



The Environmental Protection Group Ltd



Detailed quantitative gas risk assessment

Woodcroft Farm

Waterlooville

October 2018



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SUMMARY

It is proposed to develop a site known as Woodcroft Farm for residential use. Historic records in the form of maps, regulatory records and verbal communication have identified that in the far western area of the site an historic chalk pit was infilled with construction and demolition waste in the 1970s.

Several phases of site investigation have been undertaken between 2011 and the current day in order to define the lateral and vertical extent of filling in this area, and to determine whether the infilled pit represents a risk to the proposed development in the form of soil gases.

Gas monitoring results from 2011, 2016 and 2018 in the main identify that the site should be considered a Green NHBC classification. The exception is a single standpipe located in the centre of the infilled pit, which during monitoring in 2011 recorded elevated concentrations of methane and carbon dioxide combined with low flow rates.

A review of ground conditions, in particular total organic carbon content and records of organic components, indicates that the infilled pit does not represent a source of continued bulk gas generation. Further consideration of the gas regime concludes that the source of gas recorded during monitoring is residual gases sorbed to soil particles or stored in soil pore spaces, with migration occurring by diffusive flow mechanisms only.

A surface emissions survey identified no concentrations of methane at the surface in excess of background concentrations. Modelling of diffusive migration identified that the maximum concentration of gas recorded during all monitoring does not represent an unacceptable risk to the proposed development.

Based on all the lines of evidence presented within the report, it is considered in relation to the proposed development, that the site should be considered a Green NHBC classification, and that no gas protection measures are required.

1. INTRODUCTION

1.1 Purpose

Planning permission has been granted for a residential development on a site in Lovedean, Waterloooville (planning permission reference APP/13/00804). The planning permission includes a pre-commencement condition relating to contamination as follows:

Condition 11: Prior to the commencement of construction within any specified phase or defined area the development approved by this planning permission (as may be agreed in writing by the Local Planning Authority), a scheme to deal with the risks associated with contamination of the site shall be submitted to and approved in writing by the Local Planning Authority. That scheme shall include all of the following elements unless specifically excluded in writing by the Local Planning Authority.

- i) A scheme of further investigation based on the previously submitted geoenvironmental and geotechnical report. The scope of the investigation shall be sufficient to:*
 - *Confirm the preliminary assessment of the nature and extent of contamination at the site;*
 - *Inform an appropriate assessment of the risks to all receptors that may be affected, including controlled waters; and*
 - *Enable the appropriate design of remediation and/or risk mitigation measures (if required).*
- ii) The results of the further investigation and risk assessment (i) and if appropriate, a method statement based on these results giving full details of the remediation and/or risk mitigation measures required, and how they are to be undertaken.*

As implied by the wording of the condition, a previous investigation across the site had identified contamination to be present in some areas of the site. Geo-Environmental Services Limited (the Client) has been retained by the developer to fulfil parts (i) and (ii) of the condition, and to this end the Environmental Protection Group Limited (EPG) has been appointed by the Client to produce a detailed quantitative gas risk assessment in relation to the proposed development, to be submitted pursuant to discharge of parts (i) and (ii) of condition 11, in relation to gas only.

With regard to the assessment of the gas regime, this report has been prepared in general accordance with the following documents:

- BS8576:2013: *Guidance on investigations for ground gas – permanent gases and volatile organic compounds (VOCs)* (2013);

- BS8485:2015: *Code of practice for the design of protective measures for methane and carbon dioxide ground gas for new buildings* (2015);
- *Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present*. NHBC (Edition 4, March 2007);
- CIRIA Report C665: *Assessing risks posed by hazardous ground gases to buildings* (2007);
- *The Local Authority guide to ground gas*: Chartered Institute of Environmental Health (2008); and
- CIRIA Report C682: *Investigating, assessing and managing risks from inhalation of volatile organic compounds at land affected by contamination* (2009).

1.2 The site

The site is located in Lovedean, approximately one mile to the north of Waterlooville. The location of the site is shown in Figure 1, with the area covered by the planning permission bounded in black.

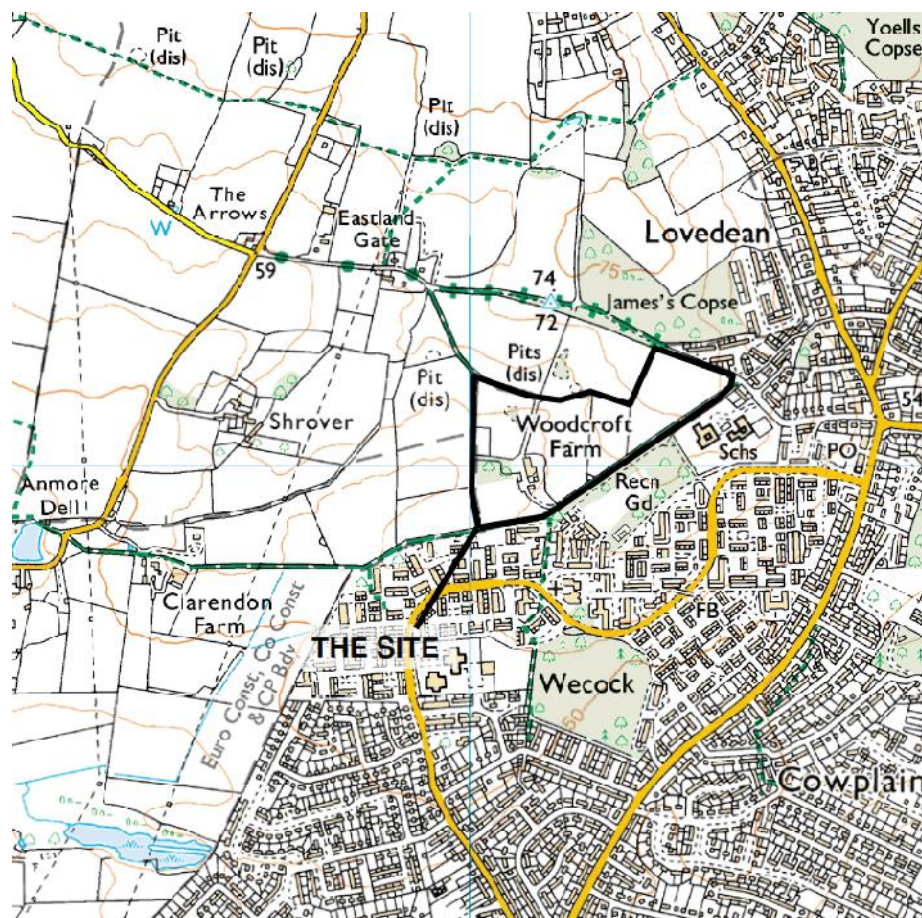


Figure 1: Site location

The site is an irregular shape, extending to approximately 10.6 hectares, and is roughly centered around National Grid Reference 468250 112090. The proposed development layout is illustrated in Figure 2.



Figure 2: Proposed development layout

As can be seen in Figure 2, the proposed development has been divided into phases. These have been identified as Phase 1 (white hatched red line running north to south), Phase 2A (blue), Phase 2B (purple) and Phase 3 (green). The potential risk to the development from gases as identified by previous reporting is limited to the western area of the site, and as such this report relates to Phase 3 and the western part of Phase 2B only, as indicated in Figure 3.



Figure 3: Area covered by report

1.3 Information sources

This report has been informed via the following sources of information:

- *Factual report on a site investigation at Woodcroft Farm, Waterloooville.* Risk Management Limited (RML), October 2011. Reference RML4750;
- *Geoenvironmental and geotechnical ground investigation report.* Peter Brett Associates (PBA), July 2013. Reference 21834/030-R02/rev01;

- *Geoenvironmental and geotechnical site assessment*. RSK Environment Limited (RSK), October 2016. Reference 28722-R01(00);
- *Letter report*. Geo-Environmental Services Limited (GESL), September 2017. Reference GE16662/FG02/170929;
- *Remediation strategy and verification plan for the land at chalk pit and landfill area (CP), Woodcroft Farm*. Geo-Environmental Services Limited (GESL), June 2018. Reference GE16943-RSVP-CP-JUN18;
- *Remediation strategy and verification plan for the land at Farmyard (FY), Woodcroft Farm*. Geo-Environmental Services Limited (GESL), June 2018. Reference GE16943-RSVP-FY-JUN18;
- *Remediation strategy and verification plan for the land at Horse Arena (HA), Woodcroft Farm*. Geo-Environmental Services Limited (GESL), June 2018. Reference GE-16943-RSVP-HA-JUN18;
- Gas monitoring records. GESL, 2018;
- Surface emissions survey. Enitall Limited, September 2018;
- Historic maps obtained from Envirocheck;
- British Geological Survey 1:50000 Series England and Wales sheet 316: Fareham solid and drift geology (BGS 1998); and
- Review of available web-based data resources, notably the Environment Agency's 'What's in your backyard?' service, and the British Geological Survey's Geology of Britain viewer.

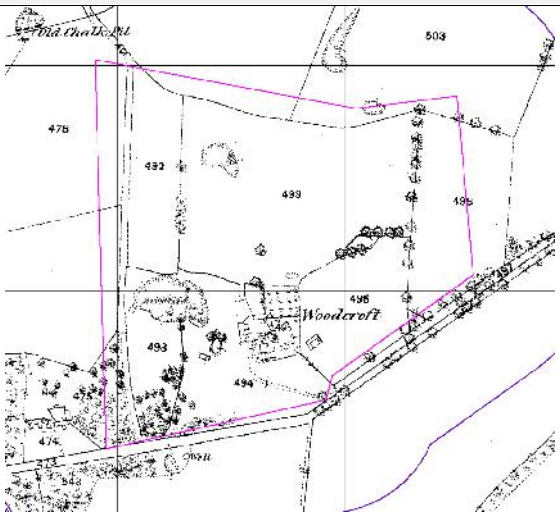
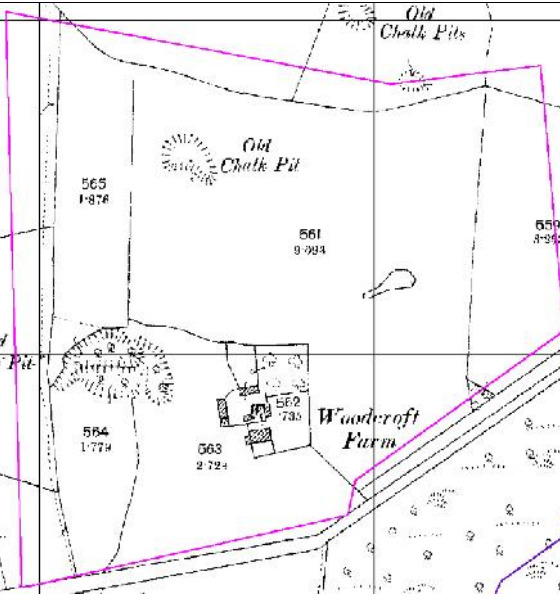
It is known that a desk study report was produced in 2010 by Peter Brett Associates, however only a summary has been available for review.

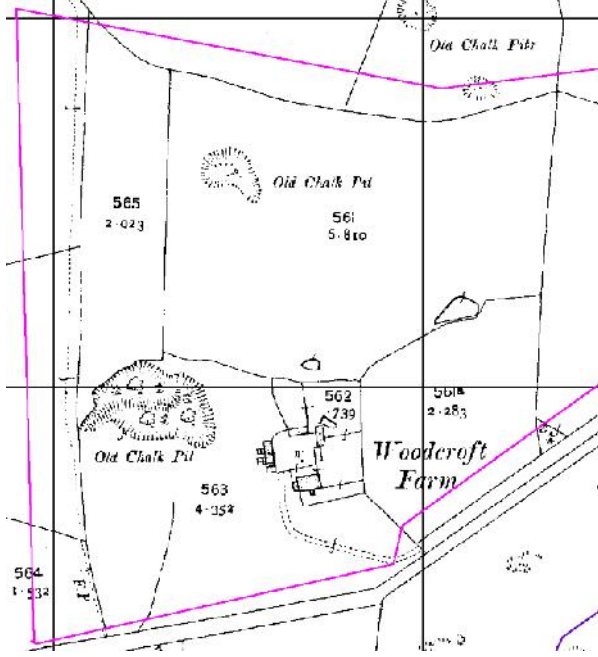
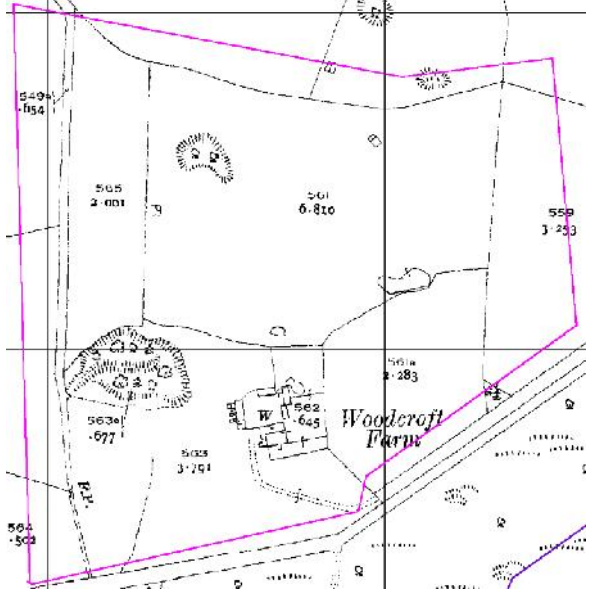
2. BACKGROUND INFORMATION

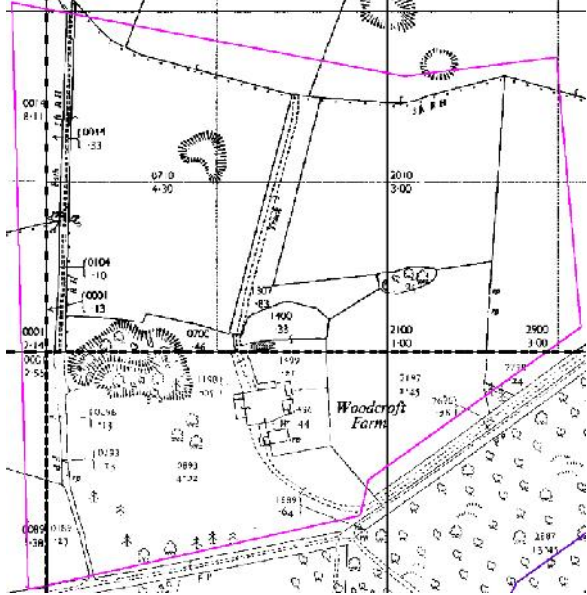
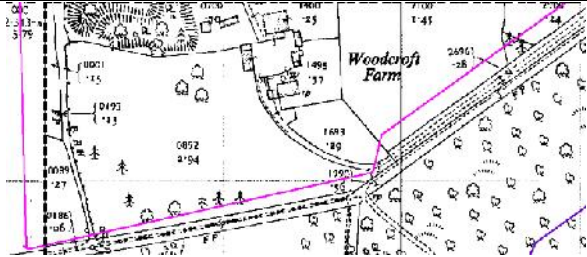
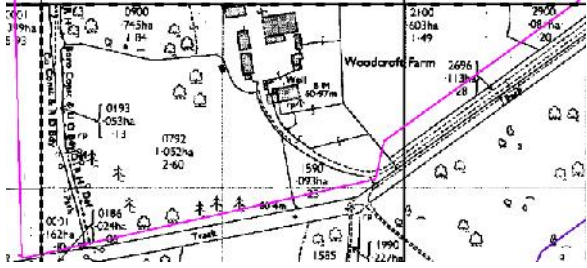
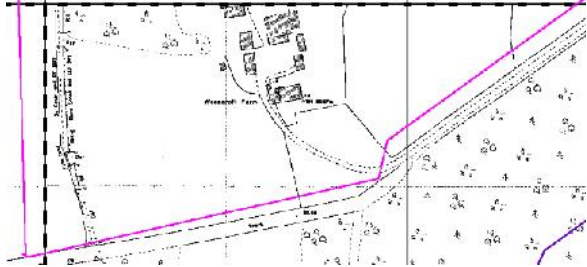
Background information from several sources has been referred to in order to gain an understanding of the site conditions. Extracts are presented below, and items relevant to a gas appraisal noted. It should be noted that the boundary polygon on the map extracts is not a wholly accurate representation of the site boundary.

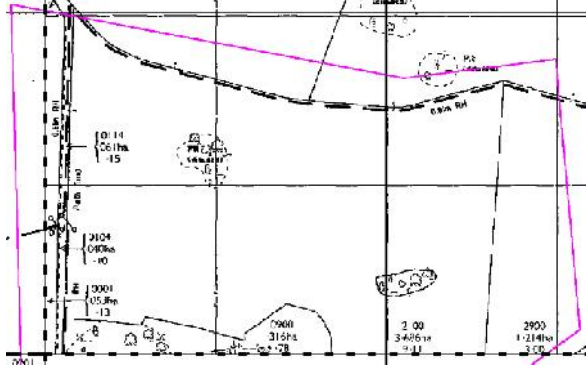
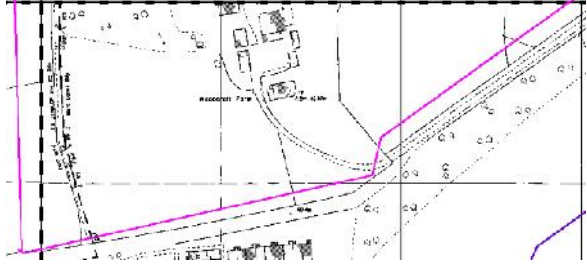
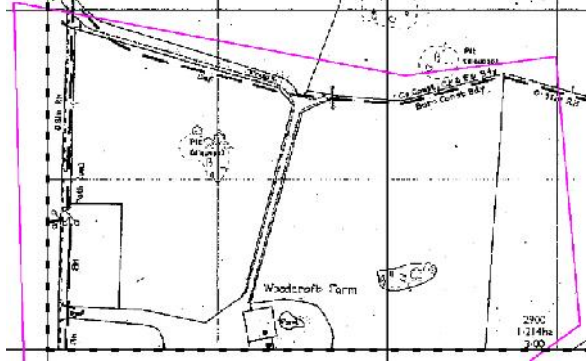
2.1 Historic maps

Table 1: Extracts from historic maps with commentary

Commentary	Extracts from historic maps Ordnance Survey Licence 0100056695
c.1868 <i>Woodcroft Farm</i> is present in its current day location. The main part of the site comprises agricultural land, with the exception of three pits (far west, far north and a small feature immediately north of the farm garden) and two ponds (one to the west of the farm, and one to the north east).	
c.1897 The pond to the west of the farm and the small pit immediately to the north are no longer shown. The larger pit in the north is identified as <i>Old Chalk Pit</i>. A well (denoted W) is shown immediately north of the main farm building.	

Commentary	Extracts from historic maps Ordnance Survey Licence 0100056695
c.1909 Both of the larger pits are identified as <i>Old Chalk Pit</i>. An additional pond is shown to the north of the farm garden, and a possible pond within the garden. The extent of the pits is not very large and the size of the slope markers in the map also indicate that it was not very deep.	
c.1932 No significant changes.	

Commentary	Extracts from historic maps Ordnance Survey Licence 0100056695
c.1965 The two smaller ponds are no longer shown. The farmyard complex has become more extensive.	
c.1959 The northern part of the map is not available for this edition. No significant changes.	
c.1970 The northern part of the map is not available for this edition. The larger chalk pit is no longer clearly marked; however, it is not clear if this is due to infilling.	
c.1973 The northern part of the map is not available for this edition. The boundary for the larger chalk pit feature (once again not clearly marked) has changed. The well is no longer indicated.	

Commentary	Extracts from historic maps Ordnance Survey Licence 0100056695
c.1975 The southern part of the map is not available for this edition. The pond and the northern chalk pit are still present. The northern extent of the larger chalk pit is not clearly marked.	
c.1976 The northern part of the map is not available for this edition. The southern extent of the larger chalk pit is not clearly marked.	
c.1980 No indication of the presence of the larger chalk pit is shown, suggesting that infilling was complete by this time. The date of infilling is unclear, as none of the previous maps denote <i>refuse tip</i>, <i>works</i> or <i>spoil heaps</i> in the vicinity.	
c.1990 No significant changes.	

Commentary	Extracts from historic maps Ordnance Survey Licence 0100056695
Extract from Environment Agency 'What's in your backyard' web tool No dates of infilling are given. Waste type is identified as <i>Industrial</i>, defined as <i>waste from a factory or industrial process, excluding waste from mines, quarries and agricultural wastes.</i>	

It can be seen from the historic maps that the site has remained in predominantly open agricultural use since the earliest edition map of 1868, with the location of the main farmhouse remaining unchanged throughout. Several features indicative of excavations (pits and ponds) are denoted. The largest feature, a chalk pit located adjacent to the western boundary, was infilled some time prior to 1980, although the actual date of infilling cannot be determined from the maps. The larger pond in the east of the site and the chalk pit in the north remain unfilled, and as such are will not be considered further as potential sources of soil gas. The evidence suggests that the chalk pit was of limited extent and depth.

The landfill boundary presented by the Environment Agency is significantly larger than would be suggested solely by the infilling of the largest chalk pit. A level of conservatism is required at this stage in the risk assessment, and as such the potential larger extent of landfilling cannot be discounted.

2.2 Additional information from earlier reports

The summary of the PBA desk study report (2010) identifies three potential sources of contamination as follows:

- *Historical landfill site within the southwest of the site*
- *Compound containing scrap cars and car parts located adjacent to the west of the farmyard*
- *Disused fuel tank located 20m to the west of the farmhouse*

Additional comment relating to the landfill is contained as follows:

'Although a historical recorded EA landfill site is located within the site boundary, it is reported by the landowner that this was infilled with 'uncontaminated' inert waste, which is backed up by information provided by the CLO (contaminated land officer). With this in mind it is considered that it may possibly not represent a likely source of significant contamination. However, it is noted that the records pertaining to this type of landfill are often inaccurate and the regulatory and inspection regime at the time was much less formal. Also, the definition of inert waste has changes since that time and so the nature of this landfill will need to be proven by future intrusive investigations to assess the potential related development constraints.'

The 2013 PBA site investigation report contains the following text:

'Available information indicates that from around the 1870s the site and the immediate surrounding area were predominantly undeveloped consisting mainly of agricultural farmland and woodlands. The (larger) site comprises six fields and several farm buildings (including a well) named as Woodcroft Farm, which are located within the southwestern part of the site. Four chalk pits and a possible pond are marked on the historical maps within the western part of the site, one of the pits is later labelled as a pond. By the 1970s the chalk pit labelled in Field 2 had been backfilled. According to the Environment Agency records the pit was filled with 'deposited waste including industrial waste' (LIG 2010). Anecdotal information from the farm tenant, Mrs Jenny Manson indicates that the pit was backfilled with inert and construction demolition materials. The farm tenant also stated that the area of the infilled pit continued to settle over the years.'

The car-breaking compound and above ground fuel tank cannot be discounted as potential secondary sources of soil gas as a result of the breakdown of hydrocarbon contamination at this stage.

2.3 Natural geology

The 1:50000 scale geological map of the area identifies bedrock comprising the Lambeth Group across the site, overlying the Upper Chalk. No superficial deposits are identified across the majority of the site however a spur of Head Deposits extends across the centre of the western site boundary and encroaches onto the site.

The Lambeth Group is described as vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels. The Head Deposits are described as comprising poorly sorted gravel, sand and clay. None of the strata identified represent a potential source of bulk permanent gases that could pose a risk to the development. However, all the soils are sedimentary materials that will contain small volumes of organic material that may represent a minor source of carbon dioxide that can cause elevated concentrations in monitoring wells.

2.4 Groundwater

The overall dip of the Lambeth Group and Chalk is to the south. It is considered likely that the main body of groundwater will be at depth within the Chalk, while the sandy elements of the Lambeth Group and Head Deposits may contain groundwater perched upon the less- or non-permeable clay elements. The prevalent direction of flow of any perched waters will be locally dependant on the extent and dip of the underlying clay surface.

2.5 Walkover descriptions

The following walkover descriptions are presented within reference documents listed above:

SI report, PBA July 2013:

At the time of the investigation the site comprised predominantly a farmyard and 6 fields used as agricultural pastureland for the grazing of horses. Woodcroft Farm farmyard is located within the central western part of the site. The farm comprised 9 sheds, the majority of which were used as stables and for hay and tack storage. Woodcroft Farm farmhouse is located immediately to the south of the farmyard, with gardens extending 15m to the north of the house and 20m to the west. A water well was located about 2m to the north of the house. A small (≈1000 litre) disused fuel storage tank (observed to be empty) was located approximately 20m to the west of the house. A number of outbuildings are located around the house and are seemingly used as garages/storage. The stables and outbuildings were observed to be of stone blockwork or metal cladding construction with either metal or possible asbestos cement sheet roofs. A yard used for dismantling and repair of cars and other vehicles is located immediately adjacent to a second yard used to store racing cars located about 20m northwest of the farmyard.

SI report, RSK November 2016:

The site comprised a series of five fields surrounding Woodcroft Farm. The fields were generally used for grazing horses. A sand riding arena was present in the west. Field 1/2 was undulating, likely due to historic landfill activities. Field 3 generally sloped down to the south. The fields were generally level within fields 4-6, sloping down gently from northeast to southwest.

A pond was noted to the rear of the farm buildings. Ground depressions were noted in the areas identified on historic maps as 'old chalk pits'.

Letter report, GESL September 2017:

At the time of the intrusive investigation, August 2017, the site predominantly comprised open fields utilised for the grazing of horses. The farm complex area comprised a farm house located in the south

east of the complex area, with private gardens to the front and rear of the property. To the north and west of the farm house were a number of stable blocks that at the time of the investigation works were occupied by a number of horses. The stable blocks were constructed on hard standing, generally concrete, and comprised a mixture of wooden stables and stables constructed within breeze block barns. These barns were noted to have corrugated roofs that have the potential to contain asbestos.

In the central area and west of the farm complex area was an area utilised for parking, and the storage of scrap type items. This included engines, vehicles (in varying states of repair), a skip of metal, and other assorted items. There was also evidence of recent burning activities being undertaken within this area, piles of ash and blackened patches were noted. A manure heap was also located within the central northern part of this area.

2.6 Discussion

Historic maps and recent walkover records presented above have identified a potential source of soil gas in the form of an infilled chalk pit. Secondary and less viable sources have also been identified in the form of a vehicle repair/breaking yard, and a (small) above ground fuel tank. The location of these features is depicted in Figure 4 below.

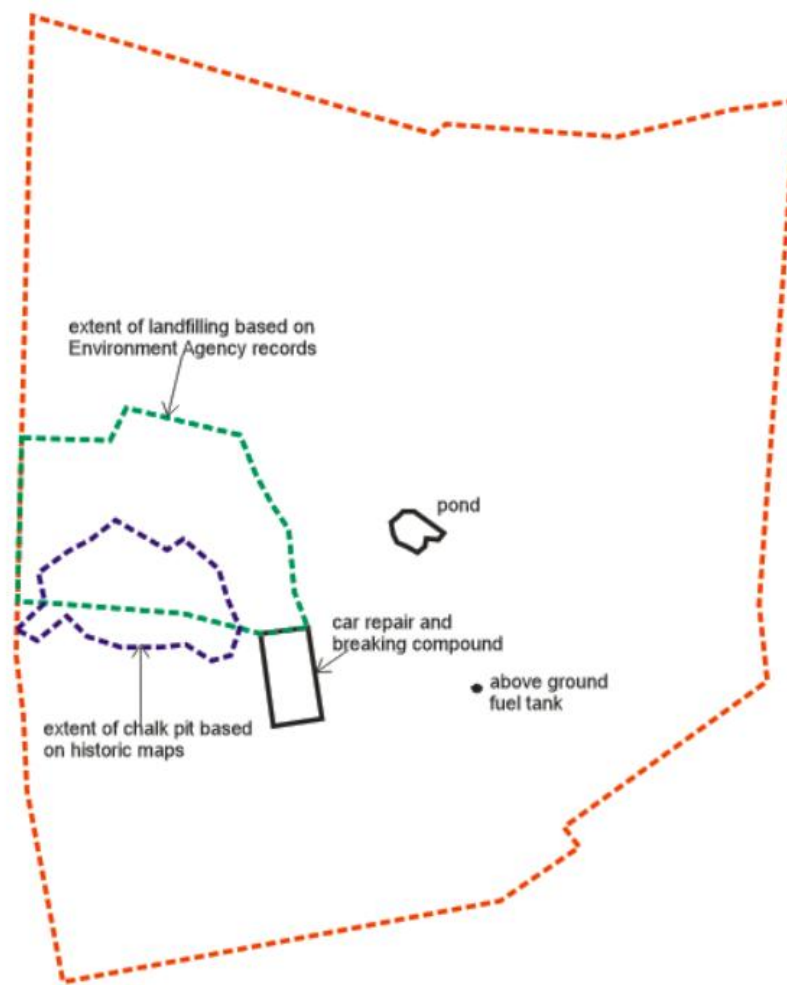


Figure 4: Approximate location of relevant features

3. GROUND CONDITIONS

Several phases of site investigation have been undertaken across the area of the site covered by this report. This section summarises the ground conditions as presented in the following source documents:

- *Factual report on a site investigation at Woodcroft Farm, Waterloooville.* RML, October 2011;
- *Geoenvironmental and geotechnical ground investigation report.* PBA, July 2013;
- *Geoenvironmental and geotechnical site assessment.* RSK, October 2016;
- *Remediation strategy and verification plan for the land at chalk pit and landfill area (CP), Woodcroft Farm.* GESL, June 2018;
- *Remediation strategy and verification plan for the land at farmyard (FY), Woodcroft Farm.* GESL, June 2018; and
- *Remediation strategy and verification plan for the land at horse arena (HA), Woodcroft Farm.* GESL, June 2018.

As discussed in section 2 above, a single viable potential source of gas has been identified, in the form of an infilled chalk pit in the western area of the site, with secondary less viable sources in the form of a car breaking compound and above ground fuel tank also identified. The extent of the pit as indicated on historic maps is not necessarily representative of its true lateral extent, and as such a significant number of exploratory holes have been excavated in an attempt to determine both the lateral extent and depth of infilling and the nature of the fill material.

3.1 Summary of ground conditions

The approximate locations of exploratory holes located within the area of interest are indicated in Figure 5 below, together with those outside the area of interest which included the installation of monitoring standpipes. The ground conditions as described in the logs are summarised within Table 2.

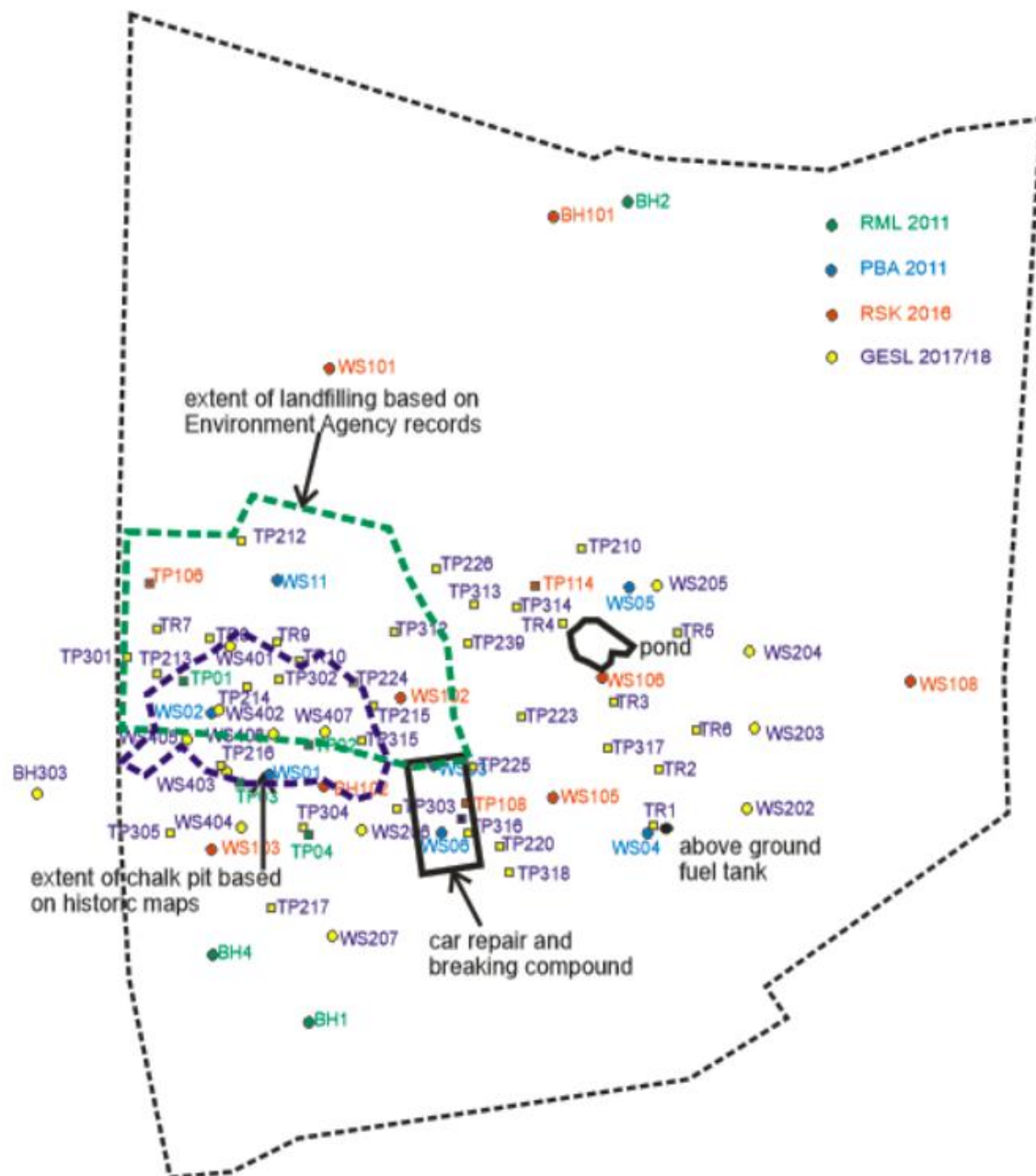


Figure 5: Approximate location of exploratory holes

Table 2: Summary of ground conditions

Reference	Ground Conditions
TP01 RML 2011	GL-0.15: grass over topsoil 0.15-1.1: MG brown clay with bricks, brick fragments, crushed concrete and gravel 1.1-2.5: MG grey/orange-brown clay with bricks, brick fragments, concrete, gravel, timber, plastic and polyurethane sheeting with organic odour 2.5-2.6 (end): MG brown/black clay with much discolouration and brick fragments Groundwater seepage at 2.2m
TP02 RML 2011	GL-0.15: grass over topsoil 0.15-2.8: MG brown clay with flint, bricks, brick fragments, crushed concrete, timber, tiles, metal, glass and plastic 2.8-3.5: MG blue-grey/red-brown clay matrix containing some organic matter with organic odour 3.5-3.6 (end): Chalk No groundwater encountered
TP03 RML 2011	GL-0.1: grass over topsoil 0.1-1.1: MG brown clay with gravel and brick fragments 1.1-2.7: MG brown/grey clay with black discolouration, flint gravel, bricks, brick fragments, concrete, timber and organic odour 2.7-3.4 (end): brown/orange-brown Clay with flint gravel, occasional partings of sand (Head Deposits) No groundwater encountered
TP04 RML 2011	GL-0.1: grass over topsoil 0.1-0.6: MG brown clay with occasional flint gravel, brick fragments, roots and chalk fragments 0.6-2.0 (end): grey/orange-brown sandy Clay/Clay with flint gravel (Head Deposits) No groundwater encountered
BH01 RML 2011	GL-0.3: grass over topsoil 0.3-2.2: orange-brown/grey Clay, occasional pockets of silt (Head Deposits) 2.2-4.2: grey/red-brown Clay, occasional pockets of silt (Lambeth Group) 4.2-5.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 5.0m
BH02 RML 2011	GL-0.15: grass over topsoil 0.15-2.2: brown/orange-brown sandy Clay with frequent gravel of flint, pockets of sand (Head Deposits) 2.2-15.0 (end): Chalk (sand between 3.15m and 4.3m in solution feature) No groundwater encountered Standpipe installed, response zone 1.0m to 7.0m
BH04 RML 2011	GL-0.15: grass over topsoil 0.15-0.6: brown sandy Clay 0.6-4.2: brown/orange-brown sandy Clay with flint gravel (Head Deposits) 4.2-7.35 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 7.0m
WS01 PBA 2011	GL-0.05: topsoil 0.05-1.1: MG brown sandy gravelly clay, gravel is flint, chalk and brick 1.1-3.0: MG brown/grey sandy gravelly clay, gravel is flint, chalk, brick. Organic odour. Grey staining between 2.2m and 3.0m 3.0-4.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 3.0m
WS02 PBA 2011	GL-0.05: topsoil 0.05-0.8: MG brown sandy gravelly clay, gravel is flint, chalk, brick and rare charcoal 0.8-1.2: MG brown/grey sandy gravel of brick and concrete 1.2-5.2: MG brown/grey slightly gravelly sandy clay with pockets of organic material. Gravel is brick, concrete, chalk. Organic odour 5.2-5.8: gravelly sandy Clay, gravel is chalk (possible MG) 5.8-6.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 4.0m

Reference	Ground Conditions
WS03 PBA 2011	GL-0.1: MG brown clayey gravel of flint and brick 0.1-0.4: MG black clayey gravelly sand, gravel is flint, clinker and brick. Slight hydrocarbon odour 0.4-0.5: MG white with grey staining gravel of chalk 0.5-1.7: brown slightly gravelly Clay, gravel is flint (Head Deposits) 1.7-3.3: brown/grey Clay (possible Lambeth Group) 3.3-4.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 4.0m
WS04 PBA 2011	GL-0.05: topsoil 0.05-0.3: MG brown slightly gravelly sandy clay, gravel is chalk and brick 0.3-1.7: gravelly sandy Clay (Head Deposits) 1.7-3.0 (end): red/blue Clay (Lambeth Group) No groundwater encountered Standpipe installed, response zone 1.0m to 3.0m
WS05 PBA 2011	GL-0.2: topsoil 0.2-3.8: brown orange clayey Sand over sandy gravelly Clay (Head Deposits) 3.8-4.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 4.0m
WS06 PBA 2011	GL-0.6: MG brown sandy gravelly clay, gravel is flint, brick and concrete 0.6-2.4: grey/red-brown Clay over grey/orange gravelly Clay (Lambeth Group) 2.4-2.6 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.6m to 2.6m
WS11 PBA 2011	GL-0.2: topsoil 0.2-1.5: slightly sandy gravelly Clay (Head Deposits) 1.5-4.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 2.5m
WS101 RSK 2016	GL-0.3: topsoil 0.3-3.45 (end): orange/brown becoming grey/orange sandy gravelly Clay No groundwater encountered Standpipe installed, response zone 1.0m to 3.0m
WS102 RSK 2016	GL-0.1: MG grey sandy gravel of flint and concrete 0.1-0.25: MG brown sandy gravelly clay, gravel is flint 0.25-0.5: MG brown/white reworked chalk, occasional black staining 0.5-0.8: MG grey sandy gravel of concrete, wood and flint 0.8-1.0: grey brown sandy gravelly Clay (possibly reworked) 1.0-3.45 (end): orange grey brown slightly sandy Clay No groundwater encountered Standpipe installed, response zone 1.0m to 3.0m
WS103 RSK 2016	GL-0.2: topsoil 0.2-0.65: orange grey sandy gravelly clay, gravel is flint (reworked) 0.65-2.9: orange grey sandy Clay 2.9-3.45 (end): brown silty gravelly Clay (weathered Chalk) No groundwater encountered Standpipe installed, response zone 1.0m to 3.0m
WS105 RSK 2016	GL-0.1: concrete 0.1-0.3: gravelly silty Clay, gravel is chalk (reworked) 0.3-3.45 (end): orange-grey-brown sandy Clay No groundwater encountered
WS106 RSK 2016	GL-0.4: MG brown sandy gravelly clay, gravel is brick and flint 0.4-0.65: MG brown sand gravelly clay, gravel is charcoal, brick and sandstone 0.65-1.5: grey-brown sandy gravelly Clay, gravel is flint 1.5-3.45 (end): orange-brown Sand No groundwater encountered
WS108 RSK 2016	GL-0.2: topsoil 0.2-1.0: orange brown grey sandy Clay 1.0-3.45 (end): orange brown grey red silty Clay (Lambeth Group) No groundwater encountered Standpipe installed, response zone 1.0m to 3.0m

Reference	Ground Conditions
BH101 RSK 2016	GL-0.2: topsoil 0.2-0.8: brown silty Clay 0.8-2.8: Sand becoming slightly silty slightly gravelly Sand 2.8-6.2: Chalk 6.2-11.0: brown sandy gravelly Clay 11.0-20.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 5.0m to 20.0m
BH102 RSK 2016	GL-0.1: topsoil 0.1-2.0: MG brown-grey/orange-brown-red sandy silty clay 2.0-2.7: MG orange-brown-grey-red clay, rare rootlets, weak organic odour 2.7-4.0: MG brown-grey/orange-brown gravelly clay, gravel is flint, layer of gravel-sized wood remains, frequent rootlets 4.0-5.0: yellow-white sandy gravelly Clay, gravel is chalk and flint, rare roots, occasional pockets of clay weak organic odour (possible MG) 5.0-5.8: grey-brown/orange-brown sandy gravelly Clay, gravel is flint and chalk (possible MG) 5.8-20.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 5.0m
TP106 RSK 2016	GL-0.1: MG yellow grey sand 0.1-0.3: grey/black Clay (possible MG) 0.3-0.8 (end): orange-brown silty gravelly Clay No groundwater encountered
TP108 RSK 2016	GL-0.45: MG brown gravelly clay with abundant fragments of brick, tarmac, slate, occasional wood, rare metal 0.45-0.9: grey-yellow-brown Clay 0.9-2.0 (end): grey-brown Clay, occasional yellow-brown sands of sand (Lambeth Group) No groundwater encountered
TP114 RSK 2016	GL-0.25: grass over topsoil 0.25-1.2: orange-brown sandy gravelly Clay, gravel is flint 1.2-2.0: grey Clay 2.0-2.8 (end): Chalk No groundwater encountered
BH303 GESL 2017	GL-0.2: topsoil 0.2-1.9: brown silty Clay (Lambeth Group) 1.9-10.0 (end): Chalk No groundwater encountered
TP210 GESL 2017	GL-0.15: grass over topsoil 0.15-1.4 (end): grey-orange sandy Clay with rootlets to 0.9m, charcoal fragments at 1.35m No groundwater encountered
TP212 GESL 2017	GL-0.15: grass over topsoil 0.15-0.35: orange-brown very sandy Clay 0.35-1.1: orange-brown Clay 1.1-1.4 (end): Chalk No groundwater encountered
TP213 GESL 2017	GL-0.1: grass over topsoil 0.1-0.2: MG brown sandy clay with brick fragments and chalk gravel 0.2-0.8: MG brown gravelly clay 0.8-1.7: MG brown sandy clay with brick, concrete, possible asbestos tiles and decaying roots 1.7-2.2 (end): grey Clay, decaying root at 2m No groundwater encountered
TP214 GESL 2017	GL-0.1: grass over topsoil 0.1-0.2: MG brown clay with bricks and chalk 0.2-0.9: MG brown-grey clay with frequent flint gravel, decaying root at 0.5m 0.9-1.9: MG brown clay with ashy deposits, plastic, brick fragments, chalk gravel and wood 1.9-2.0 (end): brown-grey Clay No groundwater encountered
TP215 GESL 2017	GL-1.0: MG ashy deposits over brown gravelly clay with bricks, concrete, flint, tarmac and chalk 1.0-1.7: orange-brown sandy re-worked clay 1.7-2.9 (end): Chalk No groundwater encountered

Reference	Ground Conditions
TP216 GESL 2017	GL-0.1: topsoil 0.1-0.2: MG brown sandy clay with charcoal and brick fragments 0.2-1.0 (end): brown-grey gravelly Clay (Lambeth Group) No groundwater encountered
TP217 GESL 2017	GL-0.05: grass over topsoil 0.05-1.0 (end): brown-grey Clay with frequent rootlets (Lambeth Group) No groundwater encountered
TP220 GESL 2017	GL-0.6: MG grass over brown gravelly clay with chalk and brick fragments 0.6-2.0 (end): brown-grey Clay with red sandy banding (Lambeth Group) No groundwater encountered
TP223 GESL 2017	GL-0.05: concrete 0.05-0.25: MG brown gravelly clay with concrete and brick fragments 0.25-1.1 (end): grey-orange slightly sandy Clay (Lambeth Group) No groundwater encountered
TP224 GESL 2017	GL-0.7: MG ashy deposits over brown gravelly clay with bricks, flint, chalk and tarmac 0.7-1.6: MG blue-grey re-worked clay with bricks 1.6-2.2 (end): grey-brown Clay (Lambeth Group) No groundwater encountered
TP225 GESL 2017	GL-0.15: chippings over tarmac 0.15-0.6 (end): MG brown gravelly clay with tarmac, brick, chalk, flint, ash and charcoal. Ended on concrete No groundwater encountered
TP226 GESL 2017	GL-0.2: grass over topsoil 0.2-1.1 (end): orange-brown slightly sandy Clay (Lambeth Group) No groundwater encountered
TP239 GESL 2017	GL-0.5: MG grass over brown sandy gravelly clay with brick, chalk, concrete and flint 0.5-0.6: MG brown sandy clay with tiles of possible asbestos, chalk, concrete and brick 0.6-1.8 (end): brown very sandy Clay No groundwater encountered
WS202 GESL 2017	GL-0.3: MG grass over topsoil 0.3-2.8: red-orange-grey sandy Clay with occasional roots and occasional red banding of sandy clay 2.8-3.0 (end): yellow-orange Sand No groundwater encountered
WS203 GESL 2017	GL-0.15: grass over topsoil 0.15-0.7: orange-brown gravelly Clay 0.7-2.3: orange-grey sandy Clay 2.3-3.0 (end): yellow-orange Sand No groundwater encountered
WS204 GESL 2017	GL-0.3: grass over topsoil 0.3-2.3: orange-brown sandy Clay 2.3-3.0 (end): orange-grey sandy Clay No groundwater encountered
WS205 GESL 2017	GL-0.25: grass over topsoil 0.25-0.9: brown clayey Sand 0.9-1.7: orange Sand 1.7-2.0: orange clayey Sand 2.0-2.6: grey sandy Clay 2.6-2.8: brown sandy Clay 2.8-3.0 (end): Chalk No groundwater encountered
WS206 GESL 2017	GL-0.35: grass over topsoil 0.35-1.9: brown-orange sandy gravelly Clay 1.9-3.0 (end): brown very gravelly Clay No groundwater encountered
WS207 GESL 2017	GL-0.15: grass over topsoil 0.15-2.8: orange-grey Clay with varying sand content 2.8-3.0 (end): grey Clay with Chalk fragments No groundwater encountered

Reference	Ground Conditions
TP301 GESL 2018	GL-0.2: grass over topsoil 0.2-0.45: MG brown sandy gravelly clay with brick (5%), wood (4%), glass (0.5%), and slate (0.5%) 0.45-0.9: MG brown sandy clay with flint (10%), brick (5%) and wood (5%) 0.9-1.3: MG brown clay with brick (5%), wood (5%), rope, flint, large concrete slab 1.3-2.7 (end): MG grey and black clay with wood (15%), brick (15%), plastic (10%), chalk gravel No groundwater encountered
TP302 GESL 2018	GL-0.25: MG grass over clayey sandy gravel of tarmac, chalk fragments, brick (3%), wood (2%) 0.25-0.4: MG brown-grey with black/dark grey staining clay with brick (5%), wood (5%) 0.4-1.2: MG grey clay with wood (10%), brick (5%), plastic (3%), cement (2%), chipboard 1.2-2.8 (end): MG brown occasional black staining gravelly sandy clay with wood (10%), brick (5%), charcoal (3%) and plastic (2%) No groundwater encountered
TP303 GESL 2018	GL-0.1: grass over topsoil 0.1-0.35: MG brown slightly sandy clay with flint (5%), brick (3%), concrete (1%), glass (0.5%), wood (0.5%), possible asbestos 0.35-0.8: MG brown clay with chalk gravel (8%), brick (2%) 0.8-1.2: brown-grey Clay 1.2-1.4: brown-grey sandy gravelly Clay, gravel is flint 1.4-1.8: brown very gravelly Clay, gravel is Chalk 1.8-2.4 (end): Chalk No groundwater encountered
TP304 GESL 2018	GL-0.1: grass over topsoil 0.1-0.6: MG grey-brown frequent black staining sandy clay with chalk gravel (15%), brick (5%), wood (3%), plastic (1.5%), glass and charcoal (0.5%) 0.6-1.0: MG brown-grey occasional black staining clay with chalk gravel and brick 1.0-1.2: brown gravelly Clay, gravel is flint 1.2-2.4 (end): brown-grey sandy Clay No groundwater encountered
TP305 GESL 2018	GL-0.2: grass over topsoil 0.2-0.9: MG brown-grey sandy clay with occasional flint, single large piece of metal 0.9-1.2 (end): MG grey occasional black staining sandy clay with wood (10%) Rapid water ingress at 1.1m
TP313 GESL 2018	GL-0.1: grass over topsoil 0.1-0.3: MG white/brown clayey chalk gravel with flint 0.3-0.6: brown very clayey gravel of Flint 0.6-1.5: orange/brown/grey Clay with occasional bands of orange Sand 1.5-1.6: orange Sand 1.6-1.8: orange/brown sandy Clay 1.8-2.5 (end): orange/brown Sand with bands of grey Clay No groundwater encountered
TP314 GESL 2018	GL-0.1: grass over topsoil 0.1-0.6: orange/brown sandy Clay 0.6-2.5 (end): orange/brown/grey Clay with occasional bands of orange Sand, band of Chalk at 1.8m No groundwater encountered
TP315 GESL 2018	GL-0.5: MG chippings over brown/grey clayey gravel of flint and chalk with brick (5%), concrete (3%) and tarmac (2%) 0.5-2.2: MG brown/grey clay with brick (5%), concrete (3%), tree roots, flint and lead pipe (3%) 2.2-2.4 (end): brown/grey Clay with occasional bands of orange Sand No groundwater encountered
TR01 (trench) GESL 2018	GL-0.1: topsoil 0.1-1.0 (end): grey/orange sandy Clay No groundwater encountered
TR02 (trench) GESL 2018	GL-0.2: MG brown sandy silty clay with slate, brick, gravel and wood 0.2-0.7 (end): orange/brown sandy Clay No groundwater encountered
TR03 (trench) GESL 2018	GL-0.5: MG brown sandy silty clay with wood, gravel, brick, pipe and concrete 0.5-1.0 (end): grey sandy Clay No groundwater encountered
TR04 (trench) GESL 2018	GL-0.5 (end): orange/brown sandy Clay No groundwater encountered

Reference	Ground Conditions
TR05 (trench) GESL 2018	GL-0.15: topsoil 0.15-0.75 (end): brown very sandy Clay No groundwater encountered
TR06 (trench) GESL 2018	GL-0.15: topsoil 0.15-0.7 (end): brown sandy Clay No groundwater encountered
TR07 (trench) GESL 2018	GL-0.5: MG grass over brown clayey sandy gravel of flint cobbles, tarmac (5%), wood (3%), charcoal and glass (2%) 0.5-1.1 (end): orange-brown slightly gravelly Clay No groundwater encountered
TR08 (trench) GESL 2018	GL-0.7: MG brown/white clayey sandy chalk and flint gravel with brick (3%) tile (2%) and concrete (2%) 0.7-1.15: orange/brown gravelly Clay, gravel is flint No groundwater encountered
TR09 (trench) GESL 2018	GL-0.7: MG brown/white clayey sandy gravel of chalk and flint with brick (5%) and tarmac (5%) 0.7-1.1 (end): orange/brown sandy Clay No groundwater encountered
TR10 (trench) GESL 2018	GL-0.5: MG brown clayey sandy gravel of flint and chalk with brick (4%), concrete (4%), tree roots and clay pipe (2%) 0.5-1.2 (end): MG grey clay with brick (3%), plastic (2%), wood/roots (2%) and chalk/flint/tile (3%) No groundwater encountered
WS401 GESL 2018	GL-0.1: grass over topsoil 0.1-0.9: MG brown clay with gravel of flint and brick 0.9-2.0: MG grey clay with flint gravel, ash, wood and brick 2.0-3.7: MG grey clay with chalk and flint gravel, red brick at 3.6m 3.7-4.8: MG brown clay with chalk gravel and rare brick fragments 4.8-5.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 5.0m
WS402 GESL 2018	GL-0.1: grass over topsoil 0.1-0.9: MG brown/grey silty clay 0.9-1.4: MG brown/grey clay with gravel of brick and slate 1.4-2.8: MG grey clay with pockets of sandy gravel, concrete, ash, charcoal, roots, wood fragments 2.8-3.7: MG brown/grey clay with concrete fragments 3.7-4.5: MG grey to black fibrous material possibly decomposed paper and wood fragments with brick 4.5-5.0 (end): MG white/grey/black chalk with ashy or possibly fine organic matter in matrix No groundwater encountered Standpipe installed, response zone 1.0m to 5.0m
WS403 GESL 2018	GL-0.1: grass over topsoil 0.1-1.1: MG brown clay with flint and rare brick 1.1-1.7: MG grey clay with clinker, ash, brick and occasional wood fragments 1.7-3.9: MG brown/grey clay with occasional gravel of flint, chalk and occasional ash and brick 3.9-5.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 5.0m
WS404 GESL 2018	GL-0.1: grass over topsoil 0.1-0.6: MG grey silty gravelly clay, gravel is flint and brick 0.6-1.9: grey/orange/brown silty Clay 1.9-2.8 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 2.5m
WS405 GESL 2018	GL-0.2: grass over topsoil 0.2-1.0: MG brown/grey clay with occasional roots, flint gravel, decomposed plant remains and wood 1.0-2.5: MG grey clay with gravel of flint, brick and concrete 2.5-3.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 2.5m

Reference	Ground Conditions
WS406 GESL 2018	GL-0.1: grass over topsoil 0.1-3.1: MG brown/grey silty clay with pockets of sandy gravel of concrete, brick, ash and rare wood 3.1-3.7: MG grey/black clay with decomposed wood and plant fragments with brick 3.7-5.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 5.0m
WS407 GESL 2018	GL-0.1: grass over topsoil 0.1-1.0: MG brown clay with much gravel of flint and brick 1.0-4.0: MG grey silty sand with much ash, charcoal and brick and occasional glass 4.0-5.0 (end): Chalk No groundwater encountered Standpipe installed, response zone 1.0m to 4.0m
RML is Risk Management Limited PBA is Peter Brett Associates RSK is RSK Environment Limited GESL is Geo-Environmental Services Limited MG is made ground All measurements are m below ground level	

From the soil descriptions it can be seen that much of the larger site area comprises topsoil over natural soils. Made ground is limited to the area around and west of the farmyard complex, which is in line with the background information presented in section 2 above. Descriptions of made ground vary from re-worked natural clays to material indicative of aged landfill waste. However, the majority of the material is soil, concrete, brick, etc that will not generate landfill gas.

Figure 6 has been created using contouring software, and cannot be considered definitive, however it does serve to illustrate the approximate distribution of made ground across the western part of the site. Only data from exploratory holes that proved the base of made ground has been used. Areas between and outside of the data points are created by interpolation using the Kriging method, a geostatistical gridding method that produces maps from irregularly spaced data by attempting to express trends.

Although not definitive, the contour map indicates that the extent of major infilling is limited to the area defined as the chalk pit on historic maps, with a lesser thickness extending outwards a short distance to the north and south, but more extensively to the east towards and within the farmyard complex. This demonstrates that the area defined by the Environment Agency records extending to the north is inaccurate.

There is some variation in the nature of made ground recorded. The majority of inclusions noted comprise inert material in the form of brick, tiles, slate, glass, concrete, metal and flint. Complex organic inclusions in the form of clinker, wood and charcoal were recorded to a lesser extent in some locations. Simple organic inclusions in the form of organic matter was recorded in TP02, WS02, and WS402 within the infilled pit. No descriptions were indicative of bagged domestic waste, and the material encountered generally supports the owner's statement that the pit was infilled with construction and demolition waste.

An organic odour was noted in some exploratory holes located within the infilled pit, and a hydrocarbon odour was recorded in WS03 located within the vehicle breaking and repair compound.

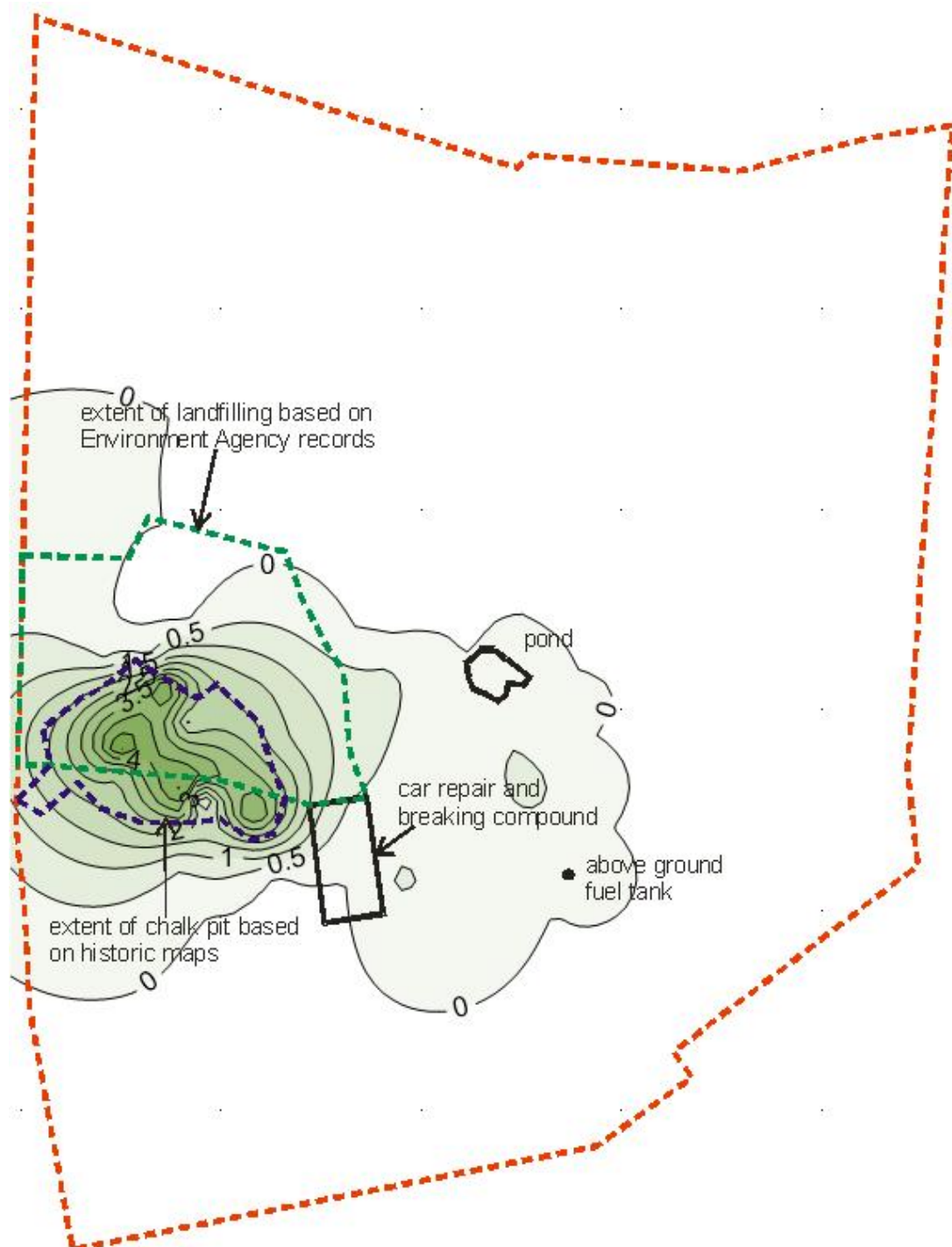


Figure 6: Contours illustrative of the distribution of thickness of made ground

3.2 Total organic carbon

The definition of inert waste in the Landfill Directive¹ is:

'waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health.'

The Environment Agency² (EA) has developed waste acceptance criteria (WAC) with which to identify soils in terms of waste category. In relation to the potential for gas generation, the key criteria included within the WAC is total organic carbon (TOC). In order for material to be designated as inert, it must demonstrate TOC of <3%. TOC gives a crude and conservative estimate of the amount of biodegradable material in soil or waste. It includes both readily available carbon that degrades relatively quickly, and non-readily available carbon that will breakdown and degrade very slowly.

During the phases of site investigation between 2011 and 2018 analytical results for soils within and in the direct vicinity of the infilled chalk pit include seventy results for either TOC or soil organic matter (SOM), which can be converted to TOC by dividing by a factor of 1.72. The results identified concentrations of between 0.05% and 3.8%, with an average of 0.99%. As defined above, in the main this represents inert material that *'does not undergo any significant physical, chemical or biological transformations'*. Those samples that exceeded 3% were taken from WS406 at 3.1m (3.8%), WS102 at 0.4m (3.47%) and TP02 at 2.0m (3.47%), coinciding with the following soil descriptions:

WS406: 3.1m to 3.7m dark grey to black clay with decomposed wood and plant fragments with red brick

WS102: 0.25m to 0.5m brown to off white reworked chalk composed of gravelly silt. Gravel is flint and chalk. Occasional black staining

TP02: 0.15m to 2.8m brown clay with flint gravel, brick, concrete, timber, tiles, metal, glass and plastic

It should also be noted that the guidance relates to the placement of fresh waste. The material within the infilled chalk pit has been in place for >40 years, and as such the residual total organic content will be comprised of complex non-readily available carbon.

¹ Council Directive 1999/31/EC. European Union, 1999.

² Waste acceptance at landfills – guidance on waste acceptance procedures and criteria. Environment Agency, 2010.

CLAIRE RB17³ and BS8485:2015⁴ use TOC results to classify a site in terms of anticipated gas risk. For recently placed material a TOC of less than 1% indicates Characteristic Situation 1, less than 1.5% indicates Characteristic Situation 2 and less than 4% indicates Characteristic Situation 3. The average concentration recorded within the made ground on this site is less than 1% therefore the overall results indicate that the material is inert, and the site is CS1 if based solely on the total organic carbon.

A summary of the anthropogenic and organic inclusions observed within the fill material and underlying natural soils as recorded in exploratory hole logs is presented in Table 3.

Table 3: Summary of fill composition

Hole ID	Evidence of anthropogenic material	Evidence of organic material
TP01-RML	Brick, concrete, wood, plastic	Organic odour recorded in MG between 1.25m and 2.5m
TP02-RML	Brick, concrete, wood, tiles, metal, glass, plastic, organic matter	'Some' organic matter with organic odour recorded in MG between 2.8m and 3.5m
TP03-RML	Brick, concrete, wood	Organic odour recorded in MG between 1.1m and 2.7m
WS01-PBA	Brick	Organic odour in MG between 1.1m and 3.0m
WS02-PBA	Brick, rare charcoal, concrete	Pockets of organic matter and organic odour recorded in MG between 1.2m and 5.2m
WS03-PBA	Brick, clinker	Black clayey gravelly sand, slight hydrocarbon odour recorded in MG between 0.1m and 0.4m
WS04-PBA	Brick	N/A
WS05-PBA	N/A	N/A
WS06-PBA	Brick, concrete	N/A
WS102-RSK	Concrete, wood	N/A
WS105-RSK	N/A	N/A
WS106-RSK	Brick, charcoal	N/A
BH102-RSK	N/A	Weak organic odour and rare rootlets recorded in MG between 2.0m and 2.7m, frequent rootlets and layer of wood remains recorded in MG between 2.7m and 4.0m, Occasional pockets of brown/grey clay with roots and rootlets and weak organic odour recorded in possible MG between 4.0m and 5.0m
TP108-RSK	Brick, tarmac, slate, occasional wood, rare metal, plastic pipe	N/A
TP213-GESL	Brick, tiles, concrete	Decaying roots recorded in MG between 0.8m and 1.7m
TP214-GESL	Brick, ash, plastic, wood	N/A
TP215-GESL	Brick, concrete, tarmac	N/A
TP216-GESL	Brick, charcoal	N/A
TP220-GESL	Brick	N/A
TP224-GESL	Brick, tarmac, ash	N/A
TP225-GESL	Tarmac, brick, ash, charcoal, concrete	N/A
TP239-GESL	Brick, concrete	N/A
TP301-GESL	Brick, tile, slate, wood, glass, concrete, plastic	Wood/decaying roots recorded in MG between 0.45m and 0.9m, large decaying tree root recorded in MG at 1.4m

³ A pragmatic approach to ground gas risk assessment. CL:AIRE Research Bulletin RB 17, 2012

⁴ BS8485:2015 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new building. British Standards Institution, 2015

Hole ID	Evidence of anthropogenic material	Evidence of organic material
TP302-GESL	Tarmac, brick, tile, charcoal, wood, plastic, cement	Decaying roots recorded in MG between 0.25m and 0.4m
TP303-GESL	Brick, glass, concrete, wood	N/A
TP304-GESL	Brick, wood, plastic, glass, charcoal	N/A
TP315-GESL	Tarmac, brick, concrete, lead pipe	Some tree roots recorded in MG between 0.5m and 2.2m
TR7-GESL	Tarmac, wood, charcoal, glass	N/A
TR8-GESL	Brick, tile, concrete	N/A
TR9-GESL	Brick, tarmac	N/A
TR10-GESL	Brick, plastic, wood, concrete, clay pipe	Tree roots recorded in MG between GL and 0.5m, roots recorded in MG between 0.5m and 1.2m
WS401-GESL	Brick, ash, wood	N/A
WS402-GESL	Brick, slate, concrete, ash, charcoal, dead roots and wood fragments	Fibrous material possibly decomposed paper and wood fragments recorded in MG between 3.7m and 4.5m, chalk with ashy or possibly fine organic matter in matrix recorded in MG between 4.5m and 5.0m
WS403-GESL	Brick, clinker, ash, occasional wood fragments	N/A
WS404-GESL	Brick	N/A
WS405-GESL	Brick, concrete, wood	Decomposed plant remains recorded in MG between 0.2m and 1.0m
WS406-GESL	Concrete, brick, ash, wood, roofing felt	N/A
WS407-GESL	Brick, ash, charcoal, glass	N/A

With the exception of ash, decomposed paper, decomposed plant remains, rare wood, charcoal and clinker, all the recorded material is representative of inert waste that will not undergo any significant physical, chemical or biological transformations. The biodegradable elements of wood, charcoal and clinker comprise complex organic materials that are slow to biodegrade, and do not represent a potential source of bulk gas generation. The biological and chemical degradation of ash, together with the daughter products, is very much source specific, however it is rarely present in sufficient volume and containing sufficient non-combusted material to represent a potential source of bulk gas generation. The paper and plant remains were reportedly decomposed, indicating that the biodegradation process is in the main complete.

In summary, up to 5.2m of aged (>40 years) predominantly inert waste (as demonstrated by site investigation soil descriptions/analytical results) are present within the infilled chalk pit and extending some distance into the farmyard complex to the east. No evidence of simple easily degradable material has been recorded, which is supported by the total organic carbon analytical results.

3.3 Organic contaminants in soils

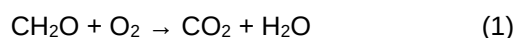
Secondary potential sources of gas in the form of hydrocarbon contamination from an above ground fuel storage tank and the use of part of the farmyard complex for the repair and breaking of vehicles have been identified. A significant amount of site investigation has been undertaken within the relevant areas, including comprehensive chemical analysis of soils. Minor exceedances of some polyaromatic hydrocarbons have been identified, when compared to acceptable concentrations for the proposed residential end use of the site. No evidence of bulk hydrocarbon contamination was

identified, and it is no considered that these findings indicate that hydrocarbon contamination represents a viable source of bulk gas generation on this site.

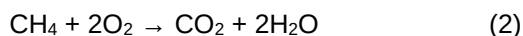
3.4 Natural soils

Natural soils with a high carbonate content, such as Chalk, or sedimentary rocks with small volumes of organic material, can represent a low production source of carbon dioxide, which does not represent a risk to development. Soils such as London Clay which were laid down in a shallow sea environment contain small volumes of non-labile organic carbon, shell fragments, calcareous nodules (claystone) and pyrites. Other soils that can also contain small amounts of organic material include Glacial Till and River Terrace Gravels. Labile organic carbon is the portion of soil organic carbon that can be readily decomposed by soil organisms. When boreholes are drilled into the soils it allows oxygen to be introduced and various chemical and biological process can take place locally immediately around the well that cause high concentrations of carbon dioxide (or methane) in the wells. The rate of gas generation and the volume produced is extremely small and high concentrations in a monitoring well do not indicate a risk to buildings.

Microbial respiration takes place wherever organic matter, oxygen and soil moisture are present together. It does so as follows:



This means that as oxygen is consumed and the oxygen concentration reduces, the carbon dioxide concentration increases in the same proportion. This produces carbon dioxide with a relationship between oxygen and carbon dioxide concentration that has a slope of -1 (Figure 7). If oxygen and other electron acceptors such as nitrate and sulphate are depleted then methane can be produced under highly reducing conditions around the outside of the well. This can be oxidised when oxygen is introduced via the well as follows:



During methane oxidation the slope on the graph in Figure 7 is -2.

The carbon dioxide and oxygen results shown in Figure 7 are all from sites where the wells were installed into natural soils in the UK, with no other nearby sources of gas that could contribute to the gas being recorded.

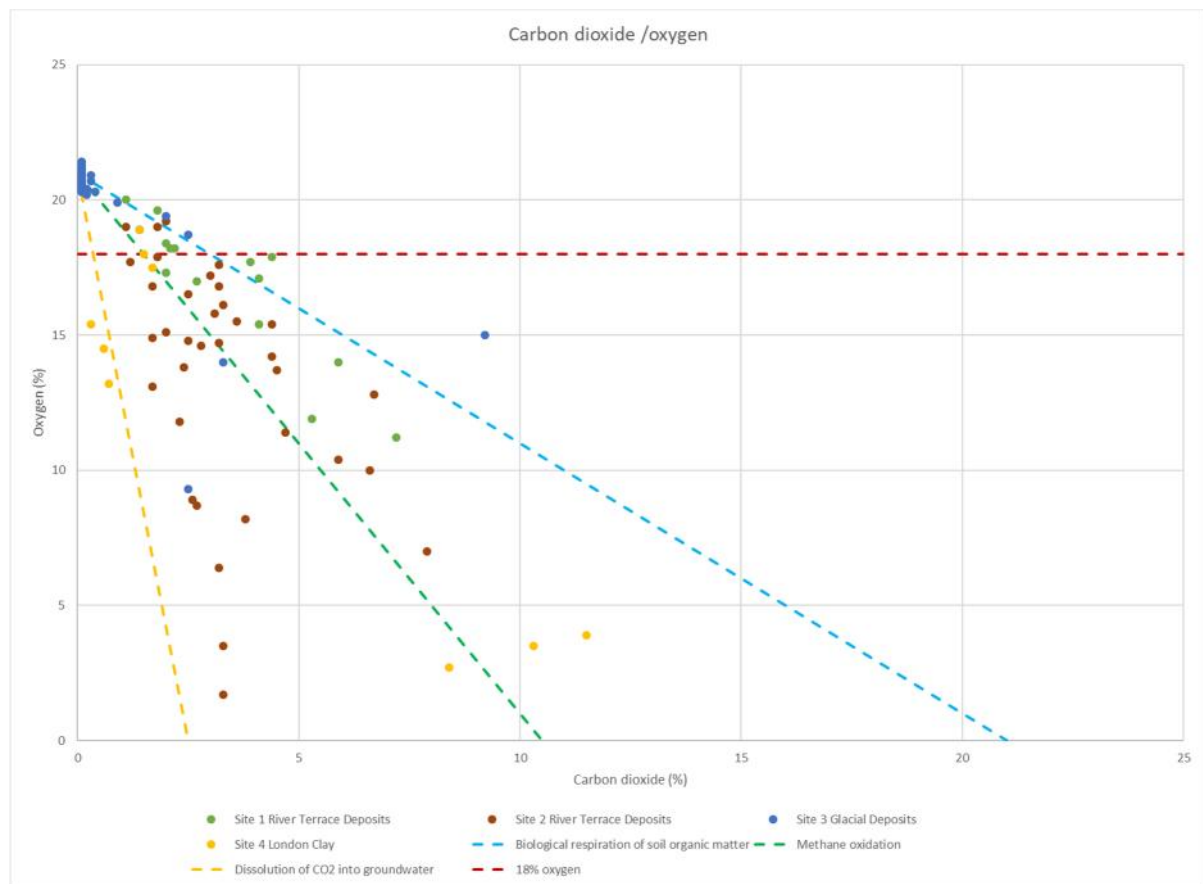


Figure 7: Carbon dioxide:oxygen relationship in natural soils

All the results are consistent with carbon dioxide being produced mainly via biological respiration with some contribution from oxidation of methane that was produced either under anaerobic conditions or under reducing conditions. There is also evidence that some of the carbon dioxide that is being produced is either reacting with carbonate in the soil or being dissolved into groundwater which acts as a sink.

The relationship between microbial respiration and methane oxidization becomes ambiguous above 18% v/v oxygen and other ratios such as nitrogen:oxygen may need to be compared to help with the assessment of the source of the carbon dioxide.

Whichever the method of gas generation, all are very slow processes with a turnover of many thousands of years. Thus, surface emissions of carbon dioxide from such sources are negligible. It can cause high gas concentrations in monitoring wells that are not representative of the risk to buildings, even those including basements. Such conditions are widespread throughout the UK with no known incidents of carbon dioxide emissions into buildings from this natural process.

4. SUMMARY OF GAS MONITORING 2011 TO 2018

Gas monitoring was undertaken on four occasions in 2011, three occasions in 2016 and seven occasions in 2018. The approximate location of all monitored standpipes is depicted in Figure 8, with the contour representative of where fill reduced to 0.5m thickness as presented in Figure 6 above indicated by the green line. The gas monitoring results are summarised in Table 4 below, and presented in full in Appendix A.

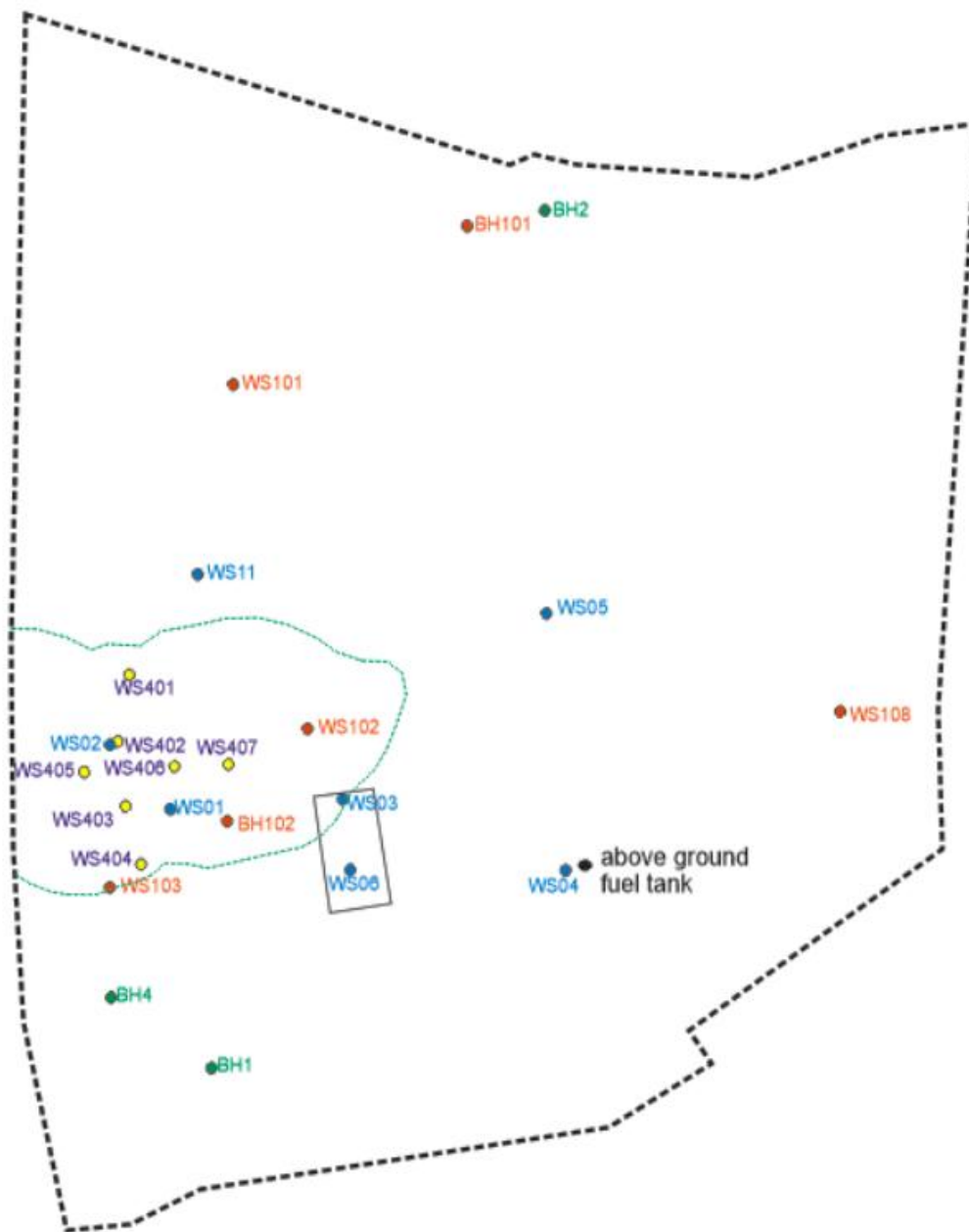


Figure 8: Location of monitored standpipes

Table 4: Summary of gas monitoring data 2011 to 2018

ID	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Flow (l/hr)	At pressure (mBar)	Comments
BH1	0.0	2.0	11.4	-0.9	1005	In far south of site, no MG recorded. Response zone 1.0m to 5.0m in natural Clay over Chalk. Standpipe dry on all monitoring events
	0.0	2.6	10.7	0.1	1015	
	0.0	3.8	6.9	-0.6	1017	
	0.0	4.7	8.0	0.0	1021	
BH2	0.0	1.4	16.7	0.2	1004	In far north of site, no MG recorded. Response zone 1.0m to 7.0m in natural Clay over Chalk. Standpipe dry on all monitoring events
	0.0	1.9	14.5	0.3	1013	
	0.0	2.5	13.7	0.0	1015	
	0.0	2.7	14.5	0.1	1021	
BH4	0.0	2.0	14.7	0.6	1004	In far south of site, no MG recorded. Response zone 1.0m to 7.0m in natural Clay over Chalk. Standpipe dry on all monitoring events
	2.0	0.0	21.0	0.0	1015	
	0.0	3.6	6.4	0.0	1017	
	0.0	3.6	8.6	0.0	1021	
WS01	0.0	6.0	7.6	0.0	1004	Within infilled pit, 3.0m of MG recorded, clay with flint, chalk and brick. Response zone 1.0m to 3.0m in MG. Standpipe dry on all monitoring events
	0.8	5.6	6.6	0.1	1014	
	0.0	12.0	0.8	0.0	1017	
	0.0	15.0	0.8	0.0	1021	
WS02	27.5	15.0	0.0	0.2	1004	Within infilled pit, 5.2m of MG recorded, clay with flint, chalk, brick, concrete, charcoal, pockets of organic material, organic odour. Response zone 1.0m to 4.0m in MG. Standpipe dry on all monitoring events
	42.5	17.0	0.0	0.3	1014	
	36.5	17.0	0.0	0.0	1017	
	35.5	19.0	0.0	1.3	1021	
WS03	0.0	6.1	6.4	0.0	1004	At eastern boundary of infilled pit, 0.5m of MG recorded, clay with flint, clinker and brick, slight hydrocarbon odour. Response zone 1.0m to 4.0m in natural Clay over Chalk. Standpipe dry on all monitoring events
	0.0	4.5	17.0	0.0	1016	
	0.0	8.2	5.7	0.0	1020	
				0.5		
WS04	0.0	2.6	17.2	0.1	1004	In south east of site adjacent to fuel tank, 0.3m of MG recorded, clay with chalk and brick. Response zone 1.0m to 3.0m in natural Clay. Standpipe dry on all monitoring events
	0.0	2.1	17.6	0.1	1013	
	0.0	2.5	17.1	0.0	1016	
	0.0	2.0	17.0	0.0	1021	
WS05	0.0	3.3	15.9	0.3	1004	East of farmyard complex, no MG recorded. Response zone 1.0m to 4.0m in natural Sand over Clay over Chalk. Standpipe dry on all monitoring events
	0.0	3.5	15.3	0.2	1013	
	0.0	2.7	16.8	0.0	1016	
	0.0	2.5	17.2	0.0	1021	
WS06	0.0	6.0	10.0	0.0	1021	In scrapyard complex outside of extent of infilled pit (from kriging), 0.6m of MG recorded, clay with flint, brick and concrete. Response zone 1.6m to 2.6m in natural Clay over Chalk. Standpipe dry on all monitoring events
WS11	0.0	3.8	14.7	0.0	1004	North of infilled pit, no MG recorded. Response zone 1.0m to 2.5m in natural Clay over Chalk. Standpipe dry on all monitoring events
	0.0	4.3	13.8	0.3	1013	
	0.0	3.7	13.8	0.1	1017	
	0.0	5.4	12.6	0.2	1021	
BH101	0.0	3.8	14.6	0.2	1015 (rising)	In far north of site, no MG recorded. Response zone 5.0m to 20.0m in natural soils. Standpipe dry or at 20m on all monitoring events
	0.0	3.8	14.4	0.0	1012 (steady)	
	0.0	3.7	16.2	0.0	1014 (steady)	
BH102	0.0	1.3	20.1	0.0	1015 (rising)	Within infilled pit, 4.0m of MG recorded, clay with flint, wood, rootlets, weak organic odour. Response zone 1.0m to 5.0m in MG/natural soils. Standpipe dry on all monitoring events
	0.0	0.5	21.3	0.0	1012 (steady)	
	0.0	0.3	21.4	0.0	1014 (steady)	
WS101	0.0	3.4	18.3	0.2	1015 (rising)	North of infilled pit, no MG recorded. Response zone 1.0m to 3.0m in natural soils. Standpipe dry on all monitoring events
	0.0	3.5	19.1	0.0	1012 (steady)	
	0.0	2.9	19.8	0.0	1014 (steady)	
WS102	0.0	8.5	5.2	0.0	1015 (rising)	Within infilled pit, 0.8m of MG recorded, clay/chalk/gravel of flint, concrete, wood, occasional black staining. Response zone 1.0m to 3.0m in natural soils. Standpipe dry on all monitoring events
	0.0	9.9	3.5	0.0	1012 (steady)	
	0.0	6.0	3.0	0.0	1014 (steady)	
WS103	0.0	8.4	11.3	0.0	1015 (rising)	On southern boundary of infilled pit, 0.65m of MG recorded, clay with flint gravel (reworked) Response zone 1.0m to 3.0m in natural soils Standpipe dry on all monitoring events
	0.0	7.2	12.5	0.0	1012 (steady)	
	0.0	7.0	14.7	0.0	1014 (steady)	
WS108	0.0	2.2	18.8	0.0	1015 (rising)	In far east of site, no MG recorded. Response zone is 1.0m to 3.0m in natural soils Standpipe dry on all monitoring events.
	0.0	3.4	17.0	0.0	1012 (steady)	
	0.0	2.1	20.4	0.0	1014 (steady)	

ID	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Flow (l/hr)	At pressure (mBar)	Comments
WS401	0.0	4.5	13.9	0.0	1004	Within infilled pit, 4.8m of MG recorded, clay with flint, ash, wood, brick and chalk. Response zone 1.0m to 5.0m in MG. Standpipe dry on all monitoring events
	0.0	6.9	11.0	0.0	1005	
	0.0	7.3	10.2	0.0	1012	
	0.0	5.0	15.4	0.0	1017	
	0.0	9.0	7.5	0.0	1009	
	0.0	6.1	14.4	0.0	1010	
	0.0	6.0	13.7	0.0	1009	
WS402	0.0	2.0	16.8	0.0	1004	Within infilled pit, depth of MG not proven at 5.0m, clay with brick, slate, concrete, ash, charcoal, roots, wood, decomposed paper, chalk. Response zone 1.0m to 5.0m in MG. Standpipe dry on all monitoring events
	0.0	4.7	10.7	0.0	1005	
	0.0	7.0	9.8	0.0	1012	
	0.0	3.3	18.0	0.0	1017	
	0.0	7.3	10.3	0.0	1009	
	0.0	5.5	14	0.0	1010	
	0.0	5.4	12.1	0.0	1009	
WS403	0.0	4.2	13.2	0.0	1004	Within infilled pit, 3.9m of MG recorded, clay with flint, brick, clinker, ash, wood and chalk. Response zone 1.0m to 5.0m in MG over chalk. Standpipe dry on all monitoring events
	0.0	5.2	15.7	0.0	1012	
	0.0	3.7	18.1	0.0	1017	
	0.0	3.4	17.8	0.0	1009	
	0.0	4.0	15.8	0.0	1010	
	0.0	4.7	13.9	0.0	1009	
WS404	0.0	0.1	20.0	0.0	1004	Towards the southern edge of the infilled pit, 0.6m MG recorded, clay, flint and brick Response zone 1.0m to 2.5m in natural soils. Standpipe dry on all monitoring events
	0.0	0.3	19.5	0.0	1005	
	0.0	0.7	18.2	0.0	1012	
	0.0	1.4	19.4	0.0	1017	
	0.0	1.6	18.9	0.0	1009	
	0.0	2.3	18.2	0.0	1010	
	0.0	2.2	18.6	0.0	1009	
WS405	0.0	6.4	8.2	0.0	1004	Within infilled pit, 2.5m of MG recorded, clay with flint, plant remains, wood, brick and concrete. Response zone 1.0m to 2.5m in MG. Standpipe dry on all monitoring events
	0.0	11.5	1.7	0.0	1005	
	0.0	3.6	14.9	0.0	1012	
	0.0	3.1	18.0	0.0	1017	
	0.0	3.9	14.9	0.0	1009	
	0.0	3.9	15.4	0.0	1010	
	0.0	4.7	13.4	0.0	1009	
WS406	0.0	0.7	18.2	0.0	1004	Within infilled pit, 3.7m of MG recorded, clay with concrete, brick, ash, wood and plant fragments. Response zone 1.0m to 5.0m in MG over chalk. Standpipe dry on all monitoring events
	0.0	0.1	20.3	0.0	1005	
	0.0	2.0	18.0	0.0	1012	
	0.0	2.2	19.1	0.0	1017	
	0.0	2.7	18.2	0.0	1009	
	0.0	2.9	16.8	0.0	1010	
	0.0	3.3	16.1	0.0	1009	
WS407	0.0	3.4	13.4	0.0	1004	Within infilled pit, 4.0m of MG recorded, clay and sand with flint, brick, ash, charcoal and glass. Response zone 1.0m to 4.0m in MG. Standpipe dry on all monitoring events
	0.0	10.1	10.3	0.0	1005	
	0.0	9.1	13.9	0.0	1012	
	0.0	4.6	17.4	0.0	1017	
	0.0	4.7	16.8	0.0	1009	
	0.0	1.9	14.7	0.0	1010	
	0.0	4.7	13.9	0.0	1009	
Values represent maximum recorded concentration and flow rate MG is made ground						

It can be seen that carbon dioxide was recorded in all standpipes, with marginally elevated concentrations in WS01, WS02, WS03, WS06, WS11, WS102, WS103, WS401, WS402, WS403, WS405 and WS407. All of these standpipes are located within the infilled pit with the exception of WS06 (within the scrapyard compound) and WS11 (north of the infilled pit). Figure 9 below presents the distribution of carbon dioxide in relation to oxygen.

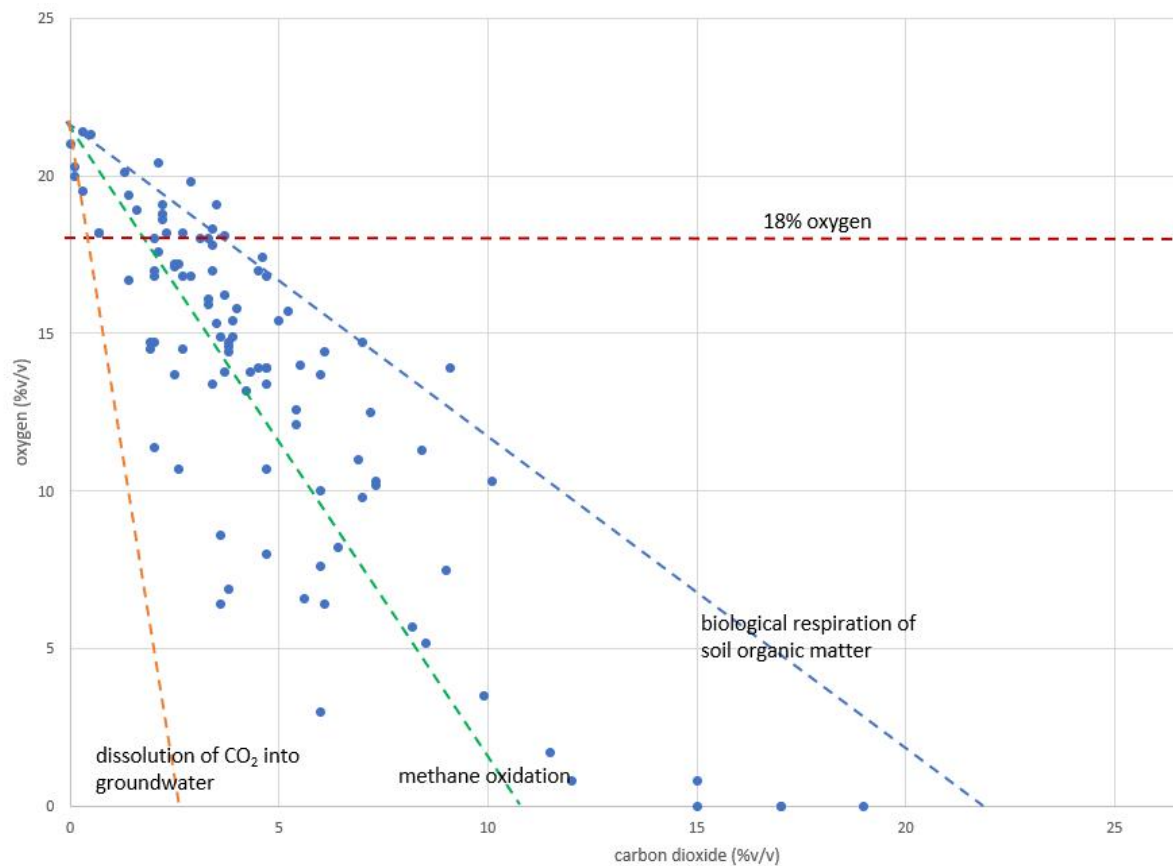


Figure 9: The relationship between oxygen and carbon dioxide

It can be seen that as in Figure 7 above, the carbon dioxide is from low risk sources, and no external source such as landfill gas generation is present.

Elevated concentrations of methane were consistently recorded within WS02 within the centre of the infilled pit, with a maximum concentration of 42.5%. WS02 was also the installation where the highest concentrations of carbon dioxide were recorded, with a maximum of 19%. Low concentrations of methane were recorded on a single occasion in BH4 (2%, located in the south of the site some distance from the infilled pit and farm complex) and WS01 (0.8%, located within the infilled pit).

No positive flow was recorded on the majority of occasions within the majority of installations. The maximum recorded flow rate was 1.3l/hr in WS02, located in the centre of the infilled pit.

The lack of notable flow indicates that the source of the methane within WS02 is residual gas stored within soils within the central area of the infilled pit, and that the bulk gas generation phase of the infill material is complete. This is supported by the lack of methane or positive flow recorded in other standpipes located within the pit. All the results indicate gas is migrating by diffusive flow only from a

'reservoir' within the deeper central area of the infilled pit. The migration would be along a diffusive continuum, with equilibrium being maintained at the outer boundary of the fill.

No groundwater was recorded on any monitoring event, with the exception of at the base of BH101 at a depth of 20m.

5. PRELIMINARY QUALITATIVE GAS RISK ASSESSMENT

Current UK guidance in the form of BS8485:2015⁵ identifies the first steps of the risk assessment process for methane and carbon dioxide as follows:

Step 1: Define conceptual site model

Step 2: Develop risk model and qualitative assessment

Step 3: Pollutant linkage identified?

The risk model develops the conceptual model to identify potential sources of gas, receptors that could be affected, and possible pathways by which the gas could reach the receptors and cause harm.

5.1 Sources

The information presented above has identified a potential source of gas within the site boundary in the form of an infilled chalk pit in the western part of the site. Exploratory hole records have identified significant thicknesses of made ground in this area, with the greatest thickness confined to the area identified as a chalk pit on historic map, although a lesser thickness extends outwards from this feature, predominantly to the east. Due to the age of the infill in the chalk pit (>40 years), biodegradation of all material that is easily and quickly biodegradable (simple carbon forms) will be complete at this time. The remainder (more complex carbon forms) represents a gas generation source that will continue to biodegrade slowly over a long period but does not represent a source of bulk gas generation.

It is normal for areas of aged landfill such as this to represent a 'reservoir' of gases stored within less permeable materials, which acts as a continued source of gas which will migrate outwards and to the surface by diffusive mechanism along a continuum that equates to atmospheric concentrations at the ground surface and reaches a soil equilibrium at a distance from the source. Over time, various changes will occur, with the central core of the reservoir reducing in size as oxygen infiltrates, concentrations gradually reducing, and methane being oxidised to carbon dioxide.

⁵ *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*. British Standards, BS8485:2015.

5.2 Pathways

Gas primarily migrates via either pressure driven (advective) flow or via diffusive flow. In general, the predominant mechanism for migration of gases from aged landfill waste such as that encountered on this site is diffusive, with no driving pressure. This is supported by the consistently negligible flow rates recorded during gas monitoring between 2011 and 2018.

As such, gas present within the made ground identified across the western part of the site will diffuse through the soils forming a continuum between the source and ground level, with only minor concentrations of gas reaching ground level, and no perceivable flow. The majority of gas will remain trapped in the soil pores or sorbed to soil particles.

5.3 Receptors

Receptors at risk from gas ingress primarily include:

- Construction workers;
- Occupants of the new buildings; and
- The new buildings' infrastructure.

5.4 Ground model

A simplistic ground model of the site as identified by intrusive investigation is presented in Figure 10 below, and an interpretation of the gas regime within the infilled pit is presented as Figure 11.

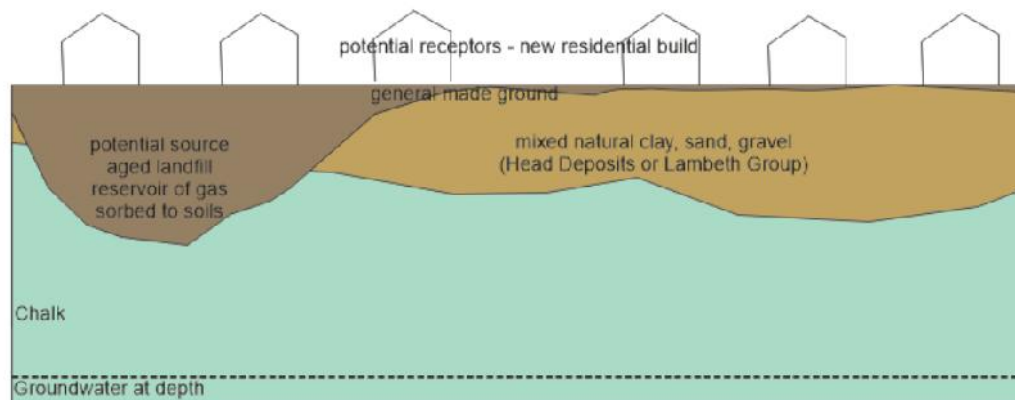


Figure 10: Simplistic ground model of western area of site

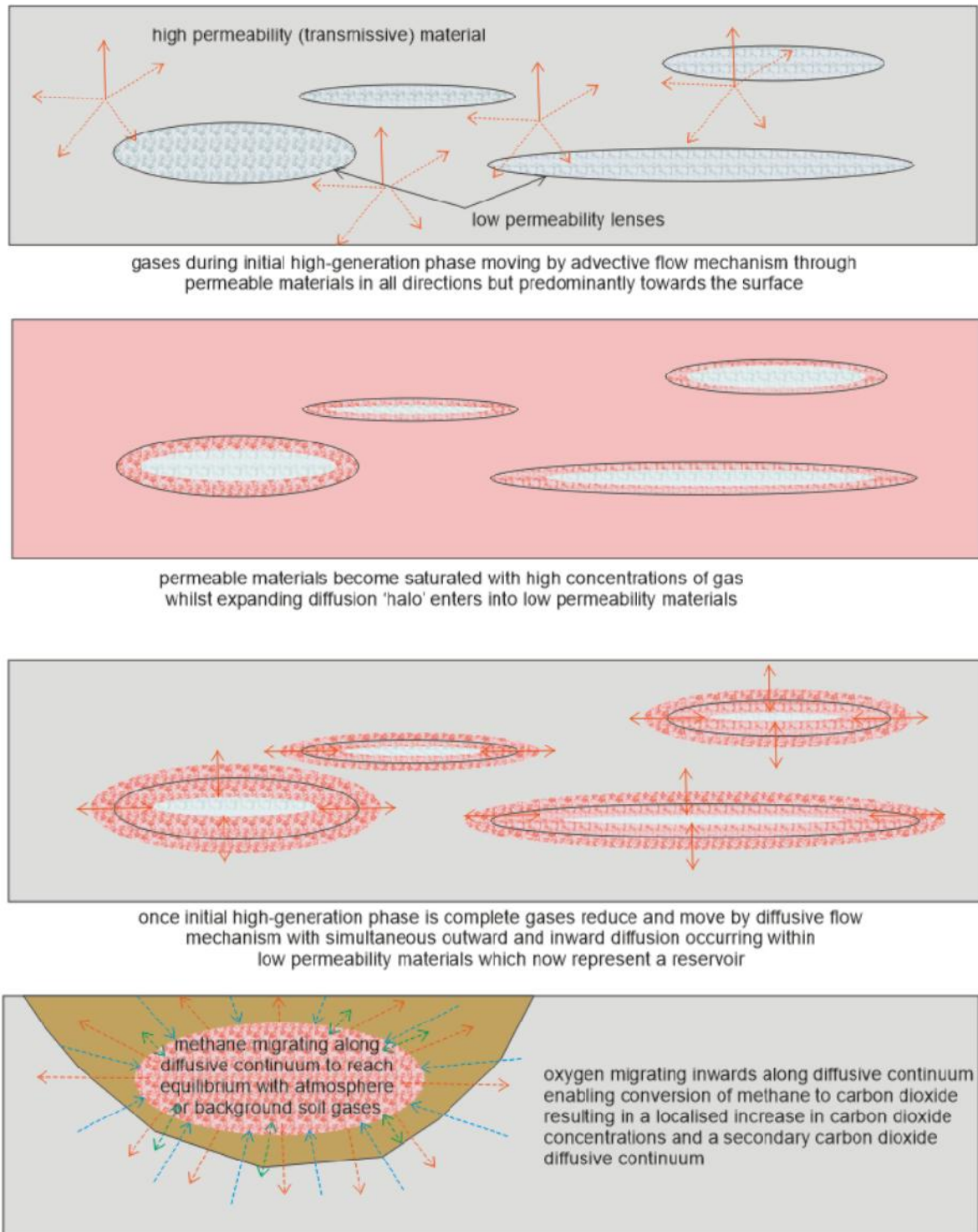


Figure 11: Low permeability soils acting as a reservoir after advective flow has ended

In summary, a single historic source of gas has been identified as predominantly inert landfill within an infilled chalk pit, with made ground extending out beyond the perimeter of the infilled pit. Due to the age and low organic content of the fill material, it is likely to have a very low ongoing gas generation potential from residual complex carbon forms. The underlying Chalk formation and chalk gravel within the made ground represents a continuous source of low levels of carbon dioxide which should be considered as background and does not pose a risk.

Lower permeability material within the deeper centre of the pit represents an anaerobic reservoir for carbon dioxide and methane. These gases will migrate in all directions along a diffusive continuum (concentration gradient) until equilibrium is reached either with atmospheric concentrations at the surface, or with air within soil pores. A secondary diffusive continuum of oxygen will migrate into the centre, introducing oxygen into the anaerobic environment with resulting conversion of methane into carbon dioxide. This will result in a localised area of higher concentrations of carbon dioxide combined with negligible methane. Negligible flow rates support the lack of advective flow.

Based on the lines of evidence presented above, it is considered that risks to the proposed development from gas are low.

6. SITE CHARACTERISATION

Appropriate values must be selected on which to base the quantitative risk assessment. The next step in the risk assessment process is to characterise the site and define gas screening value/s.

6.1 Gas screening value

CIRIA Report C665⁶ and BS8485: 2015 detail the use of the system proposed by Wilson and Card to aid interpretation of gas monitoring results in terms of actual risk. The method uses both concentration and flow rates to define a characteristic situation for the site.

BS8485 uses the concept of the borehole hazardous gas flow rate. This is obtained by multiplying the gas concentration by the flow rate of all gases from a well. It is calculated for each monitoring event in each well. Where flow is not detected the limit of detection of the instrument is used in the calculations.

The individual values of hazardous gas flow rate obtained from several monitoring locations over a number of visits are considered collectively to establish a Gas Screening Value (GSV) for the site as a whole (or more than one if it is considered that zoning is appropriate). This requires consideration of the results in relation to the conceptual site model.

Using the GSV(s) the site is characterised as one of six characteristic situations with situation CS1 being the lowest risk and situation CS6 being the highest. In addition, there is a requirement to consider an increase from CS1 to CS2 if methane concentrations exceed 1% v/v or carbon dioxide concentrations exceed 5% v/v. It is not mandatory in either BS8485 or the NHBC guidance to automatically increase the classification of a site because of elevated gas concentrations.

In order to depict the worst-case scenario on this site a slightly amended approach has been adopted. The highest flow and concentrations recorded during spot monitoring are summarised in Table 5 below, together with the corresponding HGFR derived from these worst-case values (rather than calculating the HGFR for each set of results).

⁶ C665 *Assessing risks posed by hazardous ground gases to buildings*. Construction Industry Research and Information Association, (2007);

Table 5: Hazardous gas flow rates from worst-case results

Hole ID	Flow ³ (l/hr)	CH ₄ ⁴ (%v/v)	CO ₂ ⁴ (%v/v)	HGFR ¹ CH ₄	HGFR CO ₂	CS ²
BH1	0.1	0.1	4.7	0.0001	0.0047	CS1
BH2	0.3	0.1	2.7	0.0003	0.0081	CS1
BH4	0.6	2.0	3.6	0.012	0.0216	CS1
WS01	0.1	0.8	15.0	0.0008	0.015	CS1
WS02	1.3	42.5	19	0.5525	0.247	CS2
WS03	0.5	0.1	8.2	0.0005	0.041	CS1
WS04	0.1	0.1	2.6	0.0001	0.0026	CS1
WS05	0.3	0.1	3.5	0.0003	0.0105	CS1
WS06	0.1	0.1	6.0	0.0001	0.006	CS1
WS11	0.3	0.1	5.4	0.0003	0.0162	CS1
BH101	0.2	0.1	3.8	0.0002	0.0076	CS1
BH102	0.1	0.1	1.3	0.0001	0.0013	CS1
WS101	0.2	0.1	3.5	0.0002	0.007	CS1
WS102	0.1	0.1	9.9	0.0001	0.0099	CS1
WS103	0.1	0.1	8.4	0.0001	0.0084	CS1
WS108	0.1	0.1	3.4	0.0001	0.0034	CS1
WS401	0.1	0.1	7.3	0.0001	0.0073	CS1
WS402	0.1	0.1	7.3	0.0001	0.0073	CS1
WS403	0.1	0.1	5.2	0.0001	0.0052	CS1
WS404	0.1	0.1	2.3	0.0001	0.0023	CS1
WS405	0.1	0.1	11.5	0.0001	0.0115	CS1
WS406	0.1	0.1	3.3	0.0001	0.0033	CS1
WS407	0.1	0.1	10.1	0.0001	0.0101	CS1
1. HGFR is hazardous gas flow rate as defined in BS8485:2015 2. CS is characteristic situation as defined in BS8485:2015, based solely on the assumption that the HGFR represents the Gas Screening Value (GSV) 3. All recorded negative and zero flows have been substituted with 0.1l/hr for calculation of HGFR 4. All concentrations recorded as 0% have been substituted with 0.1% for calculation of HGFR						

It can be seen that even when considering the worst-case concentrations and flow rates, all but one of the standpipes present gas conditions representative of characteristic situation 1 (i.e. requiring no gas protection measures). The exception is WS02, which presents gas conditions representative of CS2.

In this instance, based on HGFRs only, the guidance identifies that the hazard potential is very low to low, however the following factors are relevant on this site:

- The landfill materials on the site are over 40 years old;
- The source of gas is from gas held in soil pore spaces;
- No advective flow has been identified;
- In some instances, the concentrations of methane are above 30%; and
- The development is to include housing.

Given the sensitivity of the proposed development, further consideration is required to aid professional judgement.

6.2 WS02

As the sole standpipe to demonstrate gassing conditions in excess of a hazardous gas flow rate indicative of characteristic situation 1, the location, ground conditions and construction of WS02 should be considered in comparison to other standpipes in the direct vicinity. Figure 12 illustrates the approximate location of WS02 together with other standpipes within the infilled pit, with the recorded thickness of made ground in each location.

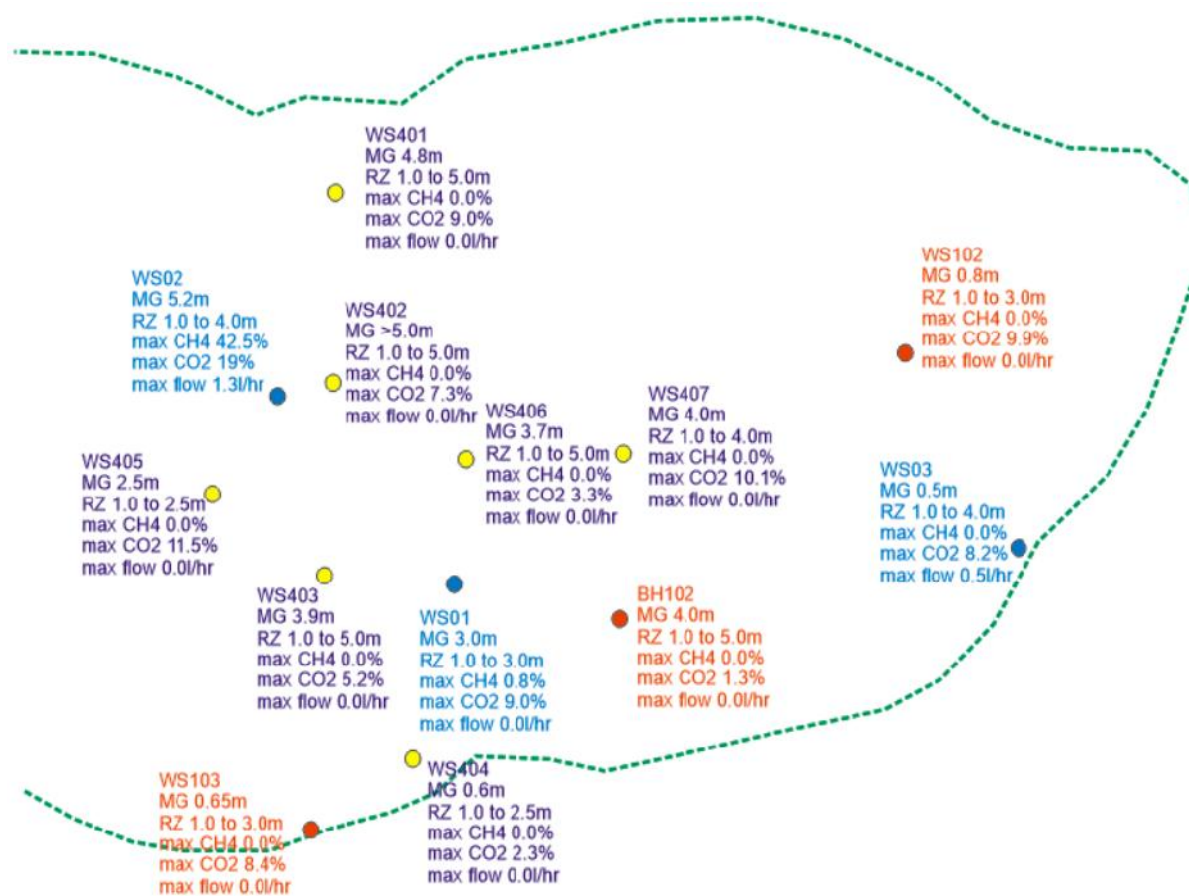


Figure 12: Location and details of WS02 in comparison to other standpipes

It can be seen that WS02 is not outstanding either in the thickness of made ground penetrated, or the depth of the response zone, however it is located in the centre of the mass of fill material and as such will be at the furthest point from any lateral ingress of fresh air, and at the centre of the concentration gradients presented in Figure 8 above (CH₄, CO₂ and O₂).

It is notable that WS02 is the only standpipe within the deeper area of fill where flow was recorded above the level of detection of 0.1l/hr. The recorded flows within WS02 were consecutively 0.2l/hr, 0.3l/hr, 0.0l/hr and 1.3l/hr, which supports the conclusion that no advective flow is occurring – even the slightest pressure driven flow would result in consistently positive flow. The variable flow between 0.0l/hr and 1.3l/hr is suggestive of a 'chimney' effect linked to granular material in contact with the response zone of the standpipe. A consideration of the recorded ground conditions identifies that a layer of granular material described as sandy gravel of brick and concrete was encountered between 0.8m and 1.2m, which would support this conclusion.

This granular layer would also result in the consistently high concentrations of gas within WS02. Diffusive flow through granular material occurs much more rapidly than in cohesive material, as the majority of pores in cohesive material are discrete (not interconnected), thus restricting movement along a concentration gradient. When diffusion into a well headspace occurs via permeable material, the headspace rapidly reaches equilibrium with the adjacent interconnected soil pore spaces. When diffusion into a well headspace occurs through impermeable material, it can take weeks to reach equilibrium, and each time the well is opened and dipped it's vented to air so the process must start again.

6.3 Carbon dioxide vs methane

It is notable that within WS02 in the centre of the mass of fill elevated concentrations of methane are combined with elevated concentrations of carbon dioxide, where as further out from the centre methane concentrations reduce to 0.0% (0.8% in WS01 on one occasion) whilst carbon dioxide concentrations remain elevated, although to a lesser extent.

It is known that the bulk gas generation phase of landfill the carbon dioxide:methane ratio is approximately 4:6. The measured concentrations have been combined with the prevalent gases in the atmosphere (oxygen and nitrogen) to make 100% and presented in a ternary plot to identify gases in the approximate range of landfill gas ratio (Figure 13).

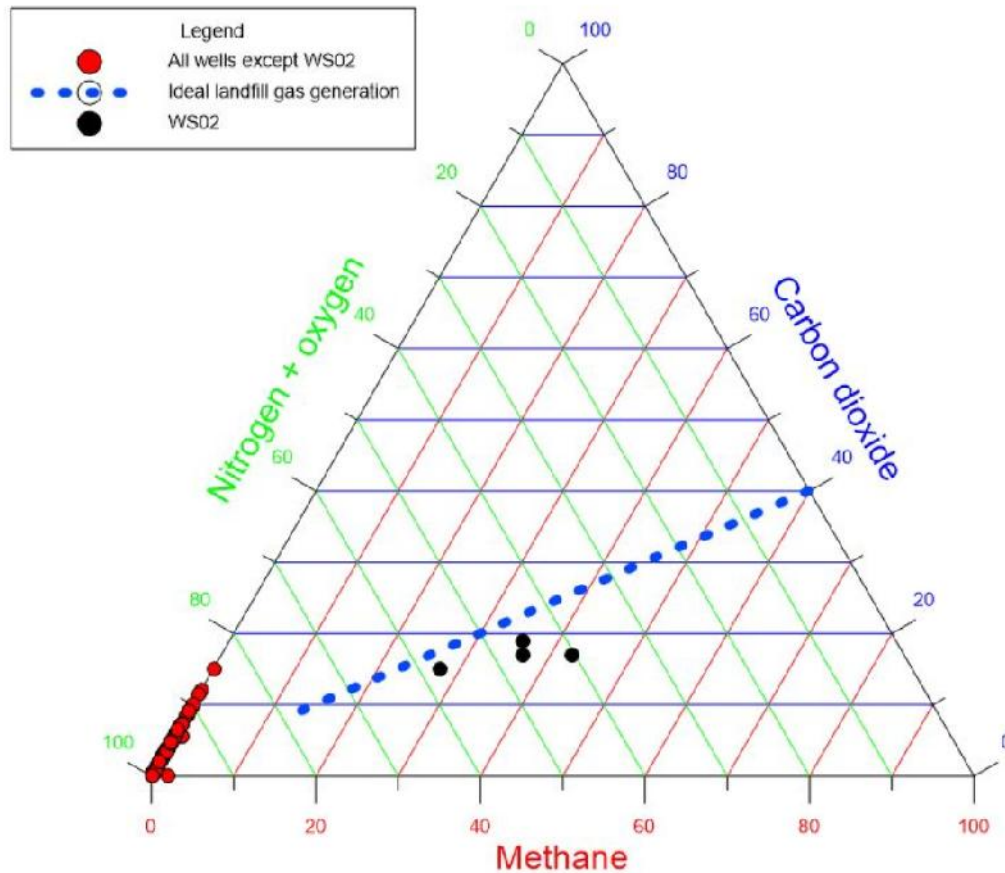


Figure 13: Ternary plot illustrating monitoring results in the context of landfill CO₂:CH₄ ratio

It can be seen that although significantly diluted, the concentrations recorded in WS02 are in the correct ratio to be representative of fresh landfill gas. This supports the conclusion that the centre of the fill is acting as a reservoir for gas generated in the phase of bulk gas generation shortly after the pit was infilled, and that aerobic conditions have not yet returned to this area. It is what is known as an anaerobic hotspot within the fill. The dilution also supports the hypothesis about the migration of gas by diffusion via the permeable layer into the well headspace until equilibrium is reached – the fresh air within the well headspace will create its own diffusive concentration gradient outwards from the response zone, with a resultant dilution of concentrations at equilibrium. It is feasible that within the pore spaces of the cohesive soils concentrations of carbon dioxide and methane are significantly higher than those recorded during monitoring, however these elevated concentrations will never reach the ground surface.

The ternary plot identifies that with the exception of WS02, no monitoring results are within the zone of fresh landfill gas ratios. The results for WS02 show diluted gas that is not in the phase of active gas generation.

6.4 Carbon dioxide

It is notable that even though concentrations of methane elsewhere throughout the infilled pit are recorded as 0.0%, elevated concentrations of carbon dioxide have been recorded in some standpipes. The main source is most likely biological respiration as explained previously. However, this may also be a result of the confluence of diffusive continuums as presented in schematic form in Figure 11 above. The following processes will be occurring in combination:

- Methane and carbon dioxide migrate out from the anaerobic centre of the mass, in all directions along a diffusion gradient;
- Oxygen migrates in towards the centre of the mass, from all directions along a diffusion gradient;
- As oxygen enters previously aerobic areas, it reacts with methane to produce hydrogen (or H_2O) and carbon dioxide, resulting in a reduction in methane and oxygen concentrations and an increase in carbon dioxide concentrations.

The migration occurs very slowly along tortuous paths, which is why many years after the active gas generation phase has ended high concentrations of gas are still present within the soils. Much of the gas will also be sorbed to soil particles or trapped in pore spaces until such time as something ruptures the soil skeleton (for example the excavation of a borehole and the introduction of a standpipe). Once this occurs, a new diffusive continuum will generate incorporating the fresh air (oxygen) introduced by the process. Unless permeable soils are present, the reaching of an equilibrium within the headspace will take place very slowly. In the absence of permeable soils, this will take place so slowly that any methane reaching the headspace will be converted to carbon dioxide by the available oxygen. Hence the elevated carbon dioxide and the coincidental reduction in oxygen concentrations recorded in a number of standpipes.

6.5 Discussion

The site characterisation identified that hazardous gas flow rates based on worse-case monitoring results all indicate that the site is a characteristic situation 1, with the exception of those recorded in WS02. A detailed consideration of the gas regime within the infilled chalk pit has concluded that the elevated methane and carbon dioxide recorded in WS02, combined with the negligible flow rates, are indicative of a reservoir of gas in the centre of the pit, sorbed to soil surfaces or trapped in pore spaces. The extent of the reservoir will continue to decrease with time as oxygen migrates inwards. In the short term, the influx of oxygen will result in a reduction in methane and oxygen and an increase in carbon dioxide concentrations. There is no evidence of advective flow, which is supported by the age and nature of the fill, including the total organic carbon content.

This interpretation of the gas regime indicates that no gas will be released at the soil surface. To explore another line of evidence to support this hypothesis, a surface emissions survey has been undertaken. The results are presented below in Section 7.

7. SURFACE EMISSIONS SURVEY

It is considered that the elevated concentrations of gas recorded in a single standpipe in 2100 are representative of high concentrations of gas stored in soil pores in the centre of the infilled chalk pit. As oxygen migrates inwards, the anaerobic conditions conducive to the continued presence of methane will continue to decrease laterally, resulting in a minor rise in carbon dioxide concentrations in the short-term. No advective flow has been identified, and the recorded concentrations do not translate into equivalent surface emissions.

In order to demonstrate this, a surface emissions survey has been undertaken across the area of the infilled pit. The surface of the site was surveyed on the 21st September 2018, using a TDL500 Laser methane detector connected to a Getac PDA to log surface methane concentrations and GPS locations at three second intervals. It was undertaken on a 5m transect/grid spacing. The results are presented below as a contour plot (Figure 14) and at a larger scale showing the grid points in Appendix B.



Figure 14: Surface emissions survey results

Background levels of methane in the UK vary dependent on location but are widely reported as being 1.7ppm to 1.8ppm. The survey comprised a total of 835 monitoring points, of which 87% were ≤ 1.8 ppm. Of the remaining 13% of readings, the average was 2.0ppm and all can be considered as negligible levels. No concentrations were recorded above 2.2ppm (0.00022%).

The results indicate that there are no significant surface emissions across the infilled pit.

8. DETAILED QUANTITATIVE RISK ASSESSMENT

The ground model schematic for the site, as defined by EPG's preliminary gas risk assessment, is graphically presented in Figure 15.

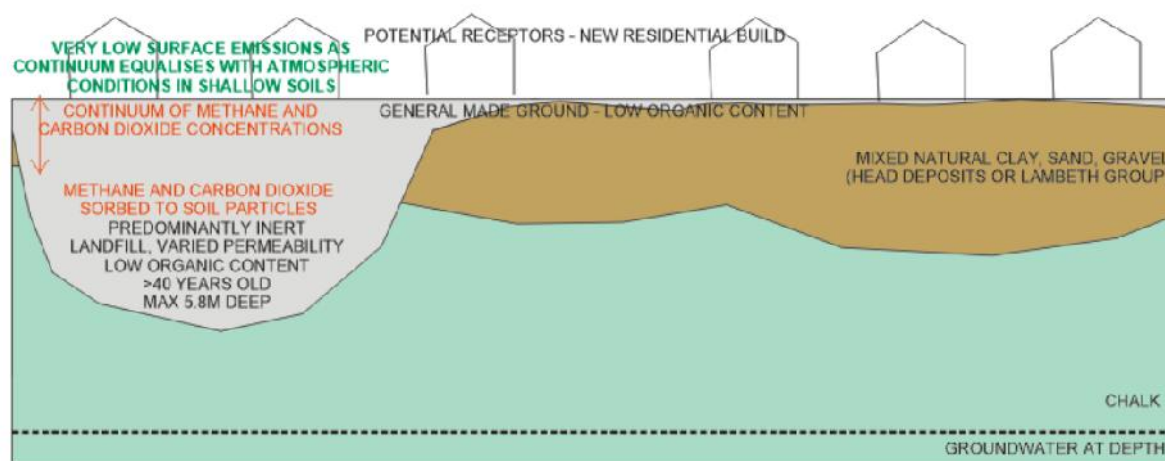


Figure 15: Ground model for Woodcroft Farm

Characteristic situation is defined within BS8485:2015 not only by the calculated HGFR but by additional factors in terms of maximum concentrations and hazard potential – for clarification an extract of the appropriate table from BS8485:2015 is reproduced in Figure 16 below:

Table 2 CS by site characteristic GSV

CS	Hazard potential	Site characteristic GSV ^{A)} L/h	Additional factors
CS1	Very low	<0.07	Typically <1% methane concentration and <5% carbon dioxide concentration (otherwise consider an increase to CS2)
CS2	Low	0.07 to <0.7	Typical measured flow rate <70 L/h (otherwise consider an increase to CS3)
CS3	Moderate	0.7 to <3.5	–
CS4	Moderate to high	3.5 to <15	–
CS5	High	15 to <70	–
CS6	Very high	>70	–

^{A)} The figures used in this column are empirical.

NOTE The CS is equivalent to the characteristic GSV in CIRIA C665 [6].

Figure 16: Extract from table 2, BS8485:2015

The HGFRs are considered along with the other information and a representative value of GSV is chosen for the site. In this instance, based on the 'look up' table, the guidance identifies that the hazard potential is very low to low. However, all current UK guidance recommends professional judgement be applied in determining the actual risk and appropriate mitigation requirements.

When considered in accordance with NHBC guidance⁷, much greater emphasis is placed on concentrations of gas recorded. The maximum calculated HGFR (referred to as GSVs in the NHBC guidance) presented in Table 5 would place the site in the Amber 1/ category, however all the others would be in the green category. The recorded gas concentrations indicate that **consideration** should be given as to whether the site should be characterized as Red. For clarification, an extract of the appropriate table from the NHBC guidance is reproduced in Figure 17 below:

Traffic Light Classification	Methane ¹		Carbon Dioxide ¹	
	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)
Green	1	0.16	5	0.78
Amber 1	5	0.63	10	1.56
Amber 2	20	1.56	30	3.10
Red				

Figure 17: Extract from Table 14.1, NHBC guidance

It can be seen that the maximum recorded methane concentration of 42.5% would place the site in the Red category in accordance with NHBC guidance. However as discussed above the maximum concentration was only present in a single standpipe located in the centre of the infilled pit and is not representative of surface gas emissions, as supported by the results of the surface emission survey.

BS8485:2015 advises that a detailed quantitative assessment of gas emissions should be carried out in appropriate situations, such as where the approach undertaken above suggests an over-conservative assessment of risk. All the lines of evidence presented in the preceding sections indicate that the prevalent migration mechanism of gases across the site is diffusive flow. As such, in order to

⁷ Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present. NHBC, 2007

provide additional decision-making information, modelling of predicted gas flow into the buildings through the floor slab via diffusive flow has been undertaken.

8.1 Assessment of risk - diffusion

Modelling of gas flowing into the proposed development by diffusion has been completed using the method of analysis as described by Wilson⁸. This uses the equations for diffusive flow of gas through the ground and dilution of gas inside a building. The rate of gas flow by diffusion is given by:

$$E = \frac{A_B (C_{source} - C_{g0}) D^{eff}}{L}$$

Where:

A_B = cross sectional area of gas migration pathway

C_{g0} = gas concentration at top of soil

C_{source} = gas concentration in soil

D^{eff} = effective diffusion coefficient of soil (or annulus around pile)

E = rate of mass transfer by diffusion

L = length of migration pathway (depth to source in soil)

The equilibrium methane concentration inside the building (in units of mass per volume) is given by:

$$Q_{building} C_{building} = Q_{entry}$$

Where:

$C_{building}$ = equilibrium concentration of vapour in building under steady state conditions

$Q_{building}$ = flow rate of fresh air into building

Q_{entry} = rate of vapour migration into building

⁸ Land Contamination and Reclamation, 16 (3) *Modular approach to analysing vapour migration into buildings in the UK*. 2008

In this equation Q_{building} has units of volume/time and Q_{entry} has units of mass/time.

The parameters for a residential building have been used as defined in CLEA briefing notes 2 and 3^{9/10}. The parameters used are summarised in Table 6.

Table 6: Summary of parameters for analysis (CLEA default for residential)

Parameter	Value	Comment
Length of building, L	2m	Based on small room within the building as worst case
Width of building, W	2m	
Occupied space height, h	2.4m	Assumed ceiling height from SR3 ¹¹
Internal ventilation air change rate, V	0.5 h ⁻¹	Used to calculate Q_{building}
Depth to source of gas, L	0.5m	Assume gas is present within shallow infill soils, although in reality gas within shallow soils will be diluted by atmospheric ingress.
Air filled porosity of soil, θ_v	0.15	Assume soil through which gas migrates is a Loam. Used to calculate effective diffusion coefficient for soil
Water filled porosity of soil, θ_w	0.36	
Methane concentration in landfill, C_{source}	42.5%v/v	Maximum value recorded
Ambient temperature in the ground, T	10 °C	

The results of the analysis using worse case assumptions (42.5% methane) indicate an equilibrium concentration of methane of 0.028% inside the building. This also ignores the retardation provided by the floor slab construction (it assumes the floors are bare soil) and ignores the effect of any ventilated underfloor void. Therefore, even if gas concentrations in the ground increase to 100%, or the building ventilation reduces to a tenth of the assumed value, the risk from gas migration remains negligible. The results of the modelling are presented in Appendix C.

⁹ CLEA briefing note 2: update on estimating vapour intrusion into buildings. Environment Agency, 2004, version 1.1

¹⁰ CLEA briefing note 3: update of supporting values and assumptions describing UK building stock. Environment Agency, 2004, version 1.1

¹¹ Updated technical background to the CLEA model. Science report: SC050021/SR3. Environment Agency, 2009.

9. CONCLUSIONS AND RECOMMENDATIONS

In summary, the site currently has a negligible gas generation potential. Importantly there is no evidence of material that could cause surface emissions of gas out of the ground in large volumes. There are localised elevated concentrations of methane in the centre of the infilled chalk pit, and carbon dioxide radiating out from the centre, but there is no evidence of advective flow.

All the lines of evidence explored above, including a surface emissions survey, indicate that there is no risk of elevated concentrations of gas reaching the soil surface. To support this, using the highest recorded concentration of methane within diffusion modelling shows that there is negligible risk of gas emissions into the proposed buildings.

In conclusion, it is considered that the site should be designated as NHBC Green, requiring no gas protection measures.

Appendix A

Gas monitoring results

Job Title	Woodcroft Farm, Waterloooville
Job No	21834/030
Date	08/09/2011
Operator	Arie Zamler

CALIBRATION			
	Limits (%)	Cal Gas Start/ End	Air Start/ End
CH4 (5%)	4.5 - 5.5	4.7/4.7	0.0/0.0
CO2 (5%)	4.5 - 5.5	6.1/6.1	0.0/0.0
O2 (6%)	5.0 - 7.0	5.5/5.5	21.2/21.1

Instrument (type/serial no) and date of last manufacturers service	
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Atmospheric Pressure	Time	- 48 hrs	- 24 hrs	0	+ 24 hrs	+ 48 hrs	Comment
	mbar	unknown	1006	1004	1010	1002	

Ground conditions	Firm and dry
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Weather	Overcast and mild
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Borehole identification and construction BH1									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	-1.7	1005	0.0	1.8	12.1	0.0	0.0	DRY	5.18
1 to 2	-0.9		0.0	1.9	11.7	0.0	0.0		
2 to 3	-1.1		0.0	2.0	11.4	0.0	0.0		

Borehole identification and construction BH2									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.2/0.0	1004	0.0	0.7	18.3	0.0	0.0	DRY	7.03
1 to 2			0.0	1.1	17.6	0.0	0.0		
2 to 3			0.0	1.4	16.7	0.0	0.0		

Borehole identification and construction BH3									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.2/0.0	1004	0.0	0.7	16.8	0.0	0.0	6.49	7.02
1 to 2			0.0	0.7	16.5	0.0	0.0		
2 to 3			0.0	1.4	13.6	0.0	0.0		

Borehole identification and construction BH4									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.6/0.2	1004	0.0	1.7	15.9	0.0	0.0	DRY	6.92
1 to 2			0.0	1.9	15.2	0.0	0.0		
2 to 3			0.0	2.0	14.7	0.0	0.0		

Borehole identification and construction WS1									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1004	0.0	3.3	10.8	0.0	0.0	DRY	3.12
1 to 2			0.0	4.1	8.0	0.0	0.0		
2 to 3			0.0	6.0	7.6	0.0	0.0		

Typed By:	Arie Zamler	Date	08/09/2011	Checked By:		Date	
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Borehole identification and construction WS2									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.2/0.0	1004	27.5	15.0	0.0	>>>	0.0	DRY	4.20
1 to 2			26.0	15.0	0.0	>>>	0.0		
2 to 3			25.0	15.0	0.0	>>>	0.0		

Borehole identification and construction WS3									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1004	0.0	5.2	5.5	0.0	0.0	DRY	4.08
1 to 2			0.0	6.0	6.2	0.0	0.0		
2 to 3			0.0	6.1	6.4	0.0	0.0		

Borehole identification and construction WS4									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.1/0.0	1004	0.0	1.4	17.3	0.0	0.0	DRY	3.13
1 to 2			0.0	2.0	17.2	0.0	0.0		
2 to 3			0.0	2.6	17.2	0.0	0.0		

Borehole identification and construction WS5									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.3/0.0	1004	0.0	3.1	15.9	0.0	0.0	DRY	4.08
1 to 2			0.0	3.3	15.9	0.0	0.0		
2 to 3			0.0	3.2	15.9	0.0	0.0		

Borehole identification and construction WS6									
Comment/Condition Not accesable									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1									
1 to 2									
2 to 3									

Borehole identification and construction WS11									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1004	0.0	3.6	14.8	0.0	0.0	DRY	2.74
1 to 2			0.0	3.8	14.7	0.0	0.0		
2 to 3			0.0	3.8	14.7	0.0	0.0		

Typed By:	Arie Zamler	Date	08/09/2011	Checked By:		Date	
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Job Title	Woodcroft Farm, Waterloooville
Job No	21834/030
Date	14/09/2011
Operator	Arie Zamler

CALIBRATION			
	Limits (%)	Cal Gas Start/ End	Air Start/ End
CH4 (5%)	4.5 - 5.5	4.5/4.6	0.0/0.0
CO2 (5%)	4.5 - 5.5	5.4/5.8	0.0/0.0
O2 (6%)	5.0 - 7.0	5.7/5.5	21.3/21.1

Instrument (type/serial no) and date of last manufacturers service	
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Atmospheric Pressure	Time	- 48 hrs	- 24 hrs	0	+ 24 hrs	+ 48 hrs	Comment
	mbar	unknown	1013	1020	1021	1017	Rising pressure

Ground conditions	Firm and dry
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Weather	Sunny and mild
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Borehole identification and construction BH01									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0/0.1	1015	0.0	2.3	12.0	0.0	0.0	DRY	5.18
1 to 2			0.0	2.6	11.1	0.0	0.0		
2 to 3			0.0	2.6	10.7	0.0	0.0		

Borehole identification and construction BH02									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.3/0.0	1013.0	0.0	1.8	15.0	0.0	0.0	DRY	7.03
1 to 2			0.0	1.9	14.8	0.0	0.0		
2 to 3			0.0	1.9	14.5	0.0	0.0		

Borehole identification and construction BH03									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.1/0.0	1013	0.0	1.7	11.2	0.0	0.0	DRY	7.02
1 to 2			0.0	1.7	11.2	0.0	0.0		
2 to 3			0.0	1.7	11.2	0.0	0.0		

Borehole identification and construction BH04									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1015	0.3/0.2	0.0	21.0	6.0	0.0	DRY	6.92
1 to 2			1.0	0.0	21.0	20.0	0.0		
2 to 3			2.0	0.0	21.0	40.0	0.0		

Borehole identification and construction WS01									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0/0.1	1014	0.8/0.7	2.0	13.8	14.0	0.0	DRY	3.13
1 to 2			0.8/0.6	3.0	12.1	13.0	0.0		
2 to 3			0.8/0.7	5.6	6.6	10.0	0.0		

Typed By:	Arie Zamler	Date	Checked By:	Date
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Borehole identification and construction WS02									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.3/0.0	1014	42.5/40.0	17.0/16.0	0.0	>>>	0.0	DRY	4.20
1 to 2			38.0/36.5	16.0	0.0	>>>	0.0		
2 to 3			31.0	13.0	0.0	>>>	0.0		

Borehole identification and construction WS04									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0/0.1	1013	0.0	1.3	17.8	0.0	0.0	DRY	3.12
1 to 2			0.0	1.9	17.6	0.0	0.0		
2 to 3			0.0	2.1	17.6	0.0	0.0		

Borehole identification and construction WS05									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0/0.2	1013	0.0	3.3	15.5	0.0	0.0	DRY	4.1
1 to 2			0.0	3.5	15.4	0.0	0.0		
2 to 3			0.0	3.5	15.3	0.0	0.0		

Borehole identification and construction WS11									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.3/0.0	1013	0.0	4.1	13.8	0.0	0.0	DRY	2.7
1 to 2			0.0	4.3	13.8	0.0	0.0		
2 to 3			0.0	4.3	13.9	0.0	0.0		

Borehole identification and construction Water well									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	-	-	-	-	-	-	-	30.13	-
1 to 2									
2 to 3									

Borehole identification and construction									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1									
1 to 2									
2 to 3									

Typed By:	Arie Zamler	14/09/2011	Date	Checked By:		Date
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Job Title	Woodcroft Farm, Waterloooville
Job No	21834/030
Date	22/09/2011
Operator	Arie Zamler

CALIBRATION			
	Limits (%)	Cal Gas Start/ End	Air Start/ End
CH4 (5%)	4.5 - 5.5	4.5/4.5	0.0/0.0
CO2 (5%)	4.5 - 5.5	5.8/5.7	0.0/0.0
O2 (6%)	5.0 - 7.0	5.6/5.7	21.3/21.1

Instrument (type/serial no) and date of last manufacturers service	
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Atmospheric Pressure	Time	- 48 hrs	- 24 hrs	0	+ 24 hrs	+ 48 hrs	Comment
	mbar	1019	1017	1021	1018	1014	

Ground conditions	Wet after heavy rain in the previous day
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Weather	Overcast and mild
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Borehole identification and construction BH01									
Comment/Condition Cover partially filled with water, water removed.									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	-0.6	1017	0.0	3.8	7.1	0.0	0.0	DRY	5.20
1 to 2			0.0	3.5	7.0	0.0	0.0		
2 to 3			0.0	3.8	6.9	0.0	0.0		

Borehole identification and construction BH02									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1015	0.0	2.4	13.9	0.0	0.0	DRY	7.12
1 to 2			0.0	2.5	13.7	0.0	0.0		
2 to 3				2.5	13.7	0.0	0.0		

Borehole identification and construction BH03									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.2/0.0	1004	0.0	0.7	16.8	0.0	0.0	4.50	7.02
1 to 2			0.0	0.9	16.5	0.0	0.0		
2 to 3			0.0	1.4	13.6	0.0	0.0		

Borehole identification and construction BH04									
Comment/Condition Some water in the cover									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1017	0.0	3.6	6.4	0.0	0.0	DRY	6.92
1 to 2			0.0	3.5	6.4	0.0	0.0		
2 to 3			0.0	3.4	6.4	0.0	0.0		

Borehole identification and construction WS01									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1017	0.0	12.0	0.8	0.0	0.0	DRY	3.12
1 to 2			0.0	12.0	0.8	0.0	0.0		
2 to 3			0.0	12.0	0.8	0.0	0.0		

Typed By:	Arie Zamler	Date	22/09/2011	Checked By:		Date	
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Borehole identification and construction WS02									
Comment/Condition Cover partially full with water.									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1017	36.5	17.0	0.0	>>>	0.0	DRY	4.20
1 to 2			34.5	17.0	0.0	>>>	0.0		
2 to 3			33.0	17.0	0.0	>>>	0.0		

Borehole identification and construction WS03									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1016	0.0	4.5	17.3	0.0	0.0	DRY	4.08
1 to 2			0.0	4.2	17.0	0.0	0.0		
2 to 3			0.0	4.3	17.0	0.0	0.0		

Borehole identification and construction WS04									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1016	0.0	0.8	17.9	0.0	0.0	DRY	3.12
1 to 2			0.0	1.9	17.3	0.0	0.0		
2 to 3			0.0	2.5	17.1	0.0	0.0		

Borehole identification and construction WS05									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1015/1016	0.0	2.0	17.5	0.0	0.0	DRY	4.12
1 to 2			0.0	2.7	17.0	0.0	0.0		
2 to 3			0.0	2.7	16.8	0.0	0.0		

Borehole identification and construction WS11									
Comment/Condition Cover filled with water water is removed.									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.1/0.0	1017	0.0	2.9	14.4	0.0	0.0	DRY	2.73
1 to 2			0.0	3.4	14.1	0.0	0.0		
2 to 3			0.0	3.7	13.8	0.0	0.0		

Borehole identification and construction									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1									
1 to 2									
2 to 3									

Typed By:	Arie Zamler	Date	22/09/2011	Checked By:		Date	
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Job Title	Woodcroft Farm, Waterloooville
Job No	21834/030
Date	28/09/2011
Operator	Arie Zamler

CALIBRATION			
	Limits (%)	Cal Gas Start/ End	Air Start/ End
CH4 (5%)	4.5 - 5.5		
CO2 (5%)	4.5 - 5.5		
O2 (6%)	5.0 - 7.0		

Instrument (type/serial no) and date of last manufacturers service	
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Atmospheric Pressure	Time	- 48 hrs	- 24 hrs	0	+ 24 hrs	+ 48 hrs	Comment
	mbar	1026	1029	1025	1022	1022	Falling pressure

Ground conditions	Firm and dry
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Weather	Sunny and warm
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Borehole identification and construction BH01									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1021	0.0	4.6	8.2	0.0	0.0	DRY	5.18
1 to 2			0.0	4.6	8.0	0.0	0.0		
2 to 3			0.0	4.7	8.1	0.0	0.0		

Borehole identification and construction BH02									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.1/0.0	1021.0	0.0	2.7	14.5	0.0	0.0	DRY	7.03
1 to 2			0.0	2.6	14.4	0.0	0.0		
2 to 3			0.0	2.7	14.5	0.0	0.0		

Borehole identification and construction BH03									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1019	0.0	1.8	8.8	0.0	0.0	4.05	7.02
1 to 2			0.0	1.8	8.7	0.0	0.0		
2 to 3			0.0	1.7	8.7	0.0	0.0		

Borehole identification and construction BH4									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1021	0.0	3.5	8.8	0.0	0.0	DRY	6.92
1 to 2				3.5	8.7	0.0	0.0		
2 to 3				3.6	8.6	0.0	0.0		

Borehole identification and construction WS01									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1021	0.0	15.0	0.8	0.0	0.0	DRY	3.12
1 to 2			0.0	15.0	0.7	0.0	0.0		
2 to 3			0.0	15.0	0.8	0.0	0.0		

Typed By:	Arie Zamler	Date	29/09/2011	Checked By:		Date	
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Borehole identification and construction WS02									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	1.3/0.3	1021	35.5	19.0	0.0	>>>	1.2/1.1	DRY	4.20
1 to 2			34.5	16.0	0.0	>>>	1.1		
2 to 3			32.5	16.0	0.0	>>>	1.1		

Borehole identification and construction WS03									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.5/0.0	1020	0.0	7.5	5.0	0.0	0.0	DRY	4.08
1 to 2				8.1	5.5	0.0	0.0		
2 to 3				8.2	5.7	0.0	0.0		

Borehole identification and construction WS04									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1021	0.0	0.8	17.8	0.0	0.0	DRY	3.14
1 to 2				1.6	17.0	0.0	0.0		
2 to 3				2.0	17.0	0.0	0.0		

Borehole identification and construction WS05									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1021	0.0	2.3	17.3	0.0	0.0	DRY	4.09
1 to 2			0.0	2.5	17.2	0.0	0.0		
2 to 3			0.0	2.4	17.2	0.0	0.0		

Borehole identification and construction WS06									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.0	1021	0.0	5.2	12.0	0.0	0.0	DRY	2.5
1 to 2				6.0	10.0	0.0	0.0		
2 to 3				5.5	10.0	0.0	0.0		

Borehole identification and construction WS11									
Comment/Condition									
Start time with pump time (minutes)	Flow (l/hr) Peak/Steady	Pressure (mb) Peak/Steady	CH4 (%v/v) Peak/Steady	CO2 (%v/v) Peak/Steady	O2 (%v/v) Peak/Steady	CH4 (%LEL) Peak/Steady	H2S (ppm) Peak/Steady	Groundwater Level (mBGL)	Depth to base (mBGL)
0 to 1	0.2/0.1	1021	0.0	5.4	12.6	0.0	0.0	DRY	2.74
1 to 2			0.0	5.4	12.7	0.0	0.0		
2 to 3			0.0	5.3	12.7	0.0	0.0		

Typed By:	Arie Zamler	Date	Checked By:	Date
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IN-SITU GAS MONITORING RESULTS

[Pressures]	Previous	During	Start	End	Equipment Used & Remarks
Round 1	-	-	1013	1015	Ground: Damp + Wind: None + Air Temp: 15DegC
Round 2	-	-	1012	1012	GA2000 + Weather: Sunny + Ground: Damp + Wind: Medium + Air Temp: 14DegC
Round 3	-	-	1014	1014	GA2000 + Weather: Sunny with showers + Ground: Damp + Wind: Light + Air Temp: 15DegC

Exploratory Position ID	Monitoring Round	Measured Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
BH2	1	7.00	19/09/2016 09:55:00	-	-	-	DRY	-	-	-	-	-	-	-	
BH101	1	20.05	19/09/2016 10:04:00	1015	1015	0.1 _(I)	DRY	0.1	0.0	20.8	0.0	0.6	0.0	0.0	
BH101	1	---	15 secs	1015	1015	0.2 _(SS)	-	3.6	0.0	17.6	0.0	-	1.0	0.0	
BH101	1	---	30 secs	1015	1015	-	-	3.6	0.0	15.0	0.0	-	1.0	0.0	
BH101	1	---	60 secs	1015	1015	-	-	3.7	0.0	14.8	0.0	-	1.0	0.0	
BH101	1	---	90 secs	1015	1015	-	-	3.8	0.0	14.7	0.0	-	1.0	0.0	
BH101	1	---	120 secs	1015	1015	-	-	3.8	0.0	14.6	0.0	-	1.0	0.0	
BH101	1	---	180 secs	1015	1015	-	-	3.8	0.0	14.6	0.0	-	1.0	0.0	
BH101	1	---	240 secs	1015	1015	-	-	3.8	0.0	14.5	0.0	-	1.0	0.0	
BH101	1	---	300 secs	1015	1015	-	-	3.8	0.0	14.4	0.0	-	1.0	0.0	
BH101	2	20.00	18/10/2016 12:17:00	-	1012	0.0 _(I)	20.00	0.0	0.0	21.4	0.0	-	-	-	
BH101	2	---	15 secs	-	1012	0.0 _(SS)	-	2.9	0.0	18.5	0.0	-	-	-	
BH101	2	---	30 secs	-	1012	-	-	3.0	0.0	16.9	0.0	-	-	-	
BH101	2	---	60 secs	-	1012	-	-	3.0	0.0	16.7	0.0	-	-	-	
BH101	2	---	90 secs	-	1012	-	-	3.1	0.0	16.7	0.0	-	-	-	
BH101	2	---	120 secs	-	1012	-	-	3.1	0.0	16.6	0.0	-	-	-	
BH101	2	---	180 secs	-	1012	-	-	3.1	0.0	16.5	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:
	<i>R. Speight</i>	26/10/16			28722
	Contract: Woodcroft Farm				Page: 1 of 10 

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
BH101	3	20.00	25/10/2016 14:31:00	-	1014	0.0 _(I)	20.00	0.1	0.0	21.4	0.0	-	-	-	
BH101	3	---	15 secs	-	-	0.0 _(SS)	-	3.5	0.0	17.0	0.0	-	-	-	
BH101	3	---	30 secs	-	-	-	-	3.5	0.0	16.5	0.0	-	-	-	
BH101	3	---	60 secs	-	-	-	-	3.6	0.0	16.4	0.0	-	-	-	
BH101	3	---	90 secs	-	-	-	-	3.6	0.0	16.3	0.0	-	-	-	
BH101	3	---	120 secs	-	-	-	-	3.7	0.0	16.2	0.0	-	-	-	
BH101	3	---	180 secs	-	-	-	-	3.7	0.0	16.2	0.0	-	-	-	
BH102	1	5.20	19/09/2016 10:51:00	1015	1015	0.0 _(I)	DRY	0.2	0.0	20.7	0.0	0.1	0.0	0.0	
BH102	1	---	15 secs	1015	1015	0.0 _(SS)	-	0.4	0.0	20.7	0.0	-	1.0	0.0	
BH102	1	---	30 secs	1015	1015	-	-	0.4	0.0	20.6	0.0	-	4.0	0.0	
BH102	1	---	60 secs	1015	1015	-	-	0.4	0.0	20.6	0.0	-	3.0	0.0	
BH102	1	---	90 secs	1015	1015	-	-	0.5	0.0	20.6	0.0	-	3.0	0.0	
BH102	1	---	120 secs	1015	1015	-	-	0.5	0.0	20.5	0.0	-	2.0	0.0	
BH102	1	---	180 secs	1015	1015	-	-	0.6	0.0	20.5	0.0	-	2.0	0.0	
BH102	1	---	240 secs	1015	1015	-	-	0.8	0.0	20.4	0.0	-	1.0	0.0	
BH102	1	---	300 secs	1015	1015	-	-	1.0	0.0	20.3	0.0	-	1.0	0.0	
BH102	1	---	360 secs	1015	1015	-	-	1.2	0.0	20.2	0.0	-	1.0	0.0	
BH102	1	---	420 secs	1015	1015	-	-	1.3	0.0	20.1	0.0	-	1.0	0.0	
BH102	2	5.21	18/10/2016 11:49:00	-	1012	0.0 _(I)	DRY	0.0	0.0	21.7	0.0	-	-	-	
BH102	2	---	3 secs	-	1012	-	-	0.4	0.0	21.4	0.0	-	-	-	
BH102	2	---	15 secs	-	1012	0.0 _(SS)	-	0.3	0.0	21.6	0.0	-	-	-	
BH102	2	---	60 secs	-	1012	-	-	0.4	0.0	21.4	0.0	-	-	-	
BH102	2	---	90 secs	-	1012	-	-	0.5	0.0	21.4	0.0	-	-	-	
BH102	2	---	120 secs	-	1012	-	-	0.5	0.0	21.3	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:
	<i>R. Speight</i>	26/10/16			28722
	Contract: Woodcroft Farm				Page: 2 of 10 

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
BH102	2	---	180 secs	-	1012	-	-	0.5	0.0	21.3	0.0	-	-	-	
BH102	3	5.21	25/10/2016 14:07:00	-	1014	0.0 _(I)	DRY	0.0	0.0	21.3	0.0	-	-	-	
BH102	3	---	15 secs	-	-	0.0 _(SS)	-	0.3	0.0	21.4	0.0	-	-	-	
BH102	3	---	30 secs	-	-	-	-	0.3	0.0	21.4	0.0	-	-	-	
BH102	3	---	60 secs	-	-	-	-	0.3	0.0	21.4	0.0	-	-	-	
BH102	3	---	90 secs	-	-	-	-	0.3	0.0	21.4	0.0	-	-	-	
BH102	3	---	120 secs	-	-	-	-	0.3	0.0	21.4	0.0	-	-	-	
BH103	1	10.13	19/09/2016 11:17:00	1014	1014	0.0 _(I)	DRY	0.1	0.0	20.9	0.0	0.4	0.0	0.0	
BH103	1	---	15 secs	1014	1014	0.1 _(SS)	-	0.1	0.0	20.8	0.0	-	0.0	0.0	
BH103	1	---	30 secs	1014	1014	-	-	0.1	0.0	20.8	0.0	-	0.0	0.0	
BH103	1	---	60 secs	1014	1014	-	-	0.1	0.0	20.8	0.0	-	0.0	0.0	
BH103	1	---	90 secs	1014	1014	-	-	0.1	0.0	20.8	0.0	-	0.0	0.0	
BH103	1	---	120 secs	1014	1014	-	-	0.1	0.0	20.8	0.0	-	0.0	0.0	
BH103	1	---	180 secs	1014	1014	-	-	0.1	0.0	20.8	0.0	-	0.0	0.0	
BH103	1	---	240 secs	1014	1014	-	-	0.1	0.0	20.7	0.0	-	0.0	0.0	
BH103	1	---	300 secs	1014	1014	-	-	0.1	0.0	20.7	0.0	-	0.0	0.0	
BH103	2	10.08	18/10/2016 12:51:00	-	1012	0.0 _(I)	DRY	0.1	0.0	21.1	0.0	-	-	-	
BH103	2	---	15 secs	-	1012	0.0 _(SS)	-	0.5	0.0	20.9	0.0	-	-	-	
BH103	2	---	30 secs	-	1012	-	-	0.6	0.0	20.4	0.0	-	-	-	
BH103	2	---	60 secs	-	1012	-	-	0.6	0.0	20.4	0.0	-	-	-	
BH103	2	---	90 secs	-	1012	-	-	0.6	0.0	20.4	0.0	-	-	-	
BH103	2	---	120 secs	-	1012	-	-	0.6	0.0	20.4	0.0	-	-	-	
BH103	3	10.08	25/10/2016 14:58:00	-	1014	0.0 _(I)	DRY	0.1	0.0	21.3	0.0	-	-	-	
BH103	3	---	15 secs	-	-	0.0 _(SS)	-	1.2	0.0	20.6	0.0	-	-	-	

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	Monitoring Round	Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
BH103	3	---	30 secs	-	-	-	-	1.2	0.0	20.4	0.0	-	-	-	
BH103	3	---	60 secs	-	-	-	-	1.2	0.0	20.3	0.0	-	-	-	
BH103	3	---	90 secs	-	-	-	-	1.3	0.0	20.3	0.0	-	-	-	
BH103	3	---	120 secs	-	-	-	-	1.3	0.0	20.3	0.0	-	-	-	
BH103	3	---	180 secs	-	-	-	-	1.3	0.0	20.3	0.0	-	-	-	
WS101	1	2.83	19/09/2016 10:20:00	1015	1015	0.1 _(I)	DRY	0.1	0.0	20.9	0.0	0.2	0.0	0.0	
WS101	1	---	15 secs	1015	1015	0.2 _(SS)	-	2.4	0.0	19.9	0.0	-	1.0	0.0	
WS101	1	---	30 secs	1015	1015	-	-	2.8	0.0	18.7	0.0	-	0.0	0.0	
WS101	1	---	60 secs	1015	1015	-	-	3.0	0.0	18.5	0.0	-	0.0	0.0	
WS101	1	---	90 secs	1015	1015	-	-	3.0	0.0	18.5	0.0	-	0.0	0.0	
WS101	1	---	120 secs	1015	1015	-	-	3.0	0.0	18.5	0.0	-	0.0	0.0	
WS101	1	---	180 secs	1015	1015	-	-	3.2	0.0	18.4	0.0	-	0.0	0.0	
WS101	1	---	240 secs	1015	1015	-	-	3.3	0.0	18.4	0.0	-	0.0	0.0	
WS101	1	---	300 secs	1015	1015	-	-	3.4	0.0	18.3	0.0	-	0.0	0.0	
WS101	2	---	18/10/2016 12:09:00	-	1012	0.0 _(I)	-	0.0	0.0	21.1	0.0	-	-	-	
WS101	2	2.74	15 secs	-	1012	0.0 _(SS)	DRY	2.8	0.0	19.8	0.0	-	-	-	
WS101	2	---	30 secs	-	1012	-	-	2.9	0.0	19.4	0.0	-	-	-	
WS101	2	---	60 secs	-	1012	-	-	2.9	0.0	19.4	0.0	-	-	-	
WS101	2	---	90 secs	-	1012	-	-	3.0	0.0	19.3	0.0	-	-	-	
WS101	2	---	120 secs	-	1012	-	-	3.1	0.0	19.2	0.0	-	-	-	
WS101	2	---	180 secs	-	1012	-	-	3.5	0.0	19.1	0.0	-	-	-	
WS101	3	2.74	25/10/2016 14:23:00	-	1014	0.0 _(I)	DRY	0.0	0.0	21.5	0.0	-	-	-	
WS101	3	---	15 secs	-	-	0.0 _(SS)	-	2.2	0.0	20.3	0.0	-	-	-	
WS101	3	---	30 secs	-	-	-	-	2.5	0.0	20.1	0.0	-	-	-	

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	Monitoring Round	Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
WS101	3	---	60 secs	-	-	-	-	2.5	0.0	20.1	0.0	-	-	-	
WS101	3	---	90 secs	-	-	-	-	2.5	0.0	20.0	0.0	-	-	-	
WS101	3	---	120 secs	-	-	-	-	2.6	0.0	20.0	0.0	-	-	-	
WS101	3	---	180 secs	-	-	-	-	2.9	0.0	19.8	0.0	-	-	-	
WS102	1	3.05	19/09/2016 12:02:00	1015	1015	0.0 _(I)	DRY	0.1	0.0	20.8	0.0	0.3	0.0	0.0	
WS102	1	---	15 secs	1015	1015	0.0 _(SS)	-	0.1	0.0	20.8	0.0	-	3.0	0.0	
WS102	1	---	30 secs	1015	1015	-	-	0.1	0.0	20.7	0.0	-	3.0	0.0	
WS102	1	---	60 secs	1015	1015	-	-	0.2	0.0	20.2	0.0	-	2.0	0.0	
WS102	1	---	90 secs	1015	1015	-	-	1.0	0.0	18.4	0.0	-	1.0	0.0	
WS102	1	---	120 secs	1015	1015	-	-	2.8	0.0	14.4	0.0	-	0.0	0.0	
WS102	1	---	180 secs	1015	1015	-	-	6.4	0.0	7.6	0.0	-	0.0	0.0	
WS102	1	---	240 secs	1015	1015	-	-	7.6	0.0	6.3	0.0	-	0.0	0.0	
WS102	1	---	300 secs	1015	1015	-	-	8.0	0.0	5.8	0.0	-	0.0	0.0	
WS102	1	---	360 secs	1015	1015	-	-	8.2	0.0	5.5	0.0	-	0.0	0.0	
WS102	1	---	420 secs	1015	1015	-	-	8.4	0.0	5.3	0.0	-	0.0	0.0	
WS102	1	---	480 secs	1015	1015	-	-	8.5	0.0	5.2	0.0	-	0.0	0.0	
WS102	2	2.94	18/10/2016 11:57:00	-	1012	-0.1 _(I)	DRY	0.1	0.0	21.7	0.0	-	-	-	
WS102	2	---	15 secs	-	1012	0.0 _(SS)	-	7.1	0.0	6.3	0.0	-	-	-	
WS102	2	---	30 secs	-	1012	-	-	7.3	0.0	3.8	0.0	-	-	-	
WS102	2	---	60 secs	-	1012	-	-	7.4	0.0	3.4	0.0	-	-	-	
WS102	2	---	90 secs	-	1012	-	-	7.5	0.0	3.3	0.0	-	-	-	
WS102	2	---	120 secs	-	1012	-	-	7.5	0.0	3.4	0.0	-	-	-	
WS102	2	---	180 secs	-	1012	-	-	8.4	0.0	3.5	0.0	-	-	-	
WS102	2	---	240 secs	-	1012	-	-	9.5	0.0	3.6	0.0	-	-	-	

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	Monitoring Round	Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
WS102	2	---	300 secs	-	1012	-	-	9.9	0.0	3.6	0.0	-	-	-	
WS102	2	---	330 secs	-	1012	-	-	9.9	0.0	3.5	0.0	-	-	-	
WS102	3	3.03	25/10/2016 14:14:00	-	1014	0.0 _(I)	DRY	0.1	0.0	21.8	0.0	-	-	-	
WS102	3	---	15 secs	-	-	0.0 _(SS)	-	5.7	0.0	8.5	0.0	-	-	-	
WS102	3	---	30 secs	-	-	-	-	6.0	0.0	3.5	0.0	-	-	-	
WS102	3	---	60 secs	-	-	-	-	6.0	0.0	3.1	0.0	-	-	-	
WS102	3	---	90 secs	-	-	-	-	5.8	0.0	3.0	0.0	-	-	-	
WS102	3	---	120 secs	-	-	-	-	5.6	0.0	2.9	0.0	-	-	-	
WS102	3	---	180 secs	-	-	-	-	6.0	0.0	3.0	0.0	-	-	-	
WS103	1	2.81	19/09/2016 10:40:00	1015	1015	0.0 _(I)	DRY	0.2	0.0	20.8	0.0	-	0.0	0.0	
WS103	1	---	15 secs	1015	1015	0.0 _(SS)	-	8.0	0.0	14.8	0.0	-	3.0	0.0	
WS103	1	---	30 secs	1015	1015	-	-	8.5	0.0	10.7	0.0	-	1.0	0.0	
WS103	1	---	60 secs	1015	1015	-	-	8.7	0.0	10.4	0.0	-	0.0	0.0	
WS103	1	---	90 secs	1015	1015	-	-	8.6	0.0	10.7	0.0	-	0.0	0.0	
WS103	1	---	120 secs	1015	1015	-	-	8.5	0.0	11.1	0.0	-	0.0	0.0	
WS103	1	---	180 secs	1015	1015	-	-	8.4	0.0	11.3	0.0	-	0.0	0.0	
WS103	1	---	240 secs	1015	1015	-	-	8.4	0.0	11.3	0.0	-	0.0	0.0	
WS103	1	---	300 secs	1015	1015	-	-	8.4	0.0	11.3	0.0	-	0.0	0.0	
WS103	2	2.75	18/10/2016 11:41:00	-	1012	0.0 _(I)	DRY	0.0	0.0	21.5	0.0	-	-	-	
WS103	2	---	15 secs	-	1012	0.0 _(SS)	-	0.8	0.0	14.4	0.0	-	-	-	
WS103	2	---	30 secs	-	1012	-	-	7.1	0.0	12.8	0.0	-	-	-	
WS103	2	---	60 secs	-	1012	-	-	7.1	0.0	12.6	0.0	-	-	-	
WS103	2	---	90 secs	-	1012	-	-	7.1	0.0	12.4	0.0	-	-	-	
WS103	2	---	120 secs	-	1012	-	-	7.1	0.0	12.4	0.0	-	-	-	

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IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
WS103	2	---	180 secs	-	1012	-	-	7.2	0.0	12.5	0.0	-	-	-	
WS103	3	2.75	25/10/2016 14:00:00	-	1014	0.0 _(I)	DRY	0.0	0.0	20.9	0.0	-	-	-	
WS103	3	---	15 secs	-	-	0.0 _(SS)	-	6.8	0.0	15.2	0.0	-	-	-	
WS103	3	---	30 secs	-	-	-	-	7.0	0.0	14.7	0.0	-	-	-	
WS103	3	---	60 secs	-	-	-	-	7.0	0.0	14.7	0.0	-	-	-	
WS103	3	---	90 secs	-	-	-	-	7.0	0.0	14.7	0.0	-	-	-	
WS103	3	---	120 secs	-	-	-	-	7.0	0.0	14.7	0.0	-	-	-	
WS108	1	2.89	19/09/2016 09:29:00	1013	1013	0.0 _(I)	DRY	0.2	0.0	20.9	0.0	0.2	0.0	0.0	
WS108	1	---	15 secs	1013	1013	0.0 _(SS)	-	2.2	0.0	19.7	0.0	-	2.0	0.0	
WS108	1	---	30 secs	1013	1013	-	-	2.2	0.0	18.8	0.0	-	0.0	0.0	
WS108	1	---	60 secs	1013	1013	-	-	2.2	0.0	18.8	0.0	-	0.0	0.0	
WS108	1	---	90 secs	1013	1013	-	-	2.2	0.0	18.9	0.0	-	0.0	0.0	
WS108	1	---	120 secs	1013	1013	-	-	2.0	0.0	19.2	0.0	-	0.0	0.0	
WS108	1	---	180 secs	1013	1013	-	-	1.8	0.0	19.5	0.0	-	0.0	0.0	
WS108	1	---	240 secs	1013	1013	-	-	1.6	0.0	19.6	0.0	-	0.0	0.0	
WS108	1	---	300 secs	1013	1013	-	-	1.6	0.0	19.6	0.0	-	0.0	0.0	
WS108	2	2.92	18/10/2016 12:31:00	-	1012	0.0 _(I)	DRY	0.0	0.0	20.8	0.0	-	-	-	
WS108	2	---	15 secs	-	1012	0.0 _(SS)	-	3.1	0.0	18.5	0.0	-	-	-	
WS108	2	---	30 secs	-	1012	-	-	3.4	0.0	17.0	0.0	-	-	-	
WS108	2	---	60 secs	-	1012	-	-	3.4	0.0	17.1	0.0	-	-	-	
WS108	2	---	90 secs	-	1012	-	-	3.2	0.0	17.4	0.0	-	-	-	
WS108	2	---	120 secs	-	1012	-	-	2.9	0.0	18.0	0.0	-	-	-	
WS108	2	---	180 secs	-	1012	-	-	2.5	0.0	18.5	0.0	-	-	-	
WS108	3	2.94	25/10/2016 14:41:00	-	1014	0.0 _(I)	DRY	0.1	0.0	20.8	0.0	-	-	-	

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 RSK Environment Ltd 18 Frogmore Road Hemel Hempstead Hertfordshire HP3 9RT	Compiled By	Date	Checked By	Date	Contract Ref:
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IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
WS108	3	---	15 secs	-	-	0.0 _(SS)	-	2.0	0.0	20.7	0.0	-	-	-	
WS108	3	---	30 secs	-	-	-	-	2.1	0.0	20.4	0.0	-	-	-	
WS108	3	---	60 secs	-	-	-	-	2.0	0.0	20.4	0.0	-	-	-	
WS108	3	---	90 secs	-	-	-	-	2.0	0.0	20.4	0.0	-	-	-	
WS108	3	---	120 secs	-	-	-	-	1.9	0.0	20.4	0.0	-	-	-	
WS108	3	---	180 secs	-	-	-	-	1.9	0.0	20.4	0.0	-	-	-	
WS112	1	2.84	19/09/2016 09:10:00	1013	1013	0.1 _(I)	DRY	0.1	0.0	20.9	0.0	0.5	0.0	0.0	
WS112	1	---	15 secs	1013	1013	0.2 _(SS)	-	2.4	0.0	20.1	0.0	-	3.0	0.0	
WS112	1	---	30 secs	1013	1013	-	-	2.4	0.0	19.3	0.0	-	0.0	0.0	
WS112	1	---	60 secs	1013	1013	-	-	2.5	0.0	19.2	0.0	-	0.0	0.0	
WS112	1	---	90 secs	1013	1013	-	-	2.6	0.0	19.1	0.0	-	0.0	0.0	
WS112	1	---	120 secs	1013	1013	-	-	2.6	0.0	19.1	0.0	-	0.0	0.0	
WS112	1	---	180 secs	1013	1013	-	-	2.3	0.0	19.2	0.0	-	0.0	0.0	
WS112	1	---	240 secs	1013	1013	-	-	1.8	0.0	19.6	0.0	-	0.0	0.0	
WS112	1	---	300 secs	1013	1013	-	-	1.4	0.0	20.0	0.0	-	0.0	0.0	
WS112	1	---	360 secs	1013	1013	-	-	1.2	0.0	20.1	0.0	-	0.0	0.0	
WS112	1	---	420 secs	1013	1013	-	-	1.1	0.0	20.3	0.0	-	0.0	0.0	
WS112	1	---	480 secs	1013	1013	-	-	1.0	0.0	20.3	0.0	-	0.0	0.0	
WS112	2	2.72	18/10/2016 12:40:00	-	1012	0.0 _(I)	2.55	0.0	0.0	20.8	0.0	-	-	-	
WS112	2	---	15 secs	-	1012	0.0 _(SS)	-	0.1	0.0	20.8	0.0	-	-	-	
WS112	2	---	30 secs	-	1012	-	-	0.3	0.0	20.7	0.0	-	-	-	
WS112	2	---	60 secs	-	1012	-	-	0.5	0.0	20.6	0.0	-	-	-	
WS112	2	---	90 secs	-	1012	-	-	0.7	0.0	20.5	0.0	-	-	-	
WS112	2	---	120 secs	-	1012	-	-	0.9	0.0	20.4	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:
	<i>R. Speight</i>	26/10/16			28722
	Contract: Woodcroft Farm				Page: 8 of 10 

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
WS112	2	---	180 secs	-	1012	-	-	1.0	0.0	20.4	0.0	-	-	-	
WS112	3	2.72	25/10/2016 14:50:00	-	1014	0.0 _(I)	2.41	0.1	0.0	21.5	0.0	-	-	-	
WS112	3	---	15 secs	-	-	0.0 _(SS)	-	1.6	0.0	20.8	0.0	-	-	-	
WS112	3	---	30 secs	-	-	-	-	1.6	0.0	20.6	0.0	-	-	-	
WS112	3	---	60 secs	-	-	-	-	1.6	0.0	20.6	0.0	-	-	-	
WS112	3	---	90 secs	-	-	-	-	1.6	0.0	20.6	0.0	-	-	-	
WS112	3	---	120 secs	-	-	-	-	1.6	0.0	20.6	0.0	-	-	-	
WS113	1	2.88	19/09/2016 08:50:00	1013	1013	0.0 _(I)	1.28	0.1	0.0	20.8	0.0	0.2	0.0	0.0	
WS113	1	---	15 secs	1013	1013	0.0 _(SS)	-	1.3	0.0	20.5	0.0	-	1.0	0.0	
WS113	1	---	30 secs	1013	1013	-	-	1.3	0.0	20.0	0.0	-	0.0	0.0	
WS113	1	---	60 secs	1013	1013	-	-	1.6	0.0	19.8	0.0	-	0.0	0.0	
WS113	1	---	90 secs	1013	1013	-	-	1.9	0.0	19.5	0.0	-	0.0	0.0	
WS113	1	---	120 secs	1013	1013	-	-	2.3	0.0	19.3	0.0	-	0.0	0.0	
WS113	1	---	180 secs	1013	1013	-	-	2.3	0.0	19.2	0.0	-	0.0	0.0	
WS113	1	---	240 secs	1013	1013	-	-	2.3	0.0	19.1	0.0	-	0.0	0.0	
WS113	1	---	300 secs	1013	1013	-	-	2.2	0.0	19.2	0.0	-	0.0	0.0	
WS113	2	2.87	18/10/2016 12:58:00	-	1012	0.0 _(I)	1.26	0.0	0.0	21.0	0.0	-	-	-	
WS113	2	---	15 secs	-	1012	0.0 _(SS)	-	1.7	0.0	20.7	0.0	-	-	-	
WS113	2	---	30 secs	-	1012	-	-	1.7	0.0	19.9	0.0	-	-	-	
WS113	2	---	60 secs	-	1012	-	-	1.7	0.0	19.9	0.0	-	-	-	
WS113	2	---	90 secs	-	1012	-	-	1.7	0.0	19.9	0.0	-	-	-	
WS113	2	---	120 secs	-	1012	-	-	1.7	0.0	19.9	0.0	-	-	-	
WS113	3	2.87	25/10/2016 15:06:00	-	1014	0.0 _(I)	1.35	0.1	0.0	21.2	0.0	-	-	-	
WS113	3	---	15 secs	-	-	0.0 _(SS)	-	1.7	0.0	20.7	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:
	<i>R. Speight</i>	26/10/16			28722
	Contract: Woodcroft Farm				Page: 9 of 10 

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	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)	Hydrogen Sulphide (ppm)	
WS113	3	---	30 secs	-	-	-	-	1.8	0.0	20.2	0.0	-	-	-	
WS113	3	---	60 secs	-	-	-	-	1.8	0.0	20.2	0.0	-	-	-	
WS113	3	---	90 secs	-	-	-	-	1.8	0.0	20.2	0.0	-	-	-	
WS113	3	---	120 secs	-	-	-	-	1.8	0.0	20.2	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:
	<i>R. Speight</i>	26/10/16			28722
Contract: Woodcroft Farm					Page: 10 of 10 

Project: Woodcroft Farm - Remediation
 Ref: GE16943
 Client: Grainger PLC



Location	Date	Time (sec)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH ₄	CO ₂	BS8485 & C665		Flow	CH ₄	CO ₂	CH ₄		CO ₂	
												CH ₄	CO ₂				GSV	Conc.	GSV	Conc.
WS401	30/05/18	0	0.0	0.0	20.8	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	30/05/18	10	0.0	4.4	15.5	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	30/05/18	20	0.0	4.5	13.9	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	30/05/18	30	0.0	4.5	14.9	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	30/05/18	60	0.0	4.0	16.0	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	30/05/18	90	0.0	3.3	16.9	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	30/05/18	120	0.0	3.3	17.3	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	30/05/18	180	0.0	3.1	17.3	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	30/05/18	0	0.0	0.0	20.8	0.0	0.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	30/05/18	10	0.0	1.5	18.0	0.0	0.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	30/05/18	20	0.0	2.0	16.8	0.0	0.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	30/05/18	30	0.0	1.9	16.9	0.0	0.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	30/05/18	60	0.0	1.7	17.2	0.0	0.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	30/05/18	90	0.0	1.5	17.4	0.0	0.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	30/05/18	120	0.0	1.4	17.6	0.0	0.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	30/05/18	180	0.0	0.4	19.2	0.0	0.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	30/05/18	0	0.0	0.0	20.8	0.0	0.6	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	30/05/18	10	0.0	3.7	14.8	0.0	0.6	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	30/05/18	20	0.0	4.1	13.8	0.0	0.6	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	30/05/18	30	0.0	4.2	13.3	0.0	0.6	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	30/05/18	60	0.0	4.2	13.2	0.0	0.6	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	30/05/18	90	0.0	4.1	13.4	0.0	0.6	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	30/05/18	120	0.0	4.1	13.4	0.0	0.6	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	30/05/18	180	0.0	4.1	13.4	0.0	0.6	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	30/05/18	0	0.0	0.0	20.8	0.0	2.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	30/05/18	10	0.0	0.0	20.1	0.0	2.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	30/05/18	20	0.0	0.1	20.0	0.0	2.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	30/05/18	30	0.0	0.1	20.0	0.0	2.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	30/05/18	60	0.0	0.0	20.1	0.0	2.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	30/05/18	90	0.0	0.0	20.1	0.0	2.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	30/05/18	120	0.0	0.0	20.2	0.0	2.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	30/05/18	180	0.0	0.0	20.2	0.0	2.5	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	30/05/18	0	0.0	0.0	20.8	0.0	0.0	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	30/05/18	10	0.0	2.5	14.6	0.0	0.0	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	30/05/18	20	0.0	3.3	11.9	0.0	0.0	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	30/05/18	30	0.0	3.8	11.1	0.0	0.0	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	30/05/18	60	0.0	5.0	9.7	0.0	0.0	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	AMBER 1
WS405	30/05/18	90	0.0	6.2	8.5	0.0	0.0	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS405	30/05/18	120	0.0	6.4	8.2	0.0	0.0	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS405	30/05/18	180	0.0	6.4	8.2	0.0	0.0	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS406	30/05/18	0	0.0	0.0	20.8	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	30/05/18	10	0.0	0.5	19.1	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	30/05/18	20	0.0	0.6	18.6	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	30/05/18	30	0.0	0.6	18.5	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	30/05/18	60	0.0	0.6	18.5	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	30/05/18	90	0.0	0.6	18.4	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN

Project: Woodcroft Farm - Remediation
 Ref: GE16943
 Client: Grainger PLC



Location	Date	Time (sec)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH ₄	CO ₂	BS8485 & C665		Flow	CH ₄	CO ₂	CH ₄		CO ₂	
												CH ₄	CO ₂				GSV	Conc.	GSV	Conc.
WS406	30/05/18	120	0.0	0.7	18.2	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	30/05/18	180	0.0	0.7	18.2	0.0	0.3	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	30/05/18	0	0.0	0.0	20.8	0.0	0.1	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	30/05/18	10	0.0	0.0	18.0	0.0	0.1	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	30/05/18	20	0.0	0.0	18.0	0.0	0.1	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	30/05/18	30	0.0	0.0	17.9	0.0	0.1	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	30/05/18	60	0.0	0.0	17.1	0.0	0.1	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	30/05/18	90	0.0	1.7	15.0	0.0	0.1	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	30/05/18	120	0.0	3.2	13.4	0.0	0.1	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	30/05/18	180	0.0	3.4	13.5	0.0	0.1	1004	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	06/06/18	0	0.0	0.0	20.9	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	06/06/18	10	0.0	2.1	18.1	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	06/06/18	20	0.0	3.0	17.0	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	06/06/18	30	0.0	3.3	16.2	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	06/06/18	60	0.0	6.4	11.5	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	06/06/18	90	0.0	6.7	11.1	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	06/06/18	120	0.0	6.7	11.1	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	06/06/18	180	0.0	6.9	11.0	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	06/06/18	0	0.0	0.0	20.9	0.0	0.5	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/06/18	10	0.0	0.4	19.9	0.0	0.5	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/06/18	20	0.0	0.5	19.5	0.0	0.5	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/06/18	30	0.0	0.7	18.9	0.0	0.5	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/06/18	60	0.0	1.0	17.7	0.0	0.5	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/06/18	90	0.0	4.0	12.1	0.0	0.5	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/06/18	120	0.0	4.6	10.7	0.0	0.5	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/06/18	180	0.0	4.7	10.7	0.0	0.5	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/06/18	0	0.0	0.0	20.9	0.0	1.7	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/06/18	10	0.0	0.3	20.1	0.0	1.7	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/06/18	20	0.0	0.3	20.1	0.0	1.7	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/06/18	30	0.0	0.3	20.1	0.0	1.7	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/06/18	60	0.0	0.3	19.5	0.0	1.7	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/06/18	90	0.0	0.3	19.5	0.0	1.7	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/06/18	120	0.0	0.3	19.5	0.0	1.7	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/06/18	180	0.0	0.3	19.5	0.0	1.7	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/06/18	0	0.0	0.0	20.9	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/06/18	10	0.0	6.0	12.0	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS405	06/06/18	20	0.0	11.2	1.8	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2
WS405	06/06/18	30	0.0	11.4	1.7	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2
WS405	06/06/18	60	0.0	11.5	1.7	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2
WS405	06/06/18	90	0.0	11.5	1.7	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2
WS405	06/06/18	120	0.0	11.5	1.8	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2
WS405	06/06/18	180	0.0	11.5	1.8	0.0	0.2	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2
WS406	06/06/18	0	0.0	0.0	20.9	0.0	0.1	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/06/18	10	0.0	0.0	20.5	0.0	0.1	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/06/18	20	0.0	0.0	20.5	0.0	0.1	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/06/18	30	0.0	0.0	20.4	0.0	0.1	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN

Project: Woodcroft Farm - Remediation
Ref: GE16943
Client: Grainger PLC



Location	Date	Time (sec)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH ₄	CO ₂	BS8485 & C665		Flow	CH ₄	CO ₂	CH ₄		CO ₂	
												CH ₄	CO ₂				GSV	Conc.	GSV	Conc.
WS406	06/06/18	60	0.0	0.1	20.3	0.0	0.1	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/06/18	90	0.0	0.1	20.3	0.0	0.1	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/06/18	120	0.0	0.1	20.3	0.0	0.1	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/06/18	180	0.0	0.1	20.3	0.0	0.1	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	06/06/18	0	0.0	0.0	20.9	0.0	0.0	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	06/06/18	10	0.0	8.5	12.4	0.0	0.0	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	06/06/18	20	0.0	9.4	10.7	0.0	0.0	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	06/06/18	30	0.0	9.5	10.5	0.0	0.0	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	06/06/18	60	0.0	9.7	10.4	0.0	0.0	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	06/06/18	90	0.0	9.8	10.4	0.0	0.0	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	06/06/18	120	0.0	10.1	10.3	0.0	0.0	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2
WS407	06/06/18	180	0.0	10.1	10.3	0.0	0.0	1005	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2
WS401	20/06/18	0	0.0	0.0	20.9	0.0	1.1	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	20/06/18	10	0.0	4.5	16.2	0.0	1.1	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	20/06/18	20	0.0	4.6	15.6	0.0	1.1	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	20/06/18	30	0.0	4.8	15.1	0.0	1.1	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	20/06/18	60	0.0	5.2	14.0	0.0	1.1	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	20/06/18	90	0.0	6.3	12.4	0.0	1.1	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	20/06/18	120	0.0	7.0	10.8	0.0	1.1	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	20/06/18	180	0.0	7.3	10.2	0.0	1.1	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	20/06/18	0	0.0	0.0	20.9	0.0	0.3	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	20/06/18	10	0.0	3.0	17.7	0.0	0.3	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	20/06/18	20	0.0	3.2	17.3	0.0	0.3	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	20/06/18	30	0.0	3.3	17.0	0.0	0.3	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	20/06/18	60	0.0	3.4	16.6	0.0	0.3	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	20/06/18	90	0.0	5.8	12.0	0.0	0.3	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	20/06/18	120	0.0	6.4	10.6	0.0	0.3	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	20/06/18	180	0.0	7.0	9.8	0.0	0.3	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS403	20/06/18	0	0.0	0.0	20.9	0.0	1.8	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	20/06/18	10	0.0	4.6	16.4	0.0	1.8	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	20/06/18	20	0.0	4.9	15.8	0.0	1.8	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	20/06/18	30	0.0	5.0	15.8	0.0	1.8	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	AMBER 1
WS403	20/06/18	60	0.0	5.0	15.7	0.0	1.8	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	AMBER 1
WS403	20/06/18	90	0.0	5.1	15.7	0.0	1.8	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS403	20/06/18	120	0.0	5.1	15.8	0.0	1.8	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS403	20/06/18	180	0.0	5.2	15.7	0.0	1.8	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS404	20/06/18	0	0.0	0.0	20.9	0.0	1.6	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	20/06/18	10	0.0	0.5	19.6	0.0	1.6	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	20/06/18	20	0.0	0.6	19.3	0.0	1.6	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	20/06/18	30	0.0	0.6	18.6	0.0	1.6	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	20/06/18	60	0.0	0.6	18.3	0.0	1.6	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	20/06/18	90	0.0	0.6	18.2	0.0	1.6	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	20/06/18	120	0.0	0.6	18.2	0.0	1.6	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	20/06/18	180	0.0	0.7	18.2	0.0	1.6	1011	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	20/06/18	0	0.0	0.0	20.9	0.0	0.3	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	20/06/18	10	0.0	2.9	16.5	0.0	0.3	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN

Project: Woodcroft Farm - Remediation
Ref: GE16943
Client: Grainger PLC



Location	Date	Time (sec)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH ₄	CO ₂	BS8485 & C665		Flow	CH ₄	CO ₂	CH ₄		CO ₂	
												CH ₄	CO ₂				GSV	Conc.	GSV	Conc.
WS405	20/06/18	20	0.0	3.0	16.2	0.0	0.3	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	20/06/18	30	0.0	3.1	16.1	0.0	0.3	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	20/06/18	60	0.0	3.2	15.8	0.0	0.3	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	20/06/18	90	0.0	3.4	15.5	0.0	0.3	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	20/06/18	120	0.0	3.5	15.2	0.0	0.3	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	20/06/18	180	0.0	3.6	14.9	0.0	0.3	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	20/06/18	0	0.0	0.0	20.9	0.0	0.0	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	20/06/18	10	0.0	1.8	19.3	0.0	0.0	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	20/06/18	20	0.0	1.8	19.3	0.0	0.0	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	20/06/18	30	0.0	1.8	19.2	0.0	0.0	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	20/06/18	60	0.0	1.9	19.1	0.0	0.0	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	20/06/18	90	0.0	2.0	18.0	0.0	0.0	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	20/06/18	120	0.0	2.0	18.8	0.0	0.0	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	20/06/18	180	0.0	2.0	18.8	0.0	0.0	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	20/06/18	0	0.0	0.0	20.9	0.0	0.4	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	20/06/18	10	0.0	7.9	15.1	0.0	0.4	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	20/06/18	20	0.0	8.0	14.9	0.0	0.4	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	20/06/18	30	0.0	8.0	14.9	0.0	0.4	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	20/06/18	60	0.0	8.2	14.8	0.0	0.4	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	20/06/18	90	0.0	8.3	14.7	0.0	0.4	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	20/06/18	120	0.0	8.9	14.2	0.0	0.4	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS407	20/06/18	180	0.0	9.1	13.9	0.0	0.4	1012	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	10/07/18	0	0.0	0.0	20.9	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	10/07/18	10	0.0	4.3	17.0	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	10/07/18	20	0.0	4.5	16.5	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	10/07/18	30	0.0	4.6	15.9	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	10/07/18	60	0.0	4.6	15.9	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	10/07/18	90	0.0	5.0	15.4	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	AMBER 1
WS401	10/07/18	120	0.0	5.0	15.4	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	AMBER 1
WS401	10/07/18	180	0.0	5.0	15.4	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	AMBER 1
WS402	10/07/18	0	0.0	0.0	20.9	0.0	0.7	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	10/07/18	10	0.0	3.2	18.3	0.0	0.7	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	10/07/18	20	0.0	3.3	18.2	0.0	0.7	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	10/07/18	30	0.0	3.3	18.1	0.0	0.7	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	10/07/18	60	0.0	3.3	18.0	0.0	0.7	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	10/07/18	90	0.0	2.2	19.2	0.0	0.7	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	10/07/18	120	0.0	2.1	19.5	0.0	0.7	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	10/07/18	180	0.0	2.0	19.7	0.0	0.7	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	10/07/18	0	0.0	0.0	20.9	0.0	1.5	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	10/07/18	10	0.0	3.4	18.3	0.0	1.5	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	10/07/18	20	0.0	3.5	18.2	0.0	1.5	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	10/07/18	30	0.0	3.5	18.2	0.0	1.5	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	10/07/18	60	0.0	3.5	18.2	0.0	1.5	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	10/07/18	90	0.0	3.7	18.1	0.0	1.5	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	10/07/18	120	0.0	3.7	18.1	0.0	1.5	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	10/07/18	180	0.0	3.7	18.1	0.0	1.5	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN

Project: Woodcroft Farm - Remediation
 Ref: GE16943
 Client: Grainger PLC



Location	Date	Time (sec)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH ₄	CO ₂	BS8485 & C665		Flow	CH ₄	CO ₂	CH ₄		CO ₂	
												CH ₄	CO ₂				GSV	Conc.	GSV	Conc.
WS404	10/07/18	0	0.0	0.0	20.9	0.0	1.3	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	10/07/18	10	0.0	1.1	19.7	0.0	1.3	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	10/07/18	20	0.0	1.2	19.5	0.0	1.3	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	10/07/18	30	0.0	1.3	19.5	0.0	1.3	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	10/07/18	60	0.0	1.4	19.4	0.0	1.3	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	10/07/18	90	0.0	1.4	19.4	0.0	1.3	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	10/07/18	120	0.0	1.4	19.4	0.0	1.3	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	10/07/18	180	0.0	1.4	19.4	0.0	1.3	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	10/07/18	0	0.0	0.0	20.9	0.0	0.3	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	10/07/18	10	0.0	2.9	18.1	0.0	0.3	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	10/07/18	20	0.0	3.0	18.0	0.0	0.3	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	10/07/18	30	0.0	3.1	18.1	0.0	0.3	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	10/07/18	60	0.0	3.0	18.3	0.0	0.3	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	10/07/18	90	0.0	3.0	18.3	0.0	0.3	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	10/07/18	120	0.0	3.0	18.5	0.0	0.3	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	10/07/18	180	0.0	3.0	18.8	0.0	0.3	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	10/07/18	0	0.0	0.0	20.9	0.0	0.1	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	10/07/18	10	0.0	1.9	19.7	0.0	0.1	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	10/07/18	20	0.0	2.2	19.2	0.0	0.1	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	10/07/18	30	0.0	2.2	19.1	0.0	0.1	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	10/07/18	60	0.0	2.0	19.1	0.0	0.1	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	10/07/18	90	0.0	2.0	19.2	0.0	0.1	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	10/07/18	120	0.0	2.0	19.4	0.0	0.1	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	10/07/18	180	0.0	2.0	19.4	0.0	0.1	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	10/07/18	0	0.0	0.0	20.9	0.0	0.8	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	10/07/18	10	0.0	3.2	18.8	0.0	0.8	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	10/07/18	20	0.0	3.6	18.1	0.0	0.8	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	10/07/18	30	0.0	3.7	18.1	0.0	0.8	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	10/07/18	60	0.0	3.8	18.0	0.0	0.8	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	10/07/18	90	0.0	3.9	18.0	0.0	0.8	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	10/07/18	120	0.0	4.4	17.5	0.0	0.8	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	10/07/18	180	0.0	4.6	17.4	0.0	0.8	1016	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	26/07/18	0	0.0	0.0	20.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	26/07/18	10	0.0	5.3	13.5	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	26/07/18	20	0.0	5.7	13.0	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	26/07/18	30	0.0	8.3	7.8	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	26/07/18	60	0.0	8.3	7.8	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	26/07/18	90	0.0	9.0	7.5	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	26/07/18	120	0.0	9.0	7.5	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	26/07/18	180	0.0	9.0	7.5	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	26/07/18	0	0.0	0.0	20.9	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	26/07/18	10	0.0	3.3	16.7	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	26/07/18	20	0.0	3.8	15.7	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	26/07/18	30	0.0	4.4	14.5	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	26/07/18	60	0.0	7.0	11.2	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	26/07/18	90	0.0	7.3	10.9	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1

Project: Woodcroft Farm - Remediation
 Ref: GE16943
 Client: Grainger PLC



Location	Date	Time (sec)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH ₄	CO ₂	BS8485 & C665		Flow	CH ₄	CO ₂	CH ₄		CO ₂	
												CH ₄	CO ₂				GSV	Conc.	GSV	Conc.
WS402	26/07/18	120	0.0	7.3	10.3	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO ₂ >CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	26/07/18	180	0.0	7.3	10.3	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO ₂ >CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS403	26/07/18	0	0.0	0.0	20.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	26/07/18	10	0.0	3.0	18.1	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	26/07/18	20	0.0	3.1	18.0	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	26/07/18	30	0.0	3.3	17.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	26/07/18	60	0.0	3.4	17.8	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	26/07/18	90	0.0	3.4	17.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	26/07/18	120	0.0	3.4	17.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	26/07/18	180	0.0	3.4	17.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	26/07/18	0	0.0	0.0	20.9	0.0	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	26/07/18	10	0.0	0.9	20.1	0.0	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	26/07/18	20	0.0	1.1	19.6	0.0	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	26/07/18	30	0.0	1.4	19.0	0.0	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	26/07/18	60	0.0	1.6	18.9	0.0	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	26/07/18	90	0.0	1.6	18.9	0.0	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	26/07/18	120	0.0	1.6	18.9	0.0	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	26/07/18	180	0.0	1.6	18.9	0.0	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	26/07/18	0	0.0	0.0	20.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	26/07/18	10	0.0	3.1	17.1	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	26/07/18	20	0.0	3.8	15.0	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	26/07/18	30	0.0	3.9	15.0	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	26/07/18	60	0.0	3.9	15.0	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	26/07/18	90	0.0	3.9	15.0	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	26/07/18	120	0.0	3.9	14.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	26/07/18	180	0.0	3.9	14.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	26/07/18	0	0.0	0.0	20.9	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	26/07/18	10	0.0	1.5	19.4	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	26/07/18	20	0.0	2.0	19.0	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	26/07/18	30	0.0	2.7	18.2	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	26/07/18	60	0.0	2.7	18.2	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	26/07/18	90	0.0	2.7	18.2	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	26/07/18	120	0.0	2.7	18.2	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	26/07/18	180	0.0	2.7	18.2	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	26/07/18	0	0.0	0.0	20.9	0.0	0.4	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	26/07/18	10	0.0	2.0	19.2	0.0	0.4	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	26/07/18	20	0.0	2.2	18.9	0.0	0.4	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	26/07/18	30	0.0	3.2	18.0	0.0	0.4	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	26/07/18	60	0.0	4.7	16.8	0.0	0.4	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	26/07/18	90	0.0	4.7	16.8	0.0	0.4	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	26/07/18	120	0.0	4.7	16.8	0.0	0.4	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	26/07/18	180	0.0	4.7	16.8	0.0	0.4	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	06/08/18	0	0.0	0.0	20.9	0.0	0.7	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	06/08/18	10	0.0	5.7	15.0	0.0	0.7	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO ₂ >CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	06/08/18	20	0.0	6.0	14.5	0.0	0.7	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO ₂ >CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	06/08/18	30	0.0	6.1	14.4	0.0	0.7	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO ₂ >CS1 limit	GREEN	GREEN	GREEN	AMBER 1

Project: Woodcroft Farm - Remediation
 Ref: GE16943
 Client: Grainger PLC



Location	Date	Time (sec)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH ₄	CO ₂	BS8485 & C665		Flow	CH ₄	CO ₂	CH ₄		CO ₂	
												CH ₄	CO ₂				GSV	Conc.	GSV	Conc.
WS401	06/08/18	60	0.0	6.1	14.7	0.0	0.7	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	06/08/18	90	0.0	6.0	14.8	0.0	0.7	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	06/08/18	120	0.0	6.0	14.7	0.0	0.7	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	06/08/18	180	0.0	6.0	14.7	0.0	0.7	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	06/08/18	0	0.0	0.0	20.9	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/08/18	10	0.0	4.7	15.2	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/08/18	20	0.0	4.9	14.8	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/08/18	30	0.0	4.8	14.8	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/08/18	60	0.0	4.8	14.9	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	06/08/18	90	0.0	5.2	14.3	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	06/08/18	120	0.0	5.4	14.2	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	06/08/18	180	0.0	5.5	14.0	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS403	06/08/18	0	0.0	0.0	20.9	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	06/08/18	10	0.0	3.7	16.5	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	06/08/18	20	0.0	3.8	16.0	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	06/08/18	30	0.0	3.9	16.0	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	06/08/18	60	0.0	3.9	16.0	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	06/08/18	90	0.0	3.9	15.9	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	06/08/18	120	0.0	4.0	15.8	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	06/08/18	180	0.0	4.0	15.8	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/08/18	0	0.0	0.0	20.9	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/08/18	10	0.0	1.9	19.2	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/08/18	20	0.0	2.1	18.7	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/08/18	30	0.0	2.1	18.6	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/08/18	60	0.0	2.2	18.5	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/08/18	90	0.0	2.2	18.3	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/08/18	120	0.0	2.3	18.2	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	06/08/18	180	0.0	2.3	18.3	0.0	0.1	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/08/18	0	0.0	0.0	20.9	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/08/18	10	0.0	3.6	15.9	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/08/18	20	0.0	3.7	15.5	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/08/18	30	0.0	3.8	15.1	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/08/18	60	0.0	3.9	15.4	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/08/18	90	0.0	3.9	15.4	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/08/18	120	0.0	3.9	15.4	0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	06/08/18	180	0.0			0.0	0.3	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/08/18	0	0.0	0.0	20.9	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/08/18	10	0.0	2.4	17.4	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/08/18	20	0.0	2.5	17.1	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/08/18	30	0.0	2.3	17.0	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/08/18	60	0.0	2.8	16.9	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/08/18	90	0.0	2.9	16.8	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/08/18	120	0.0	2.9	16.8	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	06/08/18	180	0.0	2.9	16.9	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	06/08/18	0	0.0	0.0	20.6	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	06/08/18	10	0.0	3.7	16.5	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN

Project: Woodcroft Farm - Remediation
Ref: GE16943
Client: Grainger PLC



Location	Date	Time (sec)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH ₄	CO ₂	BS8485 & C665		Flow	CH ₄	CO ₂	CH ₄		CO ₂	
												CH ₄	CO ₂				GSV	Conc.	GSV	Conc.
WS407	06/08/18	20	0.0	3.7	16.3	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	06/08/18	30	0.0	3.8	15.8	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	06/08/18	60	0.0	3.9	16.0	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	06/08/18	90	0.0	4.0	15.9	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	06/08/18	120	0.0	4.5	15.3	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	06/08/18	180	0.0	4.9	14.7	0.0	0.3	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	22/08/18	0	0.0	0.0	20.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	22/08/18	10	0.0	2.4	19.0	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS401	22/08/18	20	0.0	5.9	13.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	22/08/18	30	0.0	5.9	13.8	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	22/08/18	60	0.0	6.0	13.7	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	22/08/18	90	0.0	6.0	13.7	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	22/08/18	120	0.0	6.0	13.7	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS401	22/08/18	180	0.0	6.0	13.7	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	22/08/18	0	0.0	0.0	20.9	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	22/08/18	10	0.0	4.0	16.5	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	22/08/18	20	0.0	4.3	15.7	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	22/08/18	30	0.0	4.4	15.3	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	22/08/18	60	0.0	4.0	14.3	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS402	22/08/18	90	0.0	5.4	13.1	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	22/08/18	120	0.0	5.1	12.3	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS402	22/08/18	180	0.0	5.4	12.1	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 1
WS403	22/08/18	0	0.0	0.0	20.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	22/08/18	10	0.0	4.0	15.3	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	22/08/18	20	0.0	4.2	14.8	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	22/08/18	30	0.0	4.2	14.7	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	22/08/18	60	0.0	4.3	14.6	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	22/08/18	90	0.0	4.3	14.6	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	22/08/18	120	0.0	4.7	13.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS403	22/08/18	180	0.0	4.7	13.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	22/08/18	0	0.0	0.0	20.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	22/08/18	10	0.0	1.9	19.0	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	22/08/18	20	0.0	2.0	18.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	22/08/18	30	0.0	2.0	18.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	22/08/18	60	0.0	2.1	18.7	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	22/08/18	90	0.0	2.1	18.7	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	22/08/18	120	0.0	2.2	18.6	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS404	22/08/18	180	0.0	2.2	18.6	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	22/08/18	0	0.0	0.0	20.9	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	22/08/18	10	0.0	4.3	14.8	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	22/08/18	20	0.0	4.4	14.5	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	22/08/18	30	0.0	4.4	14.5	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	22/08/18	60	0.0	4.4	14.5	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	22/08/18	90	0.0	4.6	13.6	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	22/08/18	120	0.0	4.7	13.4	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS405	22/08/18	180	0.0	4.7	13.4	0.0	0.0	1009	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN

Project: Woodcroft Farm - Remediation
Ref: GE16943
Client: Grainger PLC



Location	Date	Time (sec)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH ₄	CO ₂	BS8485 & C665		Flow	CH ₄	CO ₂	CH ₄		CO ₂	
												CH ₄	CO ₂				GSV	Conc.	GSV	Conc.
WS406	22/08/18	0	0.0	0.0	20.9	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	22/08/18	10	0.0	2.4	17.6	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	22/08/18	20	0.0	2.5	17.1	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	22/08/18	30	0.0	2.5	17.1	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	22/08/18	60	0.0	2.6	17.0	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	22/08/18	90	0.0	3.2	16.2	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	22/08/18	120	0.0	3.3	16.1	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS406	22/08/18	180	0.0	3.3	16.1	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	22/08/18	0	0.0	0.0	20.9	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	22/08/18	10	0.0	3.5	15.9	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	22/08/18	20	0.0	3.7	15.5	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	22/08/18	30	0.0	3.8	15.3	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	22/08/18	60	0.0	3.9	15.1	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	22/08/18	90	0.0	4.7	13.9	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	22/08/18	120	0.0	4.4	13.9	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS407	22/08/18	180	0.0	4.4	13.9	0.0	0.0	1010	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
Max values			0.0	11.5	20.9	0.0	2.5	1017.0	0.0	0.000	0.000	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2
Min Vaules			0.0	0.0	1.7	0.0	0.0	1004.0	0.0	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
BH Flow LoD check			0.0	11.5	20.9	0.1	-	-	-	0.000	0.012	CS1	CS1	NO	NO	CO2>CS1 limit	GREEN	GREEN	GREEN	AMBER 2

Appendix B

Surface emissions survey

Woodcroft Farm

Methane Emissions Mapping Survey

September 2018

Approval Sheet

Customer: Geo-Environmental Services Limited

Site: Woodcroft Farm

Project title: Emissions Mapping (TDL) Survey

Project Manager: J Freestone

Project Staff: J Freestone, T Freestone

Address: enital
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Issue	Status	Date	Prepared By	Signature	Date
1	Final	21/09/2018	J Freestone		21/09/2018
			Checked By	Signature	Date
			C Keightley	C. F. Keightley	21/09/2018

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Appendix

A	Survey Route and Data Logging Points
B	Methane Concentration Plot
C	HeatWave Methane Plot
D	TDL500 Calibration Certificate

1.0 Introduction

1.1 Brief and Desk Study

enital were commissioned by Geo-Environmental Services Limited (GESL) to undertake a Methane Surface Emissions Mapping (TDL) Survey at their Woodcroft Farm Site on 18 September 2018.

Woodcroft Farm is located to the North of Waterlooville in Hampshire, off Woodcroft Lane at National Grid Reference SU681120. It is understood that the area of Woodcroft Farm surveyed consists of a former chalk pit which has been filled with inert waste at some point in the latter 1900's. The site is currently earmarked for residential development.

The desk study for the Emissions Mapping Survey consisted of gathering mapping information and producing survey grid GIS design and files. Information was created for use with enital's bespoke HeatWave GIS PDA based software for mapping emissions on site.

2.0 Surface Emissions Mapping Survey Summary

2.1 Survey Overview

The Surface Emissions Mapping Survey was undertaken on 18 September 2018.

A TDL500 Laser Methane Detector instrument was used to undertake the survey which detects methane from 0ppm to 100% v/v with a resolution of 1ppm. A Getac PS236 PDA utilising a sub-metre Differential GPS receiver was connected to the TDL500 providing continuous GPS and time stamped data logging.

The survey was undertaken on a 5m transect spacing using the site grid setup as part of the desk study. Data logging was set at 3 second intervals. During the survey, the surface was scanned at a distance not exceeding 5cm above

the surface where possible whilst a steady walking pace was maintained. Areas of the site had established vegetation in the form of grassland and occasional perennial weeds. To ensure accurate emissions data, the TDL probe was poked through any vegetation, where surface scanning was not possible, this was done in tandem with each stride giving a distance of approximately 1m between surface readings.

A plan showing the survey route taken and data logging points is presented in Appendix A.

2.2 Site Personnel and Equipment

Table 2.2 details the personnel on site during the survey and the equipment used including serial number and calibration expiry details. A gas check was undertaken prior to and upon completion of the survey, details of which are also shown in Table 2.2.

Table 2.2 Site Personnel and Equipment

Date	Personnel	Instrument Type	Instrument Serial Number	Calibration Due	110ppm Gas Check
18/09/2018	J Freestone	Geotech TDL500	6940315	18/01/2019	107.7

The calibration certificate for the instrument used is presented in Appendix D.

2.3 Weather Conditions and Meteorological Data

In order to ensure that monitoring was undertaken in accordance with best practice for Surface Emissions surveying, meteorological data was recorded from on site observations and details from www.metoffice.gov.uk. Table 2.3 details conditions and observations made during the survey. Wind speeds of 18 to 19mph were recorded during the survey which are at the upper limits for undertaking an Emissions Mapping Survey, however wind speeds within the survey area were significantly lower due to the trees and dense hedges to the southern and western boundaries providing a sheltering effect from the wind.

Table 2.3 Weather Conditions and Meteorological Data

Date / Time Period	Weather Conditions	Ground Conditions	Pressure (mbar)	Temp (°C)	Wind Speed (mph)	Wind Direction
18/09/2018 09:00	Medium-level cloud	Moist	1008	17	18	WSW
18/09/2018 11:00	Low-level cloud	Moist	1010	19	19	WSW

3.0 Surface Emissions Mapping Survey Results

3.1 Results Overview

The TDL500 raw data GPS records were converted from Latitude and Longitude to British National Grid co-ordinates using the Ordnance Survey GridInquest software and a WGS84 to OSGB36 transformation setting. Data was plotted on the plans in Appendix A and B showing the data logging locations and also the methane levels as a coloured contour plot. A HeatWave aerial plot showing methane readings is presented in Appendix C.

3.2 Surface Results

Background levels of methane in the UK vary dependant on location but are widely reported as being 1.7 to 1.8ppm. A total of 835 readings were recorded at Woodcroft Farm of which 87% were ≤ 1.8 ppm methane. Of the remaining 13% of readings above ≥ 1.8 ppm methane, the average was 2.0ppm and can be considered as negligible levels in line with the uncertainty of measurement of the instrument used being 1ppm between 0 and 10ppm.

4.0 Conclusion

The Surface Emissions Mapping Survey undertaken on the historical landfill area of Woodcroft Farm has returned average values of methane below UK and background levels. The average methane level recorded was 1.6ppm. No methane levels were recorded above 2.2ppm.

5.0 Closure

enital has used its best endeavours, experience and expertise to provide a meaningful, accurate and relevant representation of the works carried out. The works were based on a defined programme and scope of works and terms and conditions agreed with the Client.

The findings discussed in this document relating to information provided by the Client relate only to those to which we have had access. No attempt has been made to validate any data or information provided. It is acknowledged that certain aspects may be superseded or rendered irrelevant by information in documentation to which we have not accessed.

enital cannot accept responsibility to any parties whatsoever, following the issue of this report, for any matters arising which may be considered outside the agreed scope of works.

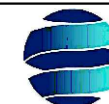
This report is issued solely to the Client. enital does not accept any responsibility to any third parties to whom this report may be circulated, in part or in full, and any such parties rely on the contents at their own risk.

Appendix A

Survey Route and Data Logging Points



KEY:
+ + + + SURVEY ROUTE AND DATA LOGGING POINTS



Geo-Environmental

WOODCROFT FARM

**EMISSIONS MAPPING SURVEY
TRACK LOG / SURVEY POINTS
SEPTEMBER 2018**

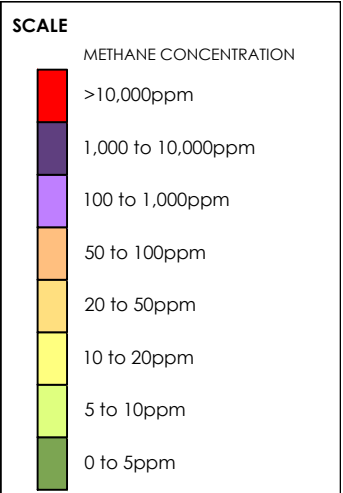
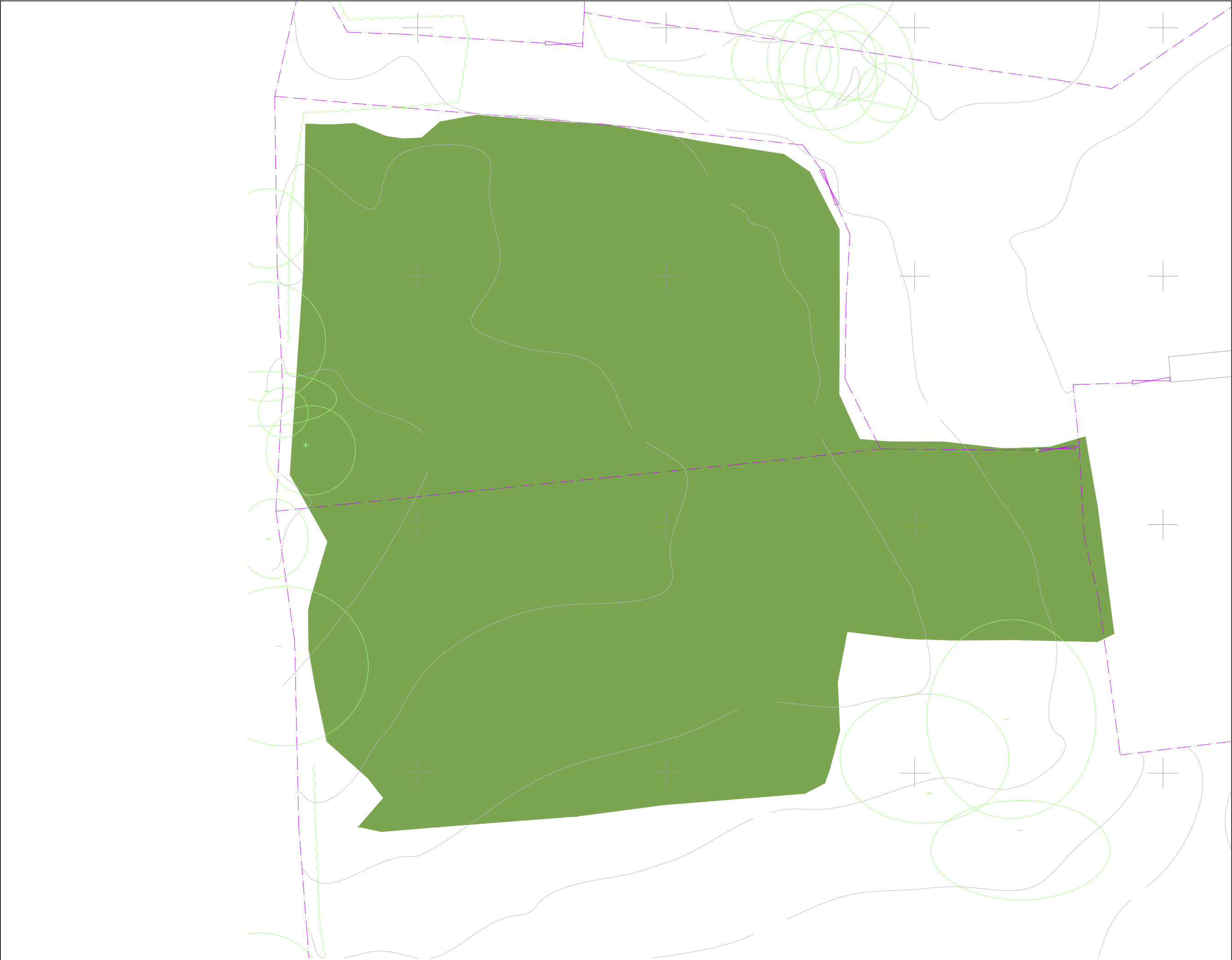
DRAWN BY	TF	DATE	20/09/2018
APPROVED BY	JF	SCALE @ A3	1:350
DRAWING No	0918/WCF/01	STATUS	FINAL

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Appendix B

Methane Concentration Plot





Geo-Environmental

WOODCROFT FARM

EMISSIONS MAPPING SURVEY
CONTOUR PLOT
SEPTEMBER 2018

DRAWN BY	TF	DATE	20/09/2018
APPROVED BY	JF	SCALE @ A3	1:350
DRAWING No	0918/WCF/02	STATUS	FINAL

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Appendix C

HeatWave Methane Plot



Woodcroft Farm Emissions Mapping Survey
HeatWave Data Plot September 2018

Appendix D

TDL500 Calibration Certificate

Certificate Of Calibration

Delivered to : ENITIAL - UK

Date of the report : 18/01/2018

Identifier of the detector

Detector name : Spectra Laser Serial Number : 6940315
Scale numbers : 1 Next visit : 18/01/2019

Method of Checking

Internal procedures : ATE04226
Calibration Bench n° : 13

Each scale of the checked apparatus was the subject of a measurement for zero value, and of a measurement for the value of the concentration of the gas standard injected .

Scale	Gaz	Concentration of the gas standard	Traceability of the gas (N° of production)	Specifications (awaited posted values)	Uncertainty on the concentration of the gas standard
PPM	CH4	0,001% GAS	17-0979	10 PPM(± 10% relative)	± 2% relative
PPM	CH4	0,05% GAS	040006249472	500 PPM(± 10% relative)	± 2% relative
PPM	CH4	0,25% GAS	040006249830	2507 PPM(± 10% relative)	± 2% relative
PPM	CH4	1% GAS	040006024895	10000 PPM(± 10% relative)	± 2% relative
PPM	CH4	2% GAS	17-0360	20040 PPM(± 10% relative)	± 2% relative
PPM	CH4	100% GAS	82A-2850906	999950 PPM(± 10% relative)	± 2% relative

Base : CH4

Name	Gaz	Usual gas injected	Awaited value	Value read on the detector	Corrected value	Tolerance	Result
PPM	AZOTE	0 PPM	0 PPM	0 PPM	Without	5 PPM	Conforms
PPM	CH4	10 PPM	10 PPM	9,5 PPM	Without	10 %	Conforms
PPM	CH4	500 PPM	500 PPM	508,6 PPM	Without	10 %	Conforms
PPM	CH4	2500 PPM	2524 PPM	2574,7 PPM	Without	10 %	Conforms
PPM	CH4	10000 PPM	9990 PPM	10382,9 PPM	Without	10 %	Conforms
PPM	CH4	20000 PPM	20030 PPM	20352,9 PPM	Without	10 %	Conforms
PPM	CH4	1000000 PPM	999950 PPM	1021300 PPM	Without	10 %	Conforms

Result of the checking

The detector is considered to be in conformity with the specifications of reference

After sale manager



This document includes 1 page.

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This document is carried out according to the recommendations of the booklet of documentation X 07-011 defining the report of checking. It can be used to show the connection of the means of measurement to the national or international standards, provided it answers the recommendations of the booklet of documentation X 07-015.

Appendix C

Diffusive flow modelling

Modified Johnson and Ettinger approach

Methane

Equilibrium concentration in building

C_v , Equilibrium concentration in building

$$= \frac{E}{Q_{FV}}$$

Q_{FV}	Volumetric fresh air flow through building	cm ³ /s	1333.3
Air changes in building	Air changes per hour in building	No/h	0.5 SR3, Table 4.21, default for residential.
	Air changes per day in building	No/day	12
Hv	Height of ground floor space	cm	240 SR3, Table 4.21, default for residential.
	Width of building	cm	200 Default for small bathroom. Note this is not a sensitive input parameter because the area of ingress is proportionate to the volume of the space.
	Length of building	cm	200 Default for small bathroom. Note this is not a sensitive input parameter because the area of ingress is proportionate to the volume of the space.

C_v Equilibrium vapour concentration in building mg/m³ 1.93E+02 Using ventilation equation from J&E method (same as CIRIA C149)

g/cm³ 1.93E-07

% 0.028 = $C_{ppm} (12.187 \times MW) / (273.15 + T)$ - at an ambient pressure of 1 atmosphere.

ASSUMES NO RETARDATION FROM FLOOR SLAB

Rate of mass transfer by diffusion

E, Rate of mass transfer by diffusion (g/s)

$$E = \frac{A_b (C_{source} - C_{g0}) D^{eff}}{L}$$

	Width of building	cm	200	Default for small bathroom. Note this is not a sensitive input parameter because the area of ingress is proportionate to the volume of the space.
	Length of building	cm	200	Default for small bathroom. Note this is not a sensitive input parameter because the area of ingress is proportionate to the volume of the space.
A_b	Cross sectional area of migration pathway	cm ²	4.00E+04	Area of migration pathway
C_{source}	Vapour concentration in soil	g/cm ³	3.09E-04	From measured gas concentration
C_{g0}	Vapour concentration at top of soil	g/cm ³	0.00E+00	Assume = zero (to give worst case)
D^{eff}	Effective diffusion coefficient of soil	cm ² /s	0.001041	D^{eff} is calculated in same way as in J&E method
L	Depth of migration pathway (depth to source in soil)	cm	50	Assume gas is within capillary fringe above water table

E Rate of mass transfer into building by diffusion g/s 0.000257 Diffusion of vapour through ground into building.

Effective diffusion coefficient through soil

D^{eff}

$$= \frac{\theta_v - 3.33}{\theta_w - 2} D^{air} + \frac{1}{H} \frac{\theta_w - 3.33}{\theta_t - 2} D^w$$

θ_v	Volumetric content of soil vapour	cm ³ - vapour/cm ³ -	0.15	Loam
θ_w	Volumetric content of soil pore water	cm ³ - water/cm ³ - ϵ	0.36	Loam
θ_t	Total volumetric content of pore space in soil	cm ³ /cm ³ - soil	0.51	
D^{air}	Diffusion coefficient in air - chemical specific	cm ² /s	1.50E-01	Diffusion coefficients in water usually around 10,000 times less than air values
D^w	Diffusion coefficient in water - chemical specific	cm ² /s	1.50E-05	From <i>Local Authority guide to ground gas</i>
H	Henry's Law constant - chemical specific	(cm ³ -H ₂ O)/(cm ³ -air)	29	Kjeldsen P (1996) <i>Landfill gas migration in soil</i> . In landfilling wastes: biogas.

D^{eff} Calculated value cm²/s 0.00104

Conversion of vapour concentration to g/cm³

Volumetric concentration (mg/m³) = $C_{ppm} (12.187 \times MW) / (273.15 + T)$ - at an ambient pressure of 1 atmosphere.

MW	Molecular weight of the gas or vapour.		16	From <i>Local Authority guide to ground gas</i>
T	Ambient temperature	°C	10	Typical in ground temperature in UK
C_{source}	Concentration of gas at source	%	42.5	Maximum methane concentration recorded on site.
$C_{receptor}$	Concentration of gas at receptor	%	0	

C_{source} Concentration of gas or vapour in g/cm³ g/cm³ 3.09E-04

$C_{receptor}$ Concentration of gas or vapour in g/cm³ g/cm³ 0.00E+00