreholes and 4No machine assisted trial pits with laboratory analysis plus subsequent groundwater and gas monitoring;
- Development of a refined conceptual site model followed by generic quantitative risk assessment (GQRA) to assess complete pollutant linkages that may require the implementation of mitigation measures to facilitate redevelopment;
- Identification of outline mitigation measures for complete pollutant linkages or recommendations for further work;

- Interpretation of ground conditions and geotechnical data to provide recommendations with respect to foundations and infrastructure design;
- A factual and interpretative report with recommendations for further works (i.e. undertake a remedial options appraisal to identify appropriate mitigation measures/produce a remedial implementation and verification plan) and/or remediation as necessary;
- An assessment of the potential waste classification implications of soil arisings.

1.2 Limitations

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work, on the results of tests made in the field and in the laboratory and on information provided by others. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows may vary from those reported due to seasonal, or other, effects.

Whilst asbestos containing materials were not identified during the fieldworks or supporting laboratory analysis, the history of the site indicates asbestos may well be present. Asbestos is often present in discrete areas. Thus, although not encountered during the site investigation, may be found during more extensive ground works.

2 THE SITE

2.1 Site location and description

The site, which may be located by National Grid reference 456437^{E} 222281^{N}, is located on the western outskirts of Bicester, approximately 1.85 km west from the town centre. It comprises part of the wider residential development known as South West Bicester (Kingsmere).

The site slopes gently to the southeast at elevations between 82.06 m AOD in the northwest and 73.77 m AOD in the southeast.

An extract of the 1:25,000 Ordnance Survey map showing the location of the site is included in **Figure 1**.

The site, covering an approximate area of 13.4 hectares, predominantly comprises open fields and agricultural land. The site is bound to the north, east and south by open fields and to the west by the B4030 (Vendee Drive). Light vegetation and hedgerow bounds the site to the northwest and west. A site layout plan is presented as **Figure 2**.

The site setting predominantly comprises open fields, farmlands and residential properties, as detailed in **Table 1**.

Table 1: Site setting

To the north:	Open field farmland and Middleton Stoney Road running in an east west orientation with residential housing further beyond.
To the east:	The site is bound to the east by open fields and the ongoing residential development of Kingsmere further beyond.
To the south:	Open fields, farmland and recent residential development associated with Whitelands Farm Development.
To the west:	Open fields and farmland with the B4030 (Vendee Drive) running along the western perimeter of the site.

2.2 Proposed development

The site is being considered for development with low rise housing of between 338 and 435 units with associated infrastructure, landscaping, neighbourhood pocket parks and a green corridor is proposed adjacent to the site's southern boundary.

The planned layout of the site is shown on **Figure 3**.

2.3 Site reconnaissance

The site walkover was carried out by RSK on the 15 June 2017. The aim of the survey was to identify the range of potentially contaminative activities carried out on and in the immediate vicinity of the site, and also to identify any obvious potential sources of ground contamination. The characteristics of the site observed during the walkover and obtained from Ordnance Survey maps are summarised in **Table 2**.

Table 2: Reconnaissance survey

Feature	Description
Physical characteristics	
Area of site	Approximately 13.4 hectares.
Existing site conditions.	The site is currently open fields surrounded by mature and semi-mature trees and hedgerow.
Ground levels	The site is relatively level with a gentle slope to the southeast.
Depressions in the ground surface	A slight depression in the ground to the west of the site.
Waterlogged or marshy ground	Marshy ground observed to the west of the site.
Surface water	None observed.
Trees and hedges	Mature and semi-mature deciduous trees are present along the northern and south west boundary and hedgerows surround the perimeter of the site.
Basements on site	None observed.
External hardstanding	None observed.
Retaining walls and adjacent buildings on or close to site boundary	None observed.
Made ground, earthworks and quarrying	Localised made ground is anticipated to be present associated with the agricultural use of the site.
Buried services present	'French' land drains could be present.
Environmental characteristics	
Tank storage and dispensing facilities	None observed.
Potentially hazardous materials storage and use	None observed.
Asbestos-containing materials	None observed.
Electricity sub-stations	None observed
Evidence of possible land contamination on site	None observed.
Potential off-site sources of ground contamination	None observed.
Invasive species	None observed

3 SUMMARY OF PREVIOUS REPORTS

3.1 General

As outlined in **Section 1**, the site has been subject to previous assessments. The project was commissioned principally to obtain and collate information on the environmental and geotechnical characteristics of the site and hence to assess the potential liabilities associated with site development.

The following report was made available for review:

- WSP Combined Phase I & Phase II Geo-environmental Assessment Report; Kingsmere Phase 2, Bicester (Report No. 00028453, May 2013).

RSK have relied fully upon the contents of this report for the purposes of the investigation. Salient information from the report has been summarised in the relevant subsections.

3.2 Preliminary Risk Assessment

3.2.1 Introduction

In February 2013, WSP Environmental Ltd was commissioned by Countryside Properties (Bicester) Limited to assess the ground conditions in relation to the Client's proposal to develop the site for a residential end use. The information presented below is taken from the report (Report No. 00028453, February 2013).

3.2.2 Historical setting

The Site

The site comprised arable fields from at least the late 19th Century onwards. An 'old windmill' is shown on site in the northeast and an old quarry is labelled approximately 200m to the north, during the pre-1899 and pre-1922 edition maps. No significant changes were observed on successive maps.

The Surrounding Area

The surrounding area has been characterised by open fields until residential development occurred in the late 1900s to the north and northeast. Whiteland's Farm is located to the southeast and is now part of the Whiteland Farm Development. A quarry was shown to the northwest from pre-1899 to pre-1967. More recently, the surrounding area to the east has been the subject of residential development as part of the South West Bicester Kingsmere development from 2008 and is currently ongoing.

3.2.3 Environmental Setting

Table 3 summarises the information obtained from the environmental searches undertaken for the site.

Table 3: Environmental Setting

Feature	Distance (m)	Direction	Details
Industrial land uses (within 250 m radius of the site)	On site/ Adjacent	NW	Unspecified Old Quarry
Integrated Pollution Prevention and Control (IPPC) authorisation	-	-	No records of facilities currently operating under the IPPC within 500 m of the site.
Local Authority Pollution and Prevention Control (LAPPC) authorisation	-	-	No records of facilities operating under the LAPPC within 1000 m of the site.
Records of Part A(2) and Part B Activities and Enforcements within a 500 m radius.	-	-	No records of Part A(2) and Part B Activities and Enforcements within a 500 m radius.
Discharge Consents	-	-	No records of Discharge consents within a 500 m radius.
Current and Historical Landfills	-	-	No records of EA/Local Authority registered landfill sites within 500 m radius of the site.
Mining/ mineral extraction	160	N	A quarry has been recorded to the northwest of the site from 1898 to the 1966 edition map.
Environment Agency Recorded Pollution Incidents			No pollution incidents have been recorded by the Environment Agency within a 500 m radius.
Radioactive Substance Consent	-	-	No records of any facilities operating under a Radioactive Substance Consent within 1000 m of the site.
Site situated within a radon affected area	-	-	The property is not in a Radon Affected Area, as less than 1 % of properties are above the Action Level. No radon protection is necessary.

3.2.4 Geological, hydro-geological and hydrological setting

A review of the published 1:50,000 scale geological map of the area (Sheet No. 219 'Buckingham') indicates that the site is underlain by the Cornbrash Formation, which is further underlain by the Forest Marble Formation. On the basis of the published

geological maps of the area, the full succession of the natural strata in the vicinity of the site is summarised in **Table 4**.

Table 4: Geology at the site

Geological unit	Description	Estimated thickness (m)
Great Oolite Group		
Cornbrash Formation	Rubbly grey brown limestone and stiff to very stiff orange brown clay.	2 - 4 m
Forest Marble Formation	Grey mudstone and limestone interbedded with stiff to hard grey clay.	Up to 45 m

Given the 'Greenfield; nature of the site and previous agricultural use, cultivated topsoil is present across the site. Also, significant made ground is unlikely to be present. Where present, it is likely to be localised and not diffuse.

The Environment Agency (EA) has classified the Cornbrash and the Forest Marble Formations as a Secondary A aquifer, i.e. strata with permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

A groundwater abstraction licence is noted on site for general farming and domestic purposes from 1967. No other groundwater abstraction licences have been recorded within a 1 km radius of the site.

A drainage ditch is noted approximately 200 m to the north. Gagle Brook is recorded approximately 400 m to the southwest and flows in a southeast orientation.

According to the EA website, the site is not considered susceptible to fluvial flooding, in addition, the site does not lie within a Source Protection Zone (SPZ).

According to the WSP Environmental Ltd report, the groundwater is anticipated to be approximately 6 - 7 m bgl.

3.2.5 Preliminary Conceptual Site Model (PCSM)

The information presented in the desk-based assessment has been used to compile an initial conceptual site model. The identified potential source of contamination, associated contaminants and receptors have been considered with plausible pathways that may link each pollutant linkage.

Given the history and nature of the site, potential sources of contamination were limited to the possible presence of made ground associated with former agricultural use including herbicides and pesticides, asbestos from former farm buildings and metals such as naturally occurring arsenic. Another potential source of contamination includes made ground associated with the potential backfilling of the former quarry to the north and northwest.

The key receptors identified were human health, controlled waters and vegetation. Pathways by which potential contaminants might impact sensitive receptors were noted as migration, direct contact, ground gas and soil vapour inhalation.

3.2.6 Geo-environmental site assessment

To confirm the geological/hydrogeological setting, a comprehensive intrusive ground investigation was undertaken by WSP Environmental Ltd consisting of a series of machine-assisted trial pits, drive-in sampler boreholes and rotary cored boreholes with in-situ testing to clarify the geotechnical properties of the sub soils.

The soil profile confirmed Cultivated Topsoil (up to 0.5 m bgl) overlying the Cornbrash Formation which was further underlain by the Forest Marble Formation as expected within the initial conceptual site model. The Cornbrash Formation initially comprised a granular portion consisting of very dense orange brown clayey to very clayey sandy fine to coarse gravel of tabular limestone. The cohesive portion was generally recovered as stiff to very stiff orange brown slightly sandy gravelly to very gravelly clay with the gravel fraction containing limestone and mudstone lithorelics. The Forest Marble Formation was encountered at depth and generally comprised alternating horizons of clay/mudstone and limestone. The clay layers were generally recorded as very stiff to hard dark bluish grey silty clay occasionally grading into a very weak pale grey mudstone. The limestone horizons were generally recorded as medium strong to strong light grey fine grained limestone. Groundwater was recorded between depths of 0.5 m and 3.0 m bgl across the site.

A limited programme of gas monitoring data was undertaken and identified negligible concentrations of methane and a maximum concentration of carbon dioxide of 1.7 %. A maximum positive gas flow rate of 0.1 l/hr was recorded, however it should be noted that the response zones within some of the wells were saturated.

3.2.7 Quantitative risk assessment

Review of the soil data indicated that the results were below the threshold limits of the adopted GAC with respect to human health via direct contact, however elevated arsenic was recorded within subject area to the southeast. A total of 7 No samples identified no asbestos fibres within the made ground. With respect to controlled waters, slightly elevated concentrations of heavy end petroleum hydrocarbons were recorded. A total of three ground gas monitoring visits were undertaken and a Low Risk (Characteristic Situation 1) has been concluded.

No significant risks were identified with respect to the proposed residential end use. Recommendations were given to undertake additional works to further characterise the ground conditions.

3.2.8 Geotechnical consideration

Given the presence of competent natural soils at a relatively shallow depth, it was considered that traditional spread foundations would be suitable to support relatively light loads.

The results of chemical tests carried out on soil and groundwater samples indicate 2:1 water soil extract sulphate contents of < 500 mg/l with generally near neutral pH values.

Classification carried out indicated that the Aggressive Chemical Environment for Concrete (ACEC) Classification was ***AC-1*** with a Design Sulphate Class for the site of ***DS-1***.

A recommended CBR value of 3 % for the cohesive strata and 4 % for the granular strata was recommended for the pavement design.

In-situ soakaway tests were performed at three locations (TP705, TP716 and TP720). The infiltration rates recorded ranged from practically impermeable to low permeability, due to the nature of the variable ground conditions. To fully assess the infiltration characteristics, further testing in accordance with BRE 365: 2007 is recommended, based on final locations, invert levels and required storage capacities.

3.3 Uncertainty and data confidence

A number of data confidence issues were identified associated with the intrusive works completed to date. Key to the assessment, the following are highlighted:

- Further targeted sampling is recommended across the site to confirm and supplement the existing data;
- Further ground gas monitoring to fully characterise the ground gas regime of the site;
- Additional analysis of soil samples to supplement the chemical dataset and fully characterise the contamination status of the site, notably the presence of arsenic;
- Additional analysis of groundwater samples to supplement the existing dataset in particular, heavy-end hydrocarbons recorded in the previous investigation.

To address the points highlighted above, a supplementary phase of investigation was undertaken by RSK which is discussed in the relevant following sections.

4 SITE INVESTIGATION METHODOLOGY

RSK carried out intrusive investigation works and subsequent ground gas and groundwater monitoring between 29 August and 11 October 2017 to further assess the ground conditions in relation to the proposed residential development.

4.1 Sampling strategy and methodology

The techniques adopted for the investigation have been chosen considering the anticipated ground conditions, existing land use and the proposed development. The intrusive ground investigation techniques are summarised in **Table 5**.

4.1.1 Health, safety and environment considerations

The works were fully undertaken fully in accordance with RSK's Safety, Health Environment and Quality Management Systems (SHEQMS).

4.1.2 Investigation locations

The investigation and soil descriptions were carried out in general accordance with 'BS 5930:2015. Code of Practice for Site Investigations' (BSI, 2015). The exploratory hole logs are presented in **Appendix B**. The intrusive works comprised the activities summarised in **Table 5** which also includes a justification for the exploratory hole locations.

Table 5: Exploratory hole and monitoring well location rationale

Investigation Type	Exploratory hole number	Rationale
Boreholes – by drive-in-sampler.	WS3 to WS5	To log the upper strata and provide information within the data gaps and further assess the contamination status of the site.
Boreholes – by rotary coring	RC3 - RC5	To prove the geological succession beneath the site and obtain geotechnical data.
Monitoring well installations	WS4, WS5 & RC4	Measurement of ground gas within close proximity to backfilled quarry to the northwest.
Machine assisted trial pits	TP5 to TP10	To log the upper strata and provide information on identified data gaps and further assess the contamination status of the site.
Standard penetration test (SPT)	WS03, WS05, RC3 & RC4	Determine the in-situ soil strength of the sub soils at regular intervals to a maximum depth of 9.0 m bgl.

The investigation points were located using GPS for accuracy and are shown in **Figure 2.**

4.1.3 Soil sampling, in-situ testing and laboratory analysis

Soils collected for laboratory analysis were collected in a variety of containers appropriate to the anticipated testing suite required. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross-contamination.

The samples were transported to the laboratory in chilled cool boxes. Laboratory chain of custody forms can be provided if required.

The soil sample chemical analysis was undertaken on 5No. soil samples and comprised metals, asbestos screen, total petroleum hydrocarbons, speciated polycyclic aromatic hydrocarbons, pH, total organic matter, asbestos screen and forensic analysis.

In addition to the above, a programme of geotechnical tests was performed on a number of representative samples (disturbed and undisturbed) which comprised, moisture content, plasticity index, quick undrained triaxial tests, unconfined compressive strength, pH, water soluble sulphate, acid soluble sulphate and total sulphur.

4.1.4 Groundwater monitoring

Depths to groundwater were recorded using an electronic dip meter between 27 September 2017 and 11 October 2017. The monitoring results are presented in **Appendix B**.

4.1.5 Groundwater developing, sampling and analysis

Subsequent to the installation of groundwater monitoring wells the installations were developed at least one week before sampling.

Groundwater samples were retrieved using a United States Environment Protection Agency (USEPA) approved low-flow purging and sampling methodology. The low-flow method relies on moving groundwater through the well screen at approximately the same rate as it flows through the geological formation. This results in a significant reduction in the volume of water extracted before sampling and significantly reduces the amount of disturbance of the water in the monitoring well during purging and sampling. Drawdown levels in the monitoring well and water quality indicator parameters (pH, temperature, electrical conductivity, redox potential and dissolved oxygen) are monitored during low-flow purging and sampling, with stabilisation indicating that purging is complete and sampling can begin. As the flow rate used for purging, in most cases, is the same or only slightly higher than the flow rate used for sampling, and because purging and sampling are conducted as one continuous operation in the field, the process is referred to as low-flow purging and sampling.

In-situ water quality measurements undertaken during the low-flow sampling process are provided in **Appendix B**.

The groundwater samples were collected in containers appropriate to the anticipated testing suite required. The containers were filled to capacity and placed in a cool box to minimise volatilisation and samples were transported directly to the testing laboratory under chain of custody documentation. The rationale for groundwater analysis is presented in **Table 6.**

Table 6: Scheduled analysis – groundwater

Exploratory hole	Analyte	Rationale
RC4	Total Petroleum Hydrocarbons, metals, redox and potential and dissolved oxygen	Assessment of groundwater quality with respect to controlled waters and human health

4.1.6 Ground gas monitoring

Additional monitoring was carried out on three separate occasions between the 27 September and 11 October 2017.

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

The atmospheric pressure before and during monitoring, together with the weather conditions, were recorded.

All monitoring results together with the temporal conditions are contained within **Appendix B** and discussed in **Section 6.2.7.**

5 GROUND CONDITIONS

5.1 General succession of strata encountered

The exploratory holes revealed that the site is underlain by cultivated topsoil/subsoil overlying the Cornbrash Formation, which in turn overlies the Forest Marble Formation. This appears to confirm the stratigraphical succession described within the preliminary conceptual site model (PCSM). For the purposes of discussion, the ground conditions are summarised in **Table 7** and the strata discussed in subsequent subsections.

Table 7: General succession of strata encountered

Strata	Exploratory holes encountered	Depth to top of stratum m bgl	Thickness (m)
Cultivated Topsoil/ subsoil	All exploratory hole locations	Ground level	0.3 to 0.5
Cornbrash Formation	All exploratory hole locations	0.3 and 0.5	0.5 to 2.5 (base only proven within WS4, TP5, RC3, RC04 and RC5)
Forest Marble Formation	WS4, TP5, RC3, RC04 and RC5	0.5 to 2.5	Base not proven

5.1.1 Cultivated Topsoil/Subsoil

All the exploratory holes revealed a superficial mantle of cultivated topsoil ranging between 0.3 m and 0.5 m in thickness. The stratum typically comprised dark brown/brown slightly organic sandy gravelly clay with a sub-soil interface typically comprising dark reddish brown slightly gravelly clayey sand. The gravel fraction contained fine to coarse sub-rounded to sub-angular flint and fine grained limestone with rare inclusions of brick fragments.

Visual/olfactory evidence of contamination was not recorded. On-site PID screening of disturbed samples indicated concentrations of volatile organic compounds (VOC) <0.1 ppm, indicating the absence of significant VOC within the samples.

5.1.2 Cornbrash Formation

Underlying the cultivated topsoil, the Cornbrash Formation was encountered to a maximum depth of 2.4 m bgl and generally comprised very dense light orange brown sandy fine to course subangular tabular gravel of limestone and calcareous sandstone with occasional to frequent cobbles of the same composition.

Cohesive deposits were also encountered comprising very stiff fissured slightly gravelly sandy clay with the gravel fraction containing fine to course fine-grained limestone and occasional calcite nodules.

A summary of the in-situ and laboratory test results for the cohesive portion of this stratum is presented in **Table 8** and for the granular portion, the results are presented in

Table 9. The in-situ and laboratory test results can be found in **Appendix I,** reference should also be made to the previous report.

Table 8: Summary of in-situ and laboratory test results for Cornbrash Formation – (Cohesive)

Soil parameters	Range	Reference
Liquid limit (%)	46 to 47	**Appendix I**
Plasticity limit (%)	22 to 23	
Plasticity index (%)	24	
Plasticity term	Intermediate	
Moisture content (%)	20 to22	
SPT 'N' values	22 to >50	**Figure 4, Appendix B**
Undrained shear strength (kN/m^2) from shear vane and undrained triaxial testing	86 to 110	**Appendix B**
Stiffness term	Stiff to very stiff	

Table 9: Summary of in-situ and laboratory test results for the Cornbrash Formation – (Granular)

Soil parameters	Range	Reference
Grading	%	**Appendix I**
Cobbles	0 to 56	
Gravel	18 to 29	
Sand	14 to 17	
Clay/ Silty	1 to 65	
SPT 'N' values	18 to >50	**Appendix B & Figure 4**
Density term	Dense to Very Dense	**Appendix B**

5.1.3 Forest Marble Formation

The Forest Marble Formation was encountered beneath the Cornbrash Formation to the full depth of the investigation and generally comprises alternating layers of very stiff to hard clay, very weak pale grey mudstone and fine-grained limestone.

The clay horizons were generally recorded as very stiff to hard dark grey to greenish grey fissured silty clay with a varying degree of organic and glauconitic content. Locally, the clay was noted to be grading into very weak pale grey fissured mudstone.

The limestone was generally recorded as moderately weak to strong light grey fine grained shelly limestone.

A summary of the in-situ and laboratory test results for the cohesive portion is presented in **Table 10** and the rock the results are presented in **Table 11**. The in-situ and laboratory test results can be found in **Appendix I** and **Appendix B**.

Table 10: Summary of in-situ and laboratory test results for Forest Marble Formation – (Cohesive)

Soil parameters	Range	Reference
Liquid limit (%)	39 to 81	**Appendix I**
Plasticity limit (%)	20 to 35	
Plasticity index (%)	19 to 54	
Plasticity term	Intermediate to High	
Moisture content (%)	14 to 36	
SPT 'N' values	18 to >50	**Figure 4, Appendix B & Appendix I**
Undrained shear strength inferred from SPT 'N' values (kN/m^2)	81 to >225	**Appendix I**
Undrained shear strength measured by shear vane testing (kN/m^2)	72 to >120	
Stiffness term	Very stiff to hard	**Appendix B**

Table 11: Summary of in-situ and laboratory test results for Forest Marble Formation – Rock

Soil parameters	Range	Reference
SPT 'N' values	>50	**Appendix B & Figure 4**
Unconfined compressive strength by unconfined compressive testing (MN/m^2)	77 to 89	**Appendix I**

5.1.4 Groundwater

Groundwater was encountered during the rotary coring, however groundwater depths could not be ascertained as water was added to facilitate drilling. The groundwater monitoring results are presented in **Table 12.** Seepage was recorded between depths of 1.0 m and 1.7 m bgl during the excavation of TP5 and TP6 respectively, reflecting the presence of localised perched groundwater within the weathered Cornbrash Formation.

Table 12: Groundwater observations

Monitoring well	strike m.bgl (m AOD)	Monitoring results m bgl (mAOD)				
		Min*[2]	Max*[2]	27/9/17	3/10/17	11/10/17
BH706*[1]	1.1 (76.03) & 4.2 (72.730	1.4 (75.53)	1.9 (75.03)	1.25 (73.78)	1.35 (75.58)	1.42 (75.51)
RC4	-	-	-	1.07 (78.22)	1.21 (78.08)	1.06 (78.23)
WS4	-	-	-	0.98 (79.70)	0.97 (79.71)	1.07 (79.61)
WS5	-	-	-	DRY	DRY	DRY

*[1] Borehole drilled by others between the 2 and the 3 of October 2012

*[2] Monitoring undertaken by others between 9 November and 14 December 2012.

From the monitoring results, it appears that the groundwater follows the topography of the site.

Groundwater samples were collected from RC4 for chemical analysis. The results of the monitoring are given in **Appendix B**. The analytical results are given in **Appendix D**.

It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal variations. Ongoing monitoring would be required to establish both the full range of conditions and any trends in groundwater levels.

5.2 Ground gas regime

To fully characterise the ground gas regime of the site, three additional rounds of ground gas monitoring have been carried out to follow on from the previous data. The gas monitoring results recorded to date have identified negligible concentrations of methane, maximum concentrations of carbon dioxide of 2.0 % v/v and a minimum oxygen concentrations of 16.1 % volume with a maximum flow rate of 0.2 l/hr recorded. Atmospheric pressure conditions varied between 1001 mbar and 1020 mbar.

The results of the ground gas monitoring and testing carried out are given in **Appendix B** and discussed in **Section 6.2.7**.

5.3 Refinement of the initial conceptual site model

The investigation generally confirmed the predicted ground model, which was anticipated to comprise a superficial thickness of Cultivated Topsoil overlying Weathered Cornbrash Formation grading into the Cornbrash Formation. Beneath this, the Forest Marble Formation was encountered at depth.

Perched groundwater was recorded within the Cornbrash Formation and within the Forest Marble Formation between depths of 0.97 m and 1.90 m bgl.

During the investigation, no visual or olfactory evidence of contamination was identified.

The soil samples were screened for the presence of VOCs using a photoionisation detector and indicated the absence of significant contamination.

The chemical analysis during the previous investigation recorded elevated arsenic in the south of the site therefore additional sampling was recommended.

An additional 3 No. rounds of gas monitoring have been carried out to supplement the initial phases of monitoring. During the previous monitoring programme, response zones from some of the wells within the subject area were saturated. The supplementary ground gas monitoring indicated negligible concentrations of methane, maximum concentrations of carbon dioxide of 2.0 % vol and a maximum flow rate of 0.2 l/hr. Very little degradable material was observed within the Cultivated Topsoil. Furthermore, the chemical analysis from the initial findings indicated low organic matter across the site therefore the potential for ground gas is considered very low, given that elevated CO_2 and relatively high flow readings has been recorded within the vicinity of the site, a ground gas assessment has been carried out in **Section 6.2.7**.

Chemical testing carried out on the groundwater samples during the previous WSP investigation recorded elevated concentrations of petroleum hydrocarbons, therefore further analysis has been carried out to further assess the contamination status of the groundwater.

The chemical analyses indicate that all samples assessed for the presence of pesticides and fertilisers including persistent organic pollutants (POPs), have been recorded below the laboratory limits of detection, as such they will not be assessed further.

The findings of this investigation generally confirm those identified in the initial conceptual site model. The following potential pollutant linkages that require further assessment are considered to be:

1. Risk to future site users from contaminants in shallow soils via direct contact (ingestion and dermal contact);
2. Risk to future site users from contaminants in shallow soils via direct contact (asbestos fibre inhalation);
3. Risk to future site users from contaminants in the shallow soils and perched water via inhalation exposure in the vapour phase;
4. Uptake of contaminants by vegetation potentially impacting plant growth;
5. The risk of organic contaminants permeating potable water supply pipes;
6. Risk to controlled waters from contaminants via leaching and dissolved phase migration to the underlying secondary aquifer; and
7. Risk to future site users (residents) from ground gases via exposure, explosion and asphyxiation;

6 QUANTITATIVE RISK ASSESSMENT

Chemical analyses has been performed on a total of 5No. samples of Cultivated Topsoil and Cornbrash Formation to further characterise the contamination status of the site down to a maximum depth of 0.65 m bgl. In addition to the chemical analyses, a total of 3No. samples of the near surface soil material were screened in the laboratory for the presence of asbestos materials. The full chemical results are presented within **Appendix C**.

In line with CLR11 (EA, 2014), there are two stages of quantitative risk assessment, generic and detailed. The GQRA comprises the comparison of soil, groundwater and ground gas results with generic assessment criteria (GAC) that are appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory/in-situ results or following statistical analysis depending upon the sampling procedure that was adopted. DQRA involves the development of site specific assessment criteria (SSAC) which essentially explores each of the exposure pathways, modifying the generic assumptions used in the derivation of GACs in order to better reflect site conditions.

For the purposes of this assessment, the results have been directly assessed against the GAC values.

6.1 Linkages for assessment

Section 5.3 presents the refined conceptual model which identifies the linkages that required assessment after the findings of the site investigation had been considered. These linkages together with the method of assessment are presented in **Table 13**.

Table 13: Linkages for generic quantitative risk assessment

Potentially relevant pollutant linkage	Assessment method
1. Direct contact with impacted soil by future residents	It is understood that the enduse will be of residential nature. As such, the soil chemical results have been compared directly against Human health GAC in **Appendix E** for a proposed residential end use with private gardens since proposed end use includes residential gardens.
2. Inhalation exposure of future residents to asbestos fibres	Qualitative assessment based on the asbestos minerals present, their form, concentration, location and the nature of the proposed development.
3. Inhalation exposure of future residents to contaminants in the vapour phase	Human health GAC in **Appendix E** for soil and groundwater based on indoor inhalation exposure to vapour-phase volatile organic compounds (VOC). Modified inhalation reference concentrations for comparison with measured concentrations of VOC in soil gas.

Potentially relevant pollutant linkage	Assessment method
4. Uptake of contaminants by vegetation potentially impacting plant growth	Comparison or soil data to GAC in **Appendix F**.
5. Contaminants permeating potable water supply pipes	Comparison of soil data to GAC in **Appendix H** for plastic water supply pipes using UKWIR (2010) guidance.
6. Leaching of soil contaminants and dissolved phase migration to Secondary aquifer.	Comparison of leachate data to lowest of those recorded in Table 1 of **Appendix G** for Principal and Secondary aquifers owing to linkages identified to both a Principal aquifer and a river upon which the GAC for Secondary aquifers are based.
7. Concentrations of methane and carbon dioxide in ground gas entering and accumulating in: Depressions and excavations that could affect workers Enclosed spaces or small rooms in new buildings, which could affect future residents. In the case of methane this could create a potentially explosive atmosphere, while death by asphyxiation could result from carbon dioxide.	Gas screening values (GSV) have been calculated using maximum methane and carbon dioxide concentrations with maximum flow rates recorded at the site. The GSV have been compared with the revised Wilson and Card classification presented within CIRIA report C665 (Wilson et al, 2007) owing to the development comprising buildings with a ground floor slab.

6.2 Methodology and results

The methodology and results of the GQRA are presented for each relevant pollutant linkage in turn.

6.2.1 Direct contact with impacted soil by future residents

The comparison of testing results against the adopted GAC (residential with home grown produce) identified all results to be below their adopted threshold limits.

6.2.2 Inhalation exposure of future residents to asbestos fibres

The visual inspection at the laboratory identified no materials suspected of potentially containing asbestos and the scheduled laboratory screening for asbestos found no detectable asbestos fibres within the samples of made ground.

6.2.3 Inhalation exposure of future residents to contaminants in the vapour phase

The following lines of evidence have been assessed in respect to the risk from VOC's:

- The ground investigation indicated that the underlying Cultivated Topsoil and subsoil largely consist of inert material. Chemical testing of the soil samples detected petroleum hydrocarbons below the assessment criteria;

- Concentrations of benzene, toluene, ethylbenzene, and xylene (BTEX) were recorded below the laboratory limits of detection (LMD);
- The groundwater results have recorded concentrations below the laboratory detection limits of BTEX and petroleum hydrocarbons;
- Slightly elevated concentrations of VOCs were recorded with the PID during gas monitoring, however given that no evidence of these compounds have been found in the soil/groundwater it is likely that the concentrations have been contributed by moisture or methane; and
- Generally low emission rates have been recorded during initial phase and subsequent phase of gas monitoring.

Based on the above lines of evidence it is considered that the risk to future site users from VOC's is low.

6.2.4 Uptake of contaminants by vegetation potentially inhibiting plant growth

With respect to potential phytotoxic effects, there are no substances present at concentrations above the relevant assessment values given in **Appendix F**. On this basis, it is considered that there is no unacceptable risk to vegetation from the root uptake pathway, however 2No. topsoil samples were assessed, within the vicinity of the site, for its compliancy in line with BS3882 – 2015 Specification for Topsoil and indicated the topsoil is not compliant for re-use. Further analysis is recommended within the subject area to assess the suitability for re-use.

6.2.5 Impact of organic contaminants on potable water supply pipes

For initial assessment purposes, the results of the investigation have been compared with the GAC presented in **Appendix H** for this linkage, which are reproduced from *UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (UKWIR, 2010).

The results indicate that a relevant linkage is unlikely to exist associated with organic contaminants and therefore pollutant polyethylene (PE) and/or polyvinyl chloride (PVC) water supply pipes are expected to be suitable for use on the development

It should be noted that at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling/analytical strategy may be required at a later date once the route(s) of the supply pipe(s) are known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

6.2.6 Migration of dissolved phase contaminants to wider secondary aquifer body

The analytical results are below the GAC indicating pollutant linkages associated with contaminants in the dissolved phase are not considered present.

6.2.7 Ground gas assessment

6.2.7.1 Conceptual Site Model

The preliminary conceptual model and initial investigations identified a potential source of ground gas from possible historical backfilling of a quarry to the northwest. A potential pollutant linkage exists from accumulation of ground gas into poorly ventilated areas via migration through permeable pathways.

Ground conditions have been found to comprise a variable thickness of cultivated Topsoil over the Cornbrash Formation, which in turn overlies the Forest Marble Formation. Perched groundwater has been identified within the weathered Cornbrash Formation.

The cultivated Topsoil was generally found to comprise gravelly sandy clayey sand with rare anthropogenic material. The anthropogenic material predominantly comprises brick and to a lesser extent glass and ceramic. TOC content was recorded to be between 1.4 % and 3.3 %, therefore potential ground gas generation from Cultivated Topsoil is considered to be very low.

The previous phase of gas monitoring indicated negligible concentrations of methane and carbon dioxide, however several of the boreholes became unsuitable for gas monitoring due to saturation of the response zones.

6.2.7.2 Risk Assessment

CIRIA C665 identifies two types of development, termed Situation A (modified Wilson and Card method), appropriate to all development excluding traditional low-rise construction, and Situation B (National House-Building Council, NHBC) only appropriate to traditional low-rise construction with ventilated sub-floor voids.

Both methods are based on calculations of the limiting borehole gas volume flow for methane and carbon dioxide, renamed as the gas screening value (GSV). The GSV (litres of gas per hour) is calculated by multiplying borehole flow rate (litres per hour) and gas concentrations (percent by volume).

In both situations, it is important to note that the GSV thresholds are guideline values and not absolute. The GSV threshold may be exceeded in certain circumstances, if the site conceptual model indicates it is safe to do so. Similarly, consideration of additional factors such as very high concentrations of methane, should lead to consideration of the need to adopt higher risk classification than the GSV threshold indicates.

The proposed layout is to comprise low-rise residential housing (assuming ventilated under floor void) and can be seen in **Figure 3,** therefore situation B has been adopted.

Situation B is a characterisation system developed by the NHBC (Boyle and Witherington, 2007), which relates only to low rise housing development constructed with a clear ventilated under floor void. The system provides a risk-based approach that is designed to allow an identification of the required gas protection measures for low-rise housing by comparing the measured gas emission rates to generic “Traffic Lights”. The Traffic Lights include typical maximum concentrations that are provided for initial screening purposes and risk-based GSVs for situations where the typical maximum concentrations are exceeded. Based on the typical maximum gas concentrations and

the GSVs, the appropriate Traffic Light, ranging from Green through Amber 1 and Amber 2 to Red, is determined from Table 8.7 of CIRIA C665.

The results of the assessment above are summarised in **Table 14** monitoring results are included in **Appendix B**.

Table 14: Worse Case - GSV calculations

Exploratory Hole ID	No of rounds	Maximum concentration (%)		Maximum flow rate (l/hr)	GSV (l/hr)		Characteristic situation
		CH4	CO2		CH4	CO2	
BH706*	6	<0.1	0.9	0.1	0.0001	0.0009	**GREEN**
RC4	3	<0.1	0.5	<0.1	0.0001	0.0005	**GREEN**
WS4	3	<0.1	2.0	0.2	0.0002	0.004	**GREEN**
WS5	3	<0.1	0.6	0.1	0.0001	0.0006	**GREEN**
ALL WELLS	**-**	**<0.1**	**2.0**	**0.2**	0.0002	0.004	**GREEN**
*Previous investigation undertaken by others							

The gas monitoring data has identified a negligible methane concentration and maximum concentration of carbon dioxide of 2.0 %. A maximum gas flow rate of 0.2 l/hr has been recorded the calculated GSV for methane is 0.0001 and the GSV for carbon dioxide is 0.004

The calculated GSVs suggest the site falls under a 'Green' site characterisation as such no gas protection measures are recommended assuming a sub floor void is adopted.

6.3 Environmental assessment conclusions

The generic quantitative assessment has enabled the investigation of the relevant pollutant linkages identified within the refined conceptual site model and recorded no significant contamination.

A generic assessment criteria (GAC) was not provided within the WSP Environmental report, however comparison with the analytical results (within the subject area) against the adopted GAC within the RSK report revealed no exceedances.

The ground gas assessment suggests the site falls under a 'Green' site characterisation based on the assumption that a sub floor void is adopted.

The topsoil analysis in line with BS3882 – 2015 Specification for Topsoil, within the wider area has indicated the topsoil on site is not compliant for re-use, therefore the provision of a clean soil cover for all soft landscaped areas is recommended. Imported materials from each individual source should be validated with appropriate chemical test certificates and approved in advance of materials being delivered to site.

It is possible that the works may reveal different conditions from those revealed by the site investigation. If suspect materials are encountered during site development, works

should cease in the affected area. The area should then be suitably cordoned off pending sampling and analysis of any suspect materials by an environmental consultant.

It is recommended that the Local Authority and Environment Agency be contacted at an early stage to seek their views on the remediation of contamination on the site. As part of this process a detailed Remediation Method Statement should be prepared and submitted to the Local Authority and Environment Agency for their approval.

7 GEOTECHNICAL SITE ASSESSMENT

7.1 Engineering considerations

It is understood that the proposed development is to involve the construction of low rise housing and associated infrastructure. At this stage no specific information relating to building loads has been provided and therefore, a wall loading of 100 kN/m has been considered.

7.2 Geotechnical hazards

A summary of commonly occurring geotechnical hazards is given in **Table 15** together with an assessment of whether the site may be affected by each of the stated hazards.

Table 15: Summary of main potential geotechnical hazards that may affect site

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect site	
Sudden lateral changes in ground conditions	✓	The Cohesive Formation contained granular and cohesive deposits at relatively shallow depths.		Likely to affect ground engineering and foundation design and construction
Shrinkable clay soils	✓	Cohesive Cornbrash Formation –medium volume change potential		Design to NHBC Standards Chapter 4 or similar
Highly compressible and low bearing capacity soils, (including peat and soft clay)		✓ Not encountered - however could be present		Likely to affect ground engineering and foundation design and construction
Silt-rich soils susceptible to rapid loss of strength in wet conditions	✓	Cornbrash Formation		Likely to affect ground engineering and foundation design and construction
Running sand at and below water table			✓	Likely to affect ground engineering and foundation design and construction
Karstic dissolution features (including ‘swallow holes’ in Chalk terrain)			✓	May affect ground engineering and foundation design and construction – refer to **Section 4.1.2**

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect site	
Evaporite dissolution features and/or subsidence			✓	May affect ground engineering and foundation design and construction
Ground subject to peri-glacial valley cambering with gulls possibly present			✓	Likely to affect ground engineering and foundation design and construction
Ground subject to or at risk from coastal or river erosion			✓	Likely to require special protection/stabilisation measures
High groundwater table (including waterlogged ground)	✓	High groundwater levels recorded locally, considered to be perched groundwater within the Weathered Cornbrash Formation.		Will affect temporary and permanent works
Underground mining			✓	Likely to require special stabilisation measures
Existing sub-structures (e.g. tunnels, foundations, basements, and adjacent sub-structures)			✓	Likely to affect ground engineering and foundation design and construction
Filled and made ground (including embankments, infilled ponds and quarries)		✓	Backfilled quarry to adjacent to the site to the north	Likely to affect ground engineering and foundation design and construction
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	**See Section 7.3.5**			May affect ground engineering and foundation design and construction
Note: Seismicity is not included in the above table as this is not normally a design consideration in the UK.				

7.3 Foundations

7.3.1 General suitability

Given the presence of competent natural soils at relatively shallow depths, it is considered that the ground conditions are suitable for the adoption of spread foundations.

7.3.2 Spread foundations

The recommendations for the design and construction of spread foundations in relation to the ground conditions are set out in **Table 16**.

Table 16: Design and construction of spread foundations

Design/construction considerations	Design/construction recommendations
Founding stratum	Variable ground conditions comprising both medium dense to dense, sandy, fine to coarse gravel, gravelly sand and cobbles and firm to stiff, slightly sandy, slightly gravelly clay, however predominately cohesive strata at relatively shallow depths.
Depth	Foundations should be taken to minimum depths of 0.9 m (cohesive strata) below finished ground level and at least 0.1 m into the founding stratum below any overlying made ground if encountered.
Special design considerations	Owing to the presence of shrinkable clay soils, in the vicinity of trees and other significant vegetation, foundations must be designed taking into account all the normal precautions, including minimum founding depths, to minimise the risk of future foundation movements in accordance with NHBC standards or similar. The findings of the ground investigation indicate that foundations should be designed for shrinkable soils of medium volume change potential (PI_m 20 % to 40 %) Owing to the significant lateral and vertical variability of the founding strata, it is recommended that foundations incorporate nominal mesh reinforcement to overcome possible differential foundation movements
Bearing capacity	Spread foundations with a width of up to 0.9 m at a minimum depth of 0.9 m may be designed using a net allowable bearing pressure of 150 kN/m^2 for both cohesive and granular soils. The bearing capacity has been limited for granular strata due to the potential for cohesive horizons with the zone of influence of foundations. The allowable bearing capacity includes an overall safety factor of 3 against bearing capacity failure and with total settlements associated with the bearing pressure estimated to be less than 25 mm.
Stability of excavations	Generally the trial pits remained stable during excavation which indicates that foundation excavations should also remain stable in the short term. In the event that excavations are to require manned entry, then suitable closely boarded side support must be provided.
Dewatering	Perched groundwater was encountered locally at relatively shallow depths, therefore dewatering may be necessary to facilitate excavation in these areas. It should be noted that fast ingress of water was

Design/construction considerations	Design/construction recommendations
	recorded at 1.0 m bgl at TP05. The cohesive nature of the soils encountered suggests that pumping from open sumps should be sufficient to keep the excavations reasonably dry. Pumping from open sumps in non-cohesive soils should be avoided as this can result in instability and general loosening of the soils at the base of the excavation.
Construction considerations	With respect to WSPs TP703 and TP705 (central region of Land Parcel J), where low strength soils were encountered, here foundations will need to be extended down to the firm gravelly clay at about 1.5 m to 2 m depths. All foundation excavations should be inspected, and any made ground and soft, organic or otherwise unsuitable materials removed and replaced with mass concrete. The cohesive soils are considered to be relatively silt-rich soil, hence susceptible to rapid softening once exposed. Hence all foundation excavations in such areas should immediately be blinded with concrete or the full foundation constructed. It should be noted that, due to the density/consistency of the ground conditions encountered, it is considered that conventional site plant will be unsuitable across the majority of the site especially for excavations extending below about 1.5 m depth.

7.3.3 Floor slabs

Whilst the ground conditions are considered potentially suitable for the adoption of ground bearing floors, it is likely the adoption of suspended floor are the preferred option. Where cohesive soils are encountered, suspended floors must be adopted within influencing distance of trees and other significant vegetation and also in areas where any made ground, if encountered, is greater than 0.6m thick.

Suspended floors should be designed in accordance with NHBC Standards, Chapter 5.2, ‘Suspended ground floors’ assuming clay of medium shrinkage potential

Where adopted, ground bearing floors must be designed in accordance with NHBC Standards, Chapter 5.1, ‘Substructure and ground bearing floors’. All formation levels should be proof-rolled and all topsoil and any other loose, soft, organic or otherwise unsuitable materials should be removed and replaced with well-compacted, suitable granular fill.

7.3.4 Roads, hardstanding and drainage

In the 1 m to 1.5 m below the proposed finished ground level the exploratory holes have revealed a soil profile comprising both granular and cohesive soils. The potentially poorest sub-grade material are the cohesive soils (medium shrinkage potential).

In pavement design terms, the groundwater conditions are anticipated to comprise a low water table, i.e. at least 1 m below the pavement formation level.

The estimated minimum, equilibrium soil-suction, California bearing ratio (CBR) value for the cohesive soils and groundwater conditions described above under a completed pavement is 3 %, based upon Table C1 in TRRL (1984) Report LR1132.

The results of in-situ and laboratory testing from the previous report indicate that the preliminary design CBR for the cohesive Cornbrash Formation to be 3 % and 4 % for the granular portion. For granular sub-grade soils, a CBR of 20 % to 40 % can be assumed.

These values assume that during construction, the formation level will be carefully compacted and any soft spots removed and replaced with well-compacted granular fill.

The sub-grade soils can be regarded as being frost-susceptible especially the more silty materials based upon the criteria given in Appendix 1 of TRRL (1970) Report Road Note 29. When the sub-grade is frost-susceptible, the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450 mm.

7.3.5 Chemical attack on buried concrete

This assessment of the potential for chemical attack on buried concrete is based on current BRE guidance (Special Digest 1: 2005 Concrete in aggressive ground). For the purposes of the assessment, the site is considered to be a 'Greenfield' development and the ground conditions does not contain pyrite. A suite of chemical tests assuming this site classification has been undertaken on 4 soil samples between 1.2 m and 8.3 m bgl.

The results of the chemical tests, given in **Appendix I**, indicate a maximum 2:1 water soil extract of <14 mg/l for shallow soils down to 2.4 m bgl but also 634 mg/l and 213 mg/l at 5.4 m and 8.3 m bgl, respectively. Based upon SD1, Table C1, Result 1 indicates a Design Sulphate Class, DS-1.

Two groundwater samples for the Kinsmere development (WSP Environmental TP56 at 1.6 m and TP65 at 1.2 m) indicate sulphate results of 43.8 mg/l and 67.3 mg/l, respectively. Based upon SD1, Table C1, Result 2 indicates a Design Sulphate Class, DS-1.

There is no Result 3 due to the site being a 'Greenfield' development.

Based upon Results 1 and 2, it is recommended that buried concrete be designed assuming a Design Sulphate Class, DS-1.

The results of pH determinations indicate slightly alkaline soil and groundwater pH conditions.

With respect to the Aggressive Chemical for Concrete (ACEC) Classification, **AC-1** can be assumed.

7.3.6 Soakaways

Previous investigation by WSP Environmental identified that within the subject area (Land Parcel J), the infiltration characteristics of the granular Cornbrash Formation is practically impervious (TP705c). Relatively good drainage has been shown within the granular portion of the Cornbrash Formation, however, significantly lower infiltration is anticipated in areas of more cohesive soils. Further testing in accordance with BRE 365: 2007 is recommended in areas of proposed soakaways.

The EA should be contacted at the design stage in order to obtain a 'consent to discharge'. This may not be forthcoming where soakage will be into or just above the water table, particularly in the Agency's sensitive aquifer protection zones. In addition, planning approval will have to be sought for their use.

Construction of soakaways and drainage runs will prove problematic with conventional plant due to the relatively hard/density of the ground conditions encountered across the majority of the site.

8 REUSE OF MATERIALS AND WASTE

8.1 Reuse of suitable materials

Under the Waste Framework Directive naturally occurring soils are not considered waste if re-used on the site of origin for the purposes of development.

In accordance with the definition provided in the Waste Framework Directive, materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Thus, soils that are not of clean and natural origin, i.e. made ground (whether contaminated or not) and other materials such as recycled aggregate, do not become waste until the aforementioned criteria are met.

The Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011) (CoP) was developed in consultation with the Environment Agency and development industry to enable the re-use of materials under certain scenarios and subject to demonstrating that specific criteria are met. The current re-use scenarios covered by the CoP comprise:

- Re-use on the site of origin (with or without treatment)
- Direct transfer of clean and natural soils between sites
- Use in the development of land other than the site of origin following treatment at an authorised Hub site (including a fixed Soil Treatment Facility).

The importation of made ground soils (irrespective of contamination status) or crushed demolition materials is not currently permitted under the CoP and requires either a standard rules environmental permit or a U1 waste exemption (see below).

In the context of excavated materials used on sites undergoing development, four factors are considered to be of particular relevance in determining if the material is a waste or when it ceases to be waste:

- The aim of the Waste Framework Directive is not undermined, i.e. if the use of the material will create an unacceptable risk of pollution of the environment or harm to human health it is likely to be waste.
- The material is certain to be used.
- The material is suitable for use both chemically and geotechnically.
- Only the required quantity of material will be used.

The CoP requires the preparation of a materials management plan (MMP) that confirms the above factors will be met. This plan needs to be reviewed by a 'Qualified Person' (QP) who will then issue a declaration form to the EA. As the project progresses, data must be collated and on completion a verification report produced that shows the MMP was followed and describes any changes.

The MMP establishes whether specific materials are classified as waste and how excavated materials will be treated and/or re-used in line with the CoP. The MMP is likely to form part of the site waste management plan.

As the site has not been previously developed all excavation works are expected to generate only clean and naturally occurring soils. Under the Waste Framework Directive naturally occurring soils are not considered waste if re-used on the site of origin. However, if it is proposed to import clean and naturally occurring soils direct from another site, an MMP would need to be in place at the receiving site.

8.2 Treatment to meet suitable-for-use criteria

Where materials do not meet the suitable for use criteria it may be possible to treat them under an environmental permit (mobile treatment licence) to enable them to be reused onsite.

To enable the treatment options to be determined, an options appraisal and a remediation strategy document will be necessary to support discussion of the issues with regulators and third parties.

8.3 Reuse of waste materials

If material is discarded as waste then its reuse on site may still be possible. Waste soils and recycled aggregate can be reused on site under a standard rules environmental permit or a U1 waste exemption from the Environmental Permitting (England and Wales) Regulations 2010 provided that they are suitable for the proposed use, i.e. not cause harm to human health or the environment. However, it should be noted that these have strict limits on the quantity of material that can be reused.

8.4 Wastes for landfill disposal

Wastes require pre-treatment prior to disposal at landfill. Pre-treatment must be a physical, thermal, chemical or biological process (including sorting) that changes the characteristics of the waste to reduce its volume, reduce its hazardous nature, facilitate its handling and enhance its recovery.

The latest, edition of the EA's 'Technical Guidance WM3' (2015) Guidance on the classification and assessment of waste, requires that within a mixed waste* the separately identifiable wastes are assessed separately. Mixing of different types of hazardous waste and hazardous waste with other waste substances is prohibited under the Waste Framework Directive. Wastes that have been mixed must be separated whenever possible.

It is best practice to provide your waste carrier (or the disposal site) with details of how the waste has been treated. Your waste carrier may provide a pre-treatment confirmation form or space on the waste transfer note to detail the pre-treatment.

The classification of waste soil is a two-stage process, the first being an assessment of whether the soil is considered hazardous or not following the guidance within Technical Guidance WM3. For off-site disposal to landfill the results of Waste Acceptance Criteria (WAC) testing must then be reviewed to establish if the soil is acceptable at the relevant class of landfill or requires pre-treatment to reduce specific hazardous properties.

8.4.1 Waste acceptance criteria

All inert, stable non-reactive hazardous and hazardous wastes have limit values (waste acceptance criteria) set out in legislation that must be met before that class of landfill can accept the waste. Currently, no WAC are in place for non-hazardous waste.

Soil and other materials that are found not to be hazardous may be classified as either non hazardous or inert. In order to determine whether they can be classed as inert the soil must be tested and found to be below the inert waste acceptance criteria.

8.4.2 Waste sampling plan

Technical Guidance WM3 sets out in **Appendix D** requirements for waste sampling. It is a legal requirement to correctly assess and classify waste. The level of sampling should be proportionate to the volume of waste and its heterogeneity. At this stage RSK consider that the level of soil sampling is/is not sufficient to robustly/fully categorise the material.

RSK recommends that a Sampling Plan be prepared to support any waste classifications and hazardous waste assessments, prior to development.

8.4.3 Preliminary waste assessment

It is a legal requirement to correctly assess and classify the waste. The level of sampling should be appropriate to the volume of waste and its heterogeneity. At this stage RSK consider that the level of soil sampling is limited to fully characterise the material, as such a robust sampling procedure should be undertaken prior to development.

Envirolab (an RSK company) has developed a waste soils characterisation assessment tool (HASWASTE), which follows the guidance within Technical Guidance WM3. The analytical results have been assessed using the tool for potential off-site disposal of materials in the future. The results are presented in **Table 17**.

Table 17: Results of waste soils characterisation assessment (HASWASTE)

Sample reference (m bgl)	Hazardous properties	Contaminant generally driving hazardous assessment	Soil material type	Preliminary Waste classification
WS03 (0.65)	None	-	Cultivated Topsoil	Non hazardous/ inert
WS04 (0.3)				
TP06 (0.2)				
TP09 (0.2)				
TP10 (0.05)				

The results indicate that the soil material tested are not likely to be classified as hazardous waste. Therefore to determine whether waste might be classified as inert or non hazardous Waste Acceptance Criteria (WAC) testing will need to be undertaken.

8.4.4 Asbestos within waste soils

The latest, edition of Technical Guidance WM3, requires that within a mixed waste the separately identifiable wastes be assessed separately.

For instance where waste soil contains identifiable pieces of asbestos (visible to the naked eye) the asbestos should, where feasible, be separated from the soil and classified separately.

Asbestos was not identified during the site investigation or subsequent laboratory analysis, however it is often in discrete locations and when in fibre form it is impossible to see by the naked eye. Therefore the risk that asbestos may be found during more extensive site works cannot be discounted.

8.5 Landfill tax

Waste producers disposing of material to landfill are required to pay landfill tax by HM Revenue and Customs.

The tax is chargeable by weight (tonnage) and two rates apply, either standard or lower rate. The lower rate only applies to those less polluting wastes as set out in the Landfill Tax (Qualifying Material) Order 2011, which include naturally occurring rock and soil, concrete, some minerals, some furnace slags and ash, and some low-activity organic compounds. Evidence confirming that the waste qualifies for the lower rate will be required, and standard rate tax will apply for the whole waste load for any loads of mixed waste.

Currently (since 1 April 2017), standard rate landfill tax is £86.10 per tonne.

The lower rate of landfill tax applicable to less polluting wastes (i.e. ‘inert’ wastes) remains at £2.70 per tonne.

Material disposed of at a soil treatment centre will not be subject to landfill tax.

8.6 Groundwater

When there is an intention to discard groundwater, chemical test results will indicate the appropriate disposal options. This could include disposal to treatment facility, via consent (issued by the water authority) to foul sewer or via consent (issued by the EA) to a watercourse or land.

8.7 Waste Recommendations

RSK recommends that consideration as to how potentially waste soils will be dealt with as part of this development/remediation is given as early in the project planning process as possible. Such planning can lead to cost savings where potentially waste soils are viewed as a resource and retained on-site as part of the development. We also recommend, where off-site disposal is being considered, that appropriate facilities are identified and discussions initiated to confirm suitability of the facility to take the material. Potentially, these may include soil treatment facilities as well as landfills.

RSK can provide specialist advice to assist in this process, which can be complex and subject to regular regulatory change.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Environmental

Based on the findings from the intrusive investigation, the site is generally underlain by a thin mantle of Cultivated Topsoil underlain by the Weathered Cornbrash Formation grading into the Cornbrash Formation with the Forest Marble Formation at depth. No visual or olfactory evidence of contamination was recorded and perched groundwater was noted within the Weathered Cornbrash Formation and at depth within the Forest Marble Formation between 0.97 m and 1.9 m bgl.

No degradable material was noted during the intrusive investigation and subsequent laboratory analysis indicates low organic content. The findings from the ground gas assessment suggests the site falls under a 'Green' site characterisation assuming a ventilated sub floor void is adopted.

Topsoil classification was carried out, within the wider area in line with BS3882:2015, and indicated that the soils across the site are not suitable for reuse, it is recommended that the provision of a clean soil cover for all soft landscaped areas is recommended.

The shallow soils across the site were found to be free of significant contamination with respect to the proposed development. As such, no significant environmental issues have been identified that would preclude residential development. No gas protection measures are considered to be necessary.

Whilst no remediation or alleviation measures are deemed necessary, it is possible that the groundworks may encounter different conditions from those revealed by the site investigation. It is currently considered that no detailed remedial strategy is required for the site. however, it is strongly recommended that the Local Authority be contacted at an early stage to seek their views on this assessment.

9.2 Reuse of materials and waste

None of the samples tested were classified as being hazardous waste. To determine where waste soils might be classified as inert or non hazardous WAC testing will need to be undertaken.

9.3 Geotechnical

The exploratory holes revealed that the site is underlain by a mantle of cultivated Topsoil which is underlain by either cohesive or granular deposits of the Cornbrash Formation. The cohesive deposits are generally stiff to very stiff silty clay and the granular portion has been recorded as very dense clayey gravel and cobbles. The Forest Marble Formation has been recorded at depth, recovered as alternating layers of very stiff to hard silty clay, mudstone and moderately weak to strong limestone to a maximum depth of 19.5 m bgl.

It is considered that the ground conditions are suitable for the adoption of traditional spread foundations founded within firm to stiff gravelly clay or sandy gravel at a

minimum depth of 0.9 m below ground final ground level or existing ground level whichever is lower. A net allowable bearing capacity of 150 kN/m^2 can be assumed.

It is recommended that spread foundations include nominal mesh reinforcement.

Foundations will need to be locally extended down in to the firm to stiff gravelly clay (approximately 1.5 m bgl) in the vicinity of WSPs TP703 and TP705 (central region of Land Parcel J, presented in **Figure 2** and **Figure 3**). Further investigation is recommended to assess the extent of the low strength soils identified in this area.

It should be noted that the clay was found to be moderately shrinkable and therefore foundations should be designed in accordance with NHBC Chapter 4.2, 'Building near trees'. Due to the varied nature of the proposed formation soils, it is recommended that foundations incorporate nominal mesh reinforcement to overcome any potential for differential settlement. It is recommended that foundations are blinded with concrete to prevent softening of silt rich soils due to the contact with perched groundwater.

It should also be noted that conventional plant may not be suitable due to the relatively dense/high strength consistency of the Cornbrash Formation encountered.

Groundwater seepages noted as fast ingress was encountered during the intrusive investigation within TP05 at 1.0 m bgl, which is thought to be perched water within the Cornbrash Formation. The sides of the foundation excavations within the cohesive portion of the Cornbrash Formation will be relatively stable in the short term although there is potential for some instability associated with groundwater seepages.

The recommended sub-grade soil CBR value for preliminary road pavement design is 3 % for the cohesive portion and 20 % to 40 % for the granular portion outlined within the previous WSP Environmental report. During construction the proposed formation level should be inspected and if soft spots, made ground or topsoil is encountered, then these must be removed and replaced with well compacted granular fill. The formation soils should be well compacted throughout.

The more cohesive sub-grade soils can be regarded as being frost susceptible.

Based on Table C1 in the BRE guidance, Result one for Design Sulphate Class DS-1 and an aggressive Chemical Environment for Concrete classification of AC-1 may be assumed for design purposes

Based upon the results of the soakaway tests presented in the WSP Environmental report there is limited potential for traditional pit soakaways within the more cohesive Cornbrash Formation, however there is potential for soakage in the more granular, unsaturated strata. Further assessment is recommended in line with BRE 365: 2007 to fully assess the infiltration characteristics of the site.

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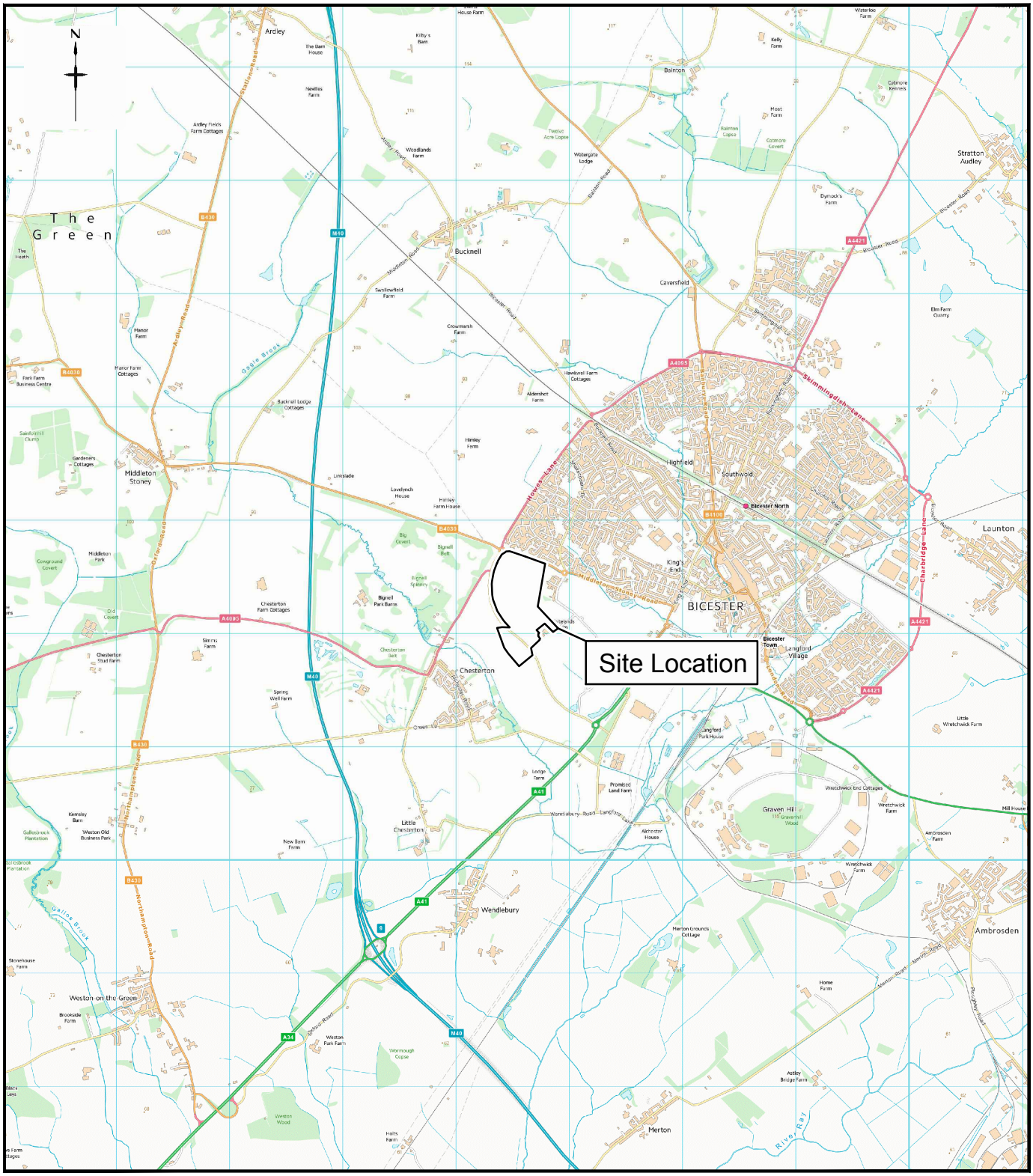
FIGURES



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Client: COUNTRYSIDE PROPERTIES PLC

Project Title: LAND SOUTH OF MIDDLETON STONEY ROAD, - KINGSMERE

Drawing Title: SITE LOCATION PLAN

Rev	Drawn	Date	Checked	Date	Approved	Date
01	ASC	24.10.17	JT	24.10.17	JT	24.10.17

Dimensions	Scale	Original Size
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Project Number	Drawing File	Drawing Number
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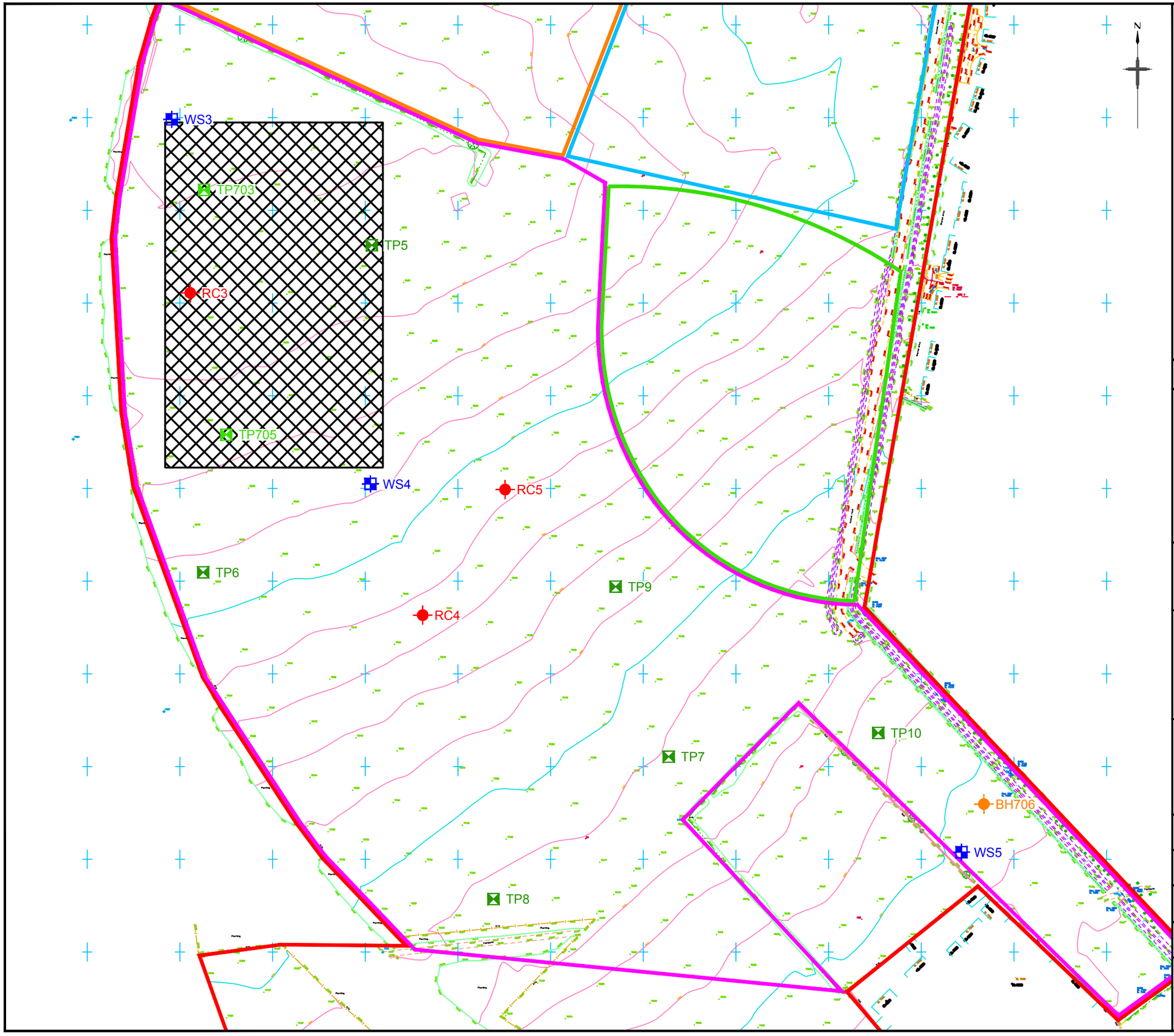

LEGEND

- Site Boundary
- School Site Boundary
- Parcel H Boundary
- Parcel I Boundary
- Full Site Boundary
- Conjectured Area of Low Strength Soils
- Rotary Location
- Window Sample Location
- Trial Pit Location
- Borehole Location (WSP)
- Trial Pit Location (WSP)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Project Title
LAND SOUTH OF MIDDLETON STONEY ROAD, BICESTER - KINGSMERE

Drawing Title
EXPLORATORY HOLE LOCATION PLAN

Drawn	Date	Checked	Date	Approved	Date
ASC	11.10.17	JT	11.10.17	JT	11.10.17

Scale	Orig Size	Dimensions
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Project No.	Drawing File
29286 - R01 (00)	29286 (R01-00) Fig 2.dwg

Drawing No.	Rev.
FIGURE 2	P1

Scale 1 : 2,000
0 20 40 60 80 100m

LEGEND

- Site Boundary
- Parcel J Boundary
- Parcel L Boundary
- Parcel M Boundary
- Parcel N Boundary
- Parcel O Boundary
- Conjectured Area of Low Strength Soils

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Project Title

LAND SOUTH OF MIDDLETON STONEY ROAD, BICESTER - KINGSMERE

Drawing Title

PROPOSED DEVELOPMENT PLAN

Drawn	Date	Checked	Date	Approved	Date
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Scale	Orig Size	Dimensions
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Project No.	Drawing File
29286 - R01 (00)	29286 (R01-00) Fig 3.dwg

Drawing No.	Rev.
FIGURE 3	P1

Scale 1 : 2,000

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SPT 'N' Values vs Depth

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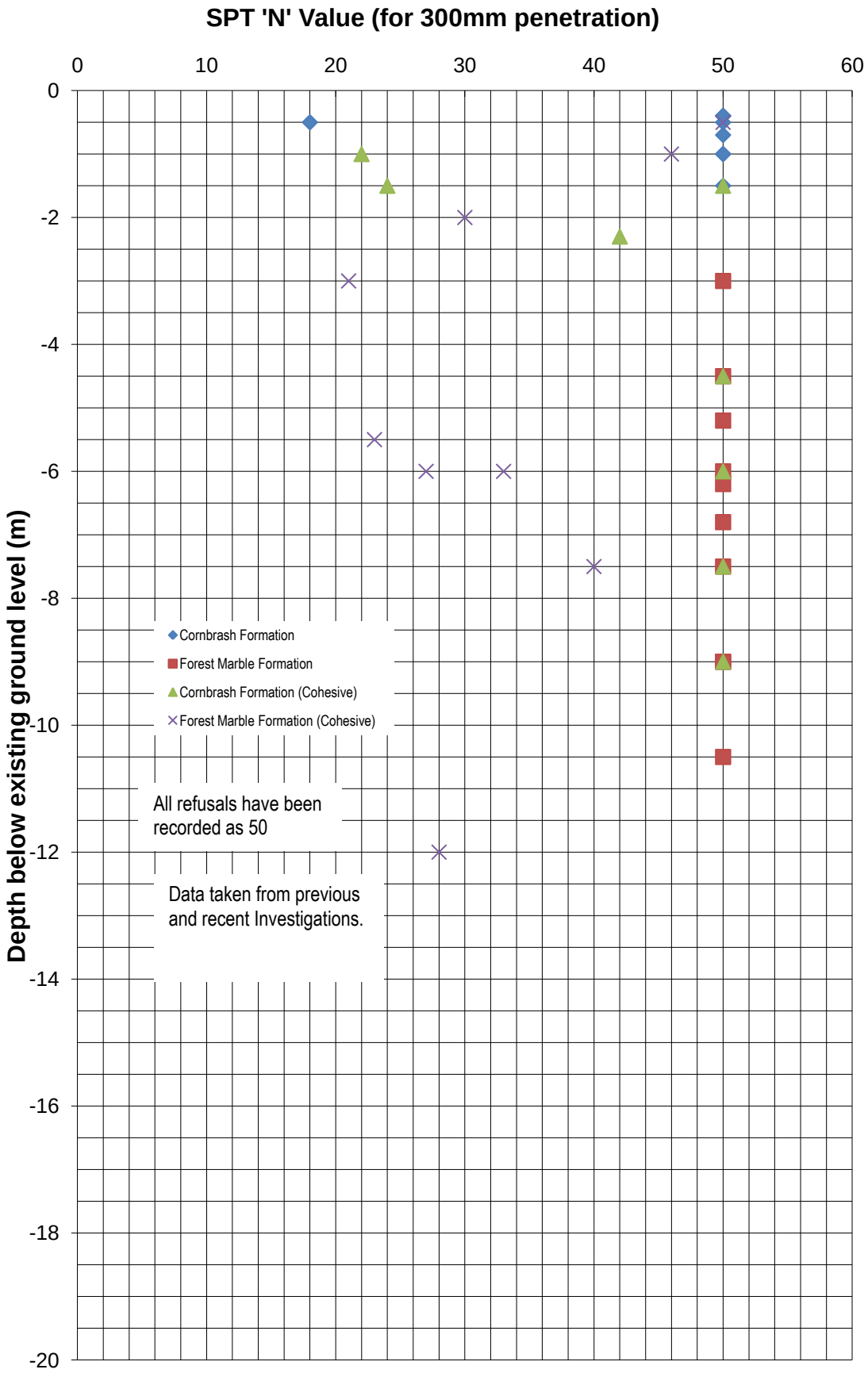
Bicester - Full Site	Countryside Propoerties (Bicester) Limited	Figure:	4



APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Countryside Properties (Bicester) Limited (the "client") in accordance with the terms of a contract between RSK and the "client", dated 15th August 2017. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.

2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed in writing the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.

7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.

8. The intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (boreholes, trial pits etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX B
FIELD RECORDS

IN-SITU GAS MONITORING RESULTS

[Pressures]	Previous	During	Start	End	Equipment Used & Remarks
Round 1	-	-	-	-	Weather: Cloud + Ground: Wet + Wind: Medium + Air Temp: 13DegC
Round 2	-	-	-	-	Weather: Overcast + Ground: Damp + Wind: Medium + Air Temp: 11DegC
Round 3	-	-	-	-	Weather: Cloud + Ground: Wet + Wind: Medium + Air Temp: 12DegC

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)		Carbon Monoxide (ppm)
BH703	1	50	1	8.00	7.49	4.00 to 8.00	27/09/2017 10:20:00	1012	1012	$0.0_{(I)}$	3.22	0.0	0.0	20.9	-	2.4		0
BH703	1	50	1		7.49	4.00 to 8.00	15 secs	1012	1012	$0.0_{(SS)}$	3.22	0.1	0.0	20.9	-	-		0
BH703	1	50	1		7.49	4.00 to 8.00	30 secs	1012	1012	$0.0_{(SS)}$	3.22	0.1	0.0	20.8	-	-		0
BH703	1	50	1		7.49	4.00 to 8.00	60 secs	1012	1012	$0.0_{(SS)}$	3.22	0.2	0.0	20.8	-	-		0
BH703	1	50	1		7.49	4.00 to 8.00	90 secs	1012	1012	$0.0_{(SS)}$	3.22	0.2	0.0	20.7	-	-		0
BH703	1	50	1		7.49	4.00 to 8.00	120 secs	1012	1012	$0.0_{(SS)}$	3.22	0.3	0.0	20.7	-	-		0
BH703	1	50	1		7.49	4.00 to 8.00	180 secs	1012	1012	$0.0_{(SS)}$	3.22	0.3	0.0	20.6	-	-		0
BH703	1	50	1		7.49	4.00 to 8.00	240 secs	1012	1012	$0.0_{(SS)}$	3.22	0.4	0.0	20.6	-	-		0
BH703	1	50	1		7.49	4.00 to 8.00	300 secs	1012	1012	$0.0_{(SS)}$	3.22	0.4	0.0	20.5	-	-		0
BH703	1	50	1		7.49	4.00 to 8.00	360 secs	1012	1012	$0.0_{(SS)}$	3.22	0.4	0.0	20.5	-	-		0
BH703	1	50	2	8.00	7.45	4.00 to 8.00	03/10/2017 10:38:00	1018	1018	$0.0_{(I)}$	3.20	0.1	0.0	20.9	0.0	-		0
BH703	1	50	2		7.45	4.00 to 8.00	15 secs	1018	1018	$0.0_{(SS)}$	3.20	1.4	0.0	20.2	0.0	-		0
BH703	1	50	2		7.45	4.00 to 8.00	30 secs	1018	1018	$0.0_{(SS)}$	3.20	1.1	0.0	18.3	0.0	-		0
BH703	1	50	2		7.45	4.00 to 8.00	60 secs	1018	1018	$0.0_{(SS)}$	3.20	0.5	0.0	19.9	0.0	-		0
BH703	1	50	2		7.45	4.00 to 8.00	90 secs	1018	1018	$0.0_{(SS)}$	3.20	0.4	0.0	20.2	0.0	-		0
BH703	1	50	2		7.45	4.00 to 8.00	120 secs	1018	1018	$0.0_{(SS)}$	3.20	0.4	0.0	20.2	0.0	-		0
BH703	1	50	2		7.45	4.00 to 8.00	180 secs	1018	1018	$0.0_{(SS)}$	3.20	0.4	0.0	20.2	0.0	-		0
BH703	1	50	2		7.45	4.00 to 8.00	240 secs	1018	1018	$0.0_{(SS)}$	3.20	0.4	0.0	20.3	0.0	-		0

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date	Contract Ref:
	07/11/17			29286

Contract: **Land south of Middleton Stoney Road, Bicester**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)		Carbon Monoxide (ppm)
BH703	1	50	2		7.45	4.00 to 8.00	300 secs	1018	1018	0.0$_{(SS)}$	3.20	0.4	0.0	20.3	0.0	-		0
BH703	1	50	3	8.00	7.41	4.00 to 8.00	11/10/2017 08:21:00	1002	1002	0.0$_{(I)}$	3.20	0.0	0.0	20.9	-	-		0
BH703	1	50	3		7.41	4.00 to 8.00	15 secs	1002	1002	0.0$_{(SS)}$	3.20	0.1	0.0	20.6	-	-		0
BH703	1	50	3		7.41	4.00 to 8.00	30 secs	1002	1002	0.0$_{(SS)}$	3.20	0.2	0.0	20.8	-	-		0
BH703	1	50	3		7.41	4.00 to 8.00	60 secs	1002	1002	0.0$_{(SS)}$	3.20	0.2	0.0	20.8	-	-		0
BH703	1	50	3		7.41	4.00 to 8.00	90 secs	1002	1002	0.0$_{(SS)}$	3.20	0.2	0.0	20.9	-	-		0
BH703	1	50	3		7.41	4.00 to 8.00	120 secs	1002	1002	0.0$_{(SS)}$	3.20	0.2	0.0	20.9	-	-		0
BH703	1	50	3		7.41	4.00 to 8.00	180 secs	1002	1002	0.0$_{(SS)}$	3.20	0.2	0.0	20.9	-	-		0
BH703	1	50	3		7.41	4.00 to 8.00	240 secs	1002	1002	0.0$_{(SS)}$	3.20	0.2	0.0	20.9	-	-		0
BH703	1	50	3		7.41	4.00 to 8.00	300 secs	1002	1002	0.0$_{(SS)}$	3.20	0.2	0.0	20.9	-	-		0
BH706	1	50	1	8.00	5.70	1.00 to 7.00	29/09/2017 07:53:00	1004	1004	0.0$_{(I)}$	1.25	0.0	0.0	20.9	-	1.4		0
BH706	1	50	1		5.70	1.00 to 7.00	15 secs	1004	1004	0.0$_{(SS)}$	1.25	0.2	0.0	20.8	-	-		0
BH706	1	50	1		5.70	1.00 to 7.00	30 secs	1004	1004	0.0$_{(SS)}$	1.25	0.2	0.0	20.7	-	-		0
BH706	1	50	1		5.70	1.00 to 7.00	60 secs	1004	1004	0.0$_{(SS)}$	1.25	0.1	0.0	20.8	-	-		0
BH706	1	50	1		5.70	1.00 to 7.00	90 secs	1004	1004	0.0$_{(SS)}$	1.25	0.1	0.0	20.9	-	-		0
BH706	1	50	1		5.70	1.00 to 7.00	120 secs	1004	1004	0.0$_{(SS)}$	1.25	0.1	0.0	20.9	-	-		0
BH706	1	50	1		5.70	1.00 to 7.00	180 secs	1004	1004	0.0$_{(SS)}$	1.25	0.1	0.0	20.9	-	-		0
BH706	1	50	1		5.70	1.00 to 7.00	240 secs	1004	1004	0.0$_{(SS)}$	1.25	0.1	0.0	20.9	-	-		0
BH706	1	50	1		5.70	1.00 to 7.00	300 secs	1004	1004	0.0$_{(SS)}$	1.25	0.1	0.0	20.9	-	-		0
BH706	1	50	2	8.00	5.80	1.00 to 7.00	03/10/2017 12:58:00	1019	1019	-0.1$_{(SS)}$	1.35	0.1	0.0	20.7	-	-		0
BH706	1	50	2		5.80	1.00 to 7.00	15 secs	1019	1019	-0.1$_{(SS)}$	1.35	0.4	0.0	20.4	-	-		0
BH706	1	50	2		5.80	1.00 to 7.00	30 secs	1019	1019	-0.1$_{(SS)}$	1.35	0.4	0.0	20.2	-	-		0
BH706	1	50	2		5.80	1.00 to 7.00	60 secs	1019	1019	-0.1$_{(SS)}$	1.35	0.5	0.0	20.1	-	-		0
BH706	1	50	2		5.80	1.00 to 7.00	90 secs	1019	1019	-0.1$_{(SS)}$	1.35	0.5	0.0	20.1	-	-		0

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IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)		Carbon Monoxide (ppm)
BH706	1	50	2		5.80	1.00 to 7.00	120 secs	1019	1019	-0.1 (SS)	1.35	0.5	0.0	20.1	-	-		0
BH706	1	50	2		5.80	1.00 to 7.00	180 secs	1019	1019	-0.1 (SS)	1.35	0.5	0.0	20.1	-	-		0
BH706	1	50	2		5.80	1.00 to 7.00	240 secs	1019	1019	-0.1 (SS)	1.35	0.5	0.0	20.1	-	-		0
BH706	1	50	3	8.00	5.72	1.00 to 7.00	11/10/2017 09:20:00	100	100	0.0 (I)	1.42	0.0	0.0	20.9	-	-		0
BH706	1	50	3		5.72	1.00 to 7.00	15 secs	100	100	0.0 (SS)	1.42	0.2	0.0	20.8	-	-		0
BH706	1	50	3		5.72	1.00 to 7.00	30 secs	100	100	0.0 (SS)	1.42	0.3	0.0	20.8	-	-		0
BH706	1	50	3		5.72	1.00 to 7.00	60 secs	100	100	0.0 (SS)	1.42	0.3	0.0	20.8	-	-		0
BH706	1	50	3		5.72	1.00 to 7.00	90 secs	100	100	0.0 (SS)	1.42	0.3	0.0	20.8	-	-		0
BH706	1	50	3		5.72	1.00 to 7.00	120 secs	100	100	0.0 (SS)	1.42	0.3	0.0	20.8	-	-		0
BH706	1	50	3		5.72	1.00 to 7.00	180 secs	100	100	0.0 (SS)	1.42	0.3	0.0	20.8	-	-		0
BH706	1	50	3		5.72	1.00 to 7.00	240 secs	100	100	0.0 (SS)	1.42	0.3	0.0	20.7	-	-		0
BH706	1	50	3		5.72	1.00 to 7.00	300 secs	100	100	0.0 (SS)	1.42	0.3	0.0	20.7	-	-		0
BHX	1	50	1	1.00	0.72	0.50 to 1.00	27/09/2017 14:23:00	1011	1011	0.0 (I)	0.72	0.0	0.0	20.9	-	-		0
BHX	1	50	1		0.72	0.50 to 1.00	15 secs	1011	1011	0.0 (SS)	0.72	1.2	0.0	19.3	-	-		2
BHX	1	50	1		0.72	0.50 to 1.00	30 secs	1011	1011	0.0 (SS)	0.72	1.2	0.0	18.9	-	-		0
BHX	1	50	1		0.72	0.50 to 1.00	60 secs	1011	1011	0.0 (SS)	0.72	1.2	0.0	18.9	-	-		0
BHX	1	50	1		0.72	0.50 to 1.00	90 secs	1011	1011	0.0 (SS)	0.72	1.2	0.0	18.8	-	-		0
BHX	1	50	1		0.72	0.50 to 1.00	120 secs	1011	1011	0.0 (SS)	0.72	1.2	0.0	18.8	-	-		0
BHX	1	50	1		0.72	0.50 to 1.00	180 secs	1011	1011	0.0 (SS)	0.72	1.2	0.0	18.9	-	-		0
BHX	1	50	1		0.72	0.50 to 1.00	240 secs	1011	1011	0.0 (SS)	0.72	1.2	0.0	18.9	-	-		0
BHX	1	50	1		0.72	0.50 to 1.00	300 secs	1011	1011	0.0 (SS)	0.72	1.2	0.0	19.0	-	-		0
BHX	1	50	2	1.00	0.71	0.50 to 1.00	03/10/2017 12:47:00	1020	1020	-0.1 (I)	0.69	0.1	0.0	20.8	-	-		0
BHX	1	50	2		0.70	0.50 to 1.00	15 secs	1020	1020	-0.1 (SS)	0.70	1.1	0.0	19.9	-	-		0
BHX	1	50	2		0.70	0.50 to 1.00	30 secs	1020	1020	-0.1 (SS)	0.70	1.1	0.0	19.1	-	-		0

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

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IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)		Carbon Monoxide (ppm)
BHX	1	50	2		0.70	0.50 to 1.00	60 secs	1020	1020	-0.1 (SS)	0.70	1.2	0.0	19.0	-	-		0
BHX	1	50	2		0.70	0.50 to 1.00	90 secs	1020	1020	-0.1 (SS)	0.70	1.2	0.0	19.0	-	-		0
BHX	1	50	2		0.70	0.50 to 1.00	120 secs	1020	1020	-0.1 (SS)	0.70	1.2	0.0	19.0	-	-		0
BHX	1	50	2		0.70	0.50 to 1.00	180 secs	1020	1020	-0.1 (SS)	0.70	1.2	0.0	19.1	-	-		0
BHX	1	50	2		0.70	0.50 to 1.00	240 secs	1020	1020	-0.1 (SS)	0.70	1.1	0.0	19.3	-	-		0
BHX	1	50	2		0.70	0.50 to 1.00	300 secs	1020	1020	-0.1 (SS)	0.70	1.1	0.0	19.3	-	-		0
BHX	1	50	3	1.00	0.72	0.50 to 1.00	11/10/2017 09:01:00	1002	1002	0.0 (I)	0.72	0.0	0.0	20.9	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	15 secs	1002	1002	0.0 (SS)	0.72	1.1	0.0	20.3	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	30 secs	1002	1002	0.0 (SS)	0.72	1.1	0.0	19.9	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	60 secs	1002	1002	0.0 (SS)	0.72	1.1	0.0	19.9	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	90 secs	1002	1002	0.0 (SS)	0.72	1.1	0.0	19.9	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	120 secs	1002	1002	0.0 (SS)	0.72	1.1	0.0	19.9	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	180 secs	1002	1002	0.0 (SS)	0.72	1.2	0.0	19.8	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	240 secs	1002	1002	0.0 (SS)	0.72	1.1	0.0	19.8	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	300 secs	1002	1002	0.0 (SS)	0.72	1.1	0.0	19.9	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	360 secs	1002	1002	0.0 (SS)	0.72	1.0	0.0	20.0	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	420 secs	1002	1002	0.0 (SS)	0.72	1.0	0.0	20.1	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	480 secs	1002	1002	0.0 (SS)	0.72	0.9	0.0	20.2	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	540 secs	1002	1002	0.0 (SS)	0.72	0.9	0.0	20.2	-	-		0
BHX	1	50	3		0.72	0.50 to 1.00	600 secs	1002	1002	0.0 (SS)	0.72	0.9	0.0	20.2	-	-		0
RC4	1	50	1	12.00	12.31	1.00 to 12.00	29/09/2017 08:15:00	1003	1004	0.0 (I)	1.07	0.0	0.0	20.9	-	1.3		0
RC4	1	50	1		12.31	1.00 to 12.00	15 secs	1003	1004	0.0 (SS)	1.07	0.5	0.0	20.4	-	-		0
RC4	1	50	1		12.31	1.00 to 12.00	30 secs	1003	1004	0.0 (SS)	1.07	0.5	0.0	20.1	-	-		0
RC4	1	50	1		12.31	1.00 to 12.00	60 secs	1003	1004	0.0 (SS)	1.07	0.5	0.0	20.1	-	-		0

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

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Compiled By	Date	Checked By	Date	Contract Ref:
	07/11/17			29286

Contract: **Land south of Middleton Stoney Road, Bicester**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)		Carbon Monoxide (ppm)
RC4	1	50	1		12.31	1.00 to 12.00	90 secs	1003	1004	$0.0_{(SS)}$	1.07	0.5	0.0	20.1	-	-		0
RC4	1	50	1		12.31	1.00 to 12.00	120 secs	1003	1004	$0.0_{(SS)}$	1.07	0.5	0.0	20.1	-	-		0
RC4	1	50	1		12.31	1.00 to 12.00	180 secs	1003	1004	$0.0_{(SS)}$	1.07	0.5	0.0	20.1	-	-		0
RC4	1	50	1		12.31	1.00 to 12.00	240 secs	1003	1004	$0.0_{(SS)}$	1.07	0.5	0.0	20.1	-	-		0
RC4	1	50	1		12.31	1.00 to 12.00	300 secs	1003	1004	$0.0_{(SS)}$	1.07	0.5	0.0	20.1	-	-		0
RC4	1	50	1		12.31	1.00 to 12.00	360 secs	1003	1004	$0.0_{(SS)}$	1.07	0.5	0.0	20.1	-	-		0
RC4	1	50	2	12.00	12.49	1.00 to 12.00	03/10/2017 13:08:00	1019	1019	$0.0_{(I)}$	1.21	0.1	0.0	20.9	-	-		0
RC4	1	50	2		12.49	1.00 to 12.00	15 secs	1019	1019	$0.0_{(SS)}$	1.21	0.5	0.0	20.5	-	-		0
RC4	1	50	2		12.49	1.00 to 12.00	30 secs	1019	1019	$0.0_{(SS)}$	1.21	0.5	0.0	20.1	-	-		0
RC4	1	50	2		12.49	1.00 to 12.00	60 secs	1019	1019	$0.0_{(SS)}$	1.21	0.5	0.0	20.1	-	-		0
RC4	1	50	2		12.49	1.00 to 12.00	90 secs	1019	1019	$0.0_{(SS)}$	1.21	0.5	0.0	20.1	-	-		0
RC4	1	50	2		12.49	1.00 to 12.00	120 secs	1019	1019	$0.0_{(SS)}$	1.21	0.5	0.0	20.1	-	-		0
RC4	1	50	2		12.49	1.00 to 12.00	180 secs	1019	1019	$0.0_{(SS)}$	1.21	0.5	0.0	20.1	-	-		0
RC4	1	50	2		12.49	1.00 to 12.00	240 secs	1019	1019	$0.0_{(SS)}$	1.21	0.5	0.0	20.2	-	-		0
RC4	1	50	2		12.49	1.00 to 12.00	300 secs	1019	1019	$0.0_{(SS)}$	1.21	0.5	0.0	20.2	-	-		0
RC4	1	50	3	12.00	12.30	1.00 to 12.00	11/10/2017 09:35:00	1001	1001	$0.0_{(I)}$	1.06	0.0	0.0	20.9	-	-		0
RC4	1	50	3		12.30	1.00 to 12.00	15 secs	1001	1001	$0.0_{(SS)}$	1.06	0.5	0.0	20.6	-	-		0
RC4	1	50	3		12.30	1.00 to 12.00	30 secs	1001	1001	$0.0_{(SS)}$	1.06	0.5	0.0	20.6	-	-		0
RC4	1	50	3		12.30	1.00 to 12.00	60 secs	1001	1001	$0.0_{(SS)}$	1.06	0.5	0.0	20.6	-	-		0
RC4	1	50	3		12.30	1.00 to 12.00	90 secs	1001	1001	$0.0_{(SS)}$	1.06	0.5	0.0	20.6	-	-		0
RC4	1	50	3		12.30	1.00 to 12.00	120 secs	1001	1001	$0.0_{(SS)}$	1.06	0.5	0.0	20.6	-	-		0
RC4	1	50	3		12.30	1.00 to 12.00	180 secs	1001	1001	$0.0_{(SS)}$	1.06	0.5	0.0	20.6	-	-		0
RC4	1	50	3		12.30	1.00 to 12.00	240 secs	1001	1001	$0.0_{(SS)}$	1.06	0.5	0.0	20.6	-	-		0
RC4	1	50	3		12.30	1.00 to 12.00	300 secs	1001	1001	$0.0_{(SS)}$	1.06	0.5	0.0	20.6	-	-		0

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date	Contract Ref:
	07/11/17			29286

Contract: **Land south of Middleton Stoney Road, Bicester**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)
WS4	1	50	1	2.00	1.97	1.00 to 2.00	29/09/2017 09:16:00	1006	1006	0.0 (I)	0.98	0.0	0.0	20.9	-	2.4	0
WS4	1	50	1		1.97	1.00 to 2.00	15 secs	1006	1006	0.0 (SS)	0.98	0.5	0.0	20.6	-	-	2
WS4	1	50	1		1.97	1.00 to 2.00	30 secs	1006	1006	0.0 (SS)	0.98	0.5	0.0	20.5	-	-	2
WS4	1	50	1		1.97	1.00 to 2.00	60 secs	1006	1006	0.0 (SS)	0.98	0.5	0.0	20.4	-	-	2
WS4	1	50	1		1.97	1.00 to 2.00	90 secs	1006	1006	0.0 (SS)	0.98	0.6	0.0	20.4	-	-	2
WS4	1	50	1		1.97	1.00 to 2.00	120 secs	1006	1006	0.0 (SS)	0.98	0.6	0.0	20.4	-	-	2
WS4	1	50	1		1.97	1.00 to 2.00	180 secs	1006	1006	0.0 (SS)	0.98	0.6	0.0	20.3	-	-	2
WS4	1	50	1		1.97	1.00 to 2.00	240 secs	1006	1006	0.0 (SS)	0.98	1.4	0.0	17.3	-	-	0
WS4	1	50	1		1.97	1.00 to 2.00	300 secs	1006	1006	0.0 (SS)	0.98	1.7	0.0	16.1	-	-	0
WS4	1	50	1		1.97	1.00 to 2.00	360 secs	1006	1006	0.0 (SS)	0.98	1.7	0.0	16.0	-	-	0
WS4	1	50	1		1.97	1.00 to 2.00	420 secs	1006	1006	0.0 (SS)	0.98	1.7	0.0	16.0	-	-	0
WS4	1	50	2	2.00	1.95	1.00 to 2.00	03/10/2017 13:47:00	1019	1019	0.2 (I)	0.97	0.0	0.0	20.8	-	-	0
WS4	1	50	2		1.95	1.00 to 2.00	15 secs	1019	1019	0.1 (SS)	0.97	0.0	0.0	19.1	-	-	0
WS4	1	50	2		1.95	1.00 to 2.00	30 secs	1019	1019	0.1 (SS)	0.97	0.0	0.0	18.9	-	-	0
WS4	1	50	2		1.95	1.00 to 2.00	60 secs	1019	1019	0.1 (SS)	0.97	0.0	0.0	19.0	-	-	0
WS4	1	50	2		1.95	1.00 to 2.00	90 secs	1019	1019	0.1 (SS)	0.97	0.0	0.0	19.2	-	-	0
WS4	1	50	2		1.95	1.00 to 2.00	120 secs	1019	1019	0.1 (SS)	0.97	0.0	0.0	19.3	-	-	0
WS4	1	50	2		1.95	1.00 to 2.00	180 secs	1019	1019	0.1 (SS)	0.97	0.0	0.0	19.5	-	-	0
WS4	1	50	2		1.95	1.00 to 2.00	240 secs	1019	1019	0.1 (SS)	0.97	0.0	0.0	19.6	-	-	0
WS4	1	50	2		1.95	1.00 to 2.00	300 secs	1019	1019	0.1 (SS)	0.97	0.0	0.0	19.6	-	-	0
WS4	1	50	3	2.00	1.94	1.00 to 2.00	11/10/2017 09:48:00	1001	1001	0.0 (I)	1.07	0.0	0.0	20.9	-	-	0
WS4	1	50	3		1.94	1.00 to 2.00	15 secs	1001	1001	0.0 (SS)	1.07	1.9	0.0	19.5	-	-	0
WS4	1	50	3		1.94	1.00 to 2.00	30 secs	1001	1001	0.0 (SS)	1.07	1.9	0.0	18.5	-	-	0
WS4	1	50	3		1.94	1.00 to 2.00	60 secs	1001	1001	0.0 (SS)	1.07	2.0	0.0	18.5	-	-	0
WS4	1	50	3		1.94	1.00 to 2.00	90 secs	1001	1001	0.0 (SS)	1.07	2.0	0.0	18.5	-	-	0

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Compiled By	Date	Checked By	Date	Contract Ref:
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Contract: **Land south of Middleton Stoney Road, Bicester**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)		Carbon Monoxide (ppm)
WS4	1	50	3		1.94	1.00 to 2.00	120 secs	1001	1001	0.0(SS)	1.07	2.0	0.0	18.5	-	-		0
WS4	1	50	3		1.94	1.00 to 2.00	180 secs	1001	1001	0.0(SS)	1.07	2.0	0.0	18.6	-	-		0
WS4	1	50	3		1.94	1.00 to 2.00	240 secs	1001	1001	0.0(SS)	1.07	2.0	0.0	18.6	-	-		0
WS4	1	50	3		1.94	1.00 to 2.00	300 secs	1001	1001	0.0(SS)	1.07	2.0	0.0	18.7	-	-		0
WS5	1	50	1	1.00	1.04	0.50 to 1.00	27/09/2017 16:03:00	1006	1006	0.0(I)	DRY	0.0	0.0	20.9	-	0.6		0
WS5	1	50	1		1.04	0.50 to 1.00	15 secs	1006	1006	0.0(SS)	DRY	0.5	0.0	20.3	-	-		0
WS5	1	50	1		1.04	0.50 to 1.00	30 secs	1006	1006	0.0(SS)	DRY	0.5	0.0	20.2	-	-		0
WS5	1	50	1		1.04	0.50 to 1.00	60 secs	1006	1006	0.0(SS)	DRY	0.5	0.0	20.2	-	-		0
WS5	1	50	1		1.04	0.50 to 1.00	90 secs	1006	1006	0.0(SS)	DRY	0.5	0.0	20.2	-	-		0
WS5	1	50	1		1.04	0.50 to 1.00	120 secs	1006	1006	0.0(SS)	DRY	0.5	0.0	20.2	-	-		0
WS5	1	50	1		1.04	0.50 to 1.00	180 secs	1006	1006	0.0(SS)	DRY	0.5	0.0	20.2	-	-		0
WS5	1	50	1		1.04	0.50 to 1.00	240 secs	1006	1006	0.0(SS)	DRY	0.5	0.0	20.2	-	-		0
WS5	1	50	1		1.04	0.50 to 1.00	300 secs	1006	1006	0.0(SS)	DRY	0.5	0.0	20.2	-	-		0
WS5	1	50	2	1.00	1.04	0.50 to 1.00	03/10/2017 12:32:00	1019	1019	0.1(I)	1.04	0.1	0.0	20.8	-	-		0
WS5	1	50	2		1.04	0.50 to 1.00	15 secs	1019	1019	0.0(SS)	1.04	0.6	0.0	20.6	-	-		0
WS5	1	50	2		1.04	0.50 to 1.00	30 secs	1019	1019	0.0(SS)	1.04	0.6	0.0	20.4	-	-		0
WS5	1	50	2		1.04	0.50 to 1.00	60 secs	1019	1019	0.0(SS)	1.04	0.6	0.0	20.3	-	-		0
WS5	1	50	2		1.04	0.50 to 1.00	90 secs	1019	1019	0.0(SS)	1.04	0.6	0.0	20.3	-	-		0
WS5	1	50	2		1.04	0.50 to 1.00	120 secs	1019	1019	0.0(SS)	1.04	0.6	0.0	20.3	-	-		0
WS5	1	50	2		1.04	0.50 to 1.00	180 secs	1019	1019	0.0(SS)	1.04	0.6	0.0	20.3	-	-		0
WS5	1	50	2		1.04	0.50 to 1.00	240 secs	1019	1019	0.0(SS)	1.04	0.6	0.0	20.3	-	-		0
WS5	1	50	2		1.04	0.50 to 1.00	300 secs	1019	1019	0.0(SS)	1.04	0.6	0.0	20.3	-	-		0
WS5	1	50	3	1.00	1.04	0.50 to 1.00	11/10/2017 08:47:00	1002	1002	0.0(SS)	DRY	0.0	0.0	20.9	-	-		0
WS5	1	50	3		1.04	0.50 to 1.00	15 secs	1002	1002	0.0(SS)	DRY	0.5	0.0	20.7	-	-		0

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	07/11/17			29286

Contract: **Land south of Middleton Stoney Road, Bicester**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)
WS5	1	50	3		1.04	0.50 to 1.00	30 secs	1002	1002	$0.0_{(SS)}$	DRY	0.5	0.0	20.7	-	-	0
WS5	1	50	3		1.04	0.50 to 1.00	60 secs	1002	1002	$0.0_{(SS)}$	DRY	0.5	0.0	20.7	-	-	0
WS5	1	50	3		1.04	0.50 to 1.00	90 secs	1002	1002	$0.0_{(SS)}$	DRY	0.5	0.0	20.6	-	-	0
WS5	1	50	3		1.04	0.50 to 1.00	120 secs	1002	1002	$0.0_{(SS)}$	DRY	0.5	0.0	20.7	-	-	0
WS5	1	50	3		1.04	0.50 to 1.00	180 secs	1002	1002	$0.0_{(SS)}$	DRY	0.5	0.0	20.6	-	-	0
WS5	1	50	3		1.04	0.50 to 1.00	240 secs	1002	1002	$0.0_{(SS)}$	DRY	0.5	0.0	20.6	-	-	0
WS5	1	50	3		1.04	0.50 to 1.00	300 secs	1002	1002	$0.0_{(SS)}$	DRY	0.5	0.0	20.6	-	-	0
WS706	1	50	1	2.00	1.83	1.00 to 2.00	27/09/2017 11:22:00	1011	1011	$0.0_{(I)}$	0.43	0.0	0.0	20.9	-	3.3	0
WS706	1	50	1		1.83	1.00 to 2.00	15 secs	1011	1011	$0.0_{(SS)}$	0.43	0.2	0.0	20.8	-	-	2
WS706	1	50	1		1.83	1.00 to 2.00	30 secs	1011	1011	$0.0_{(SS)}$	0.43	0.2	0.0	20.8	-	-	2
WS706	1	50	1		1.83	1.00 to 2.00	60 secs	1011	1011	$0.0_{(SS)}$	0.43	0.1	0.0	20.9	-	-	1
WS706	1	50	1		1.83	1.00 to 2.00	90 secs	1011	1011	$0.0_{(SS)}$	0.43	0.1	0.0	20.9	-	-	1
WS706	1	50	1		1.83	1.00 to 2.00	120 secs	1011	1011	$0.0_{(SS)}$	0.43	0.1	0.0	20.9	-	-	1
WS706	1	50	1		1.83	1.00 to 2.00	180 secs	1011	1011	$0.0_{(SS)}$	0.43	0.1	0.0	20.9	-	-	0
WS706	1	50	1		1.83	1.00 to 2.00	240 secs	1011	1011	$0.0_{(SS)}$	0.43	0.1	0.0	20.9	-	-	0
WS706	1	50	1		1.83	1.00 to 2.00	300 secs	1011	1011	$0.0_{(SS)}$	0.43	0.1	0.0	20.9	-	-	0
WS706	1	50	2	2.00	1.88	1.00 to 2.00	03/10/2017 15:28:00	1019	1020	$0.2_{(I)}$	0.55	0.1	0.0	20.9	-	-	0
WS706	1	50	2		1.88	1.00 to 2.00	15 secs	1019	1020	$0.1_{(SS)}$	0.55	2.7	0.7	19.5	-	-	2
WS706	1	50	2		1.88	1.00 to 2.00	30 secs	1019	1020	$0.1_{(SS)}$	0.55	2.4	0.6	17.8	-	-	3
WS706	1	50	2		1.88	1.00 to 2.00	60 secs	1019	1020	$0.1_{(SS)}$	0.55	2.4	0.6	17.7	-	-	4
WS706	1	50	2		1.88	1.00 to 2.00	90 secs	1019	1020	$0.1_{(SS)}$	0.55	2.4	0.6	17.6	-	-	4
WS706	1	50	2		1.88	1.00 to 2.00	120 secs	1019	1020	$0.1_{(SS)}$	0.55	2.4	0.6	17.6	-	-	4
WS706	1	50	2		1.88	1.00 to 2.00	180 secs	1019	1020	$0.1_{(SS)}$	0.55	2.4	0.6	17.6	-	-	4
WS706	1	50	2		1.88	1.00 to 2.00	240 secs	1019	1020	$0.1_{(SS)}$	0.55	2.4	0.6	17.6	-	-	4

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Compiled By	Date	Checked By	Date	Contract Ref:
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Contract: **Land south of Middleton Stoney Road, Bicester**

AGS

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)
WS706	1	50	2		1.88	1.00 to 2.00	300 secs	1019	1020	$0.1_{(SS)}$	0.55	2.4	0.6	17.6	-	-	4
WS706	1	50	3	2.00	1.97	1.00 to 2.00	11/10/2017 10:04:00	1001	1001	$0.0_{(I)}$	0.78	0.0	0.0	20.9	-	-	0
WS706	1	50	3		1.97	1.00 to 2.00	15 secs	1001	1001	$0.0_{(I)}$	0.78	5.0	2.3	15.9	-	-	0
WS706	1	50	3		1.97	1.00 to 2.00	30 secs	1001	1001	$0.0_{(I)}$	0.78	4.2	1.9	15.6	-	-	0
WS706	1	50	3		1.97	1.00 to 2.00	60 secs	1001	1001	$0.0_{(I)}$	0.78	3.3	1.4	16.9	-	-	0
WS706	1	50	3		1.97	1.00 to 2.00	90 secs	1001	1001	$0.0_{(I)}$	0.78	3.0	1.2	17.2	-	-	0
WS706	1	50	3		1.97	1.00 to 2.00	120 secs	1001	1001	$0.0_{(I)}$	0.78	2.8	1.2	17.5	-	-	0
WS706	1	50	3		1.97	1.00 to 2.00	180 secs	1001	1001	$0.0_{(I)}$	0.78	2.5	1.1	17.8	-	-	0
WS706	1	50	3		1.97	1.00 to 2.00	240 secs	1001	1001	$0.0_{(I)}$	0.78	2.2	1.1	18.1	-	-	1
WS706	1	50	3		1.97	1.00 to 2.00	300 secs	1001	1001	$0.0_{(I)}$	0.78	2.0	1.0	18.4	-	-	1
WS706	1	50	3		1.97	1.00 to 2.00	360 secs	1001	1001	$0.0_{(I)}$	0.78	1.8	0.9	18.6	-	-	1
WS706	1	50	3		1.97	1.00 to 2.00	420 secs	1001	1001	$0.0_{(I)}$	0.78	1.7	0.8	18.9	-	-	1
WS706	1	50	3		1.97	1.00 to 2.00	480 secs	1001	1001	$0.0_{(I)}$	0.78	1.5	0.8	19.0	-	-	1
WS706	1	50	3		1.97	1.00 to 2.00	540 secs	1001	1001	$0.0_{(I)}$	0.78	1.4	0.7	17.2	-	-	1
WS706	1	50	3		1.97	1.00 to 2.00	600 secs	1001	1001	$0.0_{(I)}$	0.78	1.3	0.7	17.4	-	-	2

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date	Contract Ref:
	07/11/17			29286

Contract: **Land south of Middleton Stoney Road, Bicester**

IN-SITU WATER MONITORING RESULTS

	Weather	Ground Conditions	Wind Conditions	Air Temperature (°C)	Equipment Used & Remarks
Round 2	Overcast	Damp	Medium	11	

Exploratory Position ID	Pipe Ref	Pipe Diameter	Monitoring Round / Test Number	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring	Water Depth (mbgl)	pH	Redox (mV)	Conduc-tivity (uS/cm)	Temp-erature (°C)	Dissolved Oxygen (mg/l)	Remarks
RC4	1	50	2 / 1	13.00	12.34	1.00 to 12.00	03/10/2017 13:28	1.06	7.75	103	559	15.4	7.5	
RC4	1	50	2 / 1				03/10/2017 13:31	1.06	7.65	93	555	14.7	7.7	
RC4	1	50	2 / 1				03/10/2017 13:34	1.06	7.59	89	554	14.3	7.8	
RC4	1	50	2 / 1				03/10/2017 13:37	1.06	7.56	87	553	14.3	7.9	
RC4	1	50	2 / 1				03/10/2017 13:40	1.06	7.53	82	552	14.2	7.9	

Key: NDA denotes 'no data available'.

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date	Contract Ref:
	26/10/17			29286

Contract: **Land south of Middleton Stoney Road, Bicester**

BOREHOLE LOG

Contract:	Client:	Borehole:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	RC3

Contract Ref:	Start: 14.09.17	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: 14.09.17	81.71	E:456355.6 N:222405.4	1 of 3

Mechanical Log					Samples & Testing			Backfill	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	TCR (%)	SCR (%)	RQD (%)	If (mm)	No	Type	Results					
										CULTIVATED TOPSOIL: Wheat grass over soft dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is fine to coarse subangular limestone. (SUBSOIL)	0.30 0.40	
0.50-0.95					1	SPT	4,6/4,4,6,4 N=18			Soft orangish brown slightly sandy slightly gravelly CLAY. Gravel is medium to coarse subrounded to subangular yellowish brown limestone. (SUBSOIL)	(0.60)	
											1.00	
1.50-3.00 1.50-1.95					2	SPT	25/50 N=50			Stiff orange brown slightly sany gravelly CLAY with medium cobble content. Gravel is fine to course tabular limestone. Cobbles are subangular tabular limestone. Very dense light yellowish brown sandy clayey GRAVEL with high cobble content. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse weathered limestone. Cobbles are subangular tabular limestone. Clay washed out.	(1.80)	
	26	0	0								2.80	
3.00-4.50 3.00-3.45					3	SPT	4,4/7,7,7,6 N=27			Very stiff greyish brown to orangish brown becoming dark greenish brown fissured extremely closely spaced thinly laminated silty CLAY with occasional organic fibrous material and rare shell fragments.	(1.10)	
3.15-3.30 3.30 3.40						U D V	c_u=110					
	9	7	0								3.90	
3.80 3.80						D V	c_u=72			Medium strong light grey fine to medium grained fossiliferous LIMESTONE with occasional silty fragments of fossiled wood with orangish brown staining. . . . at 3.90m occasional sandy lenses and decreasing silt content with depth. . . . between 3.90m and 4.30m subhorizontal fracture undulating open with clay infill. . . . at 4.40m subhorizontal fractures undulating open infill of sandy clay. . . . at 4.50m large fossilised wood (150mm). . . . at 4.80m subhorizontal fracture open (50mm) clayey sand infill undulating. . . . at 5.00m large fossilised wood (300mm).	(1.61)	
4.50-6.00 4.50-5.09					4	SPT	25/50 N=50					
4.80-5.00						U						
	100	30	20								5.51	
5.55-6.75						U				Very stiff dark green organic fissured silty CLAY with frequent shell fragments and occasional firbrous organic material. organic odour noted and occasional calcite mineral veins.	(0.49)	
											6.00	
6.00-7.50 6.00-6.55	83	31	13		5	SPT(c)	9,10/6,6,5,6			*Description on next sheet*		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

General Remarks

1. Inspection pit hand dug to 0.5m depth.
2. Borehole drilled using rotary coring techniques with pwf barrel, pcd core bit and air/mist flush.
3. Temporary casing installed to 1.5m depth during drilling.
4. On completion, borehole backfilled with bentonite cement.

All dimensions in metres | Scale: 1:35

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Rotary coring	Comacchio GEO 205	DSUK	JTownsend	

BOREHOLE LOG

Contract:	Client:	Borehole:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	RC3

Contract Ref:	Start: 14.09.17	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: 14.09.17	81.71	E:456355.6 N:222405.4	2 of 3

Mechanical Log					Samples & Testing			Backfill	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	TCR (%)	SCR (%)	RQD (%)	If (mm)	No	Type	Results					
6.30												
6.40-6.60						V	N=23 c_u=120			Very stiff friable heavily fissured silty gravelly CLAY. Gravel is subangular fine to coarse mudstone lithorelicts with polished fracture surfaces. *(stratum copied from 6.00m from previous sheet)*	(1.00)	
						U				. . . at 6.30m possible band of rock.		
	83	31	13							. . . at 6.70m becoming very weak mudstone.	7.00	
										Weak becoming medium strong pale greenish brown MUDSTONE with subhorizontal open fractures.		
7.43-7.50						U				. . . at 7.00 organic lens of clay.	(1.22)	
7.50-9.00												
7.50-8.25					6	SPT(c)	25/50 N=50					
										. . . between 7.90m and 8.20m subhorizontal fracture clean undulating open to tight with sandy gravel infill.	8.22	
	87	33	27							very stiff dark brown organic becomming dark green from 8.65m fissured silty CLAY		
8.30						D					(0.78)	
8.65-8.80						U				. . . at 8.65m dark brown organic becoming dark green fissured silty clay.		
8.90						D					9.00	
9.00-10.50										Weak to medium strong light grey fine to medium grained fossiliferous LIMESTONE.		
9.00-9.30					7	SPT(c)	25/50 N=50					
										. . . at 9.40m subhorizontal fractures closed tight undulating.		
9.60-9.80						U				. . . at 9.50m subhorizontal fractures closed tight undulating.		
	100	73	71							. . . at 9.60m open (40mm) sandy gravelly clay infill undulating.		
										. . . between 10.20m and 10.50m non intact.		
10.50-12.00												
										. . . at 11.00m subhorizontal fractures tight to open, undulating with gravel and clay soil infill.		
	69	69	42							. . . at 11.30m subhorizontal fractures tight to open, undulating with gravel and clay soil infill.		
										. . . at 11.35m subhorizontal fractures tight to open, undulating with gravel and clay soil infill.		
										. . . between 11.65 and 11.80m very weak.	(6.00)	
12.00-13.50										. . . from 12.00m medium grained becoming fine grained.		
	80	80	57									

Drilling Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

General Remarks

All dimensions in metres | Scale: 1:35

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Rotary coring	Comacchio GEO 205	DSUK	JTownsend	

BOREHOLE LOG

Contract:	Client:	Borehole:
Land south of Middleton Stoney Road, Bicester	**Countryside Properties PLC**	**RC3**

Contract Ref:	Start: **14.09.17**	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: **14.09.17**	**81.71**	**E:456355.6 N:222405.4**	**3** of **3**

Mechanical Log					Samples & Testing			Backfill	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	TCR (%)	SCR (%)	RQD (%)	If (mm)	No	Type	Results					
	80	80	57							Weak to medium strong light grey fine to medium grained fossiliferous LIMESTONE. *(stratum copied from 9.00m from previous sheet)*		
										. . . at 13.00m subhorizontal fractures very tight to open clean undulating.		
13.50-15.00										. . . at 13.50m rare organic fossilised wood.		
										. . . at 13.90m subhorizontal fractures.		
	87	69	57							. . . sun-horizontal fracture at 14.20m very tight to open, undulating with sandy gravel infill.		
14.45-14.75						U						
										. . . sub-horizontal fracture at 14.70m very tight to open, undulating with sandy gravel infill.	15.00	
										Borehole terminated at 15.00m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

General Remarks

All dimensions in metres | Scale: **1:35**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Rotary coring	**Comacchio GEO 205**	**DSUK**	**JTownsend**	

BOREHOLE LOG

Contract:	Client:	Borehole:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	RC4

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	14.09.17	79.29	E:456481.0 N:222231.6	1 of 3
	End: 14.09.17			

Mechanical Log					Samples & Testing			Backfill & Instrumentation	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	TCR (%)	SCR (%)	RQD (%)	If (mm)	No	Type	Results					
										CULTIVATED TOPSOIL: Wheat grass over soft dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is fine to coarse subangular limestone. (SUBSOIL)	0.30	
											0.50	
0.50-2.00 0.50-0.95					1	SPT	25/50 N=50			Soft orangish brown slightly sandy slightly gravelly CLAY. Gravel is medium to coarse subrounded to subangular yellowish brown limestone. (SUBSOIL)	(0.50)	
											1.00	
	22	0	0							Very dense light yellowish brown sandy clayey GRAVEL. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse weathered limestone. Clay washed out. . . . between 0.50m and 1.20m no recovery,		
1.50-1.95					2	SPT	6,8/6,6,6,6 N=24			Very stiff to hard slightly organic extremely closely spaced thinly laminated fissured silty slightly gravelly CLAY. Gravel is fine calcite nodules and organic fibrous lenses.		
2.00-3.50											(2.80)	
	41	0	0									
3.00-3.45					3	SPT	4,4/7,8,7,8 N=30					
3.20						D						
3.20						V	c_u=110					
3.30-3.50						U						
3.50-5.00											3.80	
3.90						D				Very stiff to hard slightly organic extremely closely spaced thinly laminated fissured silty slightly gravelly CLAY. Gravel is fine calcite nodules and organic fibrous lenses. . . . between 4.10m and 4.25m grading into very weak pale grey mudstone.		
4.00						V	c_u=>120					
4.25-4.45	97	12	0			U						
4.50-5.09					4	SPT	25/50 N=50			. . . between 4.70m and 4.80m grading into very weak pale grey mudstone then back into very stiff clay. . . . at 5.00m becoming gravelly clay.	(1.70)	
5.00-6.50											5.50	
5.50-5.80	93	43	30			U				Medium strong to strong light grey fine grained shelly LIMESTONE.	5.85	
6.00-6.55					5	SPT(c)	25/50 N=50			Medium strong fine to coarse grained dark grey shelly LIMESTONE.	(0.40)	
6.20-6.45											6.25	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

General Remarks

1. Inspection pit hand dug to 0.5m depth.
2. Borehole drilled using rotary coring techniques with pwf barrel, pcd core bit and air/mist flush.
3. Temporary casing installed to 1.5m depth during drilling.
4. 50mm diameter standpipe (complete with flush protective cover) installed to 13m depth on completion. Response zone 1m to 13m.
5. On completion, borehole backfilled with bentonite cement from 13m to 15m.

All dimensions in metres | Scale: 1:35

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Rotary coring	Comacchio GEO 205	DSUK	JTownsend	

BOREHOLE LOG

Contract:	Client:	Borehole:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	RC4

Contract Ref:	Start: 14.09.17	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: 14.09.17	79.29	E:456481.0 N:222231.6	2 of 3

Mechanical Log					Samples & Testing			Backfill & Instru-mentation	Water	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Depth	TCR (%)	SCR (%)	RQD (%)	If (mm)	No	Type	Results					
6.50-8.00	93	43	30			U				Very stiff dark greenish brown becoming black fissured silty gravelly CLAY with occasional fossilised wood fragments, mudstone lithorelicts and pyrite. *(stratum copied from 6.25m from previous sheet)* . . . at 6.90m fossilised wood fragment (100x20mm).	(0.85) 7.10	
7.50-8.25	93	20	20		6	SPT(c)	25/50 N=50			Very weak becomming medium strong from 7.35m light grey fine grained fossiliferous limestone. . . . at 7.35m very weak becoming medium strong light grey fine grained fossiliferous limestone.	(0.50) 7.60	
7.60-7.80						U				Very stiff black organic silty CLAY with occasional pyrite crystals. . . . at 8.10m becoming light grey.	(1.50)	
8.80-9.10	100	30	30			U				. . . between 8.70m and 8.85m becoming green very stiff to hard fissured clay.	9.10	
9.00-9.30					7	SPT(c)	25/50 N=50			Weak becoming medium strong coarse becoming fine grained light grey fossiliferous limestone. . . . at 9.10m organic lens.		
9.10-9.50						U						
9.50-11.00										. . . at 9.75m 45° fracture undulating open clean.		
9.95-10.05						U						
11.00-12.50	90	69	67							. . . at 10.10m subhorizontal fracture open (50mm) gravel infill.		
12.35-12.50	100	82	73			U				. . . at 11.60m bioturbation.	(5.90)	
12.50-14.00												

Drilling Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

General Remarks

All dimensions in metres | Scale: 1:35

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Rotary coring	Comacchio GEO 205	DSUK	JTownsend	

BOREHOLE LOG

Contract:	Client:	Borehole:
Land south of Middleton Stoney Road, Bicester	**Countryside Properties PLC**	**RC4**

Contract Ref:	Start: **14.09.17**	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: **14.09.17**	**79.29**	**E:456481.0 N:222231.6**	**3** of **3**

Mechanical Log					Samples & Testing			Backfill & Instru-mentation	Water	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Depth	TCR (%)	SCR (%)	RQD (%)	If (mm)	No	Type	Results					
	100	82	70							Weak becoming medium strong coarse becoming fine grained light grey fossiliferous limestone.		
	100	82	70							. . . at 9.10m organic lens.*(stratum copied from* 9.10m from previous sheet)		
										. . . between 12.60m and 12.70m non intact.		
										. . . between 13.30m and 13.60m subhorizontal fractures open undulating clean gravel infill.		
13.65-14.00						U						
14.00-15.00										. . . between 14.00m and 15.00m subhorizontal fractures open clean undulating.		
	80	75	50								15.00	
										Borehole terminated at 15.00m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

General Remarks

All dimensions in metres | Scale: **1:35**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Rotary coring	**Comacchio GEO 205**	**DSUK**	**JTownsend**	

BOREHOLE LOG

Contract:	Client:	Borehole:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	RC5

Contract Ref:	Start: 16.09.17	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: 16.09.17	79.66	E:456525.5 N:222299.4	1 of 3

Mechanical Log					Samples & Testing			Backfill	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	TCR (%)	SCR (%)	RQD (%)	If (mm)	No	Type	Results					
										Wheat grass over firm dark brown sandy gravelly CLAY. Gravel is subangular fine to coarse tabular limestone with rare brick fragments.	0.30 0.50	
										Dark reddish brown firm sandy slightly gravelly CLAY. Gravel is subangular fine to medium limestone.		
										Stiff to very stiff greyish brown mottled orangish brown slightly sandy slightly gravelly CLAY with medium cobble content. Gravel is subround fine to medium weathered oolitic limestone. Cobbles are subangular tabular limestone. . . . between 0.50m and 1.80m no recovery.	(1.50) 2.00	
2.00-3.50										Firm becoming very stiff orangish brown mottled bluish grey fissured silty slightly gravelly CLAY. Gravel is fine calcine nodules and fine to coarse tabular mudstone lithorelicts.		
2.20						V	c_u=76					
2.45-2.60						U						
2.50						D					(1.40)	
	32									. . . at 2.80m hard in places becoming heavily fissured.		
3.20						D					3.40	
										Extremely weak pale brown to orangish brown fine grained MUDSTONE.	3.50	
3.50-5.00												
3.60						V	c_u=86			Firm to stiff greenish brown to bluish grey with orangish brown layering fissured silty slightly sandy slightly gravelly CLAY. Gravel is fine calcite nodules fine to coarse mudstone lithorelicts.	(0.50)	
3.70						D						
3.80-4.00						U					4.00	
				NI								
	93	5	0	300								
4.30				600		V	c_u=112			Stiff becoming very stiff slightly organic grey fissured silty slightly gravelly CLAY. Gravel subangular fine calcite crystals. . . . between 4.35m and 4.50m very weak light grey mudstone.		
4.50-4.75						U						
4.80						D					(1.85)	
5.00-6.50												
5.30-5.50						U						
5.50				20		D						
	84	43	33	215								
				550							5.85	
										Description on next sheet		
6.20-6.35						U					(0.70)	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

General Remarks

1. Inspection pit hand dug to 0.5m depth.
2. Borehole drilled using rotary coring techniques with pwf barrel, pcd core bit and air/mist flush.
3. Temporary casing installed to 1.5m depth during drilling.
4. On completion, borehole backfilled with bentonite cement.

All dimensions in metres | Scale: 1:35

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Rotary coring	Comacchio GEO 205	DSUK	JTownsend	

BOREHOLE LOG

Contract:	Client:	Borehole:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	RC5

Contract Ref:	Start: 16.09.17	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: 16.09.17	79.66	E:456525.5 N:222299.4	2 of 3

Mechanical Log					Samples & Testing			Backfill	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	TCR (%)	SCR (%)	RQD (%)	If (mm)	No	Type	Results					
	84	43	33							. . . between 6.20m and 6.50m subhorizontal fractures open undulating.	6.55	
6.50-8.00										Medium strong becoming very weak light grey shelly LIMESTONE.		
6.65						D				. . . at 5.85m becoming hard fissured gravelly clay. Gravel is fine to coarse tabular mudstone lithorelicts. *(stratum copied from 5.85m from previous sheet)*	(1.05)	
6.85						V	c_u=>120					
6.90-7.10						U						
	95	27	27							Very stiff (becomming hard from 7.4) pale green to dark green fissured slightly gravelly silty CLAY with rare pyrite cystals. Gravel is fine to subrounded calcite nodules.	7.60	
7.80-8.00						U				Very weak becoming medium strong from 7.8m pale blue friable fissured MUDSTONE.		
										. . . at 7.70m 45° closed fracture with polished surface.		
										. . . at 7.80m very weak becoming medium strong pale blue fissured mudstone.	(1.50)	
										. . . between 8.00m and 8.65m no recovery.		
											9.10	
9.20						D				Stiff black very organic fissured silty slightly sandy slightly gravelly CLAY with occasional pyrite crystals. Gravel is subangular fine calcite.		
9.30						V	c_u=78			. . . at 9.25m becoming gluaconitic		
9.40						D				. . . between 9.50m and 9.95m no recovery.	(1.05)	
9.50-11.00												
9.95-10.15						U					10.15	
	63	50	50	50 100 150						Very weak to weak pale green fissured MUDSTONE with occasional pyrite cystals.	10.40	
11.00-12.50										Medium strong light grey fine to medium grained LIMESTONE with occasional sub horizontal calcite mineral veins.		
										. . . at 11.20m subhorizontal fractures tight clean undulating.		
	100	100	100	150 550 400						. . . at 11.75m subhorizontal fractures tight clean undulating.		
12.25-12.50						U				. . . at 12.30m subhorizontal fractures tight clean undulating.		
12.50-14.00												

Drilling Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

General Remarks

All dimensions in metres | Scale: 1:35

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Rotary coring	Comacchio GEO 205	DSUK	JTownsend	

BOREHOLE LOG

Contract:	Client:	Borehole:
Land south of Middleton Stoney Road, Bicester	**Countryside Properties PLC**	**RC5**

Contract Ref:	Start: **16.09.17**	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: **16.09.17**	**79.66**	**E:456525.5 N:222299.4**	**3** of **3**

Mechanical Log					Samples & Testing			Backfill	Water	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	TCR (%)	SCR (%)	RQD (%)	If (mm)	No	Type	Results					
	97	97	43							Medium strong light grey fine to medium grained LIMESTONE with occasional sub horizontal calcite mineral veins. *(stratum copied from 10.40m from previous sheet)*	(4.60)	
13.40-13.60	97	97	43	NI 50 190		U				. . . between 13.80m and 14.00m non intact.		
14.00-15.00	80	80	80	150 250 500						. . . between 14.00m and 14.50m subvertical fracture closed undulating. . . . at 14.20m subhorizontal fractures very tight to open undulating clean. Occasional calcite nodules. Frequent subhorizontal fractures from very tight to open undulating clean to clayey sand infill.		
14.85-15.00						U				. . . at 14.50m subhorizontal fracture open clean undulating. . . . at 14.65m subhorizontal fracture open clean undulating.	15.00	
										Borehole terminated at 15.00m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

General Remarks

All dimensions in metres | Scale: **1:35**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Rotary coring	**Comacchio GEO 205**	**DSUK**	**JTownsend**	

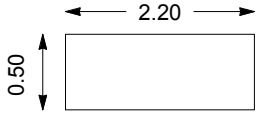
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	TP5

Contract Ref:	Start: 12.09.17	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: 12.09.17	81.72	E:456453.8 N:222431.4	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.10		PID	<0.1ppm			CULTIVATED TOPSOIL: Wheat grass over dark brown slightly organic sandy slightly gravelly CLAY with occasional rootlets. Gravel is subrounded fine to medium flint and subangular fine to coarse tabular limestone with rare gravel sized brick fragments.	(0.30)	
0.20	1	ES					0.30	
0.70	2	D		≈		Yellowish brown to orange brown clayey sandy GRAVEL with a high cobble content. Gravel is subangular fine to coarse limestone. Cobbles are subangular tabular limestone.	(0.70)	
1.00							1.00	
1.20	3	D				Very stiff pale brown to greenish brown with orange brown oxidation fissured slightly sandy slightly gravelly CLAY with interbedded orange brown sandy laminations and nodules of calcite/weathered limestone. Gravel is subangular fine to coarse limestone.		
1.20		V	c_u=86			. . . from 1.00m to 1.40m heavily fissured and weathered.	(0.70)	
1.50	4	D						
1.60	5	D					1.70	
1.80	6	D				Very stiff fissured dark greenish brown slightly sandy CLAY with occasional relict roots and rare fossilised wood 20mm to 500mm long.	(1.20)	
							2.90	
						Trial pit terminated at 2.90m depth due to refusal.		

Plan (Not to Scale)



General Remarks

1. Trial pit remained stable during excavation.
2. Ease of trial pit excavation: difficult
3. On completion, trial pit backfilled with arisings.
4. Trial pit refused at 2.9m depth.
5. Groundwater seepage was noted at 1.0m bgl, fast ingress
6. No visual or olfactory evidence of contamination was identified

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	JCB-3CX	JTownsend	

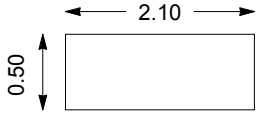
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land south of Middleton Stoney Road, Bicester	**Countryside Properties PLC**	**TP6**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	**12.09.17** End: **12.09.17**	**80.40**	**E:456362.6 N:222254.8**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.20 0.20	1	ES PID	0.1ppm			CULTIVATED TOPSOIL: Wheat grass over dark brown slightly organic sandy slightly gravelly CLAY with occasional rootlets. Gravel is subrounded fine to medium flint and subangular fine to coarse tabular limestone with rare gravel sized brick fragments.	(0.30) 0.30	
0.60	2	D				Yellowish brown to orange brown clayey sandy GRAVEL with a high cobble content. Gravel is subangular fine to coarse tabular limestone. Cobbles are limestone.	(0.40) 0.70	
1.00	3	D				Very stiff heavily fissured pale brown to orange brown slightly sandy CLAY. Gravel is subangular fine to medium weathered limestone nodules and occasional iron oxide nodules.		
1.50		V	c_u=110	≈			(1.70)	
2.00	4	D						
2.40	5	D				Trial pit terminated at 2.40m depth due to refusal.	2.40	

Plan (Not to Scale)



General Remarks

1. Trial pit remained stable during excavation.
2. Ease of trial pit excavation: difficult
3. On completion, trial pit backfilled with arisings.
4. Trial pit refused at 2.4m depth.
5. Groundwater seepage was noted at 1.7m bgl
6. No visual or olfactory evidence of contamination was identified

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**JTownsend**	

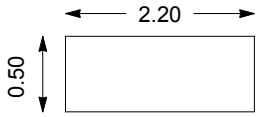
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land south of Middleton Stoney Road, Bicester	**Countryside Properties PLC**	**TP7**

Contract Ref:	Start:	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	**12.09.17** End: **12.09.17**	**78.53**	**E:456414.0 N:222155.2**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.20 0.20	1	ES PID	0.1ppm			CULTIVATED TOPSOIL: Wheat grass over slightly organic clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse flint and tabular limestone with rare gravel sized brick fragments.	(0.30) 0.30	
0.50	2	D				Yellowish brown to orange brown clayey gravelly SAND with a high cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse platey limestone. Cobbles are subangular platey limestone.	(0.40) 0.70	
						Trial pit terminated at 0.70m depth due to refusal.		

Plan (Not to Scale)



General Remarks

1. Trial pit remained stable during excavation.
2. Ease of trial pit excavation: difficult
3. On completion, trial pit backfilled with arisings.
4. Trial pit refused at 0.7m depth.
5. No groundwater encountered.
6. No visual or olfactory evidence of contamination was identified

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**JTownsend**	

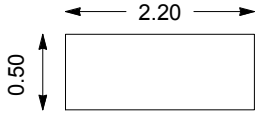
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	TP8

Contract Ref:	Start: 11.09.17	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: 11.09.17	76.86	E:456519.2 N:222078.7	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.15	1	ES				CULTIVATED TOPSOIL: Wheat grass over soft light brown organic slightly sandy slightly gravelly CLAY with occasional roots. Gravel is subrounded fine to coarse flint and limestone with rare gravel sized brick fragments.	(0.30)	
0.20	2	ES					0.30	
0.20		PID	<0.1ppm			Soft reddish brown slightly sandy gravelly CLAY. Gravel is subangular fine to medium flint and tabular limestone (SUBSOIL).	0.50	
1.00	3	D				Orange brown to yellowish brown sandy clayey GRAVEL with a high cobble content. Gravel is subangular fine to coarse tabular limestone. Cobbles are subangular tabular limestone.	(0.70)	
						Trial pit terminated at 1.20m depth due to refusal.	1.20	

Plan (Not to Scale)



General Remarks

1. Trial pit remained stable during excavation.
2. Ease of trial pit excavation: difficult
3. On completion, trial pit backfilled with arisings.
4. Trial pit refused at 1.2m depth.
5. No groundwater encountered.
6. No visual or olfactory evidence of contamination was identified

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	JCB-3CX	JTownsend	

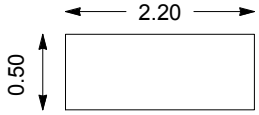
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land south of Middleton Stoney Road, Bicester	**Countryside Properties PLC**	**TP9**

Contract Ref:	Start: **11.09.17**	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: **11.09.17**	**78.26**	**E:456585.0 N:222247.0**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.20 0.20	1	ES PID	0.1ppm			CULTIVATED TOPSOIL: Wheat grass over light brown clayey gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse flint and limestone.	(0.30) 0.30	
0.40	2	D				Orange brown to yellowish brown sandy GRAVEL with a high cobble content. Gravel is subangular fine to coarse limestone. Cobbles are subangular tabular limestone.	0.50	
						Trial pit terminated at 0.50m depth due to refusal.		

Plan (Not to Scale)



General Remarks

1. Trial pit remained stable during excavation.
2. Ease of trial pit excavation: difficult
3. On completion, trial pit backfilled with arisings.
4. Trial pit refused at 0.5m depth.
5. No groundwater encountered.
6. No visual or olfactory evidence of contamination was identified

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**JTownsend**	

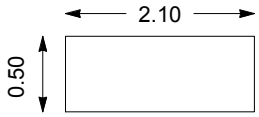
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land south of Middleton Stoney Road, Bicester	Countryside Properties PLC	TP10

Contract Ref:	Start: 11.09.17	Ground Level:	National Grid Co-ordinate:	Sheet:
29286	End: 11.09.17	75.63	E:456726.5 N:222168.0	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.15 0.15	1	ES PID	 0.1ppm			CULTIVATED TOPSOIL: Wheat grass over light brown clayey gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse flint and limestone.	(0.30) 0.30	
0.50 0.50	2	ES PID	 0.1ppm			Orange brown to yellowish brown sandy GRAVEL with a high cobble content. Gravel is subangular fine to coarse limestone. Cobbles are subangular tabular limestone.	(0.30) 0.60	
						Trial pit terminated at 0.60m depth due to refusal.		

Plan (Not to Scale)



General Remarks

1. Trial pit remained stable during excavation.
2. Ease of trial pit excavation: difficult
3. On completion, trial pit backfilled with arisings.
4. Trial pit refused at 0.6m depth.
5. No groundwater encountered.
6. No visual or olfactory evidence of contamination was identified

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	JCB-3CX	JTownsend	