PADDOCK GEO ENGINEERING

Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX

SITE CONTAMINATION RISK ASSESSMENT



GP Builders (Ampthill) Limited

February 2018

P17-132sca_v2

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For and on behalf of Paddock Geo Engineering Limited			

1.0 INTRODUCTION

Paddock Geo Engineering Limited (PGE) were instructed by GP Builders (Ampthill) Limited; the Client, to undertake an Intrusive Investigation and Generic Contamination Risk Assessment as Phase 2 of a Site Contamination Assessment in relation to the proposed residential redevelopment of a parcel of Land at Bury Farm, off Bury Lane, Codicote, Hertfordshire, SG4 8XX.

1.1 Terms of Reference

- British Standards BS 10175:2011 Investigation of Potentially Contaminated Sites – Code of Practice.
- CLR7 Assessment of Risks to Human Health from Land Contamination, 2002, DEFRA / Environment Agency (currently withdrawn).
- CLR8 Potential Contaminants for the assessment of Land, 2002, DEFRA / Environment Agency (currently withdrawn).
- CLR11 Model Procedures for the Management of Land Contamination, 2010, DEFRA / Environment Agency.
- PPG23 (PPS23) Planning and pollution control (contaminated land aspects), 2002
- GPLC1 Guiding Principles for Land Contamination, 2010, Environment Agency
- Environmental Protection Act: 1990 – Contaminated Land Statutory Guidance, April 2012, DEFRA

1.2 Overview of Previous Works

A Phase 1 Preliminary Contamination Risk Assessment (PRA) was previously produced for the site by a third party:

- PRA – Report No.13872, Phase 1 Desktop Study Report (February 2017), Herts & Essex Site Investigations.

1.2 Objectives

The objectives of the Ground Investigation at the site comprised the following elements:

- An Intrusive Investigation
- A Generic Human Health Contamination Risk Assessment

The investigation was designed to obtain ground conditions information and to obtain chemical data to allow a generic human health risk assessment as Phase 2 of a Site Contamination Assessment.

2.0 THE SITE

2.1 Site Description

The subject site is located on the north-eastern edge of the large village of Codicote in Hertfordshire. The site is located on a former farm yard and comprises an approximately triangular parcel of land, formed of a disused barn and stables and areas of concrete hardstanding and open areas. The site covers an area of approximately 0.3Ha.

Site Location Plans and an Aerial Photograph are presented in Appendix A.

2.2 Proposed Development

The proposed development proposals are indicated by the Client to be clearance of the existing barn and stables and redevelopment for residential use with associated soft landscaped gardens, private parking and associated infrastructure.

The proposed development area is detailed on the Site Plans which are presented in Appendix A.

3.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT SUMMARY

A Preliminary Contamination Risk Assessment (PRA) was carried out for the site by a third-party Herts and Essex Site Investigations Limited (report reference CSG /DTS/ 13872 dated February 2017). Salient data from this report is summarised below. The PRA should be read in conjunction with this report. Although the data within the third-party PRA report has been reviewed and summarised PGE cannot accept any liability for its accuracy.

3.1 Geology and Hydrogeology

The bedrock geology beneath the site is indicated to be Chalk of the New Pit Chalk Formation with Superficial Deposits of the Lowestoft Formation, comprising glacial Diamicton, overlying the bedrock at the site.

The groundwater vulnerability map for the site and the surrounding area indicates that the site is underlain by a Principal Aquifer and a Secondary A Aquifer. The site is indicated to be located within Zone III of a Groundwater Source Protection Zone (SPZ) with Zone II indicated 73m south-east of the site. No licensed water abstractions are indicated within 1km of the site, the nearest is indicated 1034m south-west of the site and is for farm and domestic water supply.

3.2 Mineral Sites and Landfills

There was small area of unknown filled ground noted 120m south-west of the site. No landfills were indicated within 500m of the site. A former Chalk pit was indicated 271m north of the site.

3.3 Current and Historic Site Use

At the time of the PRA walkover, the site was indicated to be accessed via a degraded concrete yard to the west of the site with a large steel portal frame and fibre cement sheet clad barn in the centre of the site, which was used for grain storage. Lean-to extensions were present to the east (rear of the barn) and to the south and were used for machinery storage. There was a steel fuel tank noted to the western corner of the barn. There were also manure piles noted to the northern end of the barn.

There was a stables of wooden frame construction to the east of the site.

The site is indicated to have been open land and developed before 1983 with the main barn with the Stables added before 1990.

When the ground investigation was undertaken by Paddock Geo Engineering in January 2018 the barn had been stripped of fibre cement sheeted cladding and was in the process of being demolished along with the stables. The tank to the west of the barn was no longer present and there was no visual of olfactory evidence to suggest where it has been located, such as staining on the concrete surfacing. A pile of macadam planings was noted to the north of the main barn and the piles of manure had been removed from the site.

3.3 PRA Risk Summary

The site was indicated to have a number of significant potential contamination sources; comprising a historic track on the site, potentially asbestos-containing construction materials with the buildings on site, the farm use of the site and tank on the site. No significant off-site sources were concluded.

Potential ground gas sources were concluded in the third-party PRA report from potential significant Made Ground on the site and the manure heaps.

4.0 INTRUSIVE INVESTIGATION Fieldworks

An intrusive investigation was designed by Paddock Geo Engineering Limited to establish the ground conditions beneath the site in relation to the development of a Ground Model for the proposed development. The works were also employed to assess the contamination status of the near surface soils, determine the potential for volatile contamination beneath the site and to recover soil samples for laboratory analysis.

The fieldworks were carried out on the 4th January 2018 and comprised the forming of 6 no. boreholes (WS1 to WS6) using track mounted percussion liner sampling techniques. The exploratory points were positioned to allow general site coverage and to assess specific features noted within the PRA stage of the assessment, including a borehole inside the main barn on site.

The percussion liner sample boreholes were targeted to a depth of 3.00m to 4.00m below ground level (bgl). The boreholes were cased to a depth of 1.00m.

The boreholes were not installed with monitoring wells and were backfilled with arisings when logged and sampled as the boreholes did not encounter groundwater or the potential ground gas drivers concluded in the associated PRA, such as significant Made Ground or Made Ground with a significant organic content. In addition, the manure piles on site had been removed at the time of the site works in early 2018. Further to this, it was considered that any wells installed on the site would be damaged in the short term during the ongoing site clearance works underway at the time of the siteworks.

The depths of the boreholes, sample details, strata descriptions and comments on the groundwater conditions are detailed in the boreholes logs for the site which are presented in Appendix B along with a Borehole Location Plan.

Disturbed samples were recovered from the percussion liner sampler borehole arisings at regular intervals and at changes in strata. The samples were recovered in suitable containers for geochemical analysis. A Photo Ionisation Detector (PID) was employed to screen the samples recovered from VOCs and associated hydrocarbon contamination.

A series of photographs taken during the fieldworks are presented in Appendix B.

4.1 Encountered Strata

The borehole arisings were logged by a Geotechnical Engineer, generally in accordance with BS5930:1999+A2:2010. Borehole logs and a Borehole Location Plan showing the positions investigated are presented in Appendix B. T

The encountered strata are summarised in the table overleaf.

ENCOUNTERED STRATA

Borehole Strata	Exploratory Hole and Basal Depth (m bgl)					
	WS1	**WS2**	**WS3**	**WS4**	**WS5**	**WS6**
CONCRETE	0.15	0.15	0.10	-	-	-
TOPSOIL Dark brown slightly sandy slightly gravelly loamy CLAY	-	-	-	0.45	0.25	-
MADE GROUND Macadam Planings	-	-	-	-	-	0.25
Multi-colour clayey SAND and GRAVEL	-	-	-	0.80	-	0.50
LOWESTOFT FORMATION Firm becoming stiff orange brown (and light grey) slightly to very sandy slightly to flint gravelly CLAY	2.80	3.00	3.00	2.10	1.20	3.00
Medium dense orange brown clayey silty fine to medium SAND	3.90	-	-	-	1.50	-
Firm becoming stiff orange brown slightly sandy slightly flint gravelly CLAY	4.00	-	-	-	3.00	-
NEW PIT CHALK FORMATION Structureless CHALK composed of off white silty sandy fine to medium subangular GRAVEL	-	-	-	3.00	-	-
Borehole Depth (m bgl)	**4.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
Any visual or olfactory Contamination identified	None	None	None	None	None	None

At surface level, the site was underlain by 0.15m of Concrete which was cored in the west of the site. The north of the site had up to 0.45m of Topsoil. The borehole WS6 in the far east of the site had Macadam planings surfacing.

The majority of boreholes had natural Lowestoft Formation soils beneath the surfacing with the exception of WS4 and WS6, which had compacted sub-base type material to a maximum depth of 0.80m bgl (which was recorded in WS4).

All boreholes except WS4, encountered Lowestoft Formation soils comprising firm becoming stiff orange brown (and light grey) slightly to very sandy slightly to flint gravelly CLAY to the full depth of the boreholes. Bands of medium dense orange brown clayey silty fine to medium SAND within WS1 and WS5 (from between 2.80m and 3.90m bgl and 1.20m and 1.50m respectively) were noted.

WS4 encountered chalk at the base below 2.10m bgl.

The geology encountered is consistent with the reviewed available published records.

4.2 Groundwater Conditions

Groundwater was not encountered within any of the boreholes during the ground investigation.

4.3 Sampling Strategy

Disturbed samples were recovered from each of the exploratory points and from each stratum encountered in suitable containers for contamination analysis.

5.0 CONTAMINATION ASSESSMENT

5.1 Chemical Analysis

A total of 10 no. soil samples were sent to an external laboratory to obtain total soil concentrations for a range of priority contaminants. The suite of analysis was decided based on consultation of the Contamination Exposure Assessment (CLEA) supporting documents and consideration for the former site and surrounding area land uses.

The suite of chemical testing included:

- Asbestos screen for Made Ground samples
- Metals and Inorganic compounds
- Polyaromatic Hydrocarbons (PAH) USEPA Priority 16 Compounds
- Total Petroleum Hydrocarbons (TPH) Screen and 3-band split.

Initial in-house screening levels derived for three band TPH fractions (roughly equivalent to PRO, DRO and Mineral Oil) are employed to initiate fully speciated hydrocarbon analysis to the TPH Committee Working Group Methodology (TPHCWG).

Results of the chemical analysis are presented in Appendix C.

5.2 Human Health Assessment Criteria

The assessment has been carried out in accordance with the Contaminated Land Exposure Assessment (CLEA) methodology as detailed within CLR11 2004. The assessment criteria employed are based on the proposed final land use of the site. For this site a worst case proposed land use of 'Residential with Home Grown Produce' will be employed for all areas of the site.

In March 2014, DEFRA published new guidance detailing the Category 4 Screening Levels (C4SL) system for the classification of contaminated land. The C4SL system was published to assist with revised statutory guidance published in 2012 for Part 2a of the Environmental Protection Act 1990.

It introduced a new four category system for the classification of land under Part 2a where a Significant Possibility of Significant Harm to human health has been concluded. The categories correspond to Category 1 – land where the level of risk is clearly unacceptable, to Category 4 – where the level of risk posed is acceptably low. In short, land that passes the category 4 test "should not be capable of being determined as contaminated land under Part 2a".

Currently no statutory chemical guidance levels for land and controlled waters contamination exist in the UK. Therefore, the reported soil total contaminants concentrations will be compared to In-House Generic Assessment Criteria (GAC) used as C4SLs.

These In-House GACs are presented in Appendix C and are generally based on the LQM / CIEH S4UL values, with the exception of Lead, which is based on the DEFRA C4SL values as there is currently no S4UL available.

The S4UL values employed are based on a Soil Organic Material (SOM) concentration of 2.5% for the initial screening.

A single DEFRA C4SL value for Lead is not available, rather a set of provisional values (pS4UL). The pS4UL values employed for the In-House lead GAC, for a residential without plant uptake land use scenario, are based on a blood lead level of 3.5ug/dl for the lower level of toxicological concern employing the Integrated Exposure Uptake Biokinetic model (IEBUK) estimated blood lead concentrations in children and employ the exposure parameters within the CLEA SR3 report.

A minimal risk approach was employed to derive the pS4UL values, whereas the C4SL models use a lower level for risk model, which is deemed generally higher than the minimal risk approach. However, as other data is unavailable for lead the use of a lower level for risk model screening criteria is considered acceptable for use within the planning regime.

However, with consideration of the C4SL and S4UL values there still remain some gaps in the available chemical and / or toxicological data for non-priority contaminants and therefore a limited number of previously used CLEA SGVs and ICRCL guideline values have been retained and include those for pH, Sulphide, Sulphur and water-soluble Boron.

Should an exceedance be noted when site priority contaminant concentrations are compared to the employed GACs, a site-specific assessment criterion can be derived using CLEA software or similar human health risk assessment software. This can also include consideration of bio-availability of the contaminants if required.

Further to the above, any Made Ground samples are generally screened for asbestos presence. Generic assessment criteria do not exist currently for asbestos presence in soil within the UK. Therefore, where asbestos is identified in soil it is recommended that further risk assessment be carried out by suitably qualified and registered persons.

5.3 Groundwater Assessment Criteria

A detailed controlled groundwater risk assessment was outside the scope of this report.

6.0 GENERIC SITE CONTAMINATION RISK ASSESSMENT

Statistical analysis of the data set is carried out employing the statistical method detailed in CL:AIRE Document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration', if exceedances are noted on individual comparison of the contaminant concentrations to the employed assessment criteria, which allows a derivation of a true mean concentration. The statistical analysis also assesses if the data is normally distributed and considers high levels to determine if they are part of the underlying data set due to 'site wide contamination' or due to contamination 'outliers'. The statistical analysis derives a 95th percentile upper confidence limit of □ for each determinands for comparison to the suitable employed guidance level (GAC) or 'Critical Concentration (Cc)'.

The sample priority contaminant concentration data set was not separated into averaging areas due to the relatively small data set.

Further to the statistical analysis of the samples, the reported individual priority contaminant concentrations were compared individually to the PGE In-House GACs presented in Appendix C. This was carried out to mitigate any bias resulting from the statistical analysis due to the small data set.

6.1 Total Soil Concentrations

The priority contaminant concentrations from soil samples analysed and a summary of the results are presented in Appendix C and are detailed in the following sections of this report.

Heavy Metals Exceedances

The comparison of the reported heavy metal concentrations within the samples analysed indicated 95th percentile upper confidence limit of μ concentrations for the heavy metal determinands Arsenic and Beryllium which are above the Human Health GAC for Residential with Home Grown Produce land use scenario employed.

Statistical analysis of this Arsenic and Beryllium data set indicated outlier concentrations or contamination *'hotspots'*. Removal of these '*hotspot'* samples reduced the 95th percentile upper confidence limit of μ concentrations to below the respective GACs.

Individual comparison of the reported heavy metal concentrations for the samples analysed indicated arsenic exceedances when compared to the employed GAC of 37mgkg^{-1} and a single beryllium exceedance when compared to the employed GAC of 1.7mgkg^{-1}. These exceeding samples corresponded with the contamination hotspot samples from the statistical analysis.

Comparison of the Copper and Zinc concentrations against their respective phytotoxicity guidance levels indicated a 95th percentile upper confidence limit of μ concentrations below the respective guidance concentrations employed.

Heavy metal guidance concentrations exceedances are summarised in the table below.

Heavy Metal GAC Exceedances – Shallow Soils <1.0m depth bgl

Determinand	Assessment Criteria (mgkg^{-1})	Borehole and Depth (m bgl) (strata)	Maximum Reported Concentration (mgkg^{-1})	95th Percentile Upper Confidence Limit (mgkg^{-1}) (with exceedances removed)
Arsenic	37	WS1 0.20m (LF) WS2 0.30m (LF) WS3 0.30m (LF)	45 76 59	17.63
Beryllium	1.7	WS4 0.70m (MG)	10	1.30

Notes:
LF Lowestoft Formation Superficial Deposits (natural soils)
MG Made Ground

Hydrocarbon Exceedances

The comparison of the reported hydrocarbon priority contaminant determinand concentrations within the samples analysed indicated a 95th percentile upper confidence limit of μ concentrations for the hydrocarbon determinand Total TPH (EC10-EC40) which is above the Human Health GAC for Residential with Home Grown Produce land use scenario employed.

Statistical analysis of the Total TPH data set indicated outlier concentrations or a contamination *'hotspot'*. Removal of the 'hotspot' sample reduced the 95th percentile upper confidence limit of μ concentrations to below the respective GAC of 600 mg/kg.

Individual comparison of the reported hydrocarbon concentrations within the samples analysed indicated exceedances when compared to the employed GAC. These exceeding included the Total TPH sample corresponding with the contamination *'hotspot'* sample from the statistical analysis.

These exceedances also included the PAH compounds benzo[a]pyrene and dibenzo[a,h]anthracene which were in excess of their respective GACs but the corresponding 95th percentile upper confidence limit of µ concentrations were not in excess of the GACs.

Hydrocarbon guidance concentrations exceedances are summarised below.

Hydrocarbons GAC Exceedances – Shallow Soils <1.0m depth

Determinand	Assessment Criteria ($mgkg^{-1}$)	Borehole and Depth (m bgl) (strata)	Maximum Reported Concentration ($mgkg^{-1}$)	95th Percentile Upper Confidence Limit ($mgkg^{-1}$) (with exceedances removed)
Total TPH (EC10-EC40)	600	WS4 0.70m (MG)	2,300	149.86
Benzo[a]pyrene	2.7	WS5 0.20m (TS)	3.2	1.30
Dibenzo[a,h]anthracene	0.28	WS4 0.70m (MG) WS5 0.20m (TS)	0.29 0.34	N/A

Notes:
TS Topsoil (natural soils)
MG Made Ground

Headspace analysis was carried out on the soil samples using a PID to assess the Volatile Organic Compound (VOCs) concentrations. This did not indicate any VOCs within the samples tested.

Other Priority Contaminants
The comparison of the reported total other priority contaminant concentrations within the shallow soil samples analysed indicated 95th percentile upper confidence limit of concentrations which were below the relevant Residential with Home Grown Produce GACs employed for all determined.

Individual comparison of the other priority contaminant concentrations data set to the relevant GAC did not indicated any exceedances.

Asbestos screening was carried out on near surface Made Ground samples. No samples were reported to be positive for asbestos. It should be noted that at the time of the ground investigation the fibre cement sheeting used to clad the main barn on the site had been removed. Therefore, it is considered that there is a negligible risk of future contamination at the site from asbestos-containing materials.

6.2 Detailed Risk Assessment

Arsenic
Elevated concentrations of Arsenic above the GAC of $37mgkg^{-1}$ were recorded in the shallow soils in WS1, WS2 and WS3 at 0.2m and 0.3m below ground level (bgl). A review of the borehole logs for these samples indicated that all of the samples taken were located within the Lowestoft Formation Superficial Deposits (natural strata).

The recorded concentrations were not highly elevated (with concentrations ranging between 45mg/kg and 76mg/kg). There was no evidence of visible contamination, anthropogenic activity i.e. the presence of Made Ground or any records to indicate that the former use of the site could have caused these elevated concentrations of Arsenic. Therefore, no viable source of Arsenic could be identified.

The naturally-occurring concentrations of heavy metals in soil was not investigated as part of the Preliminary Contamination Risk Assessment (PRA) for the site. Following a review of the data Paddock Geo Engineering Limited carried out a review of publicly-available information relating to the concentrations of naturally-occurring Arsenic in the Hertfordshire area. It was found that the clay-rich soils in the Codicote area, particularly the Lowestoft Formation frequently contain concentrations of Arsenic above the GAC of 37 mg/kg. In addition, a discussion with the Contaminated Land Officer, David Carr, at North Hertfordshire District Council confirmed that there were several instances of elevated natural Arsenic in the area of the site.

The major pathway for Arsenic to enter the human body is via soil ingestion. Therefore, in order to evaluate the risk at the site from the recorded Arsenic concentrations, the bioaccessible fraction of the Arsenic in the soil was assessed. This is considered a better indicator of the potential hazard than the GACs alone in areas where naturally-elevated Arsenic concentrations exist.

The three samples from WS1, WS2 and WS3 were sent to the laboratory for PBET testing (human bioaccessible fraction of the ingested soil) for Arsenic. The testing methods mimics the kinetic and chemicals changes in the human body environment and considers the stomach and small intestine conditions. The testing is based on the most sensitive human health receptor, a two to three-year old child. The findings of the testing are presented in the table below.

Results of the chemical analysis are presented in full in Appendix C.

Arsenic PBET Results – Shallow Soils <1.0m depth bgl

Borehole and Depth of Sample	Arsenic Concentration in ground investigation ($mgkg^{-1}$)	PBET testing Arsenic concentration ($mgkg^{-1}$)	Bioacccessible Fraction of Arsenic (%)	Maximum Bioacccessible Fraction of Arsenic (%)
WS1 0.20m	45	73	2.5% (stomach) 2.9% (Intestine 1) 2.9 % (Intestine 2)	2.9%
WS2 0.30m	76	94	3.4% (stomach) 2.7% (Intestine 1) 5.7 % (Intestine 2)	5.7%
WS3 0.30m	59	80	3.8% (stomach) 4.4% (Intestine 1) 5.3 % (Intestine 2)	5.3%

The results concluded that between 2.5% and 5.7% of the ingested soil was bioaccessible Arsenic and would therefore be absorbed by the human body. This is a very low percentage and indicates that the source of the Arsenic present in soils is naturally-occurring and not anthropogenic Arsenic, which has a much higher bioaccessibility and is therefore more toxic.

Beryllium
One sample, taken from WS4 at 0.7m bgl recorded a concentration of 10 mg/kg above the GAC for Beryllium of 1.7 mg/kg. Due to this being an isolated exceedance on site and the location of this exceedance within the Made Ground, this concentration can likely be attributed to the burning of coal in this area historically.

Total TPH (EC10-EC40)
Total TPH testing (for the EC10 to EC40 fractions) was undertaken as part of the chemical testing for the site. One sample, taken from 0.7m bgl within the Made Ground recorded a Total TPH (C10-C40) concentration of 2,300 mg/kg, which exceeded the employed GAC of 600 mg/kg. The use of this GAC is considered to be a very conservative approach and is initially used to instigate Speciated TPH testing to allow assessment again specific hydrocarbon fractions for both aliphatic and aromatic hydrocarbons. Speciated TPH testing was undertaken as second phase of testing on the sample taken from WS4, the results of which are presented in the table below.

Speciated TPH Testing Results – Shallow Soils <1.0m depth bgl

Borehole and Depth of Sample	Speciated TPH Fraction	Concentration Recorded ($mgkg^{-1}$)
WS4 0.70m	CWG - Aliphatic >EC5 - EC6	< 0.001
	TPH-CWG - Aliphatic >EC6 - EC8	< 0.001
	TPH-CWG - Aliphatic >EC8 - EC10	< 0.001
	TPH-CWG - Aliphatic >EC10 - EC12	2
	TPH-CWG - Aliphatic >EC12 - EC16	7.6
	TPH-CWG - Aliphatic >EC16 - EC21	18
	TPH-CWG - Aliphatic >EC21 - EC35	520
	TPH-CWG - Aliphatic >EC5 - EC35	550
	TPH-CWG - Aromatic >EC5 – EC8	< 0.001
	TPH-CWG - Aromatic >EC8 - EC10	< 0.001
	TPH-CWG - Aromatic >EC10 - EC12	1.8
	TPH-CWG - Aromatic >EC12 - EC16	6
	TPH-CWG - Aromatic >EC16 - EC21	31
	TPH-CWG - Aromatic >EC21 - EC35	1,000
	TPH-CWG - Aromatic >EC5 - EC35	1,100

The Speciated analysis of the sample taken from WS4 at 0.7m bgl indicated that all TPH fractional concentrations were below the relevant GACs.

Benzo[a]pyrene

A concentration of benzo(a)pyrene of 3.2 mg/kg was recorded in WS5 at 0.2m bgl. The concentration was marginally above the GAC of 2.7 mg/kg. It is considered likely that a piece of macadam that was incorporated into the sample as we do not have any other Benzo(a)pyrene exceedances anywhere on site and there was no evidence of ash contamination in the sample soils which would be likely cause of this isolated concentration.

Dibenzo[a,h]anthracene

The sample containing elevated Benzo(a)pyrene as detailed above (WS5 at 0.2m bgl) also contained a very marginal exceedance of the GAC for Dibenzo[a,h]anthracene. A concentration of 0.34 mg/kg was recorded which was above the GAC of 0.28 mg/kg. This concentration is also likely to be attributed to the suspected macadam incorporated into the sample.

A concentration of 0.29 mg/kg was recorded in WS4 at 0.7m bgl above the GAC of 0.28 mg/kg. This is a very marginal exceedance and is not considered to pose a risk to the site.

6.3 Conceptual Site Model

An assessment of the risk posed by the identified contaminant concentrations has been carried out employing the Source-Pathway-Receptor (S-P-R) methodology detailed within the CLEA methodology.

Updated Source-Pathway-Receptor Model

Potential Contaminant Sources	Potential Pathways	Potential Receptors	Pathway Complete	Risk Level Classification
Elevated Arsenic, Beryllium & PAHs in near surface soils	Dermal / Direct Contact	Current Site Users (Disused Farm)	N	
	Direct Ingestion		N	
	Direct Inhalation		N	
	Inhalation of Radon Gas		N	
	Inhalation of Wind Blown Dust		N	
	Vapour Migration		N	
	Gas Migration		N	
	Dermal / Direct Contact	Future Site Users (Residential)	Y	Low to Moderate
	Direct Ingestion		Y	Low to Moderate
	Direct Inhalation		N	
	Inhalation of Radon Gas		N	
	Inhalation of Wind Blown Dust onto the site		Y	Low
	Vapour Migration on to the site		N	
	Ground Gas Migration		N	
	Direct Contact	Services	Y	Low to Moderate
	Migration of Contaminants – Non-Aqueous Phased		N	

Potential Contaminant Sources	Potential Pathways	Potential Receptors	Pathway Complete	Risk Level Classification
	Migration of Contaminants – Aqueous Phased		N	
	Migration of Contaminants off site – Non-Aqueous Phased	Adjacent Properties	N	
	Migration of Contaminants off site – Aqueous Phased		N	
	Vapour Migration		N	
	Inhalation of Wind Blown Dust	Ecological Impacts	N	
	Migration of Contaminants - Non-Aqueous Phased		N	
	Migration of Contaminants - Aqueous Phased		N	
	Migration of Contaminants from site - Non-Aqueous Phased	Controlled groundwater	N	
	Migration of Contaminants from site - Aqueous Phased		Y	Low
	Migration of Contaminants - Non-Aqueous Phased	Surface Waters	N	
	Migration of Contaminants - Aqueous Phased		N	

6.4 Soil Waste Assessment

Waste Acceptance Criteria (WAC) testing was not carried out to determine a waste classification of the near surface soils in relation to groundworks arisings disposal.

However, total soil priority contamination concentrations indicated elevated heavy metals and hydrocarbon concentrations when compared to the most stringent human health GACs. Asbestos was not identified in any of the Made Ground on the site. Therefore, it is considered that further soil waste classification should be carried out by the receiving facility using the total chemical concentrations presented in Appendix C.

All waste classifications should be confirmed with the waste receiving facility prior to disposal. The waste receiving facility will require the total soil priority contaminant concentrations which are presented in Appendix C.

6.5 Potable Water Supply Pipe

Guidance on the type of potable water supply pipe to be employed on brownfield sites is given by UKWIR, who have published guidance for the type of potable water supply pipework to be employed for new structures on reused land.

The results of the chemical analysis carried out on samples recovered from shallow depth and at around 0.90m depth on the site, although not strictly to the UKWIR required standard, indicated detectable levels of hydrocarbon priority determinands at suspected pipe burial depth of 0.90m bgl. Therefore, regular PE pipe is not considered acceptable for the site.

However, some areas of the site, such as the western entrance areas of the site were identified to generally have below detection level hydrocarbon concentrations. Therefore, it is recommended that further sampling and risk assessment along the proposed pipe run be carried out if regular PE water supply pipe is required.

The suitable potable water supply pipe for the site should be confirmed with the local water authority prior to construction.

6.6 Site Contamination Assessment Conclusions

Based on the findings of the Source-Pathway-Receptor Model, it was concluded that some residual risks at the site remained and that follow-on works were required. Other risks previously identified, were discounted following the completion of the ground investigation as detailed below.

The potential asbestos containing construction materials identified on the site during the Phase 1 Desktop Study (including the roofing and cladding of the main barn) were considered to pose a potentially unacceptable risk to human health. Prior to the commencement of the site works in January 2018 these materials had been removed from site. Asbestos screening carried out on near surface Made Ground samples as part of the ground investigation indicated that no samples contained asbestos. Therefore, there is not considered to be a risk from asbestos at the site.

Macadam planings were identified at ground level adjacent to WS6 and to the north of the main barn on site during the ground investigation. The presence of macadam fragments on site is considered to be responsible for this elevated concentrations of Benzo(a)pyrene and Dibenzo[a,h]anthracene in WS5 at 0.2m bgl.

It was concluded that the Arsenic concentrations within the Lowestoft Formation are naturally occurring and have a low bioaccessibility. Consequently, they do not pose a significant risk to future human health receptors at the site.

There is not considered a risk to the proposed redevelopment of the site from Aromatic or Aliphatic hydrocarbons based on the findings of the Speciated Hydrocarbon testing undertaken at the site.

The concentration of Beryllium recorded in WS4 at 0.7m bgl was located within the Made Ground and can likely be attributed to the burning of coal in this area historically. This concentration is over five times the recommended GAC and is considered a *´hotspot´*.

A Plan indicating the contaminated areas is presented in Appendix C.

6.7 Remedial Works

Macadam is considered to be stable and unlikely to impact groundwater beneath the site or impact site users, therefore the identified concentrations are not considered to pose a risk to the proposed redevelopment of the site in soil but due to the highly sensitive nature of the proposed end-use of the site for residential dwellings and gardens all surface macadam should be removed from site prior to the commencement of construction works.

The *´hotspot´* of Beryllium identified in WS4 will need to be removed from the site. An area 1m long, 1m wide and 1m deep around the location of WS4 will need to be excavated and removed from site.

A chemically and geotechnical suitable fill materials will need to be used to fill this excavation upon completion.

Based on the findings of the ground investigation it is recommended that a Topsoil clean cover layer is placed across the site in all areas of soft landscaping. This will ensure the protection of human health from unidentified contamination at the site (Made Ground and macadam fragments) and provide a clean capping above the naturally-elevated concentrations of Arsenic with the site soils (this is considered a precaution as the levels of Arsenic in the site soils are not highly elevated and the Arsenic present has a low bioaccessibility). In addition, the shallow soils on site do not appear to make a comprise a good growing soil medium and are unlikely to drain well due the presence of Clay-rich soils. The imported Topsoil cover layer will also act as a drainage layer, with the recommended blend a Topsoil, overlain by a coarser Sub-soil.

It is recommended that a minimum of 600mm clean Topsoil / Sub-soil is placed in open rear garden areas of the proposed development with at least 300mm of Topsoil at surface to act as a growing medium. The front (west) of the site will require at least 300mm of Topsoil at surface to act as a growing medium.

The above thicknesses of topsoil consider the depth of the potential ´mixing zone´ within residential gardens i.e. the depth to which digging or planting in shallow soils by residents is likely to occur. Prior to the placement of the geo-textile marker layer and the clean cover Topsoil layer the underlying ground should be compacted. This will inhibit root penetration, infiltration, burrowing animals and instability. The geo-textile marker layer will act as a physical barrier at the base of the clean Topsoil cover layer and as a visual marker to discourage digging and reduce intermixing of soils.

The clean Topsoil cover layer should be imported to site from a reputable topsoil supplier. It should be a good quality growing medium and have been subjected to chemical testing (at the rate of a minimum of four samples per source and one sample per 1,000m^3 thereafter). The imported materials are required to meet the British Standard for Topsoil (BS 3822: 2015).

The above remedial works are regarded as a form of risk management, the aim of which is to demonstrably break the chain of any potentially unacceptable pollutant linkages that connect contaminant sources to receptors via pathways at the site. The aims of the remedial works are to ensure that human health (site end-users including future residents, visitors and ground workers including construction and future maintenance workers) are not exposed to elevated concentrations of hazardous substances on site. This will allow the safe occupation of the site for residential use.

A Plan detailing the proposed remedial works is presented in Appendix C.

Notwithstanding the above assessment, if any unexpected or previously unidentified contamination is discovered during the site development works or recommended remedial works, a suitably qualified and experienced person should be contacted so any further assessment required can be carried out.

7.0 CERTIFICATION

This report is produced for the sole use of the Client, and no responsibility of any kind, whether for negligence or otherwise, can be accepted for any third party who may rely upon it.

The conclusions and recommendations given in this report are based on our understanding of the future plans for the site and based on a scope of works agreed by the Client and afforded by the agreed budget. No responsibility is accepted for conditions not encountered, which are between exploratory points or outside of the agreed scope of work.

If the future plans for the site are changed, such as the site is developed for a more or less sensitive use, then a different interpretation might be appropriate.

The report has been prepared generally following the guidelines and principles established in the British Standards, BS5930:1999+A2:2010, BS 10175:2011, entitled 'Investigation of Potentially Contaminated Sites – Code of Practice' and the DEFRA/EA Contaminated Land Reports CLR7 and CLR8.

It necessarily relies on the co-operation of other organisations and the free availability of information and total access. No responsibility can, therefore, be accepted for conditions arising from information that was not available to the investigating team as a result of information being withheld or access being denied.

This report may suggest an opinion on a suspected configuration of strata or conditions between exploratory points and below the maximum depth of investigation. However, this is for guidance only and no liability can be accepted for its accuracy. Comments on the groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. It should be noted, however, that groundwater levels might vary due to seasonal or other effects. No liability can be accepted for estimated soil strength where no site-specific soil strength testing has been carried out. It should be noted that this report is based solely on the samples collected in the borehole locations investigated. During the works and following general site clearance, should the sub-soil conditions in other areas of the site appear to be inconsistent with those found in the areas sampled then this geotechnical appraisal and site contamination assessment may need to be reviewed.

This report is prepared and written in the context of the proposals stated in the introduction to this report and it should not be used in a differing context. Furthermore, new information, improved practices and changes in legislation may require an alteration to the report in whole or in part after its submission. Therefore, with any changes in circumstances, or after one year from the date of the report, the report should be referred back to Paddock Geo Engineering Limited for re-assessment (and, if necessary, for an estimate for the cost of such).

The copyright of this report and any associated plans and documents prepared by Paddock Geo Engineering Limited is owned by them and should not be reproduced, published or adapted, in whole or part, without their written consent.

REFERENCES

British Standard for Topsoil – British Standards Institution BS 3882: 2015

An appraisal of soil geochemistry for two growth areas in the South of England - British Geological Survey (BGS). 2005.

Investigation of Potentially Contaminated Sites – Code of Practice, British Standards Institution BS 10175:2001.

Code of Practice for Site Investigations, British Standards Institution BS5930: 1999

Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination, R&D Technical Report P5-066/TR, 2000, Environment Agency.

National House-Building Council, NHBC Standards Chapter 4.2 'Building near Trees', 2003

BRE 240 Low Rise Buildings on Shrinkable Clay Soils: Part 1, 1993. Building Research Establishment

BRE 241 Low Rise Buildings on Shrinkable Clay Soils: Part 2, 1990. Building Research Establishment

CLR8 Potential Contaminants for the assessment of Land, 2002, DEFRA/Environment Agency.

Health and Safety Executive, Protection of workers and the general public during the development of contaminated land, HMSO, London 1991.

BRE Special Digest 1 'Concrete in Aggressive Ground', 2001.

Contaminated Land Exposure (CLEA) Model version 1.03 developed by the Environment Agency, Department for Environment, Food and Rural Affairs and the Scottish Environment Protection Agency. 2008

CLR7 Assessment of Risks to Human Health from Land Contamination, 2002, DEFRA/Environment Agency.

CLR8 Potential Contaminants for the assessment of Land, 2002, DEFRA/Environment Agency.

CLR11 Model Procedures for the Management of Land Contamination, 2004, DEFRA/Environment Agency.

Rudland, D., Lancefield, R.M., Mayal, P.N. (2001) Contaminated Land Risk Assessment: A Guide to Good Practice. CIRIA C552. UK.

Method for Deriving Site-Specific Human Health Criteria for Contaminants in Soil, SNIFFER, 2003.

Technical evaluation of the Intervention Values for Soil/Sediment and Groundwater, RIVM Report 711701 023, National Institute of Public Health and the Environment, 2001.

Tonks D M and Whyte I L 'Dynamic soundings in site investigation: some observations and correlations', Proceedings of ICE Geotechnology Conference, Paper 10, 1988.

The Water Supply (Water Quality) Regulations. HMSO. 2000

Code of Practice for Investigation and Mitigation of Possible Petroleum –Based Land Contamination, 1993, Institute of Petroleum, London.

Contaminated Land Management – Ready Reference, J Nathanail, P Bardos and P Nathanail, Land Quality Press, 2002.

DTI/CIRIA Publication 'Engineering in Chalk'

http://www.silsoeresearch.org.uk/ Silsoe Research Organisation. Viewed July 2007.

Hydrogeological Risk Assessment for Land Contamination Remedial Targets Worksheet, release 3.1 – October 2006

Assessing risks posed by hazardous ground gases to buildings – CIRIA C665, 2007 – Wilson, Oliver, Mallet, Hutchings and Card

NHBC & RSK Group publication 'Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present' (March 2007).

Mobilising Natures Army: Monitored Natural Attenuation – dealing with pollution using natural processes, Environment Agency. 2004

Remediation Targets Methodology: Hydrogeological Risk Assessment for Land Contamination, Environment Agency. 2006

BRE Report BR211 - Radon: Protective measures for new dwellings, November 2007

Assessing risks posed by hazardous ground gasses to buildings – CIRIA Report C659, December 2007

GPLC1 - Guiding Principles for Land Contamination Environment Agency, 2010

Environment Agency Landfill Environmental Permit EPR/FP3399VV

Perimeter soil gas emissions criteria and associated management. Industry Guidance v1.01. BIFFA et al. January 2011

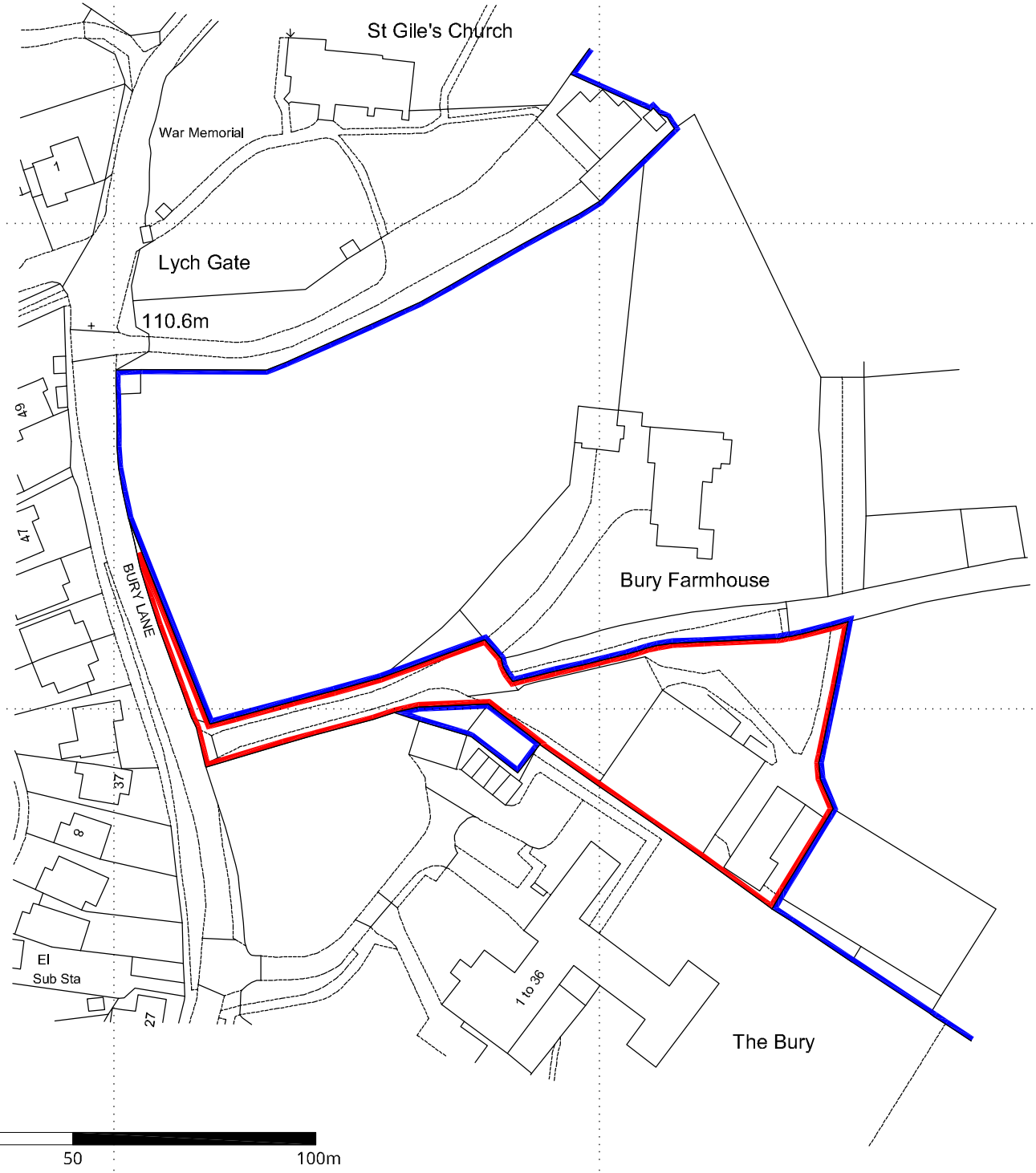
Environment Agency, Briefing Note – Monitoring Frequencies and Non-Compliance Recording

LFTGN03. Guidance on the Management of Landfill Gas. Environment Agency. 2003

Environment Agency, Final R&D Technical Report P1-471 Techniques for the Interpretation of Landfill Monitoring Data – Guidance Notes

APPENDIX A – MAPS AND PLANS

Site Plan
Proposed Development Plan



Scale 1:1250

0 5 10 20 50 100m

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Bury Farm, Codicote

Site Location Plan

N

Application Site

Other Land in Applicants Ownership

REVISIONS DATE

p.p.s.

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Bedford
MK429BA
T 01234 272829
F 01234 271412
info@phillips-planning.co.uk

Phillips Planning Services Ltd.
Town Planning and Development Consultants

PROJECT

Bury Farm, Codicote

TITLE

Site Location Plan

CLIENT

S.P. Doherty

SCALE (@ A4)	DRAWN BY	DATE
1 : 1250	LS	03/17

PROJECT NUMBER	DRAWING NUMBER	REV
164921	17-01	

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NORTH

BURY FARM HOUSE

- A. Existing paddock fencing
- B. Existing close boarded fencing
- C. Proposed paddock fencing 1.2m high
- D. Proposed close boarded fencing 1.8m high
- E. Permeable asphalt surface (land falls away from highway avoiding highway run-off)
- F. Permeable sett paving to parking areas
- G. Visitor parking area
- H. Refuse bin storage area
- J. Natural stone paving to paths and terraces
- K. Brick retaining wall approx. 0.75m high
- L. Standard turning head within roadway
- M. Section of existing laurel hedge removed
- N. Proposed tree planting
- O. Proposed indigenous hedge planting
- P. Proposed evergreen hedge planting
- Q. Turfed areas
- R. Outline of buildings to be demolished
- S. Proposed timber field gate with brick piers 1.5m high
- T. Existing barn
- U. Existing footpath
- V Refuse collection point

Scale 1 : 200 at A2 sheet

GARAGE

Proposed FFL for Dwellings - 47.00

BUILDINGS TO BE DEMOLISHED

PARAPET LEVEL 57.03

THE BURY

Levels relate to 50.00 at Entrance to Site

PROPOSED SITE PLAN

REVISION 'A' MAY 2017

Dormer windows replaced with skylight for Nos. 1 & 3

Three Proposed Dwellings and Integral Garages following Demolition of Existing Barn and Stables at Land adjoining Bury Farm, Bury Lane, Codicote, Hitchin, Herts.

Ivan J. Clarke & John W. Barrett
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Scale 1 : 200
Date : Feb.2017
Ref. W422A

Revisions		Date
Date	OCT 2016	Drawn SD
Scale	1:200 @ A1	Checked NG
Dwg. No.	16C01-S1	Job No. 16C01

Client

Mr & Mrs Doherty

Dwg. Title

SITE SURVEY

Project Title

BURY FARM, BURY LANE,
CODICOTE, HITCHIN, SG4

28 THE HEATH
BREACHWOOD GREEN
NR HITCHIN
HERTFORDSHIRE
SG4 8PJ
TEL/FAX: 01438 832046
MOBILE: 07745 468048
EMAIL: boundarypoint@tiscali.co.uk

BOUNDARY POINT LTD

ABBREVIATIONS

BD	Back Drop	IRF	Iron Railing Fence
BL	Bec Level	IWF	Interwoven Fence
BH	Bore Hole	LP	Lamp Post
B	Bollard	MH	Man Hole
BP	Brick Paviors	MKR	Marker
BRW	Brick Retaining Wall	P	Post
BW	Brick Wall	PCF	Post & Chain Fence
BT	British Telecom	PIT	Trial Pit
CB	Control Box	PMF	Plastic Mesh Fence
CBF	Close Boarded Fence	PRF	Post & Rail Fence
CCB	Cable TV Control Box	PWF	Post & Wire Fence
CD	Channel Drain	RE	Radiating Eye
CHF	Chestnut Paling Fence	RG	Rough Ground
CLF	Chain Link Fence	RL	Ridge Level
CPF	Concrete Panel Fence	RS	Road Sign
CPS	Concrete Paving Slabs	RU	Ramp Up
CRW	Concrete Retaining Wall	S	Spread
CTV	Cable Television	SC	Stop Cock
CW	Concrete Wall	SL	Soffit Level
D	Diameter	SPS	Stone Paving Slabs
DP	Down Pipe	SRW	Stone Retaining Wall
ECB	Electricity Control Box	SU	Steps Up
EL	Eave Level	SW	Stone Wall
EP	Electricity Pole	TB	Telecoms Box
FB	Flower Bed	TPS	Tactile Paving Slabs
FH	Fire Hydrant	TL	Traffic Light
FL	Floor Level	TP	Telephone Pole
FRL	Flat Roof Level	TPF	Timber Panel Fence
G	Gulley	TRW	Timber Retaining Wall
GV	Gas Valve	VP	Vent Pipe
H	Height in Metres	WL	Water Level
IC	Inspection Cover	WMF	Wire Mesh Fence
IL	Invert Level	WV	Water Valve

GATE — SURVEY STATION
EDGE OF VEGETATION
FENCES
OVERHEAD CABLES
FOUL WATER SEWER
SURFACE WATER SEWER
COMBINED SEWER

NOTES.

ALL LEVELS RELATE TO SURVEY STATION 101, MASONRY NAIL IN FOOTPATH OPPOSITE ENTRANCE TO BURY FARM. ARBITRARY VALUE 50.000m.

ALL PIPE SIZES ARE 100ø UNLESS OTHERWISE INDICATED.

UNDERGROUND SERVICES INFORMATION SHOWN ON THIS PLAN CANNOT BE GUARANTEED AND USERS SHOULD SATISFY THEMSELVES OF IT'S CORRECTNESS BEFORE COMMENCING WORK ON SITE.

TREE SPREADS ARE AVERAGES UNLESS OTHERWISE INDICATED.

TREE HEIGHTS ARE ESTIMATES ONLY.

WHILST ALL CARE HAS BEEN TAKEN IN THE IDENTIFICATION OF TREES, THIS INFORMATION CANNOT BE GUARANTEED, AND SHOULD BE VERIFIED BY A SPECIALIST SHOULD IT BE DEEMED NECESSARY.

ROOF LINES, AND TREES / DETAIL IN ADJACENT PROPERTIES HAVE BEEN PLOTTED APPROXIMATELY.

NORTH

Existing footpath

Section of existing laurel hedge removed

Permeable asphalt surface (land falls away from highway avoiding highway run-off)

Roadway relayed with permeable asphalt surface (land falls away from entrance avoiding surface run-off to highway)

Proposed timber field gate with brick piers 1.5m high

Existing Buildings to be Demolished

Paddock fence re-aligned to allow sightline to be extended. Indigenous hedge planted behind fence. Field gate re-aligned.

Section of beech hedge removed and new re-aligned beech hedge planted

Roadway widened to 5.0m

Passing bay formed

BURY LANE

Existing Site indicating alterations to roadway

KEY PLAN

S1

CONTROL SCHEDULE

STATION	EASTING	NORTHING	LEVEL
100	510.160	156.080	49.152
101	500.000	200.000	50.000
102	475.717	251.780	50.831
103	552.713	224.242	49.501
104	577.006	270.292	45.397
105	603.056	242.962	46.763
106	626.995	233.758	46.109

TREE SCHEDULE

No.	DIA.	SPREAD	HEIGHT	TYPE
1	0.5	8	6	POPLAR
2	0.4	6	9	UNKNOWN
3	0.25	4	8	UNKNOWN
4	0.3	4	9	UNKNOWN
5	0.45	10	8	MAPLE
6	0.4	3	9	SILVER BIRCH
7	0.6	8	9	POPLAR
8	0.2	9	6	DEAD
9	0.2	9	5	CYPRESS
10	0.45	7	7	HAWTHORN
11	0.35	10	7	MAPLE
12	0.6	8	3	MAPLE
13	0.5	10	11	CHERRY
14	0.8	22	15	MAPLE
15	0.19	10	5	CHERRY
16	0.3	11	6	ASH
17	0.9	20	12	SPRUCE
18	0.2	10	7	CHERRY
19	0.2	10	7	CHERRY
20	0.2 MB	8	5	CHERRY
21	0.2 MB	8	5	CHERRY
22	0.75	18	22	OAK
23	0.6	14	16	HORSE CHESTNUT
24	1.7	24	21	OAK

N

INDICATIVE

Scale 1 : 200 A1 Sheet Size

THE BURY

Three Proposed Dwellings and integral Garages following Demolition of Existing Barn and Stables at Land adjoining Bury Farm, Bury Lane, Codicote, Hitchin, Herts.

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Scale 1 : 200
Date : Feb.2017
Ref. W421

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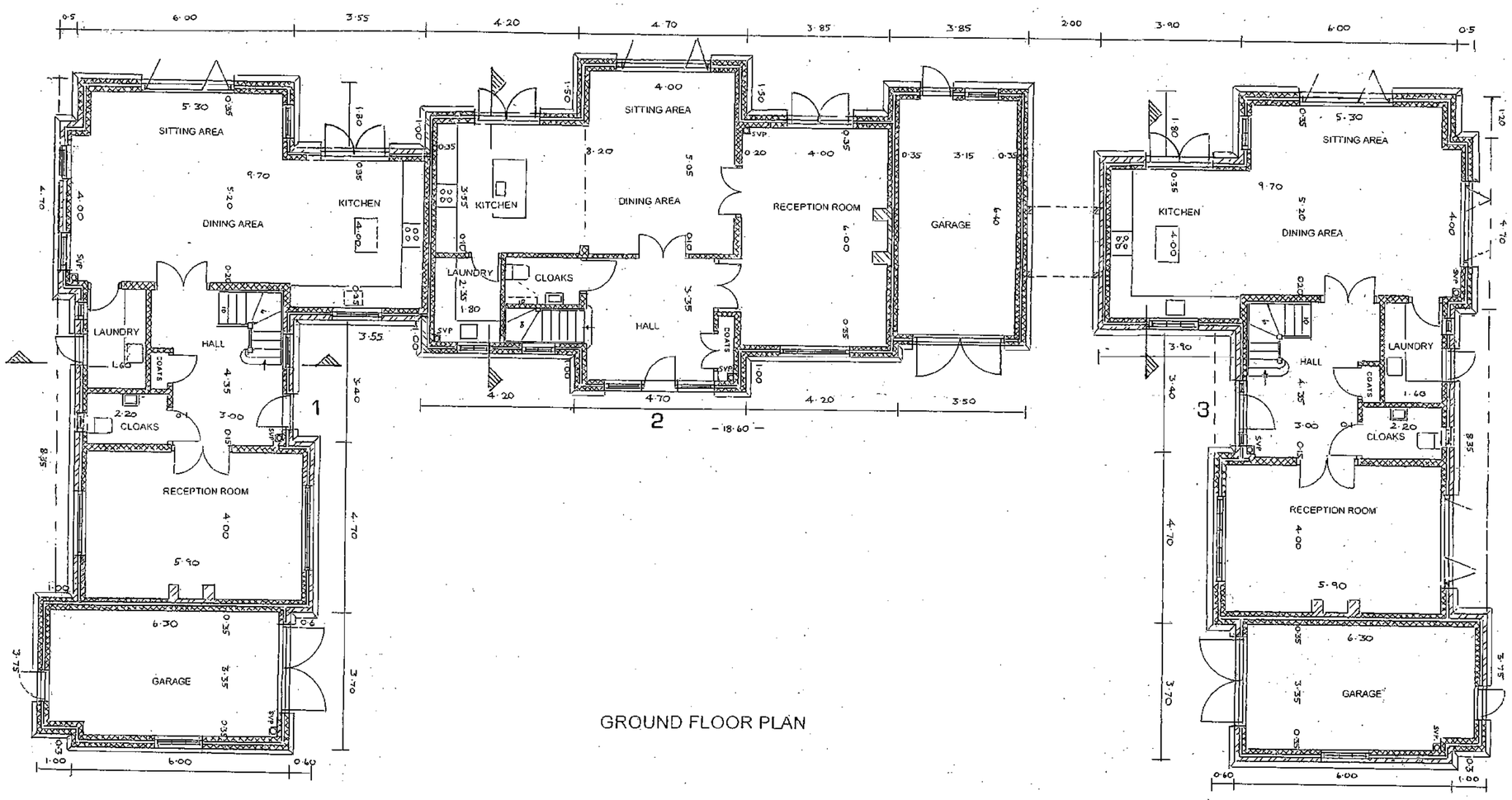
NORTH



GROUND FLOOR PLAN

Scale 1:100 at A2 Sheet Size

REVISION 'A' MAY 2017

N.E.Elevation

1. Reduction of glazed doors.
2. Replacement of dormer windows with skylights
3. Reduction of window size of remaining dormers
4. Areas of brickwork replaced with feather-edged boarding

Other Elevations

5. Areas of brickwork replaced with boarding
6. Dormer cheeks removed

Floor Plans

7. Plans revised to align with changes to elevations
8. Provision of bat boxes and bat access tiles indicated on elevations.

Three Proposed Dwellings and Integral Garages following Demolition of Existing Barn and Stables at Land adjoining Bury Farm, Bury Lane, Codicote, Hitchin, Herts.

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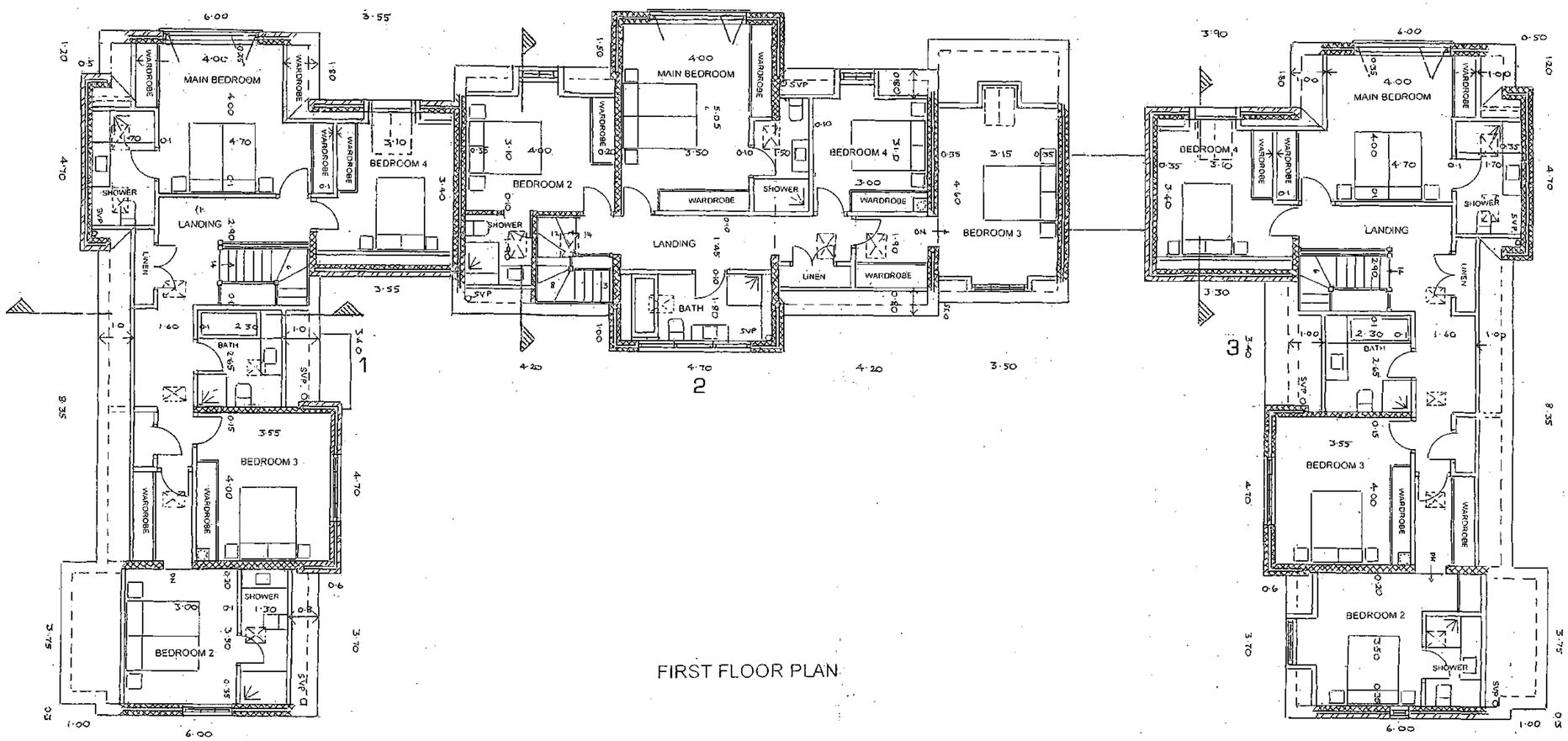
NORTH



FIRST FLOOR PLAN

REVISION 'A' MAY 2017

N.E Elevation

1. Reduction of glazed doors.
2. Replacement of dormer windows with skylights
3. Reduction of window size of remaining dormers
4. Areas of brickwork replaced with feather-edged boarding

Other Elevations

5. Areas of brickwork replaced with boarding
6. Dormer cheeks removed

Floor Plans

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Scale 1:100 at A2 Sheet Size

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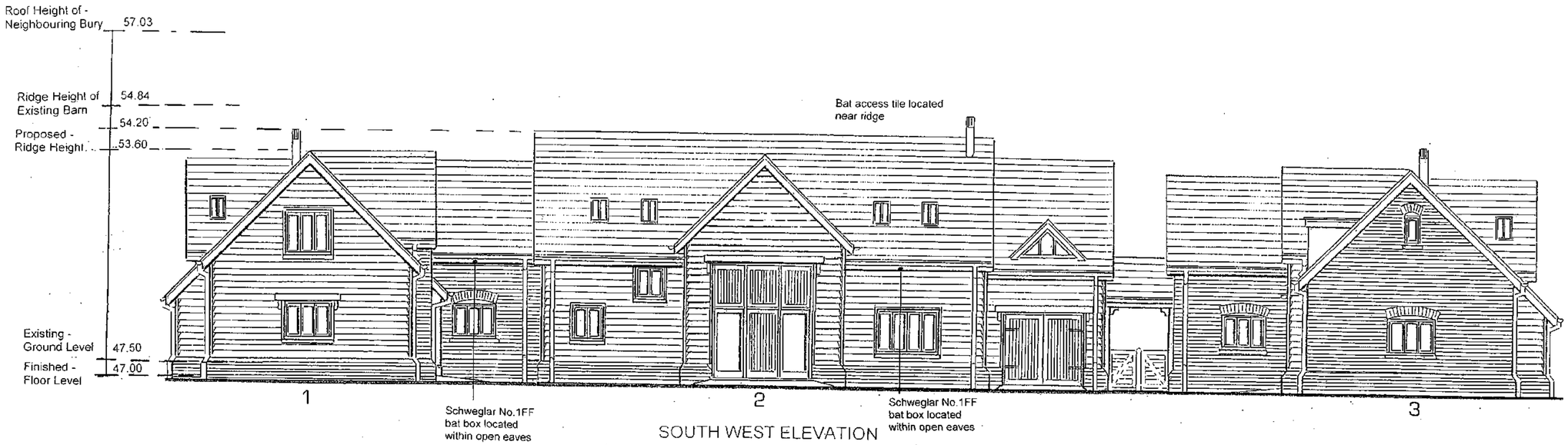
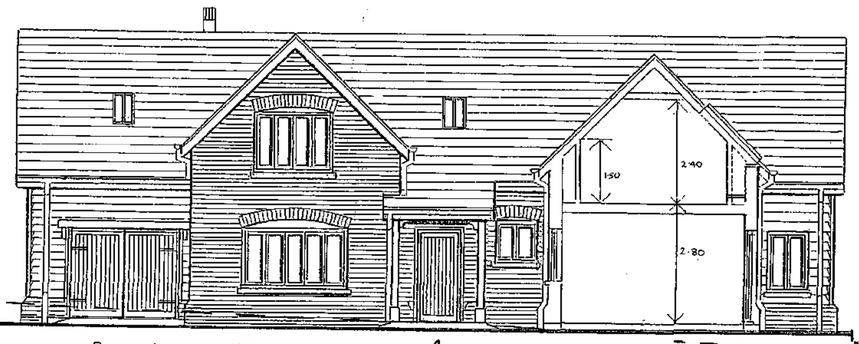
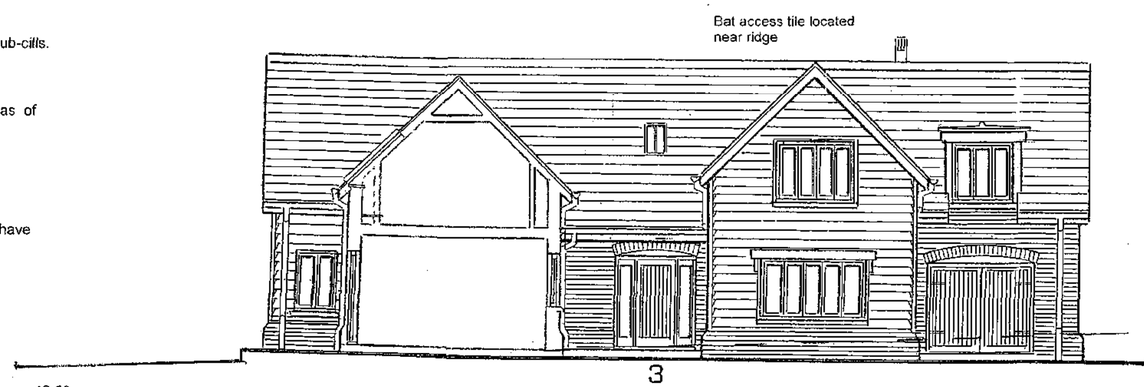


SOUTH WEST ELEVATION



SOUTH EAST ELEVATION

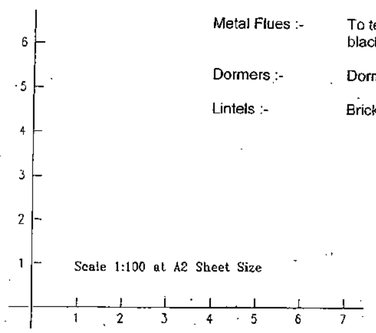


NORTH WEST ELEVATION

Existing - Ground Level 45.80

Open eaves to roof slopes to allow for location of bat boxes

Roofs :-	Natural Grey Slate for House No.2 Natural Clay Tiles for Houses Nos. 1 and 3
Walls ;-	Soft red stock brick with two course plinth for Houses Nos. 1 and 3 with areas of stained feather-boarding . House No.2 to be stained feather-edged boarding above brick plinth.
Fenestration :-	Narrow module casements with stone sub-cills.
Doors :-	Stained timber glazed doors.
Pentice Boards :-	Located over larger openings within areas of boarding.
Garage Doors :-	Side hung stained timber doors
Roof Lights :-	Low profile conservation lights.
Metal Flues :-	To terminate 600mm above ridges and have black stove finish
Dormers :-	Dormers to be lead clad
Lintels :-	Brick walls to have arched brick lintels



REVISION 'A' MAY 2017

N.E.Elevation

1. Reduction of glazed doors.
2. Replacement of dormer windows with skylights
3. Reduction of window size of remaining dormers
4. Areas of brickwork replaced with feather-edged boarding

Other Elevations

5. Areas of brickwork replaced with boarding
6. Dormer cheeks removed

Floor Plans

7. Plans revised to align with changes to elevations
8. Provision of bat boxes and bat access tiles indicated on elevations.

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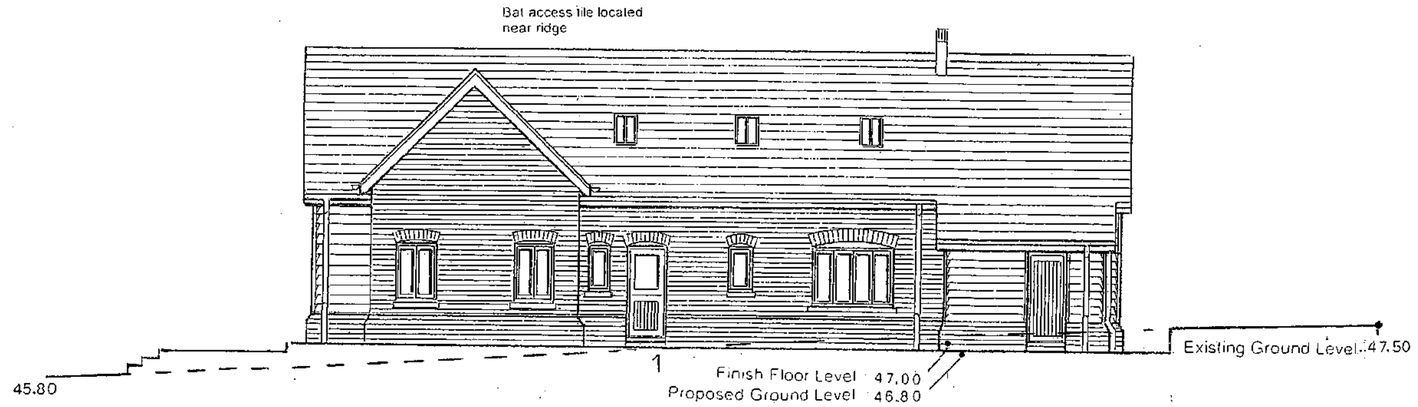
Scale 1 : 100
Date : Feb.2017
Ref. W427A

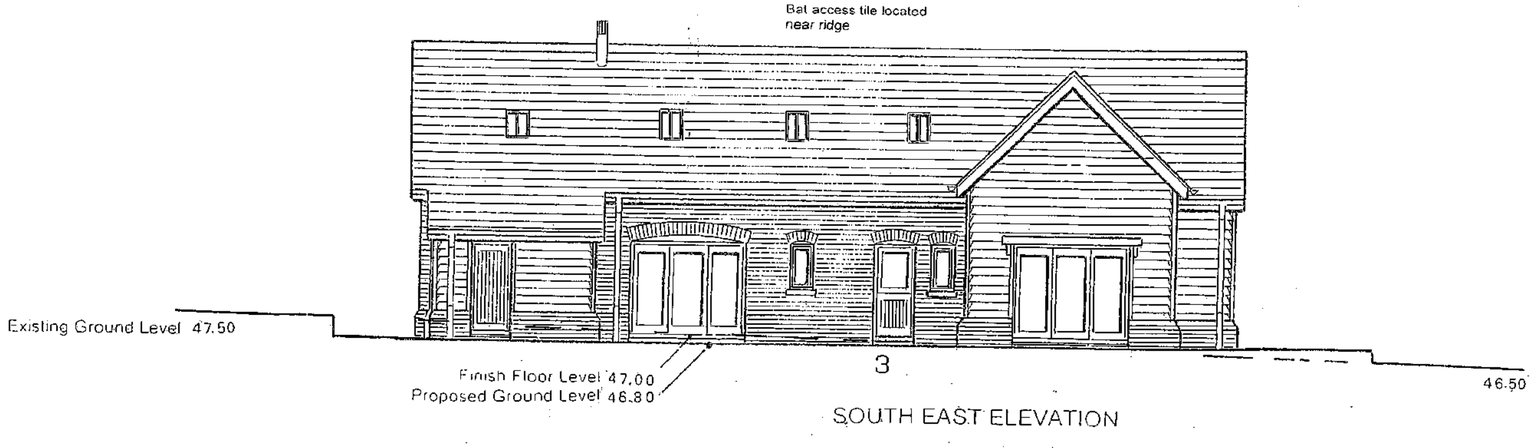


NORTH EAST ELEVATION

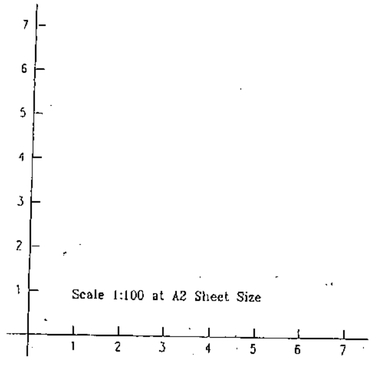
Roofs :-	Natural Grey Slate for House No.2 Natural Clay Tiles for Houses Nos. 1 and 3
Walls :-	Soft red stock brick with two course plinth for Houses Nos. 1 and 3 with areas of stained feather-boarding . House No.2 to be stained feather-edged boarding above brick plinth.
Fenestration :-	Narrow module casements with stone sub-cills.
Doors :-	Stained timber glazed doors.
Pentice Boards :-	Located over larger openings within areas of boarding.
Garage Doors :-	Side hung stained timber doors
Roof Lights :-	Low profile conservation lights.
Metal Flues :-	To terminate 600mm above ridges and have black stove finish
Dormers :-	Dormers to be lead clad
Lintels :-	Brick walls to have arched brick lintels



NORTH WEST ELEVATION



SOUTH EAST ELEVATION



REVISION 'A' MAY 2017

N.E.Elevation

1. Reduction of glazed doors.
2. Replacement of dormer windows with skylights
3. Reduction of window size of remaining dormers
4. Areas of brickwork replaced with feather-edged boarding

Other Elevations

5. Areas of brickwork replaced with boarding
6. Dormer cheeks removed

Floor Plans

7. Plans revised to align with changes to elevations
8. Provision of bat boxes and bat access tiles indicated on elevations.

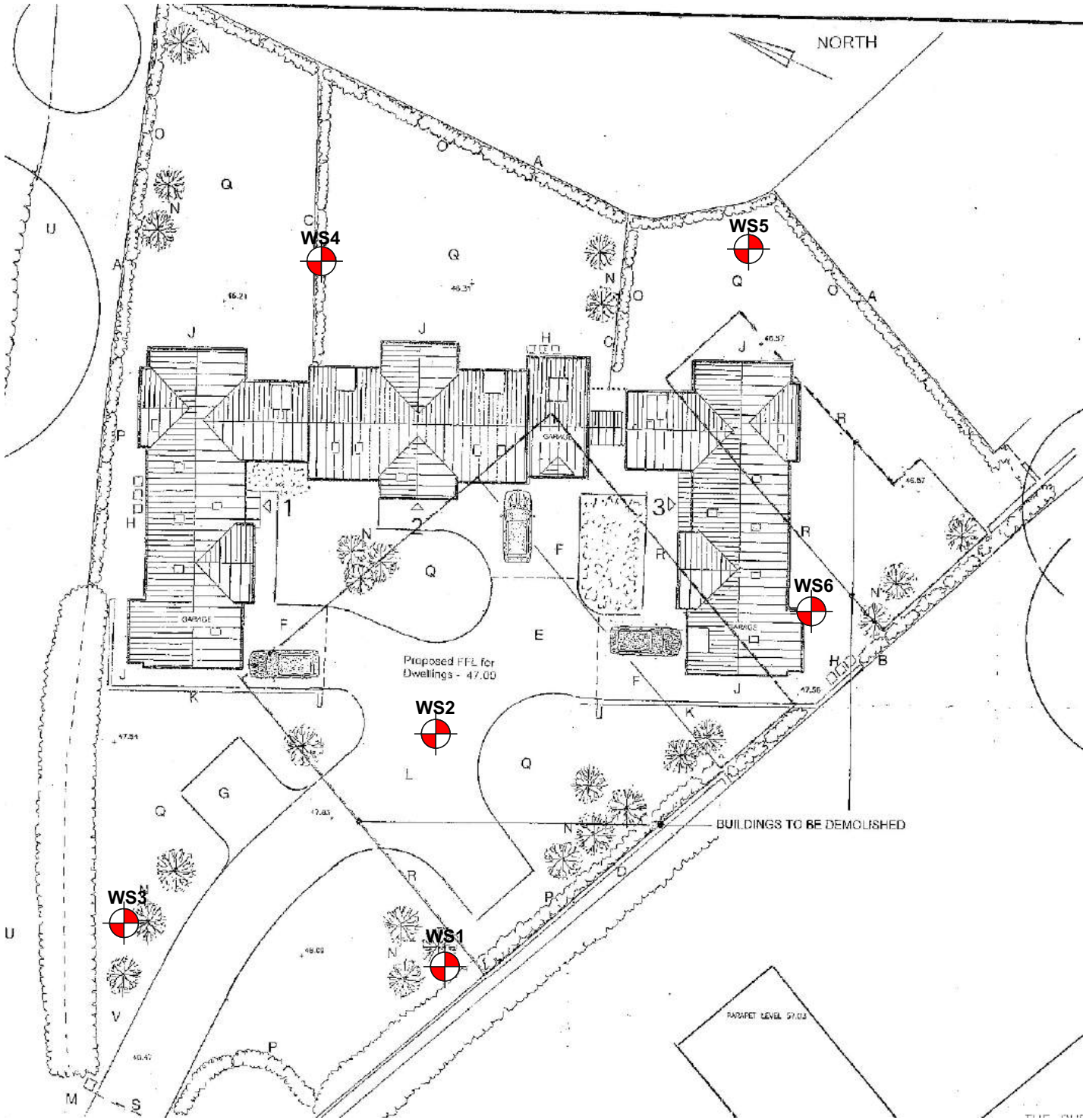
Three Proposed Dwellings and Integral Garages following Demolition of Existing Barn and Stables at Land adjoining Bury Farm, Bury Lane, Codicote, Hitchin, Herts.

Ivan J. Clarke & John W. Barrett
10A High Street, Welwyn
Hertfordshire AL6 9EQ
Tel. 01438 712804
e-mail johnandivan@btconnect.com

Scale 1 : 100
Date : Feb.2017
Ref. W428 A

APPENDIX B – SITE DETAILS

Borehole Location Plan
Borehole Logs
Siteworks Photographs



PADDOCK GEO ENGINEERING

Borehole Location Plan

**Land at Bury Farm,
Codicote,
Hertfordshire,
SG4 8XX**

GP Builders (Ampthill) Ltd

January 2018

Borehole Location

**Not to scale. All locations are approximate.
Plan based on Boundary Point Ltd -Site Survey 16C01-S1**

PADDOCK GEO ENGINEERING

Site	Number
Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX	WS1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	101mm to 2.00m 86mm to 4.00m		GP Builders (Ampthill) Limited	P17-132
	Location	**Dates** 04-01-2018	**Project Contractor** SDS	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15)	CONCRETE (Cored)		
					0.15			
0.20	C				(0.25)	Firm dark orange brown slightly sandy flint gravelly CLAY (LOWESTOFT FORMATION)		
					0.40			
0.50	HV 85kPa					Firm becoming stiff orange brown slightly sandy slightly flint gravelly CLAY (LOWESTOFT FORMATION)		
0.90	HV 78kPa							
0.90	C				(1.20)			
1.30	HV 94kPa							
1.50	D							
					1.60			
					(0.20)	Stiff orange brown sandy gravelly CLAY with rare flint cobbles (LOWESTOFT FORMATION)		
1.80	HV 101kPa				1.80			
						Stiff orange brown slightly sandy slightly flint gravelly CLAY (LOWESTOFT FORMATION)		
2.30	HV 99kPa				(1.00)			
2.50	D							
2.80	HV 99kPa				2.80			
						Medium dense orange brown clayey silty fine to medium SAND (LOWESTOFT FORMATION)		
					(1.10)			
3.50	D							
					3.90			
					(0.10)	Stiff orange brown slightly sandy slightly flint gravelly CLAY (LOWESTOFT FORMATION)		
					4.00			
						Complete at 4.00m		

Remarks
No groundwater encountered
No VOCs or hydrocarbon odours
Roots noted to 1.20m depth
Backfilled with arisings

Scale (approx)	Logged By
1:25	MIP

Figure No. P17-132.WS1

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PADDOCK GEO ENGINEERING

Site	Number
Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX	**WS2**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	101mm to 2.00m 86mm to 3.00m		GP Builders (Ampthill) Limited	P17-132
	Location	**Dates** 04-01-2018	**Project Contractor** SDS	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15)	CONCRETE (Cored)		
					0.15	Firm dark orange brown sandy flint gravelly CLAY (LOWESTOFT FORMATION)		
0.30	C				(0.35)			
0.50	HV 78kPa				0.50	Firm becoming stiff orange brown sandy very flint gravelly CLAY (LOWESTOFT FORMATION)		
					(0.45)			
0.80	C							
0.90	HV 80kPa				0.95	Stiff orange brown slightly fine gravelly sandy CLAY (LOWESTOFT FORMATION)		
1.20	HV 85kPa					becoming very sandy below 1.30m depth		
					(0.85)			
1.50	HV 78kPa							
1.50	D							
1.80	HV 110kPa				1.80	Stiff orange brown and light grey slightly sandy CLAY (LOWESTOFT FORMATION)		
2.20	HV 116kPa				(1.00)			
2.50	D							
					2.80	Stiff orange brown slightly sandy slightly flint and chalk gravelly CLAY (LOWESTOFT FORMATION)		
					(0.20)			
					3.00	Complete at 3.00m		

Remarks
No groundwater encountered
No VOCs or hydrocarbon odours
No roots noted
Backfilled with arisings

Scale (approx)	Logged By
1:25	MIP

Figure No. P17-132.WS1

Produced by the GEOtechnical DAtabase SYstem (GEODASY) (C) all rights reserved

PADDOCK GEO ENGINEERING

Site	Number
Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX	WS3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	101mm to 2.00m 86mm to 3.00m		GP Builders (Ampthill) Limited	P17-132
	Location	**Dates** 04-01-2018	**Project Contractor** SDS	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	CONCRETE (Cored)		
					(0.25)	Firm dark orange brown sandy flint gravelly CLAY (LOWESTOFT FORMATION)		
0.30	C				0.35	Stiff orange brown and light grey slightly sandy CLAY with rare flint and chalk gravel (LOWESTOFT FORMATION)		
0.50	HV 80kPa							
0.80	C							
0.90	HV 83kPa							
1.20	HV 88kPa							
1.50	HV 99kPa							
1.50	D				(2.40)			
1.80	HV 91kPa							
2.20	HV 94kPa							
2.50	HV 94kPa							
2.50	D							
2.80	HV 91kPa				2.75	Stiff orange brown slightly sandy chalk gravelly CLAY (LOWESTOFT FORMATION)		
					(0.25)			
					3.00	Complete at 3.00m		

Remarks
Roots identified to 1.0m depth
No VOCs or hydrocarbon odours
No groundwater encountered
Backfilled with arisings

Scale (approx)	Logged By
1:25	MIP

Figure No. P17-132.WS1

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PADDOCK GEO ENGINEERING

Site	Number
Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX	**WS4**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	101mm to 2.00m 86mm to 3.00m		GP Builders (Ampthill) Limited	P17-132
	Location	**Dates** 04-01-2018	**Project Contractor** SDS	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.45)	Dark brown slightly sandy slightly gravelly loamy CLAY (TOPSOIL)		
0.30	C				0.45			
					(0.35)	Multicolour clayey SAND and GRAVEL (MADE GROUND)		
0.70	C				0.80			
0.90	HV 44kPa				(0.30)	Firm dark brown and dark orange brown slightly sandy slightly gravelly CLAY (LOWESTOFT FORMATION)		
1.20	HV 88kPa				1.10			
1.50	HV 88kPa					Stiff red brown slightly sandy CLAY (LOWESTOFT FORMATION)		
1.50	D				(1.00)			
1.80	HV 91kPa							
					2.10			
2.50	D				(0.90)	Structureless CHALK composed of off white silty sandy fine to medium subangular GRAVEL (GRADE Dc - Lewes Nodular Chalk Formation And Seaford Chalk Formation (undifferentiated))		
					3.00			
						Complete at 3.00m		

Remarks
No VOCs or hydrocarbon odours
No groundwater encountered
No roots noted
Backfilled with arisings

Scale (approx)	Logged By
1:25	MIP

Figure No. P17-132.WS1

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PADDOCK GEO ENGINEERING

Site	Number
Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX	**WS5**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	101mm to 2.00m 86mm to 3.00m		GP Builders (Ampthill) Limited	P17-132
	Location	**Dates** 04-01-2018	**Project Contractor** SDS	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25)	Dark brown slightly sandy slightly gravelly loamy CLAY (TOPSOIL)		
0.20	C				0.25	Firm becoming stiff orange brown slightly gravelly CLAY (LOWESTOFT FORMATION)		
0.50	HV 52kPa							
					(0.95)			
0.80	HV 57kPa							
0.90	C							
1.10	HV 81kPa							
					1.20			
					(0.30)	Medium dense orange brown clayey silty SAND (LOWESTOFT FORMATION)		
1.50	D				1.50			
1.60	HV 88kPa					Stiff orange brown slightly flint gravell CLAY (LOWESTOFT FORMATION)		
1.90	HV 98kPa							
2.20	HV 104kPa							
					(1.50)			
2.50	HV 104kPa							
2.50	D							
2.80	HV 107kPa							
					3.00	Complete at 3.00m		

Remarks
No groundwater encountered
No VOCs or hydrocarbon odours
No roots noted
Backfilled with arisings

Scale (approx)	Logged By
1:25	MIP

Figure No. P17-132.WS1

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PADDOCK GEO ENGINEERING

Site	Number
Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX	WS6

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	101mm to 2.00m 86mm to 3.00m		GP Builders (Ampthill) Limited	P17-132
	Location	**Dates** 04-01-2018	**Project Contractor** SDS	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25)	MACADAM PLANINGS		
					0.25			
					(0.25)	Multicolour clayey SAND and GRAVEL (MADE GROUND)		
0.35	C				0.50			
0.80	C					Firm dark brown and dark grey silty sandy CLAY (LOWESTOFT FORMATION)		
0.90	HV 44kPa				(0.60)			
1.20	HV 88kPa				1.10			
1.50	HV 88kPa					Stiff orange brown and light grey silty sandy CLAY (LOWESTOFT FORMATION)		
1.50	D							
1.80	HV 91kPa							
					(1.90)			
2.50	D							
					3.00	Complete at 3.00m		

Remarks
No groundwater encountered
No VOCs or hydrocarbon odours
No roots noted
Backfilled with arisings

Scale (approx)	Logged By
1:25	MIP

Figure No. P17-132.WS1

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Site western area looking east



Area of former AST

PADDOCK GEO ENGINEERING

Client:	**GB Builders (Ampthill) Limited**
Project No:	**P17-132sca**
Project Title:	**Land at Bury Farm, Bury Lane, Codicote, Herts, SG4 8XX**



Main barn internal



Southeastern area of barn

PADDOCK GEO ENGINEERING

Client:	**GB Builders (Ampthill) Limited**
Project No:	**P17-132sca**
Project Title:	**Land at Bury Farm, Bury Lane, Codicote, Herts, SG4 8XX**



North of barn and stables demolition —macadam planings and manure pile (removed subsequent to photo)



Northern area of the site—WS4 location

PADDOCK GEO ENGINEERING

Client:	**GB Builders (Ampthill) Limited**
Project No:	**P17-132sca**
Project Title:	**Land at Bury Farm, Bury Lane, Codicote, Herts, SG4 8XX**



WS1



WS2

PADDOCK GEO ENGINEERING

Client:	**GB Builders (Ampthill) Limited**
Project No:	**P17-132sca**
Project Title:	**Land at Bury Farm, Bury Lane, Codicote, Herts, SG4 8XX**



WS3



WS4

PADDOCK GEO ENGINEERING

Client:	**GB Builders (Ampthill) Limited**
Project No:	**P17-132sca**
Project Title:	**Land at Bury Farm, Bury Lane, Codicote, Herts, SG4 8XX**



WS5



WS6

PADDOCK GEO ENGINEERING

Client:	**GB Builders (Ampthill) Limited**
Project No:	**P17-132sca**
Project Title:	**Land at Bury Farm, Bury Lane, Codicote, Herts, SG4 8XX**

APPENDIX C – CONTAMINATION ASSESSMENT DATA

Chemical Analysis Reports
Chemical Analysis Results Summary
PGE In-House GACs
Contamination Area Plan
Remediation Plan

Matt Paddock
Paddock Geo Engineering
14 Burns Road
Bletchley
Milton Keynes
MK3 5AL

t: 01908 271366

e: matt@paddockgeoengineering.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 18-72115

Replaces Analytical Report Number : 18-72115, issue no. 1

Project / Site name:	Bury Farm, Codicote	**Samples received on:**	05/01/2018
Your job number:	P17-132C01	**Samples instructed on:**	05/01/2018
Your order number:	P17-132	**Analysis completed by:**	06/02/2018
Report Issue Number:	2	**Report issued on:**	06/02/2018
Samples Analysed:	10 soil samples		

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 18-72115

Project / Site name: Bury Farm, Codicote
Your Order No: P17-132

Lab Sample Number				884568	884569	884570	884571	884572
Sample Reference				WS1	WS1	WS2	WS2	WS3
Sample Number				C	C	C	C	C
Depth (m)				0.20	0.90	0.30	0.80	0.30
Date Sampled				04/01/2018	04/01/2018	04/01/2018	04/01/2018	04/01/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	30	< 0.1	22	15	16
Moisture Content	%	N/A	NONE	9.0	11	11	7.6	12
Total mass of sample received	kg	0.001	NONE	0.43	0.44	0.52	0.38	0.46
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.9	8.0	8.2	7.4	8.2
Total Cyanide	mg/kg	1	MCERTS	< 1	-	-	-	-
Free Cyanide	mg/kg	1	MCERTS	< 1	-	-	-	-
Total Sulphate as SO_4	mg/kg	50	MCERTS	280	200	600	470	280
Sulphide	mg/kg	1	MCERTS	< 1.0	-	-	-	-
Total Sulphur	mg/kg	50	MCERTS	140	-	-	-	-
Loss on Ignition @ 450°C	%	0.2	MCERTS	3.2	2.1	3.4	2.8	3.8
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.31
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	3.5
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1.0
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	4.2
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	3.4
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1.7
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1.7
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1.7
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.72
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1.5
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.72
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.78
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	21.2
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	45	12	76	16	59
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.99	1.0	1.0	1.6	1.2
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	0.7	1.0	0.4	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.4	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	30	23	27	38	29
Copper (aqua regia extractable)	mg/kg	1	MCERTS	23	16	22	20	27
Lead (aqua regia extractable)	mg/kg	1	MCERTS	34	13	41	19	51
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	60	25	83	38	73
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	47	41	55	49	50
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	160	47	240	77	240

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 18-72115

Project / Site name: Bury Farm, Codicote
Your Order No: P17-132

Lab Sample Number				884568	884569	884570	884571	884572
Sample Reference				WS1	WS1	WS2	WS2	WS3
Sample Number				C	C	C	C	C
Depth (m)				0.20	0.90	0.30	0.80	0.30
Date Sampled				04/01/2018	04/01/2018	04/01/2018	04/01/2018	04/01/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	-	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
p & m-xylene	µg/kg	1	MCERTS	-	-	-	-	-
o-xylene	µg/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	-
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
TPH C10 - C40	mg/kg	10	MCERTS	-	< 10	< 10	< 10	41
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-
TPH (C10 - C25)	mg/kg	10	MCERTS	< 10	-	-	-	-
TPH (C25 - C40)	mg/kg	10	NONE	< 10	-	-	-	-

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 18-72115

Project / Site name: Bury Farm, Codicote
Your Order No: P17-132

Lab Sample Number				884573	884574	884575	884576	884577
Sample Reference				WS3	WS4	WS4	WS5	WS6
Sample Number				C	C	C	C	C
Depth (m)				0.80	0.30	0.70	0.20	0.35
Date Sampled				04/01/2018	04/01/2018	04/01/2018	04/01/2018	04/01/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	50	< 0.1	24
Moisture Content	%	N/A	NONE	17	17	1.9	12	9.0
Total mass of sample received	kg	0.001	NONE	0.38	0.39	0.52	0.42	0.46
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Not-detected	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.4	8.1	9.3	7.6	8.6
Total Cyanide	mg/kg	1	MCERTS	-	< 1	-	< 1	-
Free Cyanide	mg/kg	1	MCERTS	-	< 1	-	< 1	-
Total Sulphate as SO_4	mg/kg	50	MCERTS	360	780	1300	680	440
Sulphide	mg/kg	1	MCERTS	-	2.9	-	5.9	-
Total Sulphur	mg/kg	50	MCERTS	-	420	-	450	-
Loss on Ignition @ 450°C	%	0.2	MCERTS	3.2	6.7	4.1	5.9	1.1
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.34	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.19	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.17	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	2.0	1.1	2.2	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.54	0.25	0.89	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	3.1	2.0	5.8	0.28
Pyrene	mg/kg	0.05	MCERTS	< 0.05	2.6	1.8	5.7	0.33
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	1.3	0.80	2.7	0.19
Chrysene	mg/kg	0.05	MCERTS	< 0.05	1.1	1.6	3.2	0.20
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	1.7	2.9	3.7	0.37
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.62	0.78	1.7	0.27
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	1.4	1.2	3.2	0.36
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.67	1.2	1.8	0.22
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.29	0.34	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.80	1.6	2.0	0.26
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	15.7	15.4	33.9	2.48
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	13	7.6	20	13
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.3	0.83	10	1.1	0.36
Boron (water soluble)	mg/kg	0.2	MCERTS	0.9	2.0	1.7	1.5	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.4	0.5	0.5	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	29	21	41	28	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	18	19	17	26	5.8
Lead (aqua regia extractable)	mg/kg	1	MCERTS	13	61	18	73	9.0
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	34	20	6.0	29	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	2.4	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	41	41	99	39	28
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	62	94	73	180	25

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Analytical Report Number: 18-72115

Project / Site name: Bury Farm, Codicote
Your Order No: P17-132

Lab Sample Number				884573	884574	884575	884576	884577
Sample Reference				WS3	WS4	WS4	WS5	WS6
Sample Number				C	C	C	C	C
Depth (m)				0.80	0.30	0.70	0.20	0.35
Date Sampled				04/01/2018	04/01/2018	04/01/2018	04/01/2018	04/01/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	-	-	< 1.0	-	-
Toluene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
p & m-xylene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
o-xylene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-	< 0.1	-	< 0.1	-
TPH C10 - C40	mg/kg	10	MCERTS	< 10	-	2300	-	16
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	< 0.001	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	< 0.001	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	< 0.001	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	2.0	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	7.6	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	18	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	520	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	550	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	< 0.001	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	< 0.001	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	< 0.001	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	1.8	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	6.0	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	31	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	1000	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	1100	-	-
TPH (C10 - C25)	mg/kg	10	MCERTS	-	51	-	110	-
TPH (C25 - C40)	mg/kg	10	NONE	-	62	-	310	-

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Analytical Report Number : 18-72115

Project / Site name: Bury Farm, Codicote

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Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
884568	WS1	C	0.20	Brown clay and sand with gravel and stones.
884569	WS1	C	0.90	Light brown clay and sand with gravel.
884570	WS2	C	0.30	Light brown clay and sand with gravel and stones.
884571	WS2	C	0.80	Light brown clay and sand with gravel and stones.
884572	WS3	C	0.30	Light brown clay and sand with stones.
884573	WS3	C	0.80	Light brown clay and sand with gravel.
884574	WS4	C	0.30	Brown loam and clay with gravel and vegetation.
884575	WS4	C	0.70	Brown sandy loam with gravel and stones.
884576	WS5	C	0.20	Brown clay and sand with gravel and vegetation.
884577	WS6	C	0.35	Light brown sand with gravel and stones.

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Analytical Report Number : 18-72115

Project / Site name: Bury Farm, Codicote

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L047-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding.	L076-PL	W	MCERTS

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Analytical Report Number : 18-72115

Project / Site name: Bury Farm, Codicote

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPH Oils (Soils)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method	L076-PL	D	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L088/76-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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Analytical Report Number : 18-73802

Project / Site name:	Bury Farm, Codicote	**Samples received on:**	05/01/2018
Your job number:	P17-132C01	**Samples instructed on:**	24/01/2018
Your order number:	P17-132	**Analysis completed by:**	05/02/2018
Report Issue Number:	1	**Report issued on:**	05/02/2018
Samples Analysed:	3 soil samples		

Signed CCStone

Dr Claire Stone
Quality Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 18-73802

Project / Site name: Bury Farm, Codicote
Your Order No: P17-132

Lab Sample Number				894922	894923	894924		
Sample Reference				WS1	WS2	WS3		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.20	0.30	0.30		
Date Sampled				04/01/2018	04/01/2018	04/01/2018		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	56	65	65		
Moisture Content	%	N/A	NONE	9.0	11	12		
Total mass of sample received	kg	0.001	NONE	0.43	0.52	0.46		
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	73	94	80		
PBET Results (Bioaccessibile Fraction)								
Arsenic (Stomach)	%	1	NONE	2.5	3.4	3.8		
Arsenic (Intestine 1)	%	1	NONE	**2.9**	2.7	4.4		
Arsenic (Intestine 2)	%	1	NONE	2.9	**5.7**	**5.3**		
Bioaccessible Fraction %	Maximum % BAF			**2.9 % (I1)**	**5.7 % (I2)**	**5.3 % (I2)**		

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Analytical Report Number : 18-73802

Project / Site name: Bury Farm, Codicote

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
894922	WS1	None Supplied	0.20	Brown clay and sand with gravel and stones.
894923	WS2	None Supplied	0.30	Light brown clay and sand with gravel and stones.
894924	WS3	None Supplied	0.30	Light brown clay and sand with stones.

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Analytical Report Number : 18-73802

Project / Site name: Bury Farm, Codicote

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
PBET	In House Method	In house method based on Ruby et.al.		D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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Human Health Generic Contamination Risk Assessment - Bury Farm, Codicote (10 Samples)

SOIL SAMPLES < 1.0m DEPTH

Determinand	Units	95th Percentile Upper Confidence Limit (Mean)	Assessment Criteria Residential with Gardens Concentration (cc)	Mean Exceeds cc	Outliers	True Mean (μ)	Exceeding Samples
Metals/Metaloids							
Arsenic	mg kg^{-1}	43.02	37.0	Y	Y	17.6	WS1 0.20m WS2 0.30m WS3 0.30m
Berylium	mg kg^{-1}	3.81	1.7	Y	Y	1.3	WS4 0.70m
Cadmium	mg kg^{-1}	0.39	11.0				
Chromium	mg kg^{-1}	33	910				
Inorganic Mercury	mg kg^{-1}	0.30	40.0				
Nickel	mg kg^{-1}	55	180				
Lead	mg kg^{-1}	48	190				
Selenium	mg kg^{-1}	1.43	250				
Copper	mg kg^{-1}	23	2400				
Zinc	mg kg^{-1}	172	3700				
Vanadium	mg kg^{-1}	61.54	410				
Phytotoxic Metals (Phytotoxicity)							
Copper	mg kg^{-1}	23	111				
Zinc	mg kg^{-1}	172	330				
Hydrocarbons							
Total Petroleum Hydrocarbons							
TPH EC6-EC10 (PRO)	mg kg^{-1}	0.06	65				
TPH EC10-EC21 (DRO)	mg kg^{-1}	40.99	300				
TPH EC21-EC40 (Min.Oil)	mg kg^{-1}	102.28	1500				
Total TPH	mg kg^{-1}	765.80	600	Y	Y	149.86	
Poly Aromatic Hydrocarbons							
Benzo(a)pyrene	mg kg^{-1}	1.48	2.70	N			WS5 0.20m
Napthalene	mg kg^{-1}	0.05	5.60				
Dibenzo(a,h) anthracene	mg kg^{-1}	0.18	0.28	N			WS4 0.70m WS5 0.20m
Flourene	mg kg^{-1}	0.14	400.00				
Phenols	mg kg^{-1}	0.62	420.00				
OTHER							
pH	-	4.7	<5, >12				
Sulphate (Total)	mg kg^{-1}	753	2500				
Sulphur	mg kg^{-1}	220	2500				
Water Soluble Boron	mg kg^{-1}	1.34	290				
Asbestos Screen	Detection	None	Detection				
Asbestos Quantification	%	N/A	Detection Limit				

NOTE:

na - Not applicable
ne - Not evaluated, all results below the appropriate guideline level
nc - not displayed as results are not meaningful due to large uncertainty from small data set

PADDOCK GEO ENGINEERING

CLIENT: GP Builders (Ampthill) Limited
PROJECT No: P17-132sca
PROJECT TITL Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX

RESULTS SUMMARY - MAX VALUE TEST - LESS THAN 1.0M DEPTH (RESIDENTIAL WITH GARDENS)

Land at Bury Farm, Codicote

DETERMINAND	**Arsenic**
SITE ASSESSMENT CRITERIA	**37 mg/kg**

LOCATION	DEPTH	CONC ($mgkg^{-1}$)
WS1	0.20	45
WS1	0.90	12
WS2	0.30	76
WS2	0.80	16
WS3	0.30	59
WS3	0.80	11
WS4	0.30	13
WS4	0.70	7.6
WS5	0.20	20
WS6	0.35	13

N	T Values
2	6.314
3	2.92
4	2.353
5	2.132
6	2.015
7	1.943
8	1.895
9	1.86
10	1.833
11	1.812
12	1.796
13	1.782
14	1.771
15	1.761
16	1.753
17	1.746
18	1.74
19	1.734
20	1.729
21	1.725
22	1.721
N	1.717
24	1.714
25	1.711
26	1.708
27	1.706
28	1.703
29	1.701
30	1.699

MEAN CONC (x)	**27.26**
CONC ST. DEV. (s	**23.9622**
Number (n)	**10**
Y Max	**76.00**
Calculated T value	**2.03404**
Representitive T value	**1.833**

Max Value Test	**Failed**
Outlier?	**Contamination Hotspots Present**

PADDOCK GEO ENGINEERING

Client: GP Builders (Ampthill) Limited

Project No: P17-132sca

Project: Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX

RESULTS SUMMARY - MAX VALUE TEST - LESS THAN 1.0M DEPTH (RESIDENTIAL WITH GARDENS)

Land at Bury Farm, Codicote

DETERMINAND	**Beryllium**
SITE ASSESSMENT CRITERIA	**1.7 mg/kg**

LOCATION	DEPTH	CONC ($mgkg^{-1}$)
WS1	0.20	0.99
WS1	0.90	1
WS2	0.30	1
WS2	0.80	1.6
WS3	0.30	1.2
WS3	0.80	1.3
WS4	0.30	0.83
WS4	0.70	10
WS5	0.20	1.1
WS6	0.35	0.36

N	T Values
2	6.314
3	2.92
4	2.353
5	2.132
6	2.015
7	1.943
8	1.895
9	1.86
10	1.833
11	1.812
12	1.796
13	1.782
14	1.771
15	1.761
16	1.753
17	1.746
18	1.74
19	1.734
20	1.729
21	1.725
22	1.721
N	1.717
24	1.714
25	1.711
26	1.708
27	1.706
28	1.703
29	1.701
30	1.699

MEAN CONC (x)	**1.94**
CONC ST. DEV. (s	**2.850734**
Number (n)	**10**
Y Max	**10.00**
Calculated T value	**2.82804**
Representitive T value	**1.833**

Max Value Test	**Failed**
Outlier?	**Contamination Hotspots Present**

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Land at Bury Farm, Codicote

DETERMINAND	**Total TPH**
SITE ASSESSMENT CRITERIA	**600 mg/kg**

LOCATION	DEPTH	CONC ($mgkg^{-1}$)
WS1	0.20	20.1
WS1	0.90	10
WS2	0.30	10
WS2	0.80	10
WS3	0.30	41
WS3	0.80	10
WS4	0.30	113.1
WS4	0.70	2300
WS5	0.20	420.1
WS6	0.35	16

N	T Values
2	6.314
3	2.92
4	2.353
5	2.132
6	2.015
7	1.943
8	1.895
9	1.86
10	1.833
11	1.812
12	1.796
13	1.782
14	1.771
15	1.761
16	1.753
17	1.746
18	1.74
19	1.734
20	1.729
21	1.725
22	1.721
N	1.717
24	1.714
25	1.711
26	1.708
27	1.706
28	1.703
29	1.701
30	1.699

MEAN CONC (x)	**295.03**
CONC ST. DEV. (s	**715.8204**
Number (n)	**10**
Y Max	**2300.00**
Calculated T value	**2.80094**
Representitive T value	**1.833**

Max Value Test	**Failed**
Outlier?	**Contamination Hotspots Present**

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GENERIC HUMAN HEALTH SCREENING TOTAL SOIL CONCENTRATION ASSESSMENT CRITERIA (GAC)

DETERMINAND		RESIDENTIAL (mg/kg)		COMMERCIAL (mg/kg)
Chemical	**GAC Sources and units**	**With Home Grown produce**	**Without Home Grown produce**	
Asbestos Screen & ID*	-	Detected	Detected	Detected
Cyanide - Total	SNIFFER	53.25	53.25	53.25
Cyanide - Free	SNIFFER	53.25	53.25	53.25
Loss on Ignition @ 450°C	-	-	-	-
Sulphate (as SO_4) - Total	BRE****	2400	2400	2400
Sulphide	ICRCL	2500	2500	2500
Sulphur - Total	ICRCL	2500	2500	2500
Phenol (Total Monohydric)	CLEA	420	420	3200
pH	ICRCL	<5,>12	<5,>12	-
Metals and Metalloids (CLEA Metals)				
Arsenic	LQM S4UL	37	40	640
Beryllium	LQM S4UL	1.7	1.7	12
Cadmium	LQM S4UL	11	85	190
Chromium III	LQM S4UL	910	910	8600
Lead	DEFRA C4SL	190	310	2300
Mercury (Total)	LQM S4UL (Inorganic)	40	56	1100
Selenium	LQM S4UL	250	430	12000
Copper (phytotoxicity)	LQM S4UL	2400 (111)	7100	68000
Nickel	LQM S4UL	180	180	980
Zinc (phytotoxicity)	LQM S4UL	3700 (330)	40000	730000
Vanadium	LQM S4UL	410	1200	9000
Boron - Water Soluble	LQM S4UL	290	11000	240000
Total Petroleum Hydrocarbons**				
TPH (EC6-EC10) - PRO	LQM S4UL (2.5% SOM)	65	100	4800
TPH (EC10-EC21) - DRO	LQM S4UL (2.5% SOM)	300	600	23000
TPH (EC21-EC40) - Min. Oil	LQM S4UL (2.5% SOM)	1500	1900	28000
Total TPH (EC10-EC40)	LQM S4UL (2.5% SOM)	600	900	23000
Polycyclic Aromatic Hydrocarbons***				
Naphthalene	LQM S4UL (2.5% SOM)	5.6	5.6	460
Flourene	LQM S4UL (2.5% SOM)	400	3800	68000
Benzo[a]pyrene	LQM S4UL (2.5% SOM)	2.7	3.2	35
Dibenzo[a,h]anthracene	LQM S4UL (2.5% SOM)	0.28	0.32	3.6

Notes

The Generic Assessment Criteria (GAC) are based on CLEA Soil Guidance Values published values and CIEH/LQM S4CLs where available or ICRCL, DoE, BRE and HSE levels where necessary.
Where gaps remain GACs were calculated using the latest CLEA spreadsheet using DEFRA C4SL toxicology and physiochemical parameters from DEFRA SP1010.

* Guidance level set at any fibre identification.

** TPH 3 band is employed as a screening tool to instigate detailed speciated analysis to the TPHCWG methodology. Based on mean of fractions included

*** Testing based on USEPA Priority 16 compounds. GACs for four compounds and total PAH with published GACs only, used as a screening tool.

**** BRE SD1 - DS-1 Concrete Sulphate Design Class limit. Sulphate is not considered to pose a significant risk to human health under normal circumstances.

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GENERIC HUMAN HEALTH HYDROCARBON TOTAL SOIL CONCENTRATION ASSESSMENT CRITERIA (GAC)

DETERMINAND		RESIDENTIAL (mg/kg)		COMMERCIAL (mg/kg)
Chemical	**GAC Sources and units**	**With Home Grown produce**	**Without Home Grown produce**	
TPH CWG				
Aliphatic EC 5-6	LQM S4UL (2.5% SOM)	78	78	5900
Aliphatic EC >6-8	LQM S4UL (2.5% SOM)	230	230	17000
Aliphatic EC >8-10	LQM S4UL (2.5% SOM)	65	65	4800
Aliphatic EC >10-12	LQM S4UL (2.5% SOM)	330	330	23000
Aliphatic EC >12-16	LQM S4UL (2.5% SOM)	2400	2400	82000
Aliphatic EC >16-35	LQM S4UL (2.5% SOM)	92000	92000	1700000
Aliphatic EC >35-44	LQM S4UL (2.5% SOM)	92000	92000	1700000
Aromatic EC 5-7 (Benzene)	LQM S4UL (2.5% SOM)	140	690	46000
Aromatic EC >7-8 (Toluene)	LQM S4UL (2.5% SOM)	290	1800	110000
Aromatic EC >8-10	LQM S4UL (2.5% SOM)	83	110	8100
Aromatic EC >10-12	LQM S4UL (2.5% SOM)	180	590	28000
Aromatic EC >12-16	LQM S4UL (2.5% SOM)	330	2300	37000
Aromatic EC >16-21	LQM S4UL (2.5% SOM)	540	1900	28000
Aromatic EC >21-35	LQM S4UL (2.5% SOM)	1500	1900	28000
Aromatic EC >35-44	LQM S4UL (2.5% SOM)	1500	1900	28000
Aliphatic and Aromatic EC >44	LQM S4UL (2.5% SOM)	1500	1900	28000
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	LQM S4UL (2.5% SOM)	510	4700	97000
Acenaphthylene	LQM S4UL (2.5% SOM)	420	4600	97000
Anthracene	LQM S4UL (2.5% SOM)	5400	35000	540000
Benzo[a]anthracene	LQM S4UL (2.5% SOM)	11	14	170
Benzo[a]pyrene	LQM S4UL (2.5% SOM)	2.7	3.2	35
Benzo[b]fluoranthene	LQM S4UL (2.5% SOM)	3.3	4	44
Benzo[ghi]perylene	LQM S4UL (2.5% SOM)	340	360	4000
Benzo[k]fluoranthene	LQM S4UL (2.5% SOM)	93	110	1200
Chrysene	LQM S4UL (2.5% SOM)	22	31	350
Dibenzo[ah]anthracene	LQM S4UL (2.5% SOM)	0.28	0.32	3.6
Fluoranthene	LQM S4UL (2.5% SOM)	560	1600	23000
Fluorene	LQM S4UL (2.5% SOM)	400	3800	68000
Indeno[123-cd]pyrene	LQM S4UL (2.5% SOM)	36	46	510
Naphthalene	LQM S4UL (2.5% SOM)	5.6	5.6	460
Phenanthrene	LQM S4UL (2.5% SOM)	220	1500	22000
Pyrene	LQM S4UL (2.5% SOM)	1200	3800	54000
Coal Tar (BaP as marker)	LQM S4UL (2.5% SOM)	0.98	1.2	15

Notes
The Generic Assessment Criteria (GAC) are based on CIEH/LQM S4ULs.

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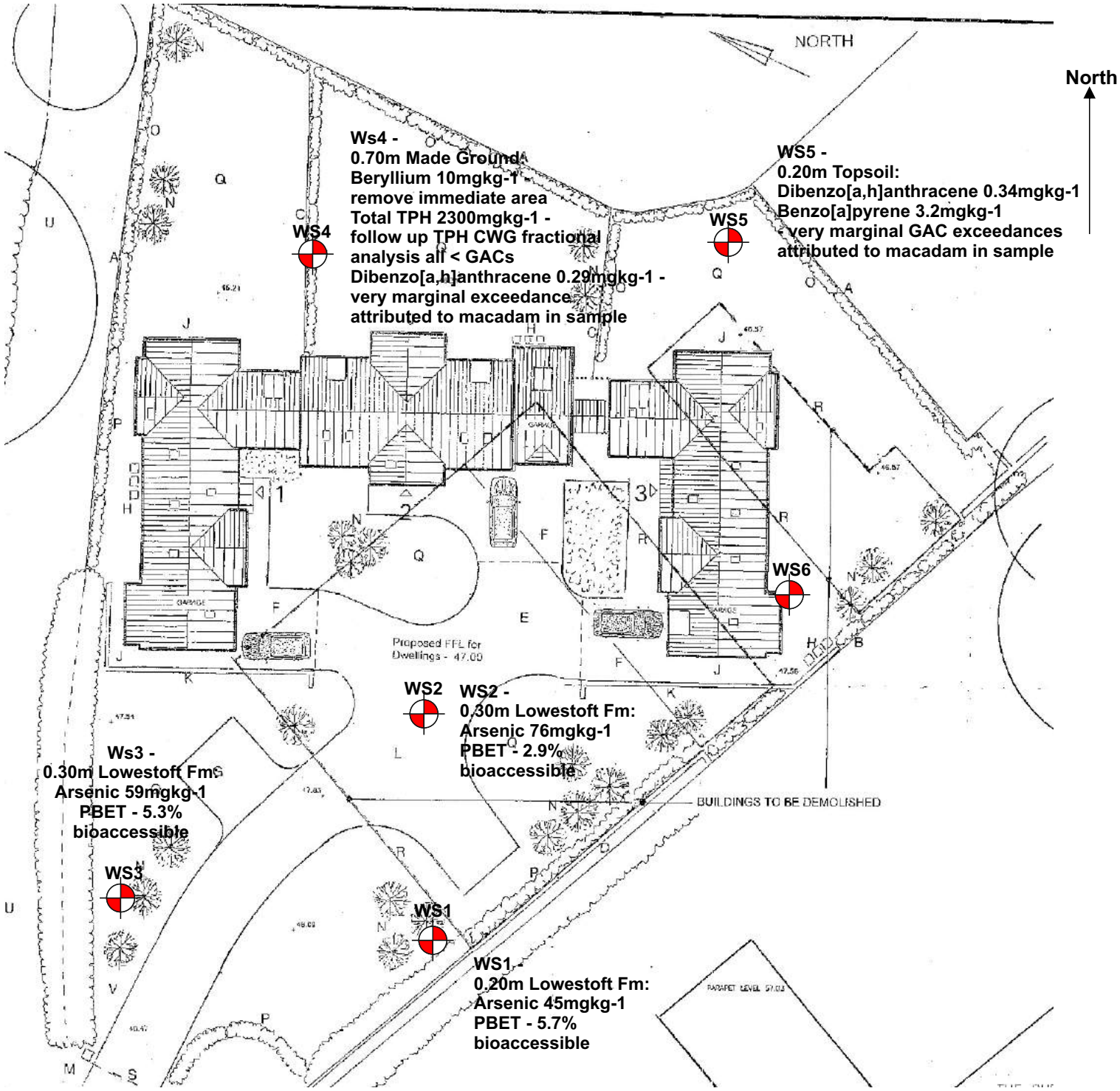

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Contamination Plan

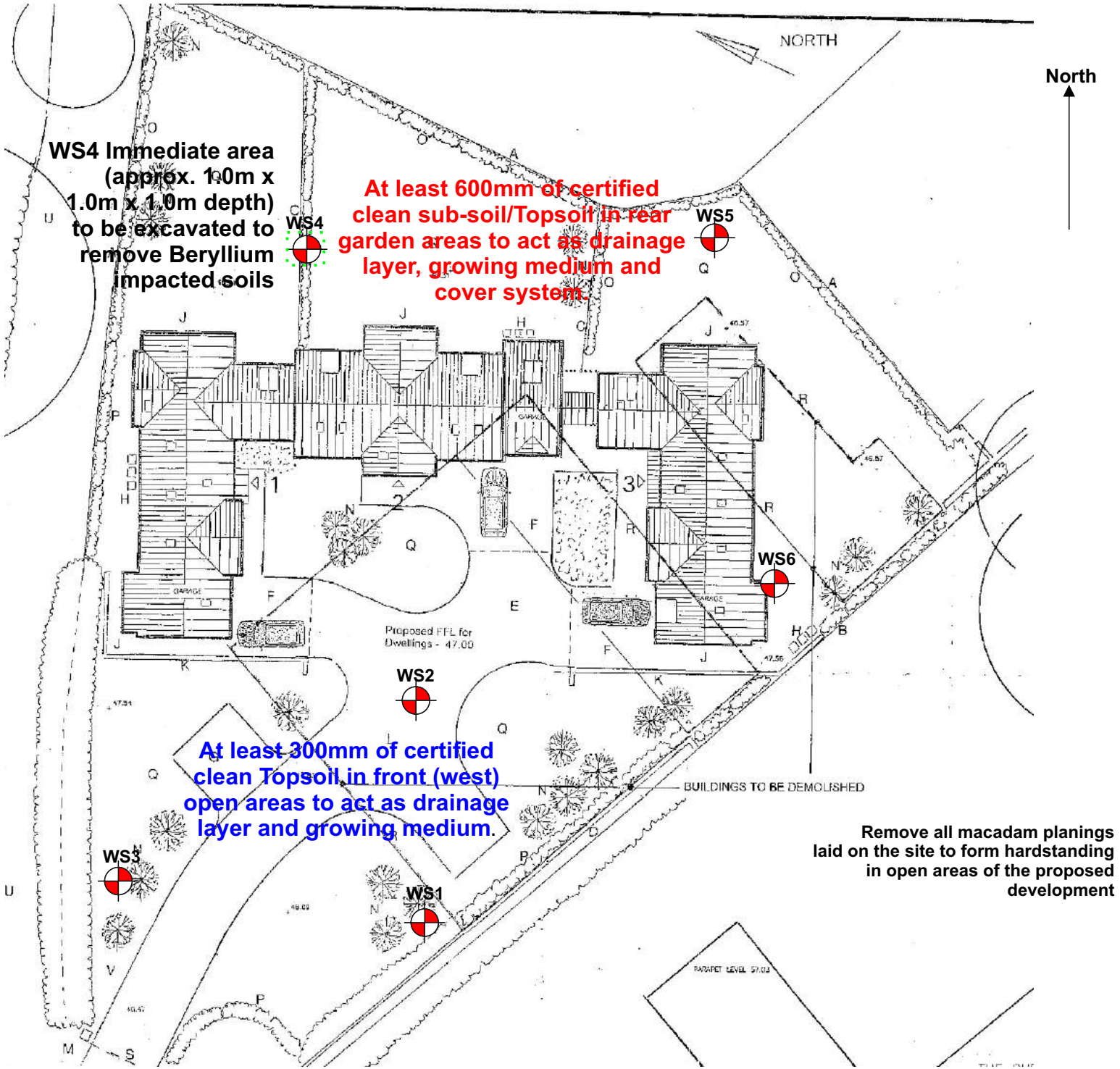
**Land at Bury Farm,
Codicote,
Hertfordshire,
SG4 8XX**

GP Builders (Ampthill) Ltd

February 2018

Borehole Location

Not to scale. All locations are approximate.
Plan based on Boundary Point Ltd -Site Survey 16C01-S1



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Remediation Plan

Land at Bury Farm, Codicote, Hertfordshire, SG4 8XX

GP Builders (Ampthill) Ltd

February 2018

Borehole Location

Not to scale. All locations are approximate.
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