

Land At Hook Lane Pagham

FRA Addendum pursuant to the discharge of conditions
10,11,12

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Contents

1	Introduction	4
2	Background Information.....	5
3	Ground Conditions.....	7
4	Flood Risk.....	8
5	Surface Water Drainage Strategy	12
6	Foul Drainage.....	14
7	Water Quality	15
8	Maintenance and Management Arrangements	16
9	Summary.....	19

Figures & Tables

Figure 2-1: -- Illustrative Masterplan -- Thrive Architects Ref OSKL-01	5
Figure 4-1: -- Flood Map for Planning from Environment Agency mapping database	8
Figure 4-2: -- Surface Water Flood Map from Environment Agency mapping database	10
Figure 4-3: Extract from illustrative drainage strategy WSP drawing ref 4147-D-02	11
Table 4-1: Catchment Summary	13
Table 8-1: Swale Maintenance Schedule	17
Table 8-2: Basin Maintenance Schedule	18

Appendices

Appendix A-- GEG - Phase 1 Review and Phase 2 Geo-Environmental Assessment
Appendix B-- Drainage Strategy and Supporting Calculations

1 Introduction

- 1.1 Brookbanks have been appointed to prepare an addendum to the previously approved Flood Risk Assessment (FRA) to support a reserved matters planning application for development at Hook Lane Pagham
- 1.2 The site already benefits from an Outline Planning Consent which covers the principles of the development and associated infrastructure within the site boundary. Whilst approved in principle as part of the outline consent (**P/30/19/OUT**) this report provides supporting details to demonstrate that the development remains acceptable from a flood risk and drainage viewpoint and accords with the previously approved Flood Risk Assessment following further detailed design.
- 1.3 This report summarises the findings of the study and specifically addresses the following issues in the context of the current legislative regime:
 - Flooding risk
 - Surface water drainage
 - Foul water drainage

2 Background Information

- 2.1 The site is located in Pagham, near Bognor Regis in West Sussex. It is bounded by Hook Lane and Pagham Road and covers an area of approximately 17.5ha. The site is currently undeveloped and is not thought to have been historically subject to any significant built development. The site is currently used for agriculture with tree lines and hedgerows marking the site boundaries.
- 2.2 WSP have prepared a Flood Risk Assessment report dated January 2017 ref 4147 FRA Rev4 (hereafter referred to as the approved FRA) with full details in relation to the site history, hydrology and hydrogeology. The FRA has been submitted and approved as part of the outline planning consent for the site. Whilst the site lies within the consented application, this report provide further justification as to the appropriateness of the development in relation to Flood Risk and water quality.
- 2.3 The proposed development comprises up to 300 new homes, a care home and primary school along with the associated infrastructure. The current masterplan is shown below.



Figure 2-1: – Illustrative Masterplan – Thrive Architects Ref OSKL-01

- 2.4 The reserved matters submission is pursuant to outline planning permission . This report seeks to discharge the drainage conditions namely 10, 11 and 12 as set out below.
- 2.5 *Condition 10- Development shall not commence, other than works of site survey and investigation, until full details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority. The design should follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations, and the recommendations of the SuDS Manual produced by CIRIA. Winter groundwater monitoring to establish highest annual ground water levels and winter Percolation testing to BRE 365, or similar approved, will be required to support the design of any Infiltration drainage. No building shall be occupied until the complete surface water drainage system serving the property has been implemented in accordance with the agreed details and the details so agreed shall be maintained in good working order in perpetuity.*
- 2.6 *Condition 11- The development shall not proceed until details have been submitted to and approved in writing by the Local Planning Authority for any proposals: to discharge flows to watercourses; or for the culverting, diversion, infilling or obstruction of any watercourse on or adjacent to the site. Any discharge to a watercourse must be at a rate no greater than the pre-development run-off values. No construction is permitted, which will restrict current and future land owners from undertaking their riparian maintenance responsibilities in respect to any watercourse or culvert on or adjacent to the site.*
- 2.7 *Condition 12 - Development shall not commence until full details of the maintenance and management of the surface water drainage system is set out in a site-specific maintenance manual and submitted to, and approved in writing, by the Local Planning Authority. The manual is to include details of financial management and arrangements for the replacement of major components at the end of the manufacturer's recommended design life. Upon completed construction of the surface water drainage system, the owner or management company shall strictly adhere to and implement the recommendations contained within the manual.*

3 Ground Conditions

- 3.1 The permeability of the site has been considered. The Environment Agency (EA) Groundwater Vulnerability Map Sheet 50 (1:100,000) indicates that the vast majority of site to be underlain by strata is underlain by a secondary aquifer. This aquifer has been characterised as a 'Secondary A' aquifer. That is permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.'
- 3.2 The online Environment Agency Groundwater map (Bedrock Designation) indicates that the site comprises stratum that is considered 'Unproductive Strata'. That is, impermeable layers incapable of supporting water supplies.
- 3.3 Site investigations completed by WSP at the outline stage indicates the site geology consists of River Terrace Deposits, supporting the information provided by the BGS superficial geology map.
- 3.4 Testing to BRE Digest 365 was conducted on site. Testing indicated that the underlying geology was relatively impermeable. A Soakaway Report was included as an appendix in the consented FRA and states *"Infiltration rates could not be calculated in accordance with BRE guidance for any of the test locations due to slow drainage rates and the absence of 75% effective depth soakage within the timeframe of the tests."* As such, it is unfeasible to drain the site via infiltration.
- 3.5 GEG have undertaken a Phase I Review and Phase II Geo-Environmental Assessment and the findings are presented in the Report Ref GEG -19-23 dated January 2020. The report is presented in Appendix B.
- 3.6 Intrusive investigations were undertaken in October 2019. The investigations confirm the findings of the WSP report as it was not possible to calculate soil infiltration rates due to the absence of significant infiltration and therefore infiltration is discounted for this site.
- 3.7 The report also confirms the presence of shallow groundwater and this is discussed further in Section 4.

4 Flood Risk

- 4.1 As part of the outline application for the site, the approved FRA assessed the risk of flooding from the Hook Lane site concluding that it is an appropriate location for development of this nature.
- 4.2 The paragraphs below outline the site flood risk mechanisms specifically in relation to the proposed development, having regard to the findings of the approved FRA

Historic Flooding

- 4.3 The approved FRA identified that there are a number of historic flood events that have occurred in the immediate vicinity of the site. Details are included in the SFRA published by Arun District Council in August 2016. Additionally anecdotal evidence at public consultation suggested flooding to Hook Lane. Arun District Council have also provided details of flooding at Sefter Cottage to the west of site. The incident was documented in Section 19 Flood Incident report which affected most of the county in June 2012 following a 1 in 212 year return period event.

Fluvial Flooding

- 4.4 The approved FRA refers to the SFRA where it mentions the watercourse Pagham Rife that is in close proximity to the west of the site. The SFRA does not discuss flood impact zones but does reference flood defences present towards Pagham Harbour. The defences in place along the western part of Pagham Village include embankments and raised walls with condition grading recorded as good and fair.
- 4.5 Fluvial Flood Zones were produced as part of the SFRA and show the site to be located in Flood Zone with regard to fluvial flooding.
- 4.6 The mapping shows the proposed Hook Lane development to lie within Flood Zone 1, being an area of Low Probability of flooding, outside both the 1 in 100 (1% AEP) and 1 in 1,000 (0.1% AEP) year flood events. The current Environment Agency (EA) Flood Zone Map is shown in Figure 4-1



Figure 4-1: – Flood Map for Planning from Environment Agency mapping database

On Site Drainage Ditch

- 4.7 Figure 4-1 illustrates that there is an ordinary watercourse or ditch that crosses the site in an east to west direction. The watercourse discharges to Pagham Rife. The FRA assessment of the EA LIDAR data calculated the catchment watershed to be approx. 67ha.
- 4.8 Topographical survey data shows the ditch to be approximately 1.0 to 2.0m with side slopes of 1 in 1 and 1 in 2. At the western end flow is controlled by a 450mm diameter culvert, estimated to have a maximum capacity of 164l/s.
- 4.9 The approved FRA has calculated the greenfield run off rate as 197l/s from the site at 1 in 100 year event and the post development flows will be restricted to Q_{bar} at approximately 18.5l/s.
- 4.10 The proposals included widening of the on site drainage ditch and providing a blue green corridor to provide additional flood risk protection along with bio-diverse and ecological benefits.
- 4.11 Fluvial flood risk does not pose a risk to the proposed development and alongside this the proposed development provides some flood risk protection measures to downstream properties in reduced runoff rates.

Tidal Flooding

- 4.12 The risk of tidal flooding is shown above in Figure 3a and was also assessed as part of the 2016 SFRA. The site is located in Flood Zone 1 and is therefore deemed to have a less than 0.1% annual probability of tidal flooding.
- 4.13 A sequential approach has been employed in the development of the masterplan, locating areas away from the most risk of flooding. As such tidal flooding is not considered a significant risk to built development at this location and the overall flood risk is low.

Groundwater Flooding

- 4.14 The SFRA shows the site to be at medium to high risk of groundwater flooding. EA mapping show that there are no Source Protection Zones within 1.5km of the site. Infiltration from the basins will not pose a risk to groundwater.
- 4.15 It is reported in the approved FRA that at public consultation residents raised concerns with the proposed development due to shallow groundwater. Groundwater levels were monitored and the findings were presented by WSP in report ref 7001417-R02 –Groundwater Monitoring Report. The findings of the report were as follows:
 - Results indicated a presence of a sub-artesian groundwater body with depths of groundwater typically less than 1.0m below ground level.
 - Risk of flooding from groundwater considered medium
 - Minor earthworks recommended to provide surface water flow paths and development areas to be raised.
 - Increase in impermeable area will decrease responsiveness of groundwater and reduce flood risk
 - Deep drainage features to be lined to prevent ground water ingress
- 4.16 Further site investigation works have been undertaken by GEG with groundwater monitoring between November 2019 to January 2020. The findings are in report attached as appendix A and reported that groundwater was encountered at depths of 1.2 to 3.0m
- 4.17 Given the mitigation measure to be employed on site the risk of groundwater flooding is considered low,

Surface Water Flooding

- 4.18** The EA's Surface Water Flood Mapping identifies a number of areas that are at high risk from surface water flooding as illustrated in Figure 4-2 below. The mapping shows there is low to medium risk of flooding from the ditches and a high risk area to the south that corresponds with a low area on the topographical survey.

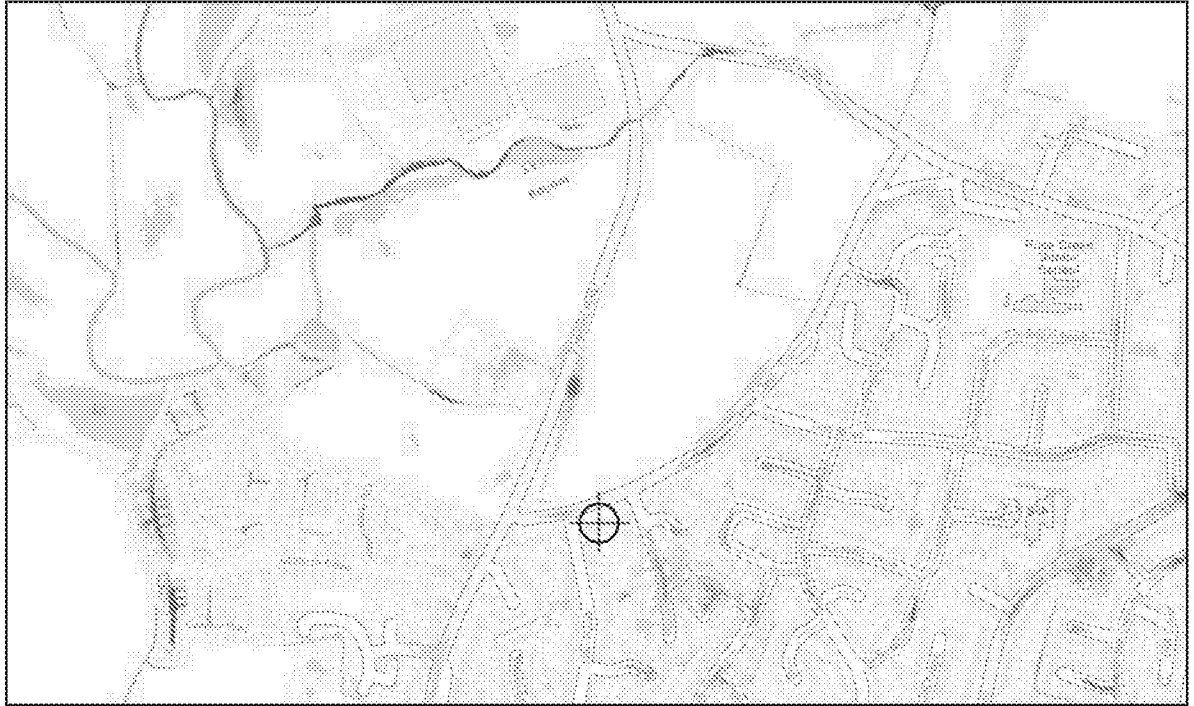


Figure 4-2: -- Surface Water Flood Map from Environment Agency mapping database

- 4.19** A site visit was undertaken as part of the approved FRA and found a gully grate in the south west corner of the site likely to allow runoff to drain beneath Pagham Road. Public consultations raised concern over surface water flooding in the area with anecdotal evidence suggesting highway flooding on a "semi-regular" basis.
- 4.20** A review of the existing highway cross sections and proposed development including the recommended earthworks found that the proposed development will drain to the west and will not exacerbate the flooding in Hook Lane .
- 4.21** The approved FRA concluded Given that the highest risk areas are in the low points of the site where SuDS drainage is to be situated, the sequential approach to masterplan development and the minor earthworks required to ensure catchments fall towards basins, the risk of flooding from surface water sources will be low.

4.22 The drainage strategy in Section 5 will discuss the exceedance flows in further detail as recommended in the approved FRA. A principal exceedance strategy was presented in WSP Drawing Ref 4147-D-02 presented in Figure 4-3 below

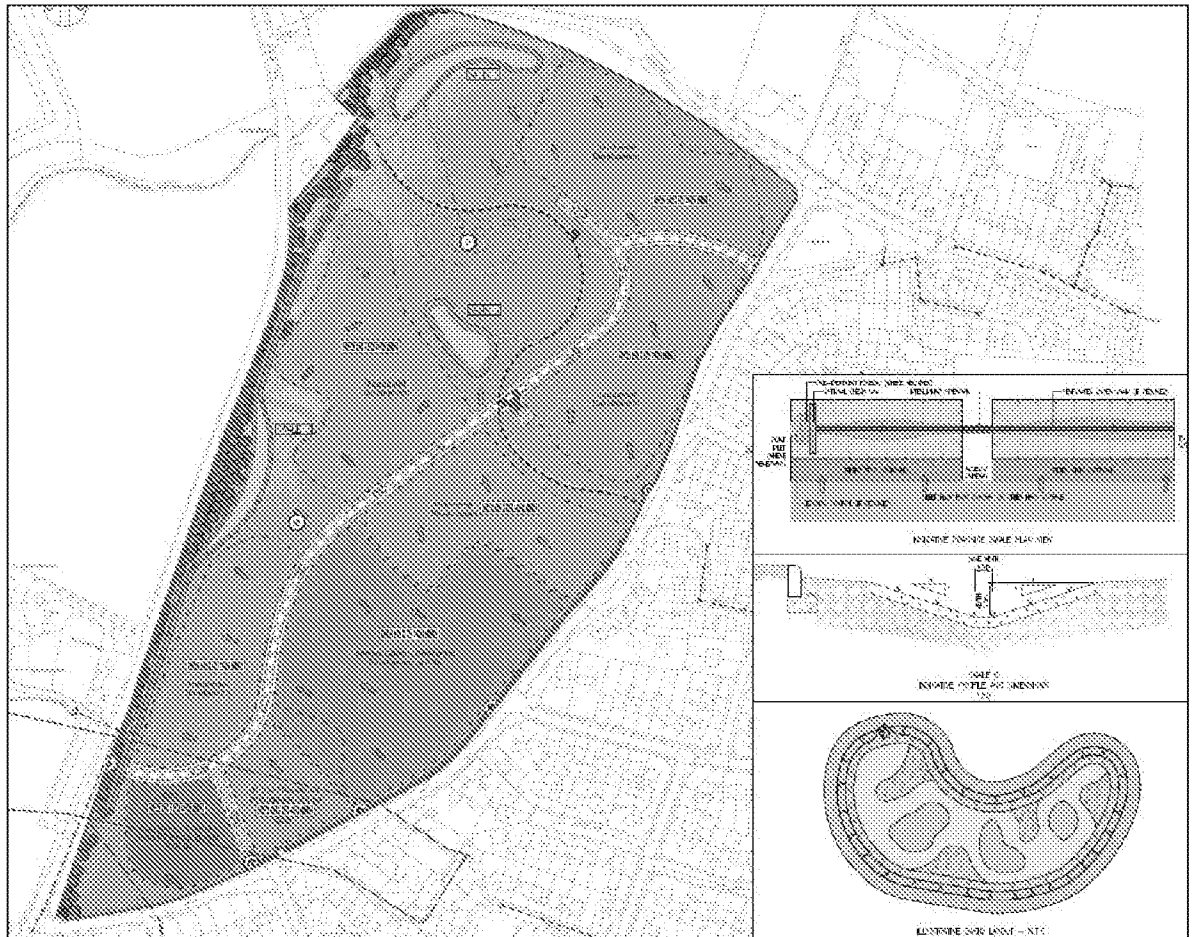


Figure 4-3: Extract from illustrative drainage strategy WSP drawing ref 4147-D-02

4.23 The risk from exceedance flows is considered low.

4.24 The approved FRA found the risk of flooding from other sources including reservoirs, canals and sewers to be low or discounted.

5 Surface Water Drainage Strategy

- 5.1** The principles of how the site is to be drained is set out in the approved FRA and therefore the drainage proposals described below follow these principles.
- Mimic the existing drainage regime of the site.
 - Maintain flow rates of volumes discharged from the site through the use of Sustainable Drainage Systems (SuDS)
 - Provide water quality, landscape , ecology and biodiversity benefits through the provision of SuDS
 - The use of infiltration to discharge surface water has been discounted therefore following current PPG guidance the next appropriate receptor for the runoff from the development will be to the existing watercourse.
 - Restrict discharge rates to Q_{bar} for up to and including the 1 in 100 year storm event plus 40% climate change.
 - Design the onsite drainage network to adoptable standards.
 - Ensure the proposed SuDS system has capacity to accommodate urban creep.
 - Consider source control measures through detailed design.
 - Management of extreme flood risk events through the design of finished floor levels set above adjacent roads and open spaces.
 - Ensure safe access and egress will be available up to and included the 1 in 100 year storm event plus 40% climate change.
- 5.2** The findings of GEG in their updated Site Investigation works confirm that infiltration is not viable for the site refer to Appendix A.
- 5.3** The illustrative drainage strategy presented in the approved FRA and the extract shown in Figure 4-3 indicates that the site will discharge to the existing watercourse via a series of basins and swales.
- 5.4** The drainage strategy has been designed in accordance with the approved FRA and is presented in drawing ref 10461-DR-001 included in Appendix B.
- 5.5** The proposed development layout has been utilised to produce a drainage network based on the contributing areas to each SuDS feature. All surface water sewers will be designed as per the requirements of Southern Water and the Design and Construction Guidance (DCG) published in April 2020.
- 5.6** Discussions have taken place with Arun District Council (ADC) as the approving LLFA in October 2020 to further inform the Drainage Strategy and agree the details to be presented in this report.
- 5.7** ADC have suggested that south west corner of the site should outfall to system under Hook Lane just south of field View. A review of the proposed layout suggests that this is not feasible and therefore the strategy complies with the outfall arrangement set out in the approved FRA i.e. existing watercourse.

- 5.8** An assessment of the impermeable area has been undertaken based on the current masterplan. An assumed impermeable area of 60% has been used to calculate the discharge rates and required storage through the use of MicroDrainage software. The 60% impermeable area includes an allowance for urban creep. Discharge rates will be restricted to Q_{bar} as set out in the approved FRA. Storage is provided for up to and including the 100 year storm event with an allowance of 40% climate change. Calculations for the SuDS basins can be found within Appendix C and are summarised in the table below:

Catchment Area Ref	Development Area (ha)	Impermeable Area (assumed 60%) (ha)	Storage (m ³) 1 in 100 yr +40% event	Discharge Rate Q_{bar} (l/s)
Catchment 1	5.3	3.41 (incl. care home)	2656	11.94
Catchment 2	1.86	1.12	898	3.92
Catchment 3	3.0	1.8	1423	6.3

Table 4-1: Catchment Summary

- 5.9** As suggested in the approved FRA there is an opportunity to naturalise the watercourse through a blue green corridor to the north of Catchment 1 and 2. Details of the naturalised watercourse are presented in Appendix B. The blue green corridor will provide further opportunity to enhance the water quality, landscape, ecology and biodiversity benefits.
- 5.10** SuDS features and the watercourse diversion will be designed with a maintenance offset of 3m. Root protection areas have been considered and where possible a 3m offset is respected, however there may be a requirement to provide root barriers where this is not achievable.
- 5.11** The swales have been designed with a 1 in 4 side slope where space allows. A bagwork retaining system has been proposed along the boundary of the western swale due to the space constraints.
- 5.12** Culvert crossings are provided to accommodate the footway/cycleway network. Through discussion with ADC it is agreed the 600mm diameter pipes are acceptable. The crossing will require Land Drainage Consent.
- 5.13** Consideration will be given to tree planting and matured root zones where in close proximity to existing culverts.
- 5.14** Due to the shallow groundwater encountered on site consideration will be given to lining the SuDS features to prevent groundwater ingress.
- 5.15** The likely exceedance routes have been assessed and have been transposed onto drawing ref 10461-DR-001 included in Appendix B

6 Foul Drainage

- 6.1 The approved FRA reported that there were no concerns raised by Southern Water to the proposal to discharge to the Pagham Sewage Treatment works. However reinforcement works are required to the 150m length of 150m diameter sewer running parallel to existing sewers to provide additional capacity.
- 6.2 It is proposed that foul water flows generated by the Hook Lane Site will be conveyed by a traditional gravity sewer network. Where gravity flows cannot be achieved the flows will be pumped. The foul flows will outfall to the agreed point of connection to the south east of the site.
- 6.3 The drainage strategy is presented in drawing 10461-DR-001 and can be found within Appendix B
- 6.4 The foul network will be offered for adoption under a S104 agreement with Southern Water.
- 6.5 Existing pump mains crossing the site to the south will be diverted to suit the development under a S185 agreement with Southern Water.

7 Water Quality

- 7.1** Impermeable surfaces collect pollutants from a wide variety of sources including cleaning activities, wear from car tyres, vehicle oil and exhaust leaks and general atmospheric deposition. The implementation of SuDS in development drainage provides a significant benefit in removal of pollutant from development run-off.
- 7.2** The SuDS Manual C753 describes a 'Simple Index Approach' for assessing the pollution risk of surface run-off to the receiving environment using indices for likely pollution levels for different land uses and SUDS performance capabilities. To deliver adequate treatment SuDS components will be selected to ensure the pollution hazards are effectively treated.
- 7.3** The conceptual drainage proposals have been developed in a manner that will allow the site wide system to be designed to encourage passive treatment of discharged flows and to improve the water quality by removing the low level silts, oils and metals associated with urban run-off. The design of the drainage system accords with the expectations of SuDS systems and with the approved FRA and will include a number of elements within the drainage train. Final design will provide for appropriate geometry and planting to seek maximise this benefit. Elements of the system may include any source control within development parcels, the collection and deposition of silt through the design of the highway gullies and sewer network system (as is normally and effectively the case within SuDS systems). Planting within the basins ahead of the basin inlet headwalls will also provide for a further level of water quality control. The RM approval also provides for reed beds to be introduced as part of the water quality management system in each basin. As for the detention features themselves the provision of open channel outfalls to the ordinary watercourse receptors provide a further measure to assist in managing water quality.
- 7.4** The SuDS storm water management features to be implemented will be designed to enhance the biodiversity and landscape character of the site, while also providing amenity space and acting as a functional feature to control storm discharges from the site and improve water quality.
- 7.5** Collectively the design of the overall drainage system will ensure a broadly based approach to enhancing water quality prior to discharge consistent with the approved FRA.

8 Maintenance and Management Arrangements

Sewer Network

- 8.1** At the time of writing it is the intention to offer surface and foul water sewers to Southern Water for adoption under a Section 104 agreement (Water Industry Act 1991). Once complete, Southern Water will be responsible for maintaining these sewer networks and ensuring their continued operation.

SuDS

- 8.2** In line with the latest DCG the SuDS features will be adopted and maintained by Southern Water.
- 8.3** A recommended maintenance schedule for the swales is set out below in accordance with SuDS Manual C753.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly or as required
	Cut grass – to retain grass height within specified design range	Monthly or as required
	Manage other vegetation and remove nuisance plants	Monthly at the start and then as required.
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half Yearly
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by re-turfing or reseedling	As required
	Relevel uneven surfaces and reinstate design levels	
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	
	Remove build-up of sediment on upstream gravel trench, low spreader or at top of filter strip	

	Remove and dispose of oils or petrol residues using safe standard practices	

Table 8-1: Swale Maintenance Schedule

- 8.1** A recommended maintenance schedule for the basins is set out below in accordance with SuDS Manual C753.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly or as required
	Cut grass – for spillways and access routes	Monthly or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly at the start and then as required.
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for signs of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly or when required
	Check flow controls and penstocks	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlets and forebay	Annually
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required
	Prune and trim trees and remove cuttings	Every 2 years or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years or as required
Remedial Actions	Repair erosion or other damage by re-turfing or reseed	As required
	Realignment of rip rap	
	Repair inlets, outlets and overflows	

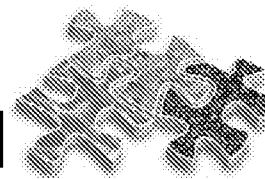
	Remove build-up of sediment on upstream gravel trench, low spreader or at top of filter strip	

Table 8-2: Basin Maintenance Schedule

9 Summary

- 9.1 This report has been prepared as an addendum to the approved FRA and seeks to discharge the conditions 10,11 and 12.
- 9.2 The risk of flooding has been assessed and is found to be low in accordance with current guidance and the approved FRA.
- 9.3 Updated Site investigation works have been undertaken and the findings have been presented in Appendix A.
- 9.4 The drainage strategy accords with the approved FRA and is presented in drawing 10461-DR-001 attached as Appendix B.
- 9.5 A surface water drainage strategy has been designed to restrict the discharge rate to Qbar and storage has been provided via a series of SuDS features designed to enhance water quality and accommodate the 1 in 100 year storm event plus allowance for 40% climate change.
- 9.6 The existing ditch that flows through the site will be naturalised within a blue green corridor to enhance the ecology, biodiversity and landscape of the site.
- 9.7 A suggested adoption and maintenance schedule has been prepared in accordance with CIRIA SuDS Manual C753
- 9.8 Foul water flows will be conveyed via gravity and pumping to the agreed outfall
- 9.9 Safe access and egress will be available to and from the site for events up to and including the 1in 100 year plus 40% climate change rainfall events.
- 9.10 For all modelled events, risk of flooding is shown to be negligible.

Appendix A— GEG - Phase 1 Review and Phase 2 Geo-Environmental Assessment



***PHASE I REVIEW & PHASE II GEO-ENVIRONMENTAL
ASSESSMENT***



***LAND WEST OF HOOK LANE
PAGHAM
PO21 3PD***

JANUARY 2020

Prepared for:



**Hallam Land
Management**

**Brookbanks
Consulting**

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REPORT TITLE: **PHASE I REVIEW &
PHASE II
GEO-ENVIRONMENTAL
ASSESSMENT**

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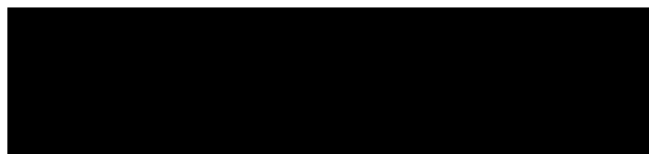
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TABLE OF CONTENTS

PAGE

1. INTRODUCTION	1
1.1 General	1
1.2 Available Information	1
1.3 Proposed Site Development	1
1.4 Scope	1
2. SITE SETTING	2
2.1 Site Location	2
2.2 Site Description	2
2.3 Adjacent Land Uses	2
3. REVIEW OF AVAILABLE DESK STUDY INFORMATION	3
3.1 Landfills	3
3.2 Waste Management	3
3.3 Discharge Consents	3
3.4 Pollution Controls	3
3.5 Pollution Incidents	3
3.6 Hazardous Substances	3
3.7 Contemporary Trade Directories	4
3.8 Ordnance	4
3.9 Historical Information	4
3.9.1 Site History	4
3.9.2 Site Surroundings	4
3.10 Geology	4
3.10.1 Published Geology	4
3.10.2 Mining and Quarrying	5
3.10.3 Potential Geo-Hazards	5
3.11 Hydrogeology	5
3.11.1 Groundwater Designation	5
3.11.2 Groundwater Source Protection Zone	5
3.11.3 Groundwater Abstractions	6
3.12 Hydrology	6
3.12.1 Nearest Watercourse	6
3.12.2 Surface Water Abstractions	6
3.12.3 Surface Water Flooding	6
3.12.4 Potential for Groundwater Flooding	6
3.13 Radon	6
4. ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY	6
4.1 Regulatory Controls	6
4.2 Environmental Protection Act - Part 2A	7
4.3 Planning and Development Controls	8
4.4 Environmental Protection Act 1990 Part III – Statutory Nuisance	9
4.5 Permitted Installations	9
4.6 Water Resources Act (WRA) 1991	9
4.7 Groundwater Regulations (GWR) 2009	9
4.8 Suitable for Use Approach	10
4.9 Assessment Methodology	10
5. PRELIMINARY RISK ASSESSMENT AND OUTLINE CONCEPTUAL MODEL	12
5.1 Potential Contaminants of Concern	12
5.2 Preliminary Human Health Conceptual Model	13
5.3 Preliminary Controlled Waters Conceptual Model	13
5.4 Preliminary Ground Gas Assessment	13
6. INTRUSIVE INVESTIGATION	14
6.1 Site Works	14
6.1.1 General	14
6.1.2 Window Sample Holes	14
6.1.3 Trial Pits	15
6.1.4 Hand Excavated Pits	15
6.1.5 Reinstatement	15
6.1.6 Rationale for Exploratory Holes	15
6.1.7 In-situ CBR Testing	15



6.1.8	Sampling	16
6.1.9	Infiltration Tests	16
6.1.10	Gas and Groundwater Monitoring	17
6.1.11	Monitoring Programme	17
6.2	Geotechnical Laboratory Testing	18
6.3	Chemical Laboratory Testing	18
6.3.1	Schedule of Analysis	18
6.3.2	Scope of Analysis	19
6.4	Ground Conditions Encountered	19
6.4.1	Topsoil	19
6.4.2	Raised Beach Deposits	19
6.4.3	River Terrace Deposits	19
6.4.4	Naturally Reworked London Clay	20
6.4.5	London Clay Formation	20
6.4.6	Groundwater	20
6.4.7	Stability of Trial Pits	20
6.4.8	Visual and Olfactory Evidence of Contamination	21
7.	GENERIC HUMAN HEALTH QUANTITATIVE RISK ASSESSMENT	21
7.1	Generic Human Health QRA	21
7.1.1	CLEA	21
7.1.2	Other Assessment Criteria	21
7.1.3	PAH Profiling	22
7.1.4	Vapour Risk Associated with PAHs	22
7.2	Statistical Analysis of Soil Chemical Data	22
7.2.1	Methodology	22
7.2.2	Natural Ground - Non-Targeted Sampling	23
7.3	Summary of Soil Contamination	24
7.4	Generic Controlled Waters Quantitative Risk Assessment	24
7.5	Ground Gas Risk Assessment	24
8.	GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS	24
8.1	Overview	24
8.1.1	Summary of Strata Encountered	24
8.1.2	Groundwater	25
8.1.3	Trial Pit Stability	25
8.1.4	Undrained Shear Strength	25
8.1.5	Standard/Cone Penetration Tests (SPT/CPT) 'N' Values - Relative Density	26
8.1.6	Plasticity Indices (PI)	26
8.1.7	Preliminary Equilibrium CBR Results from Plasticity Indices	27
8.1.8	Proposed Development	27
8.2	Foundations	27
8.2.1	Geotechnical Constraints	27
8.2.2	Anticipated Foundation Types	28
8.2.3	Floor Slabs	28
8.3	Chemical Attack on Buried Concrete	29
8.4	Flooding	29
8.5	Underground Plastic Services	29
8.6	Slope Stability and Retaining Walls	29
8.7	Earthworks	29
8.8	Fault Reactivation	29
8.9	Excavations	29
8.10	Road Pavement Design	30
8.11	Loose/Soft Spots	30
8.12	Soakaways	30
9.	ENVIRONMENTAL CONCLUSIONS & RECOMMENDATIONS	30
9.1	Revised Conceptual Model	30
9.1.1	Revised Human Health Conceptual Model	30
9.1.2	Revised Controlled Waters Conceptual Model	30
9.2	Ground Gases	31
9.3	Risks to Adjacent Land and Third Parties	31
9.4	Risks from Adjacent Land and Third Parties	31
9.5	Potential Geo-Environmental Liabilities	31
9.6	Waste Classification	31
9.7	Re-Use of Topsoil	31



9.8	Remediation	31
9.8.1	Human Health Remedial Measures	31
9.8.2	Protection of Controlled Waters	32
9.8.3	Unidentified Contamination	32
9.8.4	Unidentified Underground Structures	32
9.9	Further Investigation	32
10.	REFERENCES	32
11.	LIMITATIONS.....	34

<i>Title</i>	<i>Appendix</i>
FIGURES AND PLANS	A
Site Location Plan	Figure 1
Current Layout Plan	Figure 2
Preliminary Conceptual Model.....	Figure 3
Exploratory Hole Location Plan	Figure 4
Revised Conceptual Model (Existing)	Figure 5A
Revised Conceptual Model (Proposed)	Figure 5B
PHOTOGRAPHIC RECORD.....	B
EXPLORATORY HOLE LOGS.....	C
INFILTRATION TEST RESULTS	D
CHEMICAL ANALYSIS RESULTS	E
STATISTICAL ASSESSMENT OF CHEMICAL RESULTS.....	F
GEOTECHNICAL TESTING.....	G



EXECUTIVE SUMMARY

Current Site Status The site is located in Pagham, near Bognor Regis, in West Sussex, at the approximate National Grid Reference 489560E, 99180N. It lies on the western side of Hook Lane and east of Pagham Road and covers an area of approximately 17.5 hectares.

The site comprised 2 No. agricultural fields (south western and north eastern) with a westward-flowing drain trending in an east-west orientation along the internal hedged boundary between the fields. A second smaller section of drain was present on the north eastern site boundary.

**Geology,
Hydrogeology,
Hydrology &
Landfills**

The solid geology beneath the site comprises the London Clay Formation of the Palaeogene period (Unproductive Strata). The solid geology is conjectured to be overlain by superficial deposits of River Terrace Deposits (a Secondary A Aquifer) across the majority of the site, with the north westernmost corner conjectured to be overlain by Raised Beach Deposits 1 (a Secondary Undifferentiated Aquifer).

The site does not lie within a currently defined Groundwater Source Protection Zone (GWSPZ).

The nearest surface water feature is a drain on site flowing westwards towards the Pagham Rife 478m west of the site. A second smaller section of drain was present on the north eastern site boundary. A small pond was present 70m west of the site, as well as 2 No. reservoirs and a pond 190m north west.

There is a record of 1 No. historical landfill site within 250m of the site located 40m north west.

Flooding

The site lies within Flood Zone 1, and hence has a low probability of flooding. However, the land adjacent to the north west of the site is located within Flood Zone 3, with the smallest portion of Flood Zone 2 potentially overlapping the north westernmost tip of the northern site section.

Site History

According to the historical maps provided within the Desk Study, by 1880 the site comprised 2 No. agricultural fields in its current configuration. By 1976, a 'Drain' was identified along the internal field boundary. A second smaller section of 'Drain' was denoted along the north eastern site boundary in 2006. No further significant changes were identified.

**Intrusive
Investigations**

The intrusive investigation was undertaken from 22nd to 25th October 2019 and comprised window sample boreholes, machine-excavated trial pitting, infiltration testing and in-situ CBR testing.

Ground Conditions

Typically soft to firm CLAY topsoil was encountered across the site to depths of 0.30m to 0.50m.

Raised Beach Deposits were encountered underlying the topsoil locally in 2 No. exploratory holes in the north western corner of the site to depths



of 0.70m and 0.90m respectively. This strata comprised horizons of variably sandy/gravelly soft to firm CLAY and loose to medium dense GRAVEL.

River Terrace Deposits (RTD) were encountered underlying the topsoil to depths ranging from 1.60m to 4.30m across the majority of the site, with the exception of the north westernmost corner. These deposits were typically found to be in excess of 3.00m in thickness across the central and north eastern sections of the site, becoming thinner towards the south western (1.60m to 2.70m) and north western corners (2.50m). The RTD typically comprised horizons of variably sandy/gravelly very soft to stiff CLAY, soft to firm SILT, and very loose to dense SAND/SAND & GRAVEL/GRAVEL. Softened or low density horizons were encountered in the majority of the exploratory holes with apparent random variability throughout the soil profile from depths of 0.30m to >4.00m.

Naturally Reworked London Clay was encountered underlying the Raised Beach Deposits locally in 2 No. exploratory holes in the north western corner of the site to depths of 1.50m and 1.80m respectively. It comprised horizons of soft sandy clayey SILT with numerous boulder-sized lenses of very soft silt and gravelly sand, and firm to stiff slightly gravelly CLAY with occasional boulder-sized lenses of sand and gravel.

The London Clay Formation was encountered underlying the River Terrace Deposits and locally the Naturally Reworked London Clay across the site from depths of 1.60m to 4.30m. It typically comprised horizons of firm to stiff CLAY. The top of the London Clay was locally softened in the southernmost section of the site in 3 No. exploratory holes from depths of 1.80-3.20m.

Groundwater was encountered at depths of 1.20m to 3.00m during the intrusive investigation as as slow to moderate (and occasionally fast) inflows and from depths of 0.00m to 1.01m during the monitoring visits.

Proposed Development

The site is proposed for residential development.

Geotechnical Conclusions & Recommendations

Anticipated Foundation Types

The principal geotechnical constraint with respect to foundations is the presence of identified random softened/low density horizons across the site and also potential random softened/low density horizons remaining undetected beneath shallow foundations, resulting in unacceptable differential settlements structures.

As such, the use of piled foundations are considered likely to be the preferred foundation option for the site. Driven piles, approximately 4-5m in length, are anticipated to be the most cost effective solution, however, other systems may be suitable such as vibro concrete columns. Consequently, it is recommended that a specialist piling contractor is contacted to provide the design and warranty of a suitable foundation solution for the site.



Subject to additional investigation on a plot specific basis, traditional strip / trench fill foundations may locally be suitable; however, deepening of foundations is likely to be problematic due to anticipated excavation instability and the presence of shallow groundwater potentially reducing bearing capacities.

Raft foundations are not recommended at this stage (without further investigation and assessment) due to anticipated unacceptable differential settlements.

Vibro-stone columns are not considered suitable based on the presence of soft strata.

Ground improvement techniques such as lime stabilisation could potentially be undertaken to allow shallow/raft foundations to be used. However, the use of relatively short driven piles is considered likely to be more cost effective.

If piled foundations are adopted further investigation utilising deeper cable percussive boreholes will be required for pile design.

Other Considerations

Suspended floor slabs are recommended for the site based on the variable ground conditions.

ACEC Class AC-2 (Design Class DS-2) conditions are indicated to prevail on site.

A CBR design value of between <2% and 4.0% is recommended for the cohesive soils and geotechnically suitable Made Ground depending on localised conditions. Further Atterberg Limit testing of the cohesive soils at formation level is recommended to confirm this. A CBR design value of 20% is recommended for localised granular soils.

It was not possible to calculate soil infiltration rates in the natural strata due to the absence of significant infiltration, which was consistent with the predominantly cohesive strata and shallow groundwater encountered.

Environmental Risk Assessment & Liabilities

Risks to Site Users

Identified Sources: No significant contamination has been identified in the natural ground for the proposed residential end use.

Potential Risks: End users of the site and construction/maintenance workers are therefore not considered to be at significant risk from the site as no significant contaminant sources have been identified by the chemical analyses undertaken to date.

Risks to Controlled Waters

Potential Sources: No significant soil sources have been identified.



Potential Risks: Risks to Controlled Waters are unlikely to be significant based on the information available.

Ground Gases

According to the preliminary gas monitoring results, the site is potentially characterised as NHBC 'Green'. However, further monitoring is recommended in particular in the north west near the off site landfill located 40m north west.

The site is not in a Radon Affected Area; as such no protective radon measures are required.

Remediation

Human Health Remedial Measures

Based on the information available, no remedial measures are considered necessary to protect human health.

Protection of Controlled Waters

No remedial measures are considered necessary to protect Controlled Waters from the site itself, based on the information available.

Further Investigation Requirements

The following further work is recommended:

- Deeper cable percussive boreholes for pile design purposes.
- Additional testing of the London Clay Formation due to the potential presence of pyritic sulphate.
- Further gas monitoring is recommended in particular in the north west near the off site landfill.

This executive summary is intended to provide an outline of the site assessment in relation to ground contamination and geotechnical parameters. It does not provide a definitive analysis of the information obtained.



1. INTRODUCTION

1.1 General

Geo Environmental Group (GEG) were commissioned by Brookbanks Consulting Ltd (Brookbanks) on behalf of Hallam Land Management (HLM) (the Client) to undertake a Phase I Review & Phase II Geo-Environmental Assessment of a site known as 'Land at Pagham, West Sussex,' in order to provide relevant information with respect to the proposed residential development.

The purpose of this report was to determine:

- Potential environmental risks and liabilities associated with any potential soil and shallow groundwater contamination in accordance with current UK guidance (CLR 11) for a future residential end use.
- Geotechnical requirements for foundations, buried concrete, excavations, earthworks and slope stability with respect to the proposed residential development of the site.

1.2 Available Information

The following drawings were supplied by Brookbanks:

- Promap extract, unreferenced.
- 'Site Investigation Location Plan,' Brookbanks on behalf of HLM, Drawing No. 10461-SI-01, dated 15th January 2019.
- 'Land at Pagham, Bognor Regis, Geo-Environmental Desk Study,' WSP/Parsons Brinckerhoff on behalf of HLM, Ref. 70014147-R01, Rev. 01, dated 29th November 2019.
- Various utility company service drawings.

GEG also purchased additional utility company service drawings of the site.

1.3 Proposed Site Development

It is understood that the site is proposed for residential development; no further information is available at this stage.

1.4 Scope

The works performed by GEG included:

- A Phase I desk study review and preparation of a preliminary risk assessment and outline conceptual model.
- A Phase II intrusive investigation undertaken in accordance with a specification supplied by Brookbanks, comprising window sample boreholes, machine-excavated trial pits, infiltration testing and in-situ CBR testing.



- Chemical analysis and geotechnical testing of selected soil samples.
- Gas and groundwater monitoring.
- Development of the conceptual model and generic quantitative human health and qualitative Controlled Waters environmental risk assessments in accordance with CLR11.
- A qualitative ground gas risk assessment in accordance with NHBC, CIRIA guidance, and British Standards.
- A geotechnical assessment (including foundations, floor slabs, buried concrete, road pavement design etc.) and including recommendations for suitability of the site for soakaway drainage.
- Recommendations for further investigation and/or remedial work (if required).
- Provision of a report documenting the above.

Limitations to the scope of the report are outlined in Section 11.

2. SITE SETTING

2.1 Site Location

The site is located in Pagham (approximately 4.5km west of the centre of Bognor Regis) in West Sussex, at the approximate National Grid Reference 489560E, 99180N. It lies on the western side of Hook Lane and east of Pagham Road and covers an area of approximately 17.5 hectares.

A section of the 1:25,000 Ordnance Survey (OS) map identifying the site location is shown in Figure 1 of Appendix A. The site layout plan is presented in Figure 2 (Appendix A) and a photographic record is provided in Appendix B.

2.2 Site Description

The site comprised 2 No. agricultural fields (south western and north eastern) with a westward-flowing drain trending in an east-west orientation along the internal hedged boundary between the fields. A second smaller section of drain was present on the north eastern site boundary.

Topographically, the site was relatively level at an elevation of approximately 5m AOD.

The boundaries of the site were typically hedged with occasional semi-mature deciduous trees particularly along the western boundary. A small electricity substation was located adjacent to the south eastern site boundary.

2.3 Adjacent Land Uses

A summary of surrounding land-use in the immediate vicinity of the site is provided below.

North

Sefter Road followed by agricultural fields.



East	Hook Lane followed by residential development (and including a small electricity substation located adjacent to the south eastern site boundary).
South	Hook Lane followed by residential development.
West	Pagham Road followed by agricultural fields and occasional residential dwellings in the southernmost and northernmost parts, and Rookery Farm within the southern part. Sefter Farm including 2 No. reservoirs and a pond is located 190m west of the site.

3. REVIEW OF AVAILABLE DESK STUDY INFORMATION

Available information relating to the history of the site, geology, hydrogeology and hydrology is summarised in the following sections extracted from the Phase I Desk Study Report undertaken by WSP/Parsons Brinckerhoff.

3.1 Landfills

According to the desk study, there is a record of 1 No. historical landfill site within 250m of the site, known as Sefter Lodge, located 40m north west and relating to the deposition of 27,000m³ of inert, commercial and household waste from 1950 to 1960.

3.2 Waste Management

According to the desk study, there are no records of historical or operational waste treatment transfer or disposal sites within 250m of the site.

3.3 Discharge Consents

According to the desk study, there are 4 No. records of Discharge Consents within 250m of the site relating to sewage discharges 20m to 110m north and southwest and discharge of other matter/surface water 170-250m from the site in all directions.

3.4 Pollution Controls

No reference to pollution controls or authorisations were included within the desk study.

3.5 Pollution Incidents

No reference to Pollution Incidents to Controlled Waters were included within the desk study.

3.6 Hazardous Substances

No reference to hazardous substances were included within the desk study.



3.7 Contemporary Trade Directories

According to desk study, records of 6 No. potentially contaminative industrial sites have been identified within 250m of the site relating to a variety of end uses typically comprising light industrial or commercial activities not considered to represent a significant impact on the site.

3.8 Ordnance

According to regional unexploded bomb risks maps (online viewer) provided by Zetica, the site falls within an area of low bomb risk and therefore no further action is required. However, the earlier desk study refers to the site as being in an area where the risk is moderate. According to the current online viewer, this refers to land associated with Bognor Regis approximately 175m east of the site, and does not include the site area itself.

3.9 Historical Information

3.9.1 Site History

According to the historical maps provided within the Desk Study, by 1880 the site comprised 2 No. agricultural fields in its current configuration. By 1976, a 'Drain' was identified along the internal field boundary. A second smaller section of 'Drain' was denoted along the north eastern site boundary in 2006. No further significant changes were identified.

3.9.2 Site Surroundings

According to the historical maps provided within the Desk Study, by 1880 the site surroundings typically comprised agricultural land. 4 No. 'Wells' were identified adjacent to the site: 2 No. 10m and 50m north west at 'Seftor Bottom'; 1 No. 25m south; and 1 No. 30m east. 'Rookery Farm' was also denoted 20m west (which included a pond and a fourth 'Well' 70m west).

By 1933, only the eastern and western 'Wells' remained, and 'Brick Fields' (indicating extraction of clay for brick manufacture) were denoted 115m east and 125m south of the site.

By 1961, the 'Brick Fields' were no longer marked, and pockets of residential development had taken place east of the site. By 1976, significant residential development had taken place east of the site, and no 'Wells' were marked near the site. Earthworks indicated 40m north west of the site likely related to the landfill identified in this area (see Section 3.1). No further significant changes were identified.

3.10 Geology

3.10.1 Published Geology

Reference to the 1:50,000 scale British Geological Survey digital mapping of the area (solid and drift) indicates that the solid geology beneath the site comprises the London Clay Formation of the Palaeogene period. It is described as poorly laminated, blue grey or grey brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin



courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand.

The solid geology is conjectured to be overlain by superficial deposits of River Terrace Deposits (RTD) across the majority of the site, described generically as sand and gravel, locally with lenses of silt, clay or peat. The north westernmost corner of the site is conjectured to be overlain by Raised Beach Deposits 1, generically described as shingle, sand, silt and clay.

No faults are conjectured to intersect the site at the surface.

3.10.2 Mining and Quarrying

Reference to the Coal Authority interactive map viewer confirms that the site is not in a Coal Mining Reporting Area.

3.10.3 Potential Geo-Hazards

No significant potential geo-hazards such as underground workings, natural cavities, dissolution, landslips, compressible deposits, running sands or swelling clays were identified in the desk study report.

3.11 Hydrogeology

3.11.1 Groundwater Designation

The database search report indicates that the solid geology directly beneath the site is designated as Unproductive Strata.

Unproductive Strata - are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

The superficial deposits of the River Terrace Deposits are characterised as a Secondary A Aquifer and the Raised Beach Deposits as a Secondary Undifferentiated Aquifer.

Secondary A Aquifers are defined as permeable layers capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Secondary (undifferentiated) Aquifers are assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

3.11.2 Groundwater Source Protection Zone

The site does not lie within a currently defined Groundwater Source Protection Zone (GWSPZ).



3.11.3 Groundwater Abstractions

According to the desk study report, there are no groundwater abstraction licences within 1000m of the site.

3.12 Hydrology

3.12.1 Nearest Watercourse

The nearest surface water feature is a drain on site flowing westwards towards the Pagham Rife 478m west of the site. A second smaller section of drain was present on the north eastern site boundary. A small pond was present 70m west of the site, as well as 2 No. reservoirs and a pond 190m north west.

3.12.2 Surface Water Abstractions

According to the desk study report, there are no surface water abstraction licences within 500m of the site.

3.12.3 Surface Water Flooding

According to the Environment Agency online 'Flood Map for Planning', the site lies within Flood Zone 1, being land that lies outside the 1 in 1000 year (0.1%AEP) flood risk area and hence has a low probability of flooding.

The land adjacent to the north west of the site in the vicinity of Rookery Cottage, however, is located within Flood Zone 3, with the smallest portion of Flood Zone 2 potentially overlapping the north westernmost tip of the northern site section.

Flood Zone 2: This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

3.12.4 Potential for Groundwater Flooding

According to the desk study, no information regarding the groundwater depth or flow direction was available from the sources reviewed. However, shallow groundwater flow was anticipated to be generally westward towards the Pagham Rife.

3.13 Radon

The site is not in a Radon Affected Area, as only 1% to 3% of homes are estimated to be above the action level.

4. ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY

4.1 Regulatory Controls

Contaminated land in England is principally controlled by:

- Part 2A of the Environmental Protection Act (1990) and accompanying Statutory Guidance.



- Planning and Development Controls.

Part 2A relates to contaminated land risks from land in its current condition, whilst the planning and development control essentially is applicable to new developments which fall within the planning regime and applies to the proposed end use of the land.

These two key pieces of legislation are discussed further in the following sections together with other potentially relevant systems.

4.2 Environmental Protection Act - Part 2A

Part 2A of the Environmental Protection Act (1990) [EPA], which was introduced by section 57 of the Environment Act 1995, requires an overall risk-based approach to dealing with contaminated sites, to ensure that they are 'suitable for use'.

DETR Circular 02/2000 'Contaminated Land' which came into force in England on 1st April 2000 provided accompanying regulations and Statutory Guidance. This was superseded by DEFRA Circular 01/2006 'Contaminated Land' which included amendments to address land contaminated by radioactivity.

Definition of Contaminated Land

Contaminated land is defined in section 78A(2) of Part 2A as:

'Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in on or under the land, that –

- Significant harm is being caused or there is a significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be caused.'

The Water Act 2003 s86 modified the definition of contaminated land to:

Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in on or under the land, that –

- Significant harm is being caused or there is a significant possibility of such harm being caused; or
- Significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.'

Recent changes to Part 2A require the local authority to use a four category system in order to decide whether or not land is designated as contaminated land.

Category 1 describes land which is clearly problematic e.g. because similar sites are known to have caused a significant problem in the past.

Categories 2 and 3 cover the less straightforward land where detailed consideration is needed before deciding whether it is contaminated land. The test rests on whether



or not the Local Authority believes there is a strong case for regulatory action – and thus whether it should be placed into Category 2 (contaminated land) or Category 3 (not contaminated land). The decision basis is initially related to human health risks, and if this is not conclusive due to uncertainty over risks, wider socio-economic factors (e.g. cost, views of local people etc.).

Category 4 describes land that is clearly not contaminated land. The new Category 4 test is particularly important in terms of reducing uncertainty over when land is clearly not contaminated land in the legal sense. Land at or below SGV/GAC levels derived using the CLEA methodology is likely to be well within Category 4. DEFRA are currently in the process of producing Category 4 screening levels. PT2A states that normal levels of contaminants in soil should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise. DEFRA have commissioned BGS to produce a report determining normal levels of contaminants in UK soils.

Once land has been determined as contaminated land, the enforcing authority must consider how it should be remediated and, where appropriate, it must issue a remediation notice to require such remediation. The enforcing authority for the purposes of remediation may be the local authority which determined the land, or the Environment Agency, which takes on responsibility once land has been determined if the land is deemed to be a “special site”. The rules on what land is to be regarded as special sites, and various rules on the issuing of remediation notices, are set out in the Contaminated Land (England) Regulations 2006.

‘Special Sites’

In certain cases, the Environment Agency is the regulatory authority for the contaminated land legislation. This arises if the site under investigation has been used for certain processes, or if the site is situated on bedrock classed as a Principal Aquifer (i.e. water-bearing strata). In the legislation, these sites are referred to as “Special Sites”.

4.3 Planning and Development Controls

The Part 2A contaminated land regime will not normally apply where land is being managed within the normal cycle of land redevelopment and regeneration, where planning and development control will continue to be the primary means of control.

Land contamination, or the possibility of it, is a material consideration for the purposes of town and country planning. Current planning control on contaminated land is set out in **National Planning Policy Framework (2018)**, which was published in July 2018, and replaces the original 2012 NPPF.

National Planning Policy Framework (England) is intended to complement the pollution control framework under the Pollution Prevention and Control Act 1999 and the PPC Regulations 2000.

In addition to the planning system, the **Building Regulations 1991** (made under the Building Act 1984) may require measures to be taken to protect the fabric of new buildings, and their future occupants, from the effects of contamination. Approved Document Part C (Site Preparation and Resistance to Contaminates and Moisture) 2004 edition gives guidance on these requirements.



4.4 Environmental Protection Act 1990 Part III – Statutory Nuisance

Statutory nuisance provisions will no longer apply where the nuisance arises in relation to land in a ‘contaminated state’. However, nuisance provisions could still apply where land gives rise to a nuisance (such as an odour) that is an offence to human senses but which is not covered under the various categories of harm set out in the Contaminated Land Statutory Guidance.

4.5 Permitted Installations

Part 2A will not apply where the Environment Agency or the Local Authority has powers under Integrated Pollution Prevention and Control (IPPC) provisions of the Environmental Permitting Regulations 2007 to take action to remedy contamination resulting from the breach of an installation permit.

Waste Management Licensing (Part II of EPA 1990)

Part 2A will not normally apply where contamination has resulted from land subject to a waste management licence, although it may apply where adverse effects arise from causes other than a breach of licence conditions or from activities that are permitted under the licence. Licences are regulated and issued by the Environment Agency.

Waste management licensing is currently being incorporated into the Environmental Permitting Regulations (see Permitted Installations).

4.6 Water Resources Act (WRA) 1991

Sections 161 to 161D of the Water Resources Act 1991 give the Environment Agency powers to take action to prevent or remedy the pollution of controlled waters. The Agency can serve a ‘works notice’ on any person who has ‘caused or knowingly permitted’ potential pollution to be in a place from which it is likely to enter controlled waters, or to have caused or knowingly permitted a pollutant to enter controlled waters. The works notice specifies what actions have to be taken in what time periods. Where urgent action is required or a works notice is not complied with, the Agency has the power to carry out the works itself and recover costs from the appropriate person.

The Water Resources Act may apply where the Part 2A regime does not, for example where there is historical pollution of groundwater.

The Water Act 2003 includes a provision, not yet commenced, to amend the current Part 2A definition of pollution of controlled waters to introduce a ‘significance’ test. The Government propose to return to this issue when a significance test for radioactive and non-radioactive contamination can be considered together.

4.7 Groundwater Regulations (GWR) 2009

The existing Groundwater Directive (80/68/EEC) aims to protect groundwater from pollution by controlling discharges and disposals of certain dangerous substances to groundwater. In the UK, the directive is implemented through the Groundwater Regulations (GWR) 2009.



Groundwater is protected under these regulations by preventing or limiting the inputs of polluting substances into groundwater. Substances controlled under these regulations fall into two categories:

- **Hazardous** substances are the most toxic and must be prevented from entering groundwater. Substances in this list may be disposed of to the ground, under a permit, but must not reach groundwater. They include pesticides, sheep dip, solvents, hydrocarbons, mercury, cadmium and cyanide. Hazardous substances replace the previous List 1 substances which came under the 1998 GWR.
- **Non-hazardous pollutants** are less dangerous, and can be discharged to groundwater under a permit, but must not cause pollution. Examples include sewage, trade effluent and most wastes. Non-hazardous pollutants include any substance capable of causing pollution and the list is much wider than the previous List 2 substances. For example, nitrate is included as a pollutant but it was excluded from List 2 in the 1998 GWR.

The existing Groundwater Directive is to be repealed by the Water Framework Directive 2000/60/EC (WFD) in 2013. The GWR 2009 has recently been made law to enact both the WFD and its Daughter Directive 2006/118/EC on the protection of groundwater. This new Groundwater Directive (2006/118/EC) is commonly referred to as the Groundwater Daughter Directive (GWDD).

4.8 Suitable for Use Approach

In practice, most sites with a previous potentially contaminating history are remediated to a condition 'suitable for use' under the planning regime rather than the Part 2A legislation.

The 'suitable for use' approach outlined in DEFRA Circular 01/2006 consists of the following three elements:

- Ensuring that land is suitable for its current use.
- Ensuring that land is made suitable for any new use, as planning permission is given for that new use.
- Limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of land for which planning permission is being sought.

Where new development is taking place, it will be the responsibility of the developer to carry out the necessary remediation. In most cases, the enforcement of any remediation requirements will be through planning conditions and building control, rather than through a remediation notice issued under Part 2A.

4.9 Assessment Methodology

The DEFRA and Environment Agency Contaminated Land Report 11 (CLR11) 'Model Procedures for the Management of Land Contamination' provides a technical framework for structured decision making about land contamination.



Definition of Risk

CLR11 defines risk as:

- A combination of probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

The Concept of the ‘Pollutant Linkage’

In the context of contaminated land, there are three essential elements to any risk:

- A **contaminant (or source)** – a substance that is in, on or under land and has the potential to cause harm or cause pollution of Controlled Waters.
- A **receptor** - humans, ecological system, water body or property.
- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist separately; however, they create a risk only where they are linked together forming a **pollutant linkage**.

Conceptual Site Models

A conceptual site model represents the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors.

The Tiered Risk Assessment Approach

CLR11 presents a tiered approach to risk:

Tier 1 Preliminary risk assessment (PRA)

The purpose of the preliminary risk assessment is to develop an initial conceptual model of the site and to establish whether or not there are potentially unacceptable risks. If potential risks are identified the initial conceptual model is developed in subsequent tiers of the risk assessment process.

Tier 2 Generic quantitative risk assessment (GQRA)

The purpose of the generic quantitative risk assessment is to establish whether generic assessment criteria and assumptions are appropriate for assessing the risks and, if so, to apply them to establish whether there are actual or potential unacceptable risks. It also determines whether further detailed quantitative risk assessment is required.

Tier 3 Detailed quantitative risk assessment (DQRA)

The purpose of the detailed quantitative risk assessment is to establish and use more detailed site specific information and criteria to decide whether there are



unacceptable risks. It may be used as the sole method of quantitative assessments of risks, or it may be used to refine earlier assessments using generic assessment criteria.

5. PRELIMINARY RISK ASSESSMENT AND OUTLINE CONCEPTUAL MODEL

5.1 Potential Contaminants of Concern

Based on the historical and current usage of the site as agricultural land, potential **on-site** contamination sources are likely to be limited to:

- Any localised spillages or leakages of fuel or oils from farm machinery/vehicles.
- Pesticides and herbicides sprayed on the site (including the more persistent historical organochlorine pesticides including aldrin, DDT, dieldrin and endrin now banned in the UK).
- Any historically imported contaminated Made Ground used to raise site levels/infill voids or fly-tipped material.

The potential **off-site** contamination sources are likely to be associated with the following current and historical uses:

- Any historically imported contaminated Made Ground used to raise site levels/infill voids (such as the infilled historical 'brick fields' identified 115m east and 125m south of the site).
- The electricity sub-station located adjacent to the eastern section of the site.
- Landfill gas and leachates associated with the landfill 40m north west of the site.

The potential contaminants of concern associated with the current and historical land uses outlined above include:

- Herbicides / pesticides (including aldrin, DDT, dieldrin and endrin).
- Petroleum hydrocarbons (TPH) and polyaromatic hydrocarbons (PAHs).
- General contaminants including metals, semi-metals and non-metals, inorganic chemicals and organics.
- Polychlorinated biphenols (PCBs).
- Ground gases (including methane and carbon dioxide).

A diagrammatic illustration of the outline conceptual model is presented in Figure 3 of Appendix A.



5.2 Preliminary Human Health Conceptual Model

Potential Sources:	Potential and identified contamination associated with the usage of the site and adjacent land as detailed in Section 5.1.
Potential Pathways:	Ingestion of soil and dust, dermal contact with soil and dust, ingestion of home grown produce and attached soil, inhalation of soil and dust, and the inhalation of indoor and outdoor vapours and ground gases. Potential combustion or explosion of ground gases in confined spaces.
Potential Receptors:	Future site users (residents, site workers, visitors, construction/maintenance workers and potential trespassers) and adjacent residents. Also site flora and fauna and future buildings/structures and construction materials (e.g. water supply pipes).

5.3 Preliminary Controlled Waters Conceptual Model

Potential Sources:	Potential and identified contamination associated with the usage of the site and adjacent land as detailed in Section 5.1.
Potential Pathways:	Infiltration of precipitation through the site's surface and leaching of potential contaminants and subsequent vertical migration to the aquifer or horizontal migration to the watercourse.
Potential Receptors:	Underlying groundwater in the Secondary A and Undifferentiated Aquifers; on site drains, pond 70m west, and 2 No. reservoirs and a pond 190m north west. (The groundwater and surface water abstractions are considered too distant from the site to be at significant risk).

5.4 Preliminary Ground Gas Assessment

There are records of a historical landfill site 40m north west (which accepted inert, commercial and household waste from 1950 to 1960), as well as a potential for infilled ground relating to shallow opencast 'brick fields' 115m east and 125m south of the site. However, there is no evidence to suggest that there is a significant thickness of Made Ground on the site itself. Consequently, based on guidance given in Figure 6 of BS 8576:2013, the gas generation potential of the sources identified are considered to be low to moderate at this stage. (Further assessment is presented in the environmental conclusions in Section 9.2.)

As previously described, the site is not in a Radon Affected Area.



6. INTRUSIVE INVESTIGATION

The following section outlines the scope of the intrusive investigation carried out by GEG in accordance with the Brookbanks specification and details the ground conditions encountered and the chemical testing undertaken.

6.1 Site Works

6.1.1 General

The intrusive investigation was undertaken from 22nd to 25th October 2019 in accordance with the Brookbanks Specification, current British Standard guidance (BS:5930 and BS:10175) and ICE UK Specification for Ground Investigation (2nd Edition 2012) guidelines and comprised window sample boreholes, machine-excavated trial pitting, infiltration testing and in-situ CBR testing.

Prior to commencement of the works, service plans were viewed in order to investigate the location of all major services and each exploratory hole location screened with a cable avoidance tool.

The exploratory holes were logged and sampled by an experienced geo-environmental engineer from GEG. The ground conditions encountered were recorded on the exploratory hole logs (Appendix C). Where strengths and relative densities are in brackets on the exploratory hole logs, these are based on visual assessment in accordance with BS:5930, in the absence of in-situ or laboratory tests.

The locations of the exploratory holes as determined by Brookbanks are shown on Figure 4 presented in Appendix A.

6.1.1.1 Limitations of the Intrusive Investigation

There were no significant limitations to access across the site for the duration of the intrusive investigation. However, due to soft ground conditions at surface (following a period of prolonged heavy rainfall), the window sample boreholes were repositioned towards the field boundaries in the southern and central parts of the site. Furthermore, as the nature of the underlying ground conditions typically exhibited a degree of instability during excavation of the trial pits, TP33 was omitted due to the increased time required to complete the remaining trial pits.

6.1.2 Window Sample Holes

9 No. window sample boreholes (WS01-WS09) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 5.50m.

Continuous sampling was undertaken using a liner system and standard penetration tests (SPTs) were carried out in each hole to confirm the strength/relative density.

WS01, WS05 and WS09 were installed with 50mm diameter standpipes to depths detailed on the exploratory hole logs for subsequent gas and groundwater monitoring.



6.1.3 Trial Pits

41 No. trial pits (TP01-TP06, TP08-TP32, TP34-TP39, IT41-IT43 & TP44) were excavated using a JCB-3CX to a maximum depth of 4.00m to facilitate investigation of the near surface soils.

TP33 was not undertaken as outlined in Section 6.1.1.1.

A further 2 No. trial pit designations (TP07 & TP40) were specified for in-situ CBR testing only (and re-labelled CBR7 & CBR40, as shown on Figure 4, Appendix A) and as such no corresponding trial pit logs are provided.

The trial pit numbering system was in general accordance with drawings provided by Brookbanks Consulting.

6.1.4 Hand Excavated Pits

1 No. hand pit (PCB01) was excavated to a depth of 0.20m to facilitate investigation of the near surface soils adjacent to the existing electricity substation.

6.1.5 Reinstatement

The trial pits were backfilled with arisings and left mounded to allow for settlement. Boreholes were also backfilled with arisings or in the case of boreholes WSO1, WSO5 and WSO9 installed with 50mm diameter gas and groundwater monitoring standpipes and a lockable flush cover.

6.1.6 Rationale for Exploratory Holes

The rationale for the exploratory locations, which was undertaken in general accordance with the Brookbanks' specification, is given in Table 1 below. A plan showing the location of the exploratory holes is included as Figure 4.

Table 1. Rationale for Exploratory Holes

Exploratory Hole	Rationale
WS01-WS09, TP01-TP06, TP08-TP32, TP34-TP39 & TP44	General site coverage (9 No. window sample boreholes & 38 No. trial pits).
IT41-IT43	Infiltration testing in the northern part of the site (3 No. infiltration test pits).

6.1.7 In-situ CBR Testing

In-situ CBR testing was undertaken in 6 No. shallow trial pits in accordance with BS 1377-1:1990. The results are presented in Table 2 below.

Table 2. In-situ CBR test results

Exploratory Hole / Depth	Soil Type	Strata*	In Situ CBR Value
CBR7 / 0.40m	CLAY	RTD	7.80%



Exploratory Hole / Depth	Soil Type	Strata*	In Situ CBR Value
CBR9 / 0.40m	CLAY	RTD	3.50%
CBR15 / 0.40m	CLAY	RTD	1.10%
CBR21 / 0.40m	CLAY	RTD	2.60%
CBR24 / 0.40m	CLAY	RTD	1.00%
CBR31 / 0.40m	CLAY	RTD	1.40%

*RTD=River Terrace Deposits

6.1.8 Sampling

Samples were taken from the exploratory holes for geotechnical and chemical testing as described in Section 6.2 and 6.3 respectively.

6.1.9 Infiltration Tests

3 No. infiltration tests in 3 No. trial pits (IT41-IT43) were undertaken in general accordance with BRE Digest 365.

Trial pits IT41-IT43 were excavated to depths of 1.80m to 2.00m and infiltration tests undertaken in the most permeable strata. Clean water was dispensed from a bowser at a rapid rate to fill each excavation as quickly as possible to the proposed depth of the invert levels and/or the most permeable strata. The excavations took less than 5 minutes to fill to the maximum capacity.

Measurements were then taken of the fall of water at suitable time increments to allow the infiltration rate to be calculated from the time taken for the water level to drop from 75% to 25% effective depth (where possible).

On completion of the measurements, the infiltration pits were backfilled with arisings.

The water level measurements from the infiltration tests are tabulated and graphically depicted on Figures D-1 to D-3 in Appendix D. The results are summarised in Table 3.

Table 3. Infiltration Test Results

Location (Depth Range of Test)	Test No.	Strata*	Effective Depth Reached	Time (mins)	Infiltration Rate (m/s)
IT41 (0.79-2.00m)	1	RTD	100%	282	N/A
IT42 (0.52-1.80m)	1	RTD/LCF	100%	255	N/A



Location (Depth Range of Test)	Test No.	Strata*	Effective Depth Reached	Time (mins)	Infiltration Rate (m/s)
IT43 (0.55- 2.00m)	1	RBD/LCF	105%	267	N/A

N/A = not applicable

* RTD=River Terrace Deposits; RBD=Raised Beach Deposits; LCF=London Clay Formation

As shown in Table 3, the water levels in IT41 and IT42 showed very little infiltration and rose (due to groundwater ingress) in IT43 and consequently no infiltration rates could be calculated.

6.1.10 Gas and Groundwater Monitoring

6.1.10.1 Rationale for Gas Monitoring

The ground conditions encountered in the exploratory holes confirmed natural ground across the majority of the site. However, there is a landfill 40m north west. This is considered consistent with the low to moderate gas generation potential identified in the Preliminary Ground Gas Assessment (Section 5.4). Consequently, in accordance with Figure 6 of BS8576:2013, gas monitoring is not necessarily a requirement; however, 3 No. initial visits were undertaken for confirmatory purposes, as detailed below.

6.1.11 Monitoring Programme

Monthly gas and groundwater monitoring was undertaken targeting periods of falling atmospheric pressure where possible. Monitoring has been undertaken on 14th November and 18th December 2019 and 29th January 2020. The standpipes were monitored for methane, carbon dioxide, oxygen, hydrogen sulphide and the borehole flow rate using a GA2000 gas analyser. Atmospheric pressure and trend was also recorded.

Table 4. Gas Monitoring Results

Borehole	Date	Atmospheric Pressure (mb)	Atmospheric Pressure Trend	Methane (% Vol.)	Carbon Dioxide (% Vol.)	Oxygen (% Vol.)	Hydrogen Sulphide (ppm)	Borehole Flow (l/hr)
WS01	14/11/19	987	Falling	0.0	0.6	20.2	0	0.0
	18/12/19	1006	Falling	0.1	0.1	21.2	0	0.0
	29/01/20	1004	Falling	0.0	0.3	20.9	0	0.0
WS05	14/11/19	987	Falling	0.0	4.1	14.2	0	0.0
	18/12/19	Borehole Location Flooded						
	29/01/20	1004	Falling	0.2	0.8	21.0	0	0.0
WS09	14/11/19	988	Falling	0.0	2.2	19.0	0	0.0
	18/12/19	1008	Falling	0.2	2.6	16.8	0	0.0
	29/01/20	1004	Falling	0.0	2.8	16.4	0	0.0

The gas monitoring recorded methane concentrations of 0.0% to 0.1% and carbon dioxide concentrations of 0.6% to 4.1% with a maximum borehole flow rate 0.0 l/hr.

The water levels were monitored using a dip meter; results are presented in Section 6.4.6.



6.2 Geotechnical Laboratory Testing

Selected samples were despatched to Geo Site and Testing Services Limited and scheduled for geotechnical testing. The schedule of testing comprised:

- 10 No. natural moisture contents (BS1377: Part 2: 1990: 3.2).
- 10 No. liquid and plastic limits (BS1377: Part 2: 1990: 4.2-4.4 & 5.2-5.4).
- 5 No. particle size distribution wet sieve method (BS1377: Part 2: 1990: 9.2).
- 5 No. sedimentation by pipette carried out with wet sieve (BS1377: Part 2: 1990: 9.4).
- 5 No. dry density/moisture content relationship, 4.5kg rammer Method 1 litre mould (BS1377: Part 4: 1990: 3.5).
- 3 No. quick undrained triaxial compression test - single specimen at one confining pressure (100mm or 38mm diameter) (BS1377: 1990 Part 7: 8).
- 3 No. one-dimensional consolidation 75mm or 50mm diameter specimens (5 days) (BS1377: Part 5: 1990: 3).

10 No. water soluble sulphate, soluble magnesium, chloride and pH determinations were also undertaken on the natural soils as part of the chemical testing (Section 6.3).

6.3 Chemical Laboratory Testing

6.3.1 Schedule of Analysis

Representative samples of natural ground were despatched to DETS Ltd for chemical analysis.

The schedule of analysis as detailed below comprised a combination of a range of contaminants commonly identified on brownfield sites, together with specific determinands based on the former and current site and adjacent site uses, as identified below. All soil analysis was MCerts accredited where possible.

Soils

<i>Metals:</i>	Cadmium, chromium (total, III and VI), copper, lead, nickel, zinc, mercury, antimony.
<i>Semi-Metals and Non-Metals:</i>	Arsenic, boron, selenium.
<i>Inorganic Chemicals:</i>	Cyanide (total and free), sulphate (soluble), sulphide.
<i>Others:</i>	pH, soil organic matter
<i>Organics:</i>	Total phenols, banded petroleum hydrocarbons (TPHs), speciated polycyclic



aromatic hydrocarbons (PAHs),
 polychlorinated biphenyl (PCBs)*,
 organochlorine pesticides (OCP)*,
 organophosphorus pesticides (OPP)*.

** Selected samples only*

6.3.2 Scope of Analysis

The scope of the chemical testing as outlined in Section 6.3.1 is summarised in Table 5 below.

Table 5. Scope of Natural Ground Chemical Testing

Sample Type	Analyses	No.	Rationale
Natural Ground	General Suite	9	General coverage
	Organochlorine pesticides (OCP), organophosphorus pesticides (OPP)	8	
Natural Ground	PCBs	1	Targeted adjacent to electricity substation on south eastern boundary of the site.

6.4 Ground Conditions Encountered

The ground conditions encountered are described below and broadly confirmed the published geology. The strength/relative density of the strata is detailed further in the geotechnical assessment in Section 8.1.

6.4.1 Topsoil

Typically soft to firm CLAY topsoil was encountered across the site to depths of 0.30m to 0.50m.

6.4.2 Raised Beach Deposits

Raised Beach Deposits were encountered underlying the topsoil locally in 2 No. exploratory holes (IT42 & IT43) in the north western corner of the site to depths of 0.70m and 0.90m respectively. This strata comprised variably sandy/gravelly soft to firm CLAY and loose to medium dense GRAVEL.

6.4.3 River Terrace Deposits

River Terrace Deposits (RTD) were encountered underlying the topsoil to depths ranging from 1.60m to 4.30m across the majority of the site, with the exception of the north westernmost corner. These deposits were typically found to be in excess of 3.00m in thickness across the central and north eastern sections of the site, becoming thinner towards the south western (1.60m to 2.70m) and north western corners (2.50m). The RTD typically comprised horizons of variably sandy/gravelly very soft to stiff CLAY, soft to firm SILT, and very loose to dense SAND/SAND & GRAVEL/GRAVEL. Softened or low density horizons were encountered in the



majority of the exploratory holes (with the exception of WSo8, TP09 TP16, TP38 & TP39) with apparent random variability throughout the soil profile from depths of 0.30m to >4.00m.

6.4.4 Naturally Reworked London Clay

Naturally Reworked London Clay was encountered underlying the Raised Beach Deposits locally in 2 No. exploratory holes (IT42 & IT43) in the north western corner of the site to depths of 1.50m and 1.80m respectively. This strata comprised horizons of soft sandy clayey SILT with numerous boulder-sized lenses of very soft silt and gravelly sand, and firm to stiff slightly gravelly CLAY with occasional boulder-sized lenses of sand and gravel.

6.4.5 London Clay Formation

The London Clay Formation was encountered underlying the River Terrace Deposits and locally the Naturally Reworked London Clay across the site from depths of 1.60m to 4.30m. It comprised horizons of firm to stiff CLAY. The top of the London Clay was locally softened in the southernmost section of the site (e.g. WSo7 1.80-2.70m; TP35 2.70-3.20m; TP36 2.30 to 2.50m).

6.4.6 Groundwater

Groundwater was encountered in the majority of the exploratory holes during the investigation across the site from depths of 1.20m to 3.00m as slow to moderate (and occasionally fast) inflows.

Groundwater levels recorded in the boreholes during the subsequent monitoring visits are summarised in Table 6.

Table 6. Groundwater Levels Recorded During the Monitoring Visits

Borehole	Date	Depth of Installation (m)	Groundwater Depth (m)
WSo1	14/11/19	5.00	0.50
	18/12/19		0.33
	29/01/20		0.36
WSo5	14/11/19	5.00	0.00
	18/12/19		0.00
	29/01/20		0.00
WSo9	14/11/19	4.00	0.90
	18/12/19		0.94
	29/01/20		1.01

It should be noted that groundwater levels may vary due to seasonal and other effects.

6.4.7 Stability of Trial Pits

The majority of trial pit excavations encountered instability of the sides at depths of 2.00m to 4.00m (and occasionally from 1.00m).



6.4.8 *Visual and Olfactory Evidence of Contamination*

No visual or olfactory evidence of contamination was encountered in any of the exploratory holes undertaken.

7. **GENERIC HUMAN HEALTH QUANTITATIVE RISK ASSESSMENT**

7.1 **Generic Human Health QRA**

7.1.1 *CLEA*

A generic human health quantitative risk assessment has been undertaken primarily using generic assessment criteria (GAC) derived in CLEA, assuming a 'sand' soil type of pH 7 and SOM of 1% were used in the assessment of the natural ground.

The 'residential with home grown produce' for a semi-detached property has been used in the assessment as this is the most sensitive generic land use and building type in the CLEA model applicable to the proposed development.

The exposure pathways used in the CLEA model were:

- Ingestion of soil and dust
- Ingestion of home grown produce and attached soil
- Dermal contact with soil and dust
- Inhalation of soil and dust
- Inhalation of vapours outdoors
- Inhalation of vapours indoors

7.1.2 *Other Assessment Criteria*

EIC/AGS/CL:AIRE GAC have been used where available for organic compounds not covered by the CLEA Model. In the absence of these, the Risk Based Corrective Action (RBCA) Toolkit has been used.

A GEG in-house GAC for total cyanide (for all end uses) has been derived based on acute toxicity and a one-time soil ingestion event.

Sulphate and sulphide were not assessed as these contaminants are not generally considered to represent a significant risk to human health unless at extremely high levels.

Reference has also be made to the DEFRA Category 4 Screening Levels. These were initially derived for categorizing land affected by contamination in accordance of Part 2A of the Environmental Protection Act 1990 (as amended), but subsequently confirmed by Parliamentary Under Secretary of State for Natural Environment and Science Lord Mauley for use in the planning process. This was endorsed with respect to PAHs by Public Health England (2017).



7.1.3 PAH Profiling

Methodology

Public Health England (2017) has recommended benzo(a)pyrene as a surrogate marker for the assessment of the risks posed by genotoxic PAH compounds where sufficiently similar to the 2 No. coal tar mixtures investigated by Culp *et al.* (1998).

By using a PAH profiling tool, it is possible to assess how closely the ratio of benzo(a)pyrene correlates to the standard mixtures of PAHs. If the mean results are within $\pm 10\%$ of the 2 No. coal tar mixtures then it is possible to use benzo(a)pyrene as a surrogate PAH marker.

Assessment

PAH profiling has not been undertaken for the site as all benzo(a)pyrene concentrations were below the laboratory detection limit.

7.1.4 Vapour Risk Associated with PAHs

PAHs (including benzo(a)pyrene) are typically of low volatility. However, selected compounds including naphthalene and to a lesser degree dibenzo(ah)anthracene, benzo(a)anthracene, and ideno(123-cd)pyrene are of higher volatility. Consequently, GEG consider that the benzo(a)pyrene surrogate marker approach could potentially not fully characterise vapour risks for PAHs, particularly if mixtures are present containing for example naphthalene. As such GEG screen individual PAHs against inhalation health criteria values (IHCV) derived in CLEA in order to assess these risks.

7.2 Statistical Analysis of Soil Chemical Data

7.2.1 Methodology

The chemical analysis results from this investigation have been subjected to statistical analysis as detailed in the guidance produced by the Chartered Institute of Environmental Health (CIEH) (CIEH/CL:AIRE, May 2008) where sufficient data is available.

For details of the statistical tests and hypotheses, reference should be made to the aforementioned publication. However, a brief overview is presented below.

In the first instance, a Null Hypothesis (H_0) and Alternative Hypothesis (H_1) are defined as below, in this case based on the Planning Scenario:

H_0 $\mu \geq C_c$ i.e. the true mean concentration (μ) is equal to or greater than the critical concentration (C_c)

H_1 $\mu < C_c$ i.e. the true mean concentration (μ) is less than the critical concentration (C_c)



The data is firstly split into averaging areas based on historical site uses etc. For this site the data has been designated as natural ground soil concentrations where random sampling was undertaken (as the statistical analysis is not applicable for targeted sampling).

An outlier test (Grubb's Test) is undertaken to determine whether the soil concentrations for each determinand and averaging area belong to the same or are part of a separate population i.e. represent outliers or 'hot spots'.

A normality test is then undertaken to determine if the data is normally distributed, or otherwise.

A significance test (dependent upon the distribution of the data) is then applied to the data to test H_0 and H_1 , and determine the associated level of evidence against H_0 .

The GAC are used as critical concentrations in the assessment.

The one sample t-test is undertaken for Normal data and the Chebychev test for Non-normal data. The former derives a single value for the level of evidence against H_0 , whereas the latter derives upper and lower bound values.

The ESI Ltd Contaminated Land Statistical Calculator has been used to undertake the aforementioned statistical assessments and the output tables are presented in Appendix F and summarised in the following sections.

7.2.2 Natural Ground - Non-Targeted Sampling

Statistical analysis of the chemical data from the 9 No. samples of natural ground did not identify any outliers or 'hotspots' above the relevant critical concentrations and the upper confidence limits of the true mean were also below the relevant critical concentrations (indicating the absence of widespread contamination) for all determinands including:

- Metals (arsenic, cadmium, total chromium, chromium III, chromium VI, copper, lead, mercury, nickel and zinc antimony).
- Semi-metals and non-metals (boron and selenium).
- Inorganic chemicals (total and free cyanide).
- Organics (total phenols, C6-C40 banded petroleum hydrocarbons, USEPA 16 polycyclic aromatic hydrocarbons [naphthalene, acenaphthylene, acenaphthene, fluorine, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(123-cd)pyrene, dibenzo(ah)anthracene and benzo(ghi)perylene].

7.2.2.1 Pesticides

No organochlorine and organophosphorus pesticides were identified in the 8 No. samples of natural ground screened.



7.2.2.2 PCBs

No PCB congeners were identified above laboratory detection in the 1 No. sample of natural ground screened.

7.3 Summary of Soil Contamination

No elevated soil contaminants have been identified.

7.4 Generic Controlled Waters Quantitative Risk Assessment

No significant sources of contamination have been identified by the soil analyses undertaken.

7.5 Ground Gas Risk Assessment

The preliminary gas monitoring results recorded have been assessed using guidance presented in CIRIA C665 and BS8485 for 'Assessing risks posed by hazardous ground gas to buildings' for 'low rise traditional housing' in order to reflect the most sensitive aspects of the proposed development. Using a maximum concentrations of methane and carbon dioxide of 0.1% and 4.1% respectively, and the maximum recorded borehole flow rate of 0.0 l/hr, this corresponds to gas screening values (GSV) of 0.00 l/hr and 0.00 l/hr respectively. Therefore, according to Table 8.7 of CIRIA C665 (for use for low-rise traditional housing) using the GSV the site is provisionally characterised as NHBC 'Green'. However, monitoring is ongoing and further monitoring is recommended in particular in the north west near the off site landfill.

As previously described, no protective radon measures are required.

8. GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

8.1 Overview

8.1.1 Summary of Strata Encountered

Typically soft to firm CLAY topsoil was encountered across the site to depths of 0.30m to 0.50m.

Raised Beach Deposits were encountered underlying the topsoil locally in 2 No. exploratory holes in the north western corner of the site to depths of 0.70m and 0.90m respectively. This strata comprised horizons of variably sandy/gravelly soft to firm CLAY and loose to medium dense GRAVEL.

River Terrace Deposits (RTD) were encountered underlying the topsoil to depths ranging from 1.60m to 4.30m across the majority of the site, with the exception of the north westernmost corner. These deposits were typically found to be in excess of 3.00m in thickness across the central and north eastern sections of the site, becoming thinner towards the south western (1.60m to 2.70m) and north western corners (2.50m). The RTD typically comprised horizons of variably sandy/gravelly very soft to stiff CLAY, soft to firm SILT, and very loose to dense SAND/SAND & GRAVEL/GRAVEL. Softened or low density horizons were encountered in the



majority of the exploratory holes with apparent random variability throughout the soil profile from depths of 0.30m to >4.00m.

Naturally Reworked London Clay was encountered underlying the Raised Beach Deposits locally in 2 No. exploratory holes in the north western corner of the site to depths of 1.50m and 1.80m respectively. It comprised horizons of soft sandy clayey SILT with numerous boulder-sized lenses of very soft silt and gravelly sand, and firm to stiff slightly gravelly CLAY with occasional boulder-sized lenses of sand and gravel.

The London Clay Formation was encountered underlying the River Terrace Deposits and locally the Naturally Reworked London Clay across the site from depths of 1.60m to 4.30m. It typically comprised horizons of firm to stiff CLAY. The top of the London Clay was locally softened in the southernmost section of the site in 3 No. exploratory holes from depths of 1.80-3.20m.

8.1.2 Groundwater

Groundwater was encountered at depths of 1.20m to 3.00m during the intrusive investigation as as slow to moderate (and occasionally fast) inflows and from depths of 0.00m to 1.01m during the monitoring visits.

It should be noted that groundwater levels may vary due to seasonal and other effects.

8.1.3 Trial Pit Stability

The majority of trial pit excavations encountered instability of the sides at depths of 2.00m to 4.00m (and occasionally from 1.00m).

8.1.4 Undrained Shear Strength

8.1.4.1 Pocket Penetrometer - Unconfined Compressive Strength

2 No. in-situ pocket penetrometer tests recorded unconfined compressive strengths (UCS) of 0.00 kN/m² in the cohesive strata of the River Terrace Deposits at depths of 1.50m and 2.50m. Measurements of 0.00 kN/m² are at or below the instrumental lower limit of the penetrometer. This indicates very soft strata.

8.1.4.2 Uncorrected Hand Vane Measurements

In-situ hand shear vane tests recorded undrained shear strengths of 4 kN/m² to 169 kN/m² from 0.50m to 2.30m in the cohesive strata of the River Terrace Deposits, as shown on Graph 1 (Appendix G).

In-situ hand shear vane tests recorded undrained shear strengths of 18 kN/m² to 150 kN/m² from 1.50m to 3.90m in the cohesive strata of the London Clay Formation, as shown on Graph 1 (Appendix G).

8.1.4.3 Standard Penetration Tests (SPT) 'N' Values – Shear Strength

9 No. SPTs undertaken in the natural cohesive River Terrace Deposits, recorded 'N' values of 1 to 17 at depths of 1.00m to 4.00m, which based on the relationship: $C_u =$



$f_1 \times N$ after Stroud 1974, where f_1 is assumed as 4.5, corresponds to undrained shear strength (C_u) of 5 to 77 kN/m² respectively. The data is shown in Graph 2 (Appendix G).

8 No. SPTs undertaken in the natural cohesive London Clay Formation, recorded 'N' values of 6 to 28 at depths of 2.00m to 4.00m, which based on the relationship: $C_u = f_1 \times N$ after Stroud 1974, where f_1 is assumed as 5, corresponds to undrained shear strength (C_u) of 30 to 140 kN/m² respectively. The data is shown in Graph 2 (Appendix G).

8.1.4.4 Geotechnical Laboratory Testing

Recorded undrained shear strength results from the 3 No. quick undrained triaxial compression tests ranged from 50 kPa to 125 kPa at depths of 0.50m to 4.50m. However, it is noted that these tests were undertaken on samples taken from window sample boreholes which may have suffered a degree of consolidation during drilling. This is also potentially the case for the samples subjected to consolidation testing and as such the results presented in Appendix G should be regarded as providing a preliminary indication of consolidation parameters of the soils.

8.1.5 Standard/Cone Penetration Tests (SPT/CPT) 'N' Values - Relative Density

15 No. SPTs/CPTs were undertaken in the granular soils of the River Terrace Deposits, which recorded 'N' values from 2 to 35 corresponding to a relative density of very loose to medium dense at depths of 1.00m to 3.00m. The data is shown in Graph 2 (Appendix G).

8.1.6 Plasticity Indices (PI)

The Modified Plasticity Indices and Volume Change Potential of the natural clay are presented in Table 7 below in accordance with NHBC Standards Chapter 4.2.

Table 7. Volume Change Potential

Location / Depth (m)	Strata [#]	Plasticity Index (%)	Fraction <0.425mm (%)	Modified Plasticity Index* (%)	Volume Change Potential
TP05 / 1.20	RTD	26	98	26	Medium
TP10 / 1.20	RTD	17	100	17	Low
TP14 / 1.00	RTD	18	98	18	Low
TP20 / 1.20	RTD	14	99	14	Low
TP21 / 1.00	RTD	29	100	29	Medium
TP23 / 1.00	RTD	17	94	16	Low
TP24 / 1.00	RTD	22	100	22	Medium
TP27 / 1.00	RTD	13	100	13	Low



Location / Depth (m)	Strata [#]	Plasticity Index (%)	Fraction <0.425mm (%)	Modified Plasticity Index* (%)	Volume Change Potential
TP30 / 1.00	RTD	18	100	18	Low
TP39 / 1.00	RTD	14	100	14	Low

Notes: *Modified Plasticity Index = Plasticity Index x (% <0.425mm/100)

[#]RTD= River Terrace Deposits

8.1.7 Preliminary Equilibrium CBR Results from Plasticity Indices

In addition to the in situ CBR testing (Section 6.1.7), preliminary equilibrium CBR values have been determined based on plasticity index tests (undertaken for foundations) in accordance with HA Interim Advice Note 73/06, to determine long term values. These are presented below in Table 8. It is acknowledged that sample depths are slightly deeper than those anticipated for road pavement.

Table 8. Preliminary Equilibrium CBR Values %.

Location / Depth (m)	Strata [*]	Plasticity Index (%)	Equivalent CBR Value %
TP05 / 1.20	RTD	26	3.0-4.0
TP10 / 1.20	RTD	17	4.0
TP14 / 1.00	RTD	18	4.0
TP20 / 1.20	RTD	14	3.0-4.0
TP21 / 1.00	RTD	29	3.0
TP23 / 1.00	RTD	17	4.0
TP24 / 1.00	RTD	22	4.0
TP27 / 1.00	RTD	13	3.0-4.0
TP30 / 1.00	RTD	18	4.0
TP39 / 1.00	RTD	14	3.0-4.0

*RTD = River Terrace Deposits

8.1.8 Proposed Development

As previously described, it is understood that the site is proposed for residential development.

8.2 Foundations

8.2.1 Geotechnical Constraints

The following potential geotechnical constraints have been identified:

- Softened or low density horizons were encountered in the majority of the exploratory holes (with the exception of WSo8, TP09 TP16, TP38 & TP39) with apparent random variability throughout the soil profile from depths of 0.30m to >4.00m.



- Local softening in the London Clay in the southernmost section of the site in 3 No. exploratory holes from depths of 1.80-3.20m.
- Shallow groundwater encountered across the site at depths of 1.20m to 3.00m during the intrusive investigation as slow to moderate (and occasionally fast) inflows, and from depths of 0.00m to 1.01m during the subsequent monitoring visits.
- The majority of trial pit excavations encountered instability of the sides at depths of 2.00m to 4.00m (and occasionally from 1.00m).
- Potential desiccation of the cohesive strata with respect to existing trees.
- Potentially presence of disseminated pyrite associated with the London Clay Formation.

8.2.2 *Anticipated Foundation Types*

The principal geotechnical constraint with respect to foundations is the presence of identified random softened/low density horizons across the site and also potential random softened/low density horizons remaining undetected beneath shallow foundations, resulting in unacceptable differential settlements structures.

As such, the use of piled foundations are considered likely to be the preferred foundation option for the site. Driven piles, approximately 4-5m in length, are anticipated to be the most cost effective solution, however, other systems may be suitable such as vibro concrete columns. Consequently, it is recommended that a specialist piling contractor is contacted to provide the design and warranty of a suitable foundation solution for the site.

Subject to additional investigation on a plot specific basis, traditional strip / trench fill foundations may locally be suitable; however, deepening of foundations is likely to be problematic due to anticipated excavation instability and the presence of shallow groundwater potentially reducing bearing capacities.

Raft foundations are not recommended at this stage (without further investigation and assessment) due to anticipated unacceptable differential settlements.

Vibro-stone columns are not considered suitable based on the presence of soft strata.

Ground improvement techniques such as lime stabilisation could potentially be undertaken to allow shallow/raft foundations to be used. However, the use of relatively short driven piles is considered likely to be more cost effective.

If piled foundations are adopted further investigation utilising deeper cable percussive boreholes will be required for pile design.

8.2.3 *Floor Slabs*

Suspended floor slabs are recommended for the site based on the variable ground conditions.



8.3 Chemical Attack on Buried Concrete

On the basis of the maximum soil soluble sulphate concentration for the River Terrace Deposits on the site of 1.16 g/l (1160 mg/l), and most acidic pH of 7.2 (excluding the topsoil which is to be stripped), ACEC Class AC-2 (Design Class DS-2) conditions are indicated to prevail on site as defined in BRE Special Digest 1 (2005) for foundations, based on natural ground and mobile groundwater conditions.

Additional testing of the London Clay Formation is recommended for the BRE SD1 (2005) suite due to the potential presence of pyritic sulphate.

8.4 Flooding

The majority of the site lies within Flood Zone 1 and hence has a low probability of flooding. However, the land adjacent to the west of the site in the vicinity of Rookery Cottage is located within Flood Zone 3, with the smallest portion of Flood Zone 2 potentially overlapping the westernmost tip of the northern site section.

8.5 Underground Plastic Services

Special precautions with respect to the protection of underground plastic water mains are not considered necessary for this site.

8.6 Slope Stability and Retaining Walls

Slope stability is not considered an issue on this site.

Any proposed retaining walls would need to be designed by a suitably experienced engineer.

8.7 Earthworks

Recorded maximum dry densities, optimum moisture contents and natural moisture contents ranged from 1.74-1.83 Mg/m³, 13-15% and 18-26% respectively (Appendix G). Optimum moisture contents were typically significantly below the natural moisture contents indicating the anticipated requirement for control of moisture contents during any earthworks.

8.8 Fault Reactivation

No significant faults are indicated on the site.

8.9 Excavations

Dewatering of excavations is anticipated to deal with perched pockets of groundwater and during periods of heavy precipitation or if excavations are to remain open for prolonged periods.

In general shallow excavations are likely to be stable for short periods of time. However, in deeper excavations and/or where shallow groundwater is encountered, excavations are likely to be less stable and will locally require shoring; particularly where excavations extend beyond 1.20m depth. In accordance with current Health and Safety Requirements, shoring or battering back of excavations is required in all



cases where access for personnel is required into those excavations whenever there is a risk that collapse of the excavation could occur.

8.10 Road Pavement Design

Recorded in-situ CBR values ranged from 1.0% to 7.8%, and preliminary equilibrium CBR values of 2.5% to 4.0% were indicated based on Atterberg Limit testing (albeit for slightly deeper strata). Consequently, a CBR design value of between <2% and 4.0% is recommended for the cohesive soils and geotechnically suitable Made Ground depending on localised conditions. Further Atterberg Limit testing of the cohesive soils at formation level is recommended to confirm this. A CBR design value of 20% is recommended for localised granular soils.

8.11 Loose/Soft Spots

The formation (of foundations, floor slabs and roads etc.) should be inspected for soft/loose spots by a suitably experienced geotechnical engineer. Soft spots if encountered should be removed and replaced with suitable well compacted granular material/lean mix concrete as deemed appropriate. Soft spots beneath roads may also require the use of additional geotextiles or geotechnical improvement with lime/cement. Any loose soils at formation level may need to be proof rolled to increase the relative density.

8.12 Soakaways

As previously described, it was not possible to calculate soil infiltration rates in the natural strata due to the absence of significant infiltration, which was consistent with the predominantly cohesive strata and shallow groundwater encountered.

9. ENVIRONMENTAL CONCLUSIONS & RECOMMENDATIONS

Following the findings of the intrusive investigation and generic quantitative risk assessment, the preliminary conceptual site model has been revised as detailed below in Sections 9.1.1 and 9.1.2 and as illustrated in Figures 5A and 5B of Appendix A.

9.1 Revised Conceptual Model

9.1.1 Revised Human Health Conceptual Model

Identified Sources: No significant contamination has been identified in the natural ground for the proposed residential end use.

Potential Risks: End users of the site and construction/maintenance workers are therefore not considered to be at significant risk from the site as no significant contaminant sources have been identified by the chemical analyses undertaken to date.

9.1.2 Revised Controlled Waters Conceptual Model

Potential Sources: No significant soil sources have been identified.



Potential Risks: Risks to Controlled Waters are unlikely to be significant based on the information available.

9.2 Ground Gases

According to the preliminary gas monitoring results, the site is potentially characterised as NHBC 'Green'. However, further monitoring is recommended in particular in the north west near the off site landfill located 40m north west.

Furthermore, should any significant quantities of biodegradable materials be encountered during construction (backfilled ponds etc.), beneath the proposed properties, these should be removed and replaced with inert material.

As previously described, the site is not in a Radon Affected Area; as such no protective radon measures are required.

9.3 Risks to Adjacent Land and Third Parties

The information available indicates that risks to adjacent land from the area investigated are not considered to be significant.

9.4 Risks from Adjacent Land and Third Parties

Risks from adjacent land are not considered to be significant based on the information available.

9.5 Potential Geo-Environmental Liabilities

Potential geo-environmental liabilities under Pt2A of the Environmental Protection Act (1990) and the Groundwater Regulations (GWR) 2009, relating to the site in its current are not anticipated to be significant.

9.6 Waste Classification

The chemical analysis results indicate that the strata is likely to be characterised as non-hazardous / inert waste. Therefore, excess arisings should be suitable for use as general fill on other development sites or taken to a suitable waste treatment centre based on this initial characterisation and the total soil analyses.

9.7 Re-Use of Topsoil

The chemical analysis undertaken indicates that the topsoil present on site is suitable for re-use.

9.8 Remediation

9.8.1 Human Health Remedial Measures

Based on the information available, no remedial measures are considered necessary to protect human health.



9.8.2 Protection of Controlled Waters

No remedial measures are considered necessary to protect Controlled Waters from the site itself, based on the information available.

9.8.3 Unidentified Contamination

GEG should be contacted if any gross contamination is encountered as part of the works, with a view to its assessment and removal.

9.8.4 Unidentified Underground Structures

GEG should be contacted if any underground structures are encountered such as tanks or wells to determine further requirements.

9.9 Further Investigation

The following further work is recommended:

- Deeper cable percussive boreholes for pile design purposes.
- Additional testing of the London Clay Formation due to the potential presence of pyritic sulphate.
- Further gas monitoring is recommended in particular in the north west near the off site landfill.

10. REFERENCES

1. British Standard Institute (1990) BS: 1377 Parts 1-9. Methods of Tests for Soils for Civil Engineering Purposes.
2. British Standard Institute (2015) BS: 5930 Code of Practice for Site Investigations. BSI, London.
3. British Standard Institute (2013) BS: 8576 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds (VOCs). BSI, London.
4. British Standard Institute (2011) BS: 10175 Code of Practice for Investigation of Potentially Contaminated Sites. BSI, London.
5. BRE Report 414 (2001). Protective measures for housing on gas-contaminated land. BRE Press, Berkshire.
6. BRE Digest 412 (February 1996). Desiccation in clay soils.
7. BRE SD1 (2005): Special Digest 1:2005. Concrete in Aggressive Ground.
8. CIRIA Publication C665 (2007): Assessing risks posed by hazardous ground gases to buildings.



9. CIEH and CL:AIRE (May 2008). Comparing Soil Concentration Data with a Critical Concentration.
10. Culp, S., Gaylor, D., Sheldon, W., Goldstein, L. and Beland, F. (1998) A comparison of the tumours induced by coal tar and benzo(a)pyrene in a 2-year bioassay. *Carcinogenesis*, 19 (1) 117-124
11. DEFRA (July 2008). Guidance on the Legal Definition of Contaminated Land.
12. DEFRA (2002b) *Model Procedures for the Management of Contaminated Land, Report CLR 11*.
13. DEFRA. SP1010: (December 2014) *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.
14. Driscoll (1983) The Influence of Vegetation on the Swelling and Shrinking of Soils in Britain. *Geotechnique* Vol. 33 No.2.
15. Environment Agency. *Environmental Quality Standards*.
16. Environment Agency 2009. *Human health toxicological assessment of contaminants in soil (Science Report Final SC050021/SR2)*.
17. Environment Agency 2009. *Updated technical background to the CLEA model (Science Report Final SC050021/SR3)*.
18. Environment Agency, 2009. Science Reports SC050021: arsenic SGV, nickel SGV, mercury SGV, selenium SGV, cadmium SGV, benzene SGV, toluene SGV, ethylbenzene SGV, xylene SGV, dioxins, furans and dioxin-like PCBs SGV and phenol SGV.
19. Environment Agency, 2009. Science Reports SC050021 Supplementary Information for the derivation of arsenic SGV, nickel SGV, mercury SGV, selenium SGV, cadmium SGV, benzene SGV, toluene SGV, ethylbenzene SGV, xylene SGV, dioxins, furans and dioxin-like PCBs SGV and phenol SGV.
20. Environment Agency, Scottish Environment Protection Agency, Environment and Heritage Centre, Technical Guidance WM2. Interpretation of the definition and classification of hazardous waste.
21. Geological Society Engineering Group Working Party Report, 1970. The logging of rock cores for engineering purposes. *Quarterly Journal of Engineering Geology* 3, 1-24 (24 pages).
22. ICE Publishing (2012) UK Specification for Ground Investigation – Second Edition. Site Investigation Steering Group.
23. NHBC Standards Chapter 4.2. (2011). Building Near Trees.



24. Scotland and Northern Ireland Forum for Environment Research (2003) *Method for Deriving Site-Specific Human Health Assessment Criteria for Contaminants in Soil*.
25. Stroud, M.A. (1974). The Standard Penetration Test in Insensitive Clays and Soft Rocks. Proceedings of the European Symposium on Penetration Testing, Stockholm, Vol. 2.2 pp 367-375.
26. Stroud, M.A. and Butler, FG, (1975). The Standard Penetration Test and the Engineering Properties of Glacial Materials. Proceedings of the Symposium on the Engineering Behaviour of Glacial Materials, University of Birmingham.
27. Total Petroleum Hydrocarbon Criteria Working Group Series (1998) Volume 5. *Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach*.

11. LIMITATIONS

As with all intrusive site investigations, there is a possibility that localised contamination 'hot spots'/geotechnical features remain undetected on the site. Therefore, as with standard practices, this report does not provide a warranty to cover limited localised contamination 'hot spots'/geotechnical features or any post-investigation importation of contamination.

The conclusions and recommendations stated herein are based on information available at the time of production. These may not necessarily apply if the site is to be utilised for a more or less sensitive purpose in the future, or if operational procedures or management alter over time.

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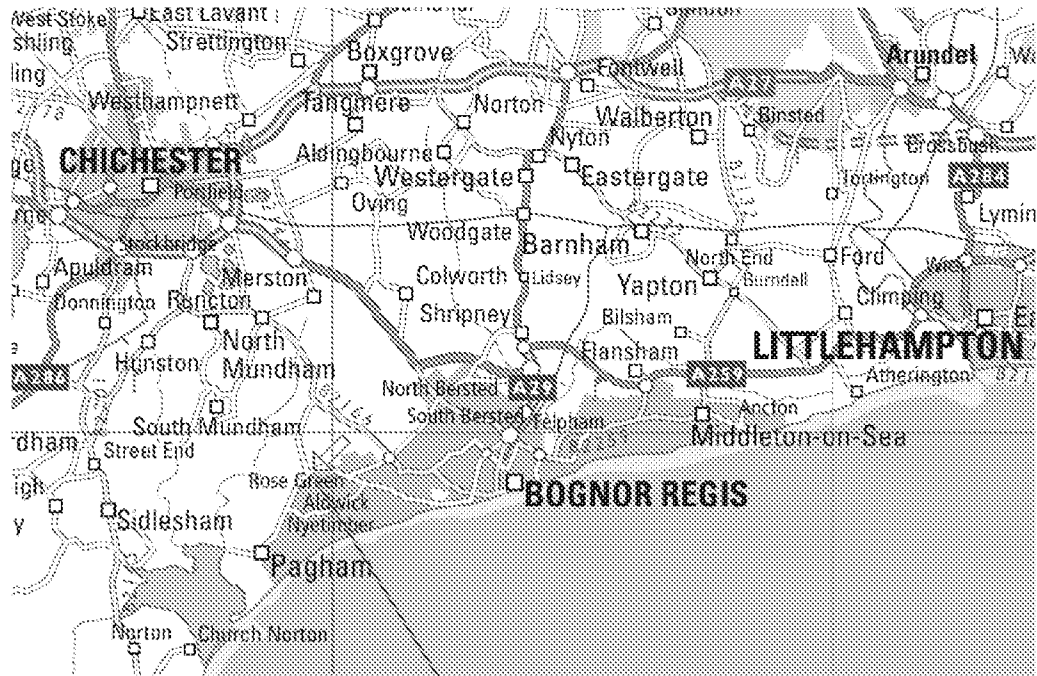
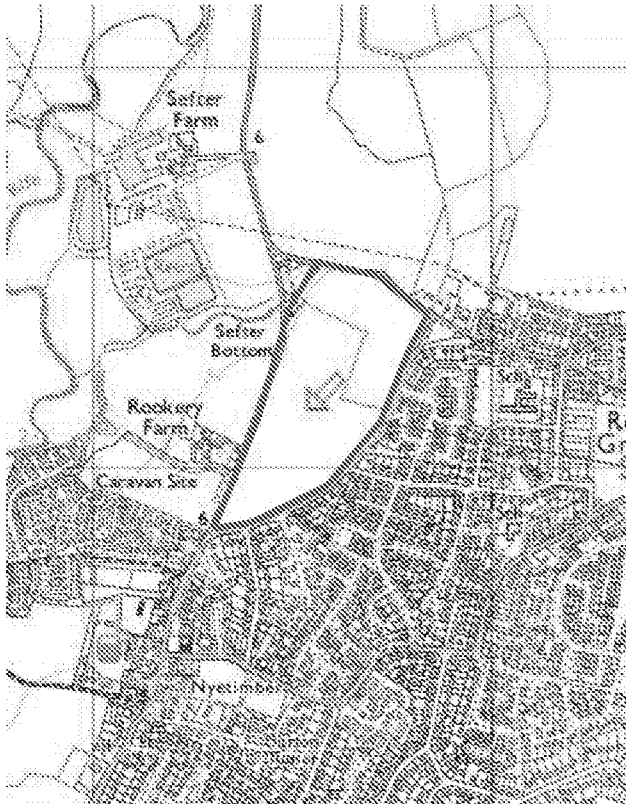
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APPENDIX A

FIGURES AND PLANS



SITE LOCATION

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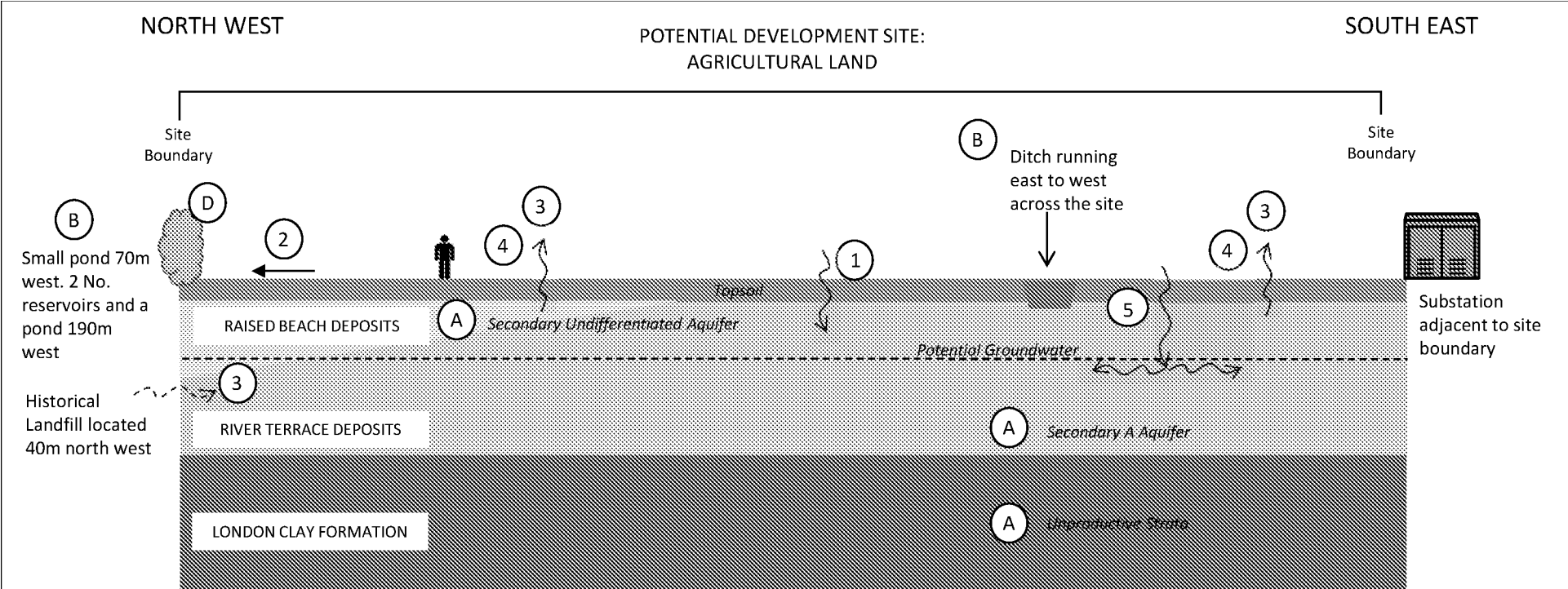
TITLE: FIGURE 1: SITE LOCATION PLAN		CLIENT: BROOKBANKS / HLM		DRAWN/CHECKED: JM / MP		GEG House, 17 Graham Road Malvern, WR14 2HR Tel. 01684 212526 Fax 01684 576917 admin@g-eg.co.uk, www.g-eg.co.uk	Geo Environmental Group	
SITE: HOOK LANE, PAGHAM	PROJECT No.: GEG-19-623	SCALE: NTS	DATE: 20/11/19	REVISION: A				



LEGEND

- NOTES:
- 1. BASE IMAGE PROVIDED BY BROOKBANKS CONSULTING.
 - 2. DRAWING TO BE USED IN CONJUNCTION WITH GEG REPORT GEG-19-623/PI_PII.

JOB NUMBER GEG-19-623			 Geo Environmental Group	
PROJECT TITLE HOOK LANE, PAGHAM				
DRAWING TITLE FIGURE 2: CURRENT LAYOUT PLAN			DRAWING NO. GEG-19-623_003	
CLIENT BROOKBANKS CONSULTING	REVISION NO. A	ORIGINAL SIZE A3	DIMENSIONS METRES	SCALE AS SHOWN
DRAWN BY NN	CHECKED BY MP	APPROVED BY MR	ISSUE FINAL ISSUE	DATE 20/11/19



PATHWAYS

- 1 Infiltration of precipitation
- 2 Surface water run off
- 3 Migration of ground gases (methane and carbon dioxide)
- 4 Potential dermal contact, ingestion of contaminated soil and/or dust and inhalation of gases/vapours
- 5 Potential leaching/mobilisation of contaminants and lateral and vertical migration

RECEPTORS

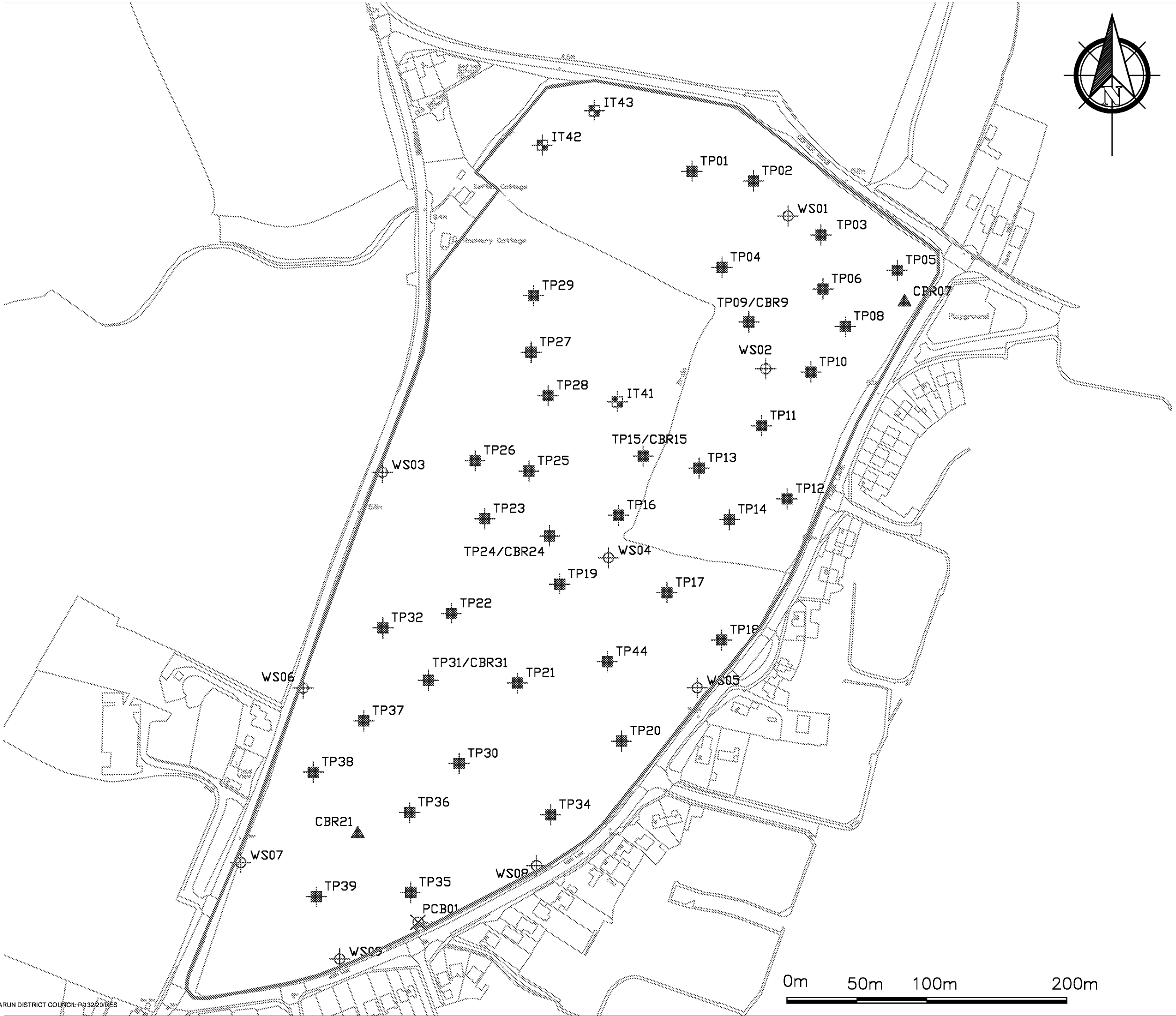
- Site users
- A Aquifer type
- B Watercourse
- C Building Materials (Not applicable)
- D Flora and fauna

SIGNIFICANT SOURCES

Potential sources of contamination associated with historical/current site usage (see text)

Please refer to the text of the report for further information relating to this diagram.

TITLE: FIGURE 3: PRELIMINARY CONCEPTUAL SITE MODEL		Geo Environmental Group  GEG House 17 Graham Road Malvern WR14 2HR Tel. 01684 212526 Fax 01684 576917 admin@g-eg.co.uk www.g-eg.co.uk
SITE: HOOK LANE, PAGHAM		
CLIENT: BROOKBANKS / HLM		
PROJECT No.: GEG-19-623	DRAWN/CHECKED: NN / MP	
SCALE: NTS	DATE: 03/12/19	



LEGEND

 TP01

GEG TRIAL PIT LOCATION

 CBR1

GEG CBR TEST LOCATION

 WS01

GEG WINDOW SAMPLE LOCATION

 IT01

GEG INFILTRATION TEST LOCATION

 PCB01

GEG HAND DUG SURFACE SAMPLE

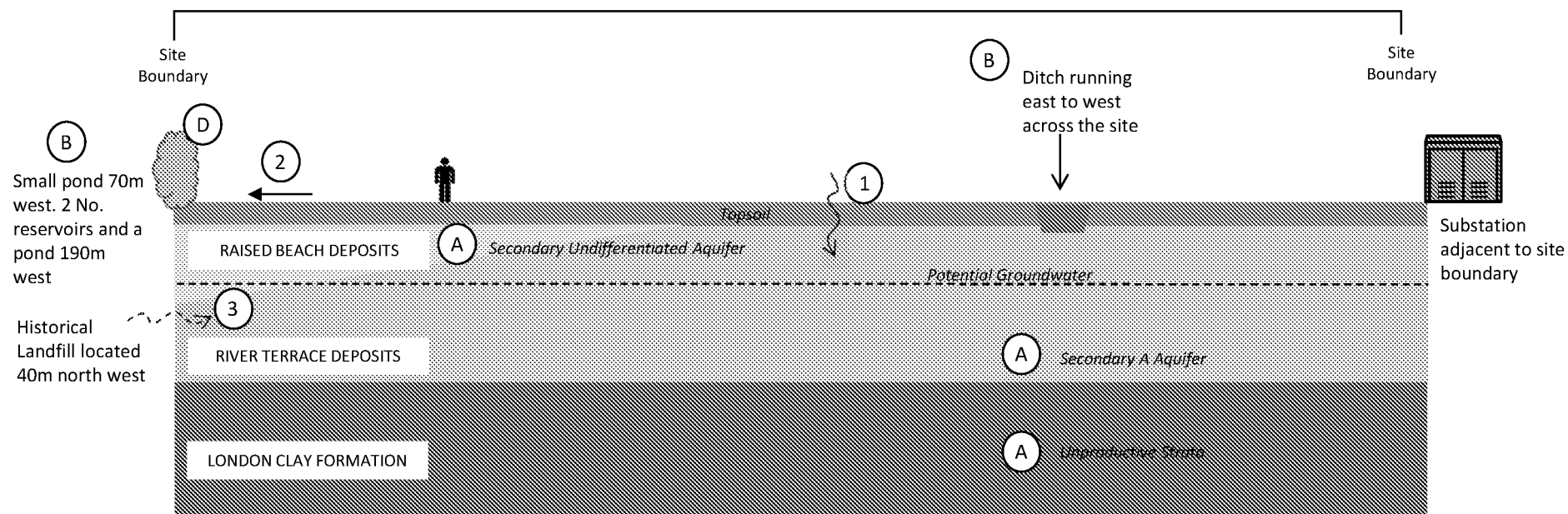
- NOTES:
- 1. BASE IMAGE PROVIDED BY BROOKBANKS CONSULTING.
 - 2. DRAWING TO BE USED IN CONJUNCTION WITH GEG REPORT GEG-19-623/PI_PII.

JOB NUMBER GEG-19-623			 Geo Environmental Group	
PROJECT TITLE HOOK LANE, PAGHAM				
DRAWING TITLE FIGURE 4: EXPLORATORY HOLE LOCATION PLAN			DRAWING NO. GEG-19-623_002	
CLIENT BROOKBANKS CONSULTING	REVISION NO. A	ORIGINAL SIZE A3	DIMENSIONS METRES	SCALE AS SHOWN
DRAWN BY NN	CHECKED BY MP	APPROVED BY MR	ISSUE FINAL ISSUE	DATE 18/11/19

NORTH WEST

POTENTIAL DEVELOPMENT SITE:
AGRICULTURAL LAND

SOUTH EAST



PATHWAYS

- 1 Infiltration of precipitation
- 2 Surface water run off
- 3 Migration of ground gases (methane and carbon dioxide)
- 4 Potential dermal contact, ingestion of contaminated soil and/or dust and inhalation of gases/vapours
- 5 Potential leaching/mobilisation of contaminants and lateral and vertical migration

RECEPTORS



Site users

- ☐ A Aquifer type
 ☐ C Building Materials (Not applicable)
- ☐ B Watercourse
 ☐ D Flora and fauna

SIGNIFICANT SOURCES

No significant sources of contamination have been identified to date associated with historical/current site usage.

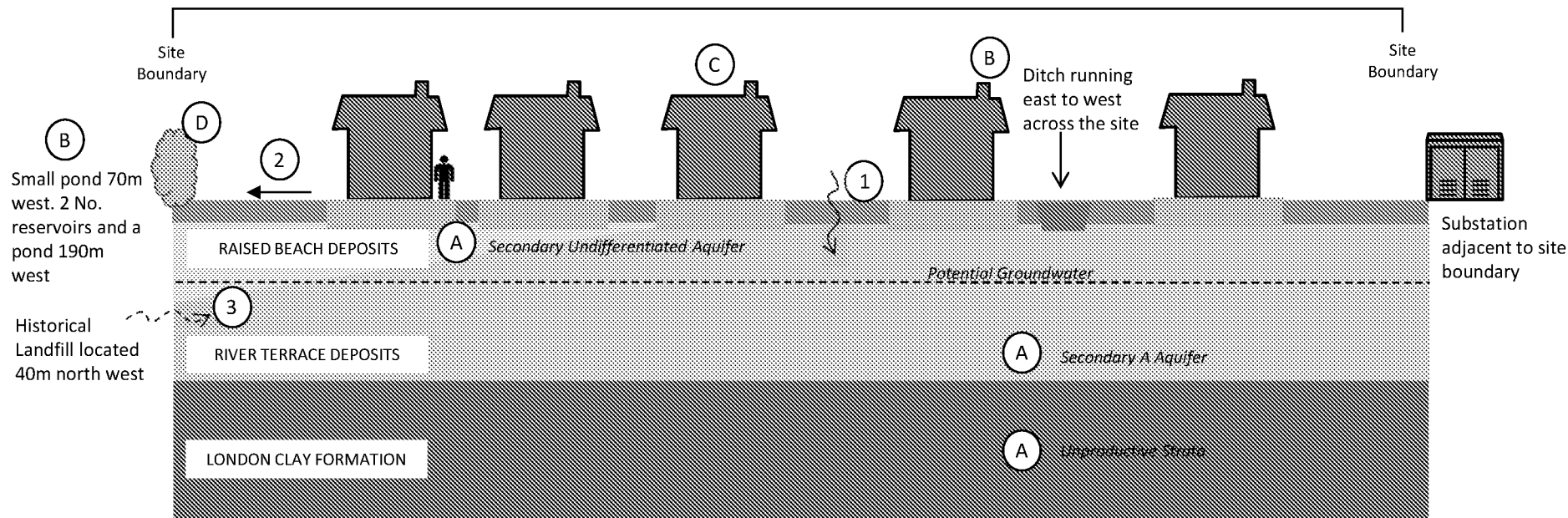
Please refer to the text of the report for further information relating to this diagram.

TITLE: FIGURE 5A: CONCEPTUAL SITE MODEL (EXISTING)		Geo Environmental Group 
SITE: HOOK LANE, PAGHAM		
CLIENT: BROOKBANKS / HLM		
PROJECT No.: GEG-19-623	DRAWN/CHECKED: NN / MP	
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NORTH WEST

POTENTIAL DEVELOPMENT SITE:
AGRICULTURAL LAND

SOUTH EAST



PATHWAYS

- 1 Infiltration of precipitation
- 2 Surface water run off
- 3 Migration of ground gases (methane and carbon dioxide)
- 4 Potential dermal contact, ingestion of contaminated soil and/or dust and inhalation of gases/vapours
- 5 Potential leaching/mobilisation of contaminants and lateral and vertical migration

RECEPTORS



Site users



Aquifer type



Watercourse



Building Materials (Not applicable)



Flora and fauna

SIGNIFICANT SOURCES

No significant sources of contamination have been identified to date associated with historical/current site usage.

Please refer to the text of the report for further information relating to this diagram.

TITLE: FIGURE 5B:
CONCEPTUAL SITE MODEL (PROPOSED)

SITE:
HOOK LANE, PAGHAM

CLIENT:
BROOKBANKS / HLM

PROJECT No.:
GEG-19-623

DRAWN/CHECKED:
NN / MP

SCALE:
NTS

DATE:
03/12/19

**Geo
Environmental
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APPENDIX B

PHOTOGRAPHIC RECORD



SITE WALKOVER



Photo 1: View east across northern section of the site.



Photo 2: View south west across northern section of the site.



Photo 3: View south across northern section of the site.



Photo 4: View south across western section of the site.

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WR14 2HR

Client: Brookbanks

Project: Pagham, West Sussex

Project No.: GEG-19-623



Photo 5: View east across central section of the site.



Photo 6: View south west across central section of the site.



Photo 7: View south across the site.



Photo 8: View south across the site.

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Ecological Consultants



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WR14 2HR

Client: Brookbanks

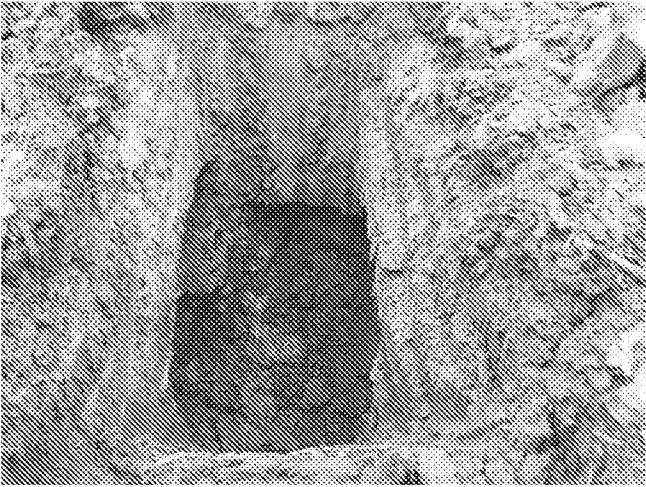
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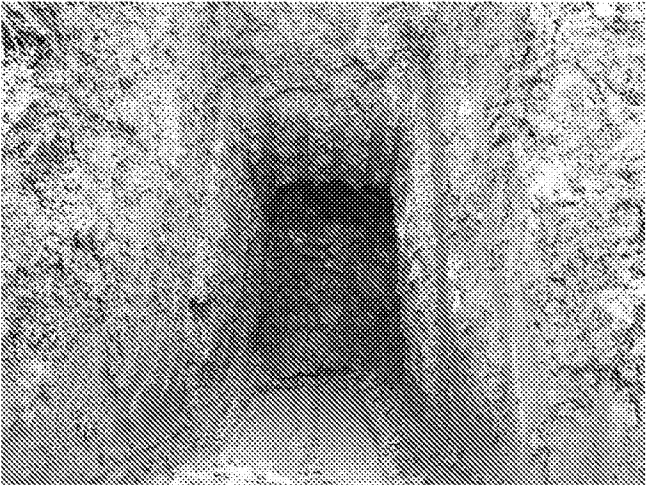
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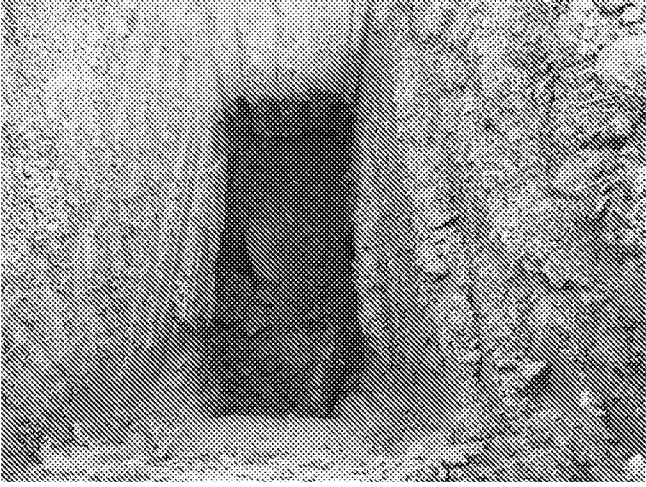
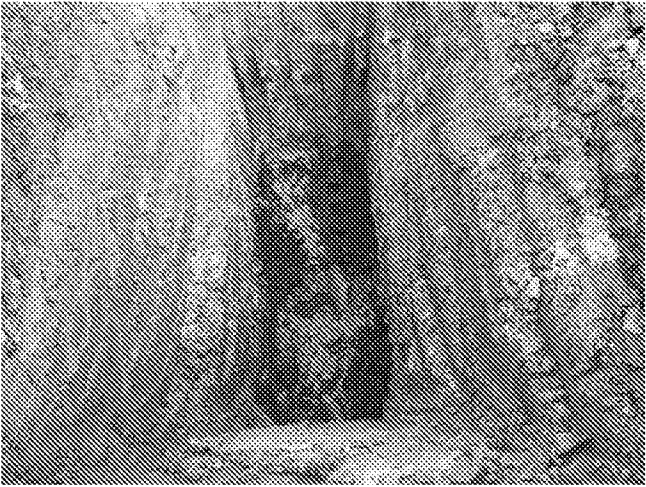


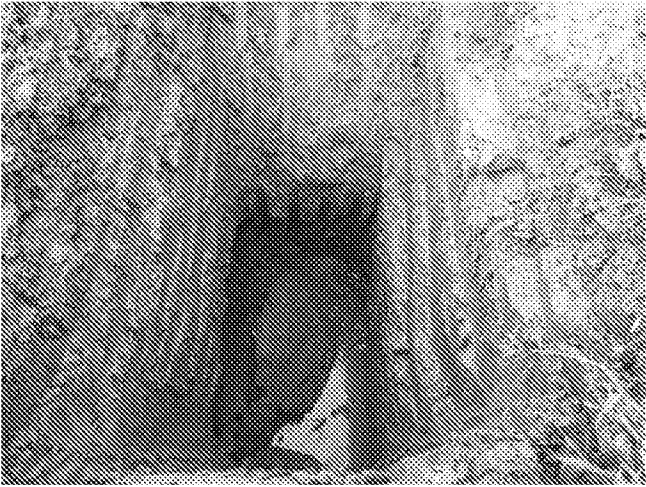
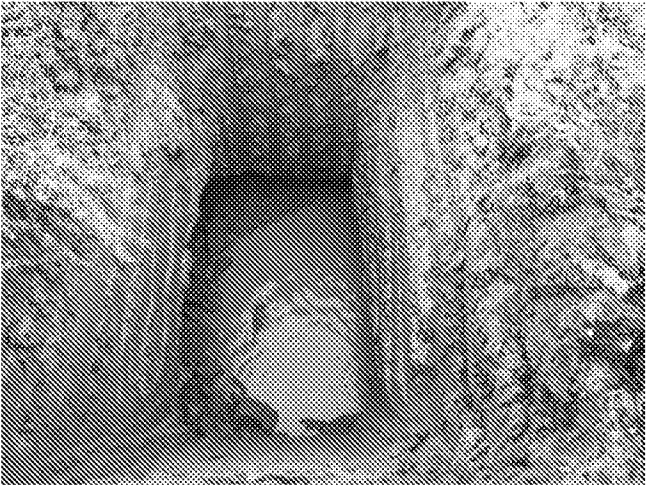
TRIAL PITTING

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 1: Excavation of trial pit TP01.	Photo 2: Arisings from trial pit TP01.	
		
Photo 3: Excavation of trial pit TP02.	Photo 4: Arisings from trial pit TP02.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 5: Excavation of trial pit TP03.	Photo 6: Arisings from trial pit TP03.	
		
Photo 7: Excavation of trial pit TP04.	Photo 8: Arisings from trial pit TP04.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 9: Excavation of trial pit TP05.	Photo 10: Arisings from trial pit TP05.	
		
Photo 11: Excavation of trial pit TP06.	Photo 12: Arisings from trial pit TP06.	

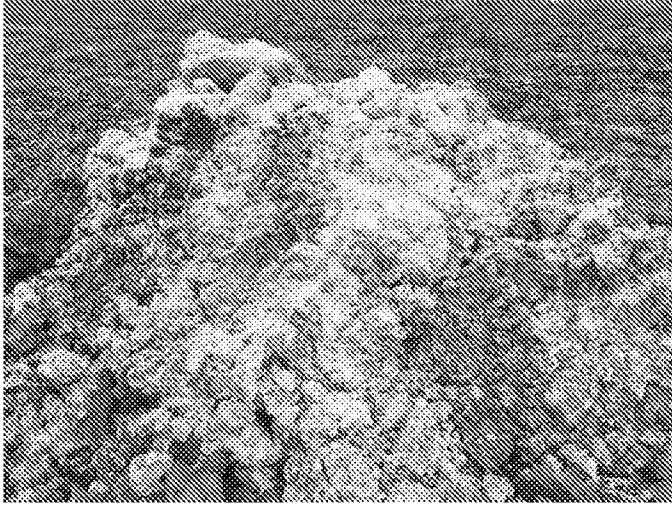
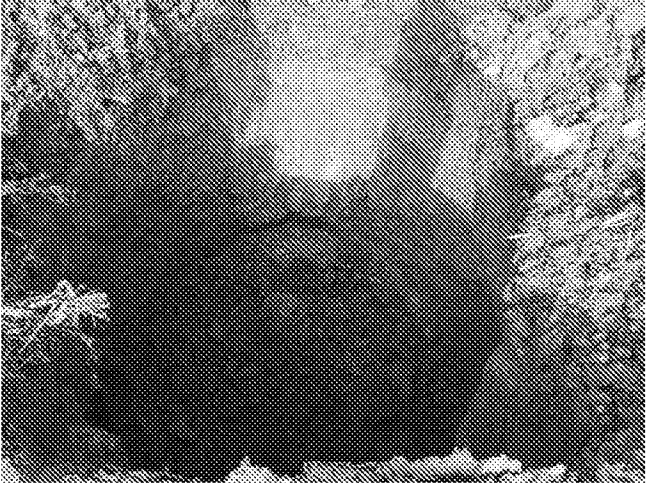
		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 13: Excavation of trial pit TP08.	Photo 14: Arisings from trial pit TP08.	
		
Photo 15: Excavation of trial pit TP09.	Photo 16: Arisings from trial pit TP09.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 17: Excavation of trial pit TP10.	Photo 18: Arisings from trial pit TP10.	
		
Photo 19: Excavation of trial pit TP11.	Photo 20: Arisings from trial pit TP11.	

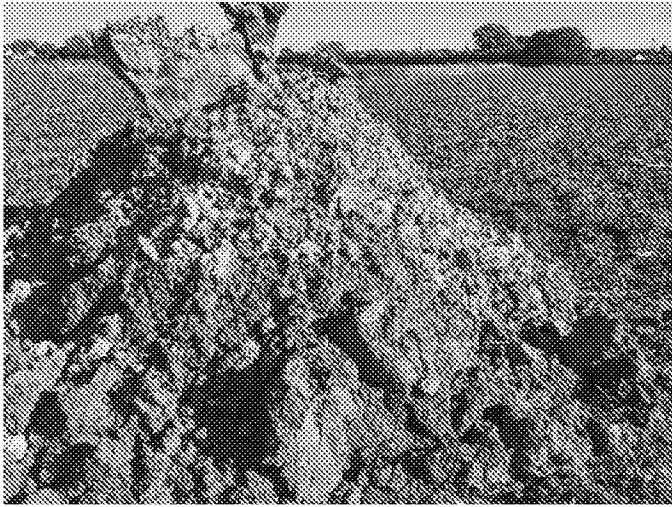
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Photo 21: Excavation of trial pit TP12.	Photo 22: Arisings from trial pit TP12.	
		
Photo 23: Excavation of trial pit TP13.	Photo 24: Arisings from trial pit TP13.	

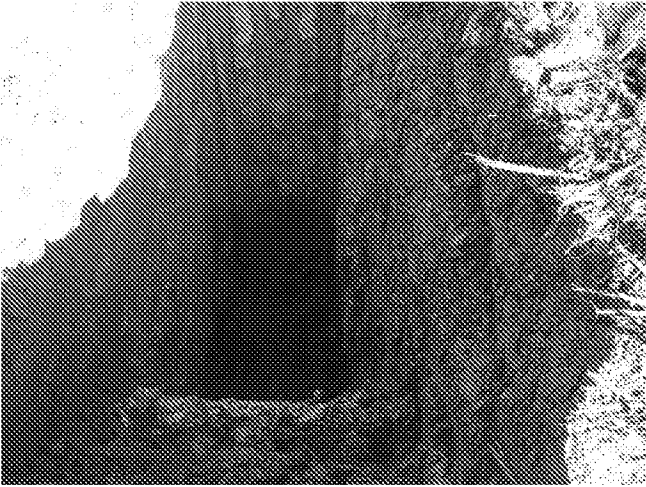
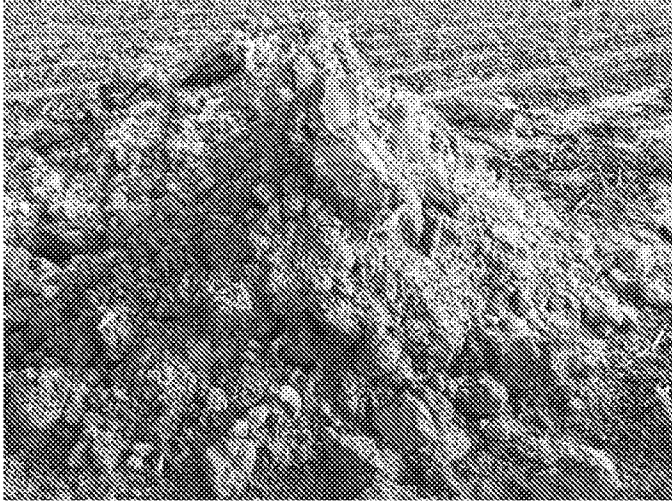
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Photo 25: Excavation of trial pit TP14.	Photo 26: Arisings from trial pit TP14.	
		
Photo 27: Excavation of trial pit TP15.	Photo 28: Arisings from trial pit TP15.	

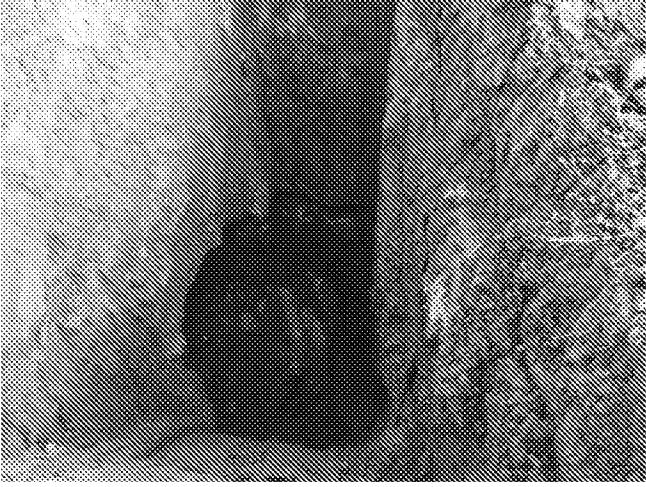
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Photo 29: Excavation of trial pit TP16.	Photo 30: Arisings from trial pit TP16.	
		
Photo 31: Excavation of trial pit TP17.	Photo 32: Arisings from trial pit TP17.	

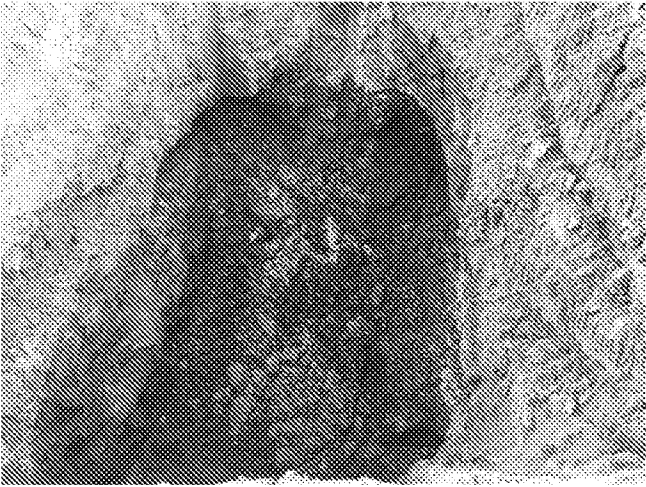
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Photo 33: Excavation of trial pit TP18.	Photo 34: Arisings from trial pit TP18.	
		
Photo 35: Excavation of trial pit TP19.	Photo 36: Arisings from trial pit TP19.	

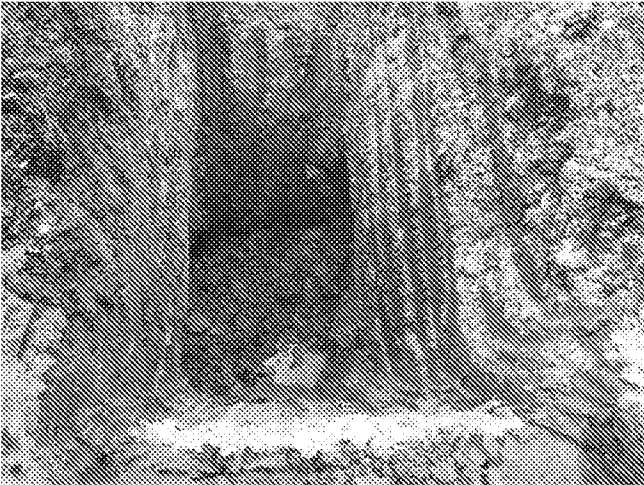
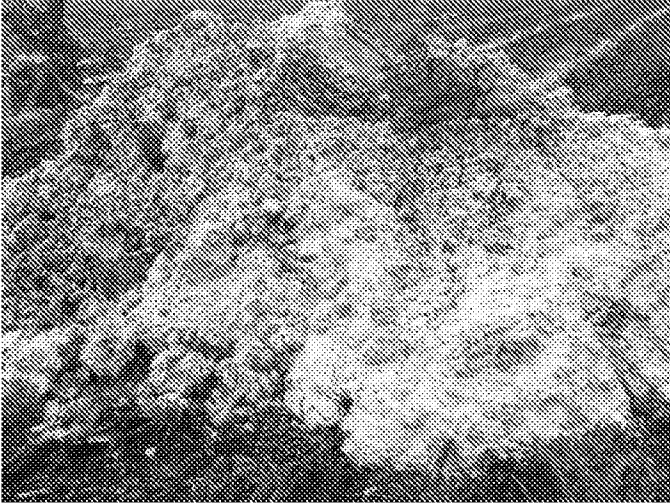
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Photo 37: Excavation of trial pit TP21.	Photo 38: Arisings from trial pit TP21.	
		
Photo 39: Excavation of trial pit TP22.	Photo 40: Arisings from trial pit TP22.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 41: Excavation of trial pit TP23.	Photo 42: Arisings from trial pit TP23.	
		
Photo 43: Excavation of trial pit TP24.	Photo 44: Arisings from trial pit TP24.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 45: Excavation of trial pit TP25.	Photo 46: Arisings from trial pit TP25.	
		
Photo 47: Excavation of trial pit TP26.	Photo 48: Arisings from trial pit TP26.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 49: Excavation of trial pit TP27.	Photo 50: Arisings from trial pit TP27.	
		
Photo 51: Excavation of trial pit TP28.	Photo 52: Arisings from trial pit TP28.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 53: Excavation of trial pit TP29.	Photo 54: Arisings from trial pit TP29.	
		
Photo 55: Excavation of trial pit TP30.	Photo 56: Arisings from trial pit TP30.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 57: Excavation of trial pit TP31.	Photo 58: Arisings from trial pit TP31.	
		
Photo 59: Excavation of trial pit TP32.	Photo 60: Arisings from trial pit TP32.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 61: Excavation of trial pit TP34.	Photo 62: Arisings from trial pit TP34.	
		
Photo 63: Excavation of trial pit TP35.	Photo 64: Arisings from trial pit TP35.	

		Geo Environmental Group Geotechnical, Environmental & Ecological Consultants  Geo Environmental Group GEG House 17 Graham Road Malvern WR14 2HR Client: Brookbanks Project: Pagham, West Sussex Project No.: GEG-19-623
Photo 65: Excavation of trial pit TP36.	Photo 66: Arisings from trial pit TP36.	
		
Photo 67: Excavation of trial pit TP37.	Photo 68: Arisings from trial pit TP37.	

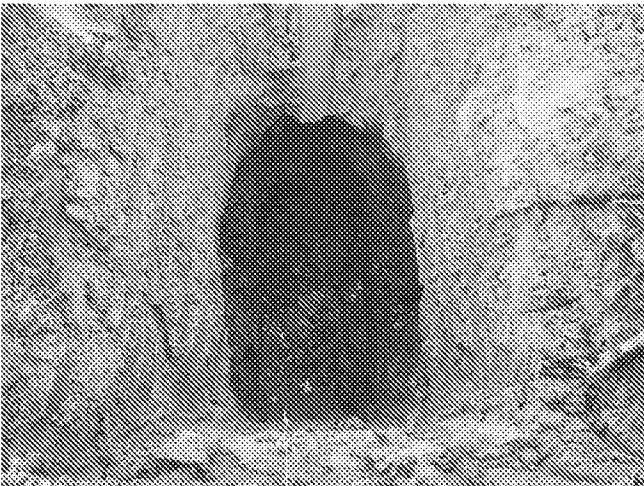
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Photo 69: Excavation of trial pit TP38.	Photo 70: Arisings from trial pit TP38.	
		
Photo 71: Excavation of trial pit TP39.	Photo 72: Arisings from trial pit TP39.	



Photo 73: Excavation of trial pit TP44.



Photo 74: Arisings from trial pit TP44.

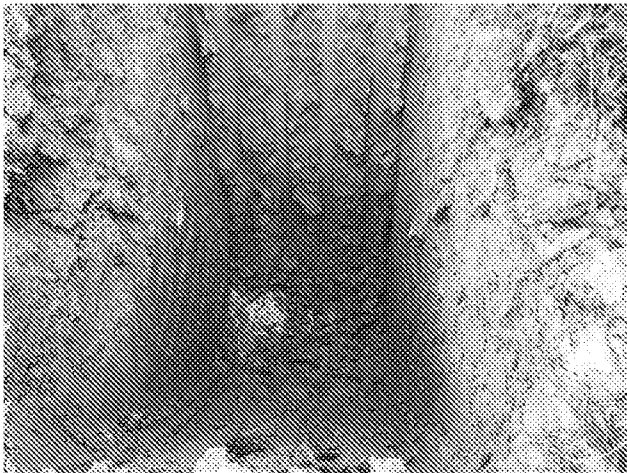


Photo 75: Excavation of trial pit IT41.

No Photograph

Photo 76: Arisings from trial pit IT41.

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Malvern
WR14 2HR

Client: Brookbanks

Project: Pagham, West Sussex

Project No.: GEG-19-623



Photo 77: Excavation of trial pit IT42.



Photo 78: Arisings from trial pit IT42.



Photo 79: Excavation of trial pit IT43.



Photo 80: Arisings from trial pit IT43.

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WR14 2HR

Client: Brookbanks

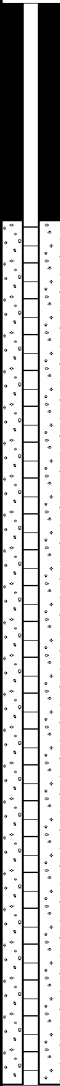
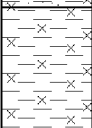
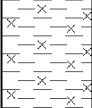
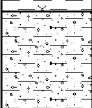
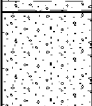
Project: Pagham, West Sussex

Project No.: GEG-19-623



APPENDIX C

EXPLORATORY HOLE LOGS

				Borehole Log			Borehole No. WS01 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489737E - 99402N		Hole Type WS	
Location: Hook Lane, Pagham, PO21 3PD						Level:		Scale 1:36	
Client: Brookbanks / Hallam Land Management						Dates: 23/10/2019		Logged By NN	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.00		 (Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
		0.50		HVP=42	0.40		 Firm orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5	
		1.00	SPT	N=6 (1,1/1,2,1,2)			 1.00-1.50m Becoming soft	1.0	
		1.50	PP	0.00	1.50		 (Soft to very soft) sandy slightly gravelly silty CLAY. Gravel is fine to medium sub-angular flint. (RIVER TERRACE DEPOSITS)	1.5	
		2.00	SPT	N=30 (2,3/5,7,8,10)	2.00		 Medium dense to dense yellowish brown gravelly medium SAND. Gravel is medium sub-rounded flint. (RIVER TERRACE DEPOSITS)	2.0	
							2.50-3.40m Becoming grey	2.5	
		3.00	SPT	N=4 (1,1/1,1,1,1)			3.00-3.40m Becoming very loose to loose	3.0	
					3.40		 (Stiff) greyish brown CLAY. (LONDON CLAY FORMATION)	3.5	
					3.70		 Stiff dark grey silty CLAY. (LONDON CLAY FORMATION)	4.0	
		4.00	SPT	N=23 (2,3/4,5,7,7)				4.5	
	5.00 - 5.50	U				5.00-5.50m QUT= 64 kPa. Becoming firm	5.0		
				5.50		End of Borehole at 5.500m	5.5		
							6.0		
							6.5		

Remarks
 1. No groundwater encountered. 2. HVP=Uncorrected Hand Vane Measurement. 3. PP = Pocket Penetrometer measurement in kPa. 4. 50mm standpipe installed 5m, response zone 5-1m, bentonite seal 1-0.3m, flush cover concreted 0.3-0m.



				Borehole Log				Borehole No. WS02 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489725E - 99297N		Hole Type WS	
Location: Hook Lane, Pagham, PO21 3PD						Level:		Scale 1:36	
Client: Brookbanks / Hallam Land Management						Dates: 23/10/2019		Logged By NN	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.00		 (Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
					0.50		 Very soft to soft greyish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5	
		0.80		HVP=20			 0.80-2.00m Becoming soft	1.0	
		1.00	SPT	N=5 (1,0/1,1,1,2)				1.5	
		2.00	SPT	N=4 (1,2/1,1,1,1)	2.00			2.0	
		3.00	SPT	N=7 (1,1/1,2,2,2)			 3.00-4.00m Becoming loose	2.5	
		4.00	SPT	N=12 (2,1/2,3,3,4)	4.00			3.0	
								3.5	
							 Firm greyish brown CLAY. (LONDON CLAY FORMATION)	4.0	
							 (Stiff) dark grey CLAY. (LONDON CLAY FORMATION)	4.5	
					 End of Borehole at 5.000m	5.0			
							5.5		
								6.0	
								6.5	

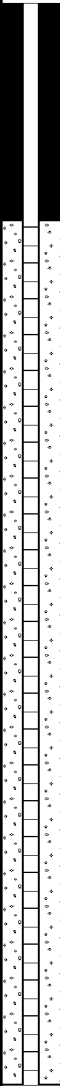
Remarks
 1. No groundwater encountered. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion borehole backfilled with arisings.



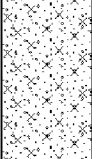
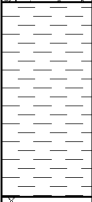
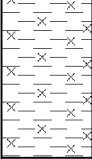
				Borehole Log			Borehole No. WS04 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489612E - 99162N		Hole Type WS	
Location: Hook Lane, Pagham, PO21 3PD						Level:		Scale 1:36	
Client: Brookbanks / Hallam Land Management						Dates: 23/10/2019		Logged By NN	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
					0.40			(Firm) reddish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
		0.80		HVP=22				<u>0.80-1.00m Becoming soft</u>	
		1.00	SPT	N=10 (1,1/2,2,3,3)				<u>1.00-1.40m Becoming firm</u>	1.0
					1.40			(Soft) orangish brown sandy gravelly SILT. Gravel is fine sub-angular flint. (RIVER TERRACE DEPOSITS)	1.5
		2.00	SPT	N=2 (1,1/1,0,0,1)	2.00			<u>1.80-2.00m Becoming (very soft)</u>	2.0
		3.00	SPT	N=34 (3,5/7,9,9,9)				Very loose white medium SAND & GRAVEL of fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	2.5
								<u>3.00-3.50m Becoming dense</u>	3.0
					3.50			End of Borehole at 3.500m	3.5
									4.0
									4.5
									5.0
									5.5
									6.0
									6.5

Remarks

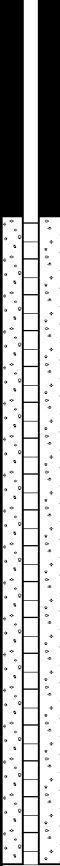
1. No groundwater encountered. 2. Sand and gravel jamming barrel at 2.00-3.50m. 3. HVP=Uncorrected Hand Vane Measurement. 4. Upon completion borehole backfilled with arisings.

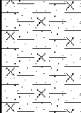
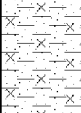

				Borehole Log				Borehole No. WS05 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489673E - 99069N		Hole Type WS	
Location: Hook Lane, Pagham, PO21 3PD						Level:		Scale 1:36	
Client: Brookbanks / Hallam Land Management						Dates: 24/10/2019		Logged By NN	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.00		 (Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
					0.30		 (Firm) yellowish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5	
							<i>0.60-2.00m Becoming very soft</i>		
					0.80				
					1.00	SPT	N=1 (0,0/0,0,1,0)		1.0
					1.40		HVP=4		1.5
					2.00	SPT	N=11 (1,0/1,3,3,4)		2.0
					2.50			 Medium dense yellowish brown silty gravelly SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	2.5
					3.00	SPT	N=11 (2,2/3,3,2,3)	 (Soft to firm) reddish brown silty CLAY. (RIVER TERRACE DEPOSITS)	3.0
					4.00	SPT	N=14 (1,2/3,3,4,4)	 Firm dark grey CLAY. (LONDON CLAY FORMATION)	4.0
				5.00			 End of Borehole at 5.000m	5.0	
Remarks 1. No groundwater encountered. 2. HVP=Uncorrected Hand Vane Measurement. 3. 50mm standpipe installed 5m, response zone 5-1m, bentonite seal 1-0.3m, flush cover concreted 0.3-0m.									

				Borehole Log				Borehole No. WS06 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489393E - 99068N		Hole Type WS	
Location: Hook Lane, Pagham, PO21 3PD						Level:		Scale 1:36	
Client: Brookbanks / Hallam Land Management						Dates: 24/10/2019		Logged By NN	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
					0.30			(Firm) brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
		0.60		HVP=18				<i>0.60-0.80m Becoming very soft</i>	
		1.00	SPT	N=15 (3,5/5,4,3,3)			<i>0.80-1.45m Becoming firm to stiff</i>	1.0	
					1.45			(Very soft to soft) sandy slightly gravelly silty CLAY with occasional lenses of sand. Gravel is fine chalk and flint. (RIVER TERRACE DEPOSITS)	1.5
		2.00	SPT	N=14 (3,4/5,4,3,2)	1.90				2.0
								Medium dense yellowish brown silty SAND & GRAVEL of fine to medium flint, chalk and quartzite. (RIVER TERRACE DEPOSITS)	2.5
		3.00	SPT	N=20 (3,3/2,5,6,7)					3.0
					3.45				3.5
								End of Borehole at 3.450m	4.0
Remarks 1. No groundwater encountered. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion borehole backfilled with arisings.									

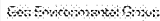
				Borehole Log				Borehole No. WS07 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489349E - 98944N		Hole Type WS		
Location: Hook Lane, Pagham, PO21 3PD						Level:		Scale 1:36		
Client: Brookbanks / Hallam Land Management						Dates: 24/10/2019		Logged By NN		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		1.00	SPT	N=35 (4,5/8,10,8,9)	0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
					0.40			(Firm) brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5	
					0.80			(Soft) brown sandy gravelly silty CLAY. Gravel is medium sub-rounded flint. (RIVER TERRACE DEPOSITS)	1.0	
					1.00			Dense greyish brown silt gravelly SAND. Gravel is fine sub-angular chalk and flint. (RIVER TERRACE DEPOSITS)	1.5	
					1.80			Soft pinkish brown CLAY. (NATURALLY REWORKED LONDON CLAY FORMATION)	2.0	
		2.00	SPT	N=6 (2,1/2,1,1,2)	2.70			Firm dark grey silty CLAY. (LONDON CLAY FORMATION)	3.0	
		3.00	SPT	N=13 (2,2/3,3,3,4)	3.45		End of Borehole at 3.450m			3.5
									4.0	
									4.5	
									5.0	
									5.5	
									6.0	
									6.5	
Remarks 1. No groundwater encountered. 2. Upon completion borehole backfilled with arisings.										

					Borehole Log			Borehole No. WS08 Sheet 1 of 1	
Project Name: Hook Lane, Pagham					Project No. GEG-19-623		Co-ords: 489560E - 98942N		Hole Type WS
Location: Hook Lane, Pagham, PO21 3PD					Level:		Scale 1:36		
Client: Brookbanks / Hallam Land Management					Dates: 24/10/2019		Logged By NN		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
					0.30			(Firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
		1.00	SPT	N=14 (1,2/3,3,4,4)	1.00			0.80-1.00m Becoming (soft)	1.0
					1.50			Firm brown and grey clayey SILT. (RIVER TERRACE DEPOSITS)	1.5
		2.00	SPT	N=27 (3,4/6,6,7,8)				Medium dense brown and orangish brown silty SAND & GRAVEL of fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	2.0
		3.00	SPT	N=20 (2,3/3,4,6,7)				Medium dense brown and orangish brown silty SAND & GRAVEL of fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	2.5
				3.70			(Stiff) dark grey silty CLAY. (LONDON CLAY FORMATION)	3.5	
				4.00			End of Borehole at 4.000m	4.0	
Remarks 1. No groundwater encountered. 2. Upon completion borehole backfilled with arisings.									

				Borehole Log				Borehole No. WS09 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489419E - 98876N		Hole Type WS	
Location: Hook Lane, Pagham, PO21 3PD						Level:		Scale 1:36	
Client: Brookbanks / Hallam Land Management						Dates:		Logged By NN	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.00		 (Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
		0.50 - 1.00	U		0.40		 Firm orangish brown slightly gravelly silty CLAY. Gravel is medium sub-rounded flint. (RIVER TERRACE DEPOSITS) <i>0.50-1.00m QUT= 50 kPa</i>	0.5	
		1.00	SPT	N=17 (2,2/3,3,5,6)			 1.00-1.50m Becoming stiff	1.0	
					1.50		 (Soft) yellowish brown sandy clayey SILT. (RIVER TERRACE DEPOSITS)	1.5	
		2.00	SPT	N=25 (5,7/8,6,6,5)	1.80		 Medium dense yellowish brown silty gravelly SAND. Gravel is medium sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)	2.0	
					2.80 2.90		 (Stiff) greyish brown CLAY. (LONDON CLAY FORMATION)  Stiff dark grey CLAY. (LONDON CLAY FORMATION)	2.5	
		3.00	SPT	N=17 (3,4/7,4,3,3)				3.0	
		4.00	SPT	N=28 (2,4/6,7,8,7)				4.0	
		4.50 - 5.00	U				 4.50-5.00m QUT= 125 kPa	4.5	
					5.00		 End of Borehole at 5.000m	5.0	
Remarks 1. No groundwater encountered. 2. 50mm standpipe installed 4m, response zone 4-1m, bentonite seal 1-0.3m, flush cover concreted 0.3-0m.									

 Geo Environmental Group				Trial Pit Log			Trial Pit No IT41 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489619.17 - 99273.30 Level:		Date 23/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.00		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 2.00		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40					(Soft to firm) orangish brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)
	1.00	HVP	30						
	1.00	HVP	30						
	1.00	HVP	30						
			1.50			Loose slightly gravelly silty clayey fine to coarse SAND. Gravel is fine to medium. (RIVER TERRACE DEPOSITS)			
1.80	B								
			2.00			End of Pit at 2.000m			
Remarks: 1. Groundwater encountered at 2.00m as very slow flow. 2. Infiltration test undertaken in trial pit. 3. HVP=Uncorrected Hand Vane Measurement. 4. Upon completion trial pit backfilled with arisings.									
Stability: Sides Stable									

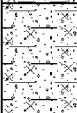
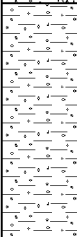




TrialPit No
IT42
Sheet 1 of 1

Date
23/10/2019

Scale 1:25	
Logged NN	

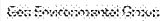
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.60	LB		0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5
				0.30			(Medium dense) orangish brown clayey silty sandy fine to coarse GRAVEL of sub-rounded quartzite and flint. (POSSIBLE RAISED BEACH DEPOSITS)	
				0.70			(Firm to stiff) pinkish brown mottled grey slightly gravelly CLAY with occasional boulder sized lenses of sand and gravel. Gravel is fine sub-angular mudstone nodules. (NATURALLY REWORKED LONDON CLAY FORMATION)	
	1.50	HVP HVP HVP	120 120 120	1.50			Stiff greyish brown mottled grey slightly gravelly CLAY. Gravel is fine sub-angular mudstone nodules. (LONDON CLAY FORMATION)	
	1.50							
	1.80					End of Pit at 1.800m		



ARUN DISTRICT COUNCIL P/132/20/RES

 GEG Environmental Group				Trial Pit Log			Trial Pit No IT43 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489600.47 - 99481.60 Level:		Date 23/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.00		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 2.00		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.80	LB		0.00		(Soft) dark brown slightly sandy silty CLAY. (TOPSOIL)	0.5		
				0.30				(Soft to firm) greenish brown and brown sandy gravelly silty CLAY. (POSSIBLE RAISED BEACH DEPOSITS)	
				0.50				(Loose to medium dense) yellowish brown silty sandy fine to coarse GRAVEL of sub-rounded flint with occasional boulder-sized lenses of clay. (POSSIBLE RAISED BEACH DEPOSITS)	
				0.90				(Soft) pinkish brown sandy clayey SILT with numerous boulder-sized lenses of (very soft) silt and yellowish brown gravelly sand. Gravel is medium sub-rounded flint nodules. (REWORKED LONDON CLAY FORMATION)	1.0
				1.80				(Stiff) greyish brown CLAY. (LONDON CLAY FORMATION)	1.5
				2.00		End of Pit at 2.000m		2.0	
Remarks: 1. Groundwater encountered at 1.20m as slow flow. 2. Infiltration test undertaken in trial pit. 3. Upon completion trial pit backfilled with arisings.									
Stability: Sides Stable									





TrialPit No
PCB01
Sheet 1 of 1

Date
24/10/2019

Logged
NN

[illegible]

ARUN DISTRICT COUNCIL P/132/20/RES

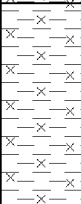
 Geot Environmental Group				Trial Pit Log			Trial Pit No TP01 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489670.90 - 99438.21 Level:		Date 23/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m):		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 3.50		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	D		0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40			(Soft) orangish brown sandy gravelly CLAY and SILT. Gravel is medium sub-rounded quartzite and flint. (RIVER TERRACE DEPOSITS)	0.5	
							0.70-1.60m With occasional boulder-sized lenses of (loose) sand and gravel.	1.0	
				1.60			(Medium dense) brown and grey clayey silty sandy fine to coarse GRAVEL of sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)	1.5	
							1.80-2.50m Becoming (loose)	2.0	
	1.70	LB		2.50			(Stiff) greyish brown CLAY. (LONDON CLAY FORMATION)	2.5	
				3.00			(Stiff) dark grey CLAY. (LONDON CLAY FORMATION)	3.0	
			3.50			End of Pit at 3.500m	3.5		
Remarks: 1. No groundwater encountered. 2. Upon completion trial pit backfilled with arisings.									
Stability: Sides Stable									



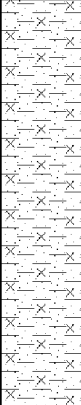
 Geo Environmental Group				Trial Pit Log			Trial Pit No TP02 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489717.01 - 99429.70 Level:		Date 23/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 1.00		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 3.50		Logged NN
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
				0.40				(Soft to firm) brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)
	1.00	HVP	24			1.00-1.40m Becoming soft		
	1.00	HVP	24					
	1.00	HVP	24					
				1.40			(Soft) orangish brown sandy gravelly SILT. Gravel is medium sub-rounded quartzite and flint. (RIVER TERRACE DEPOSITS)	
				2.00				(Loose) brownish silty medium SAND & GRAVEL of coarse sub-rounded quartzite and flint. (RIVER TERRACE DEPOSITS)
				2.40				(Medium dense) grey clayey silty gravelly medium SAND. Gravel is medium sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)
				3.50			End of Pit at 3.500m	
	Remarks: 1. No groundwater encountered. 2. HVP=Uncorrected Hand Vane Measurement. 3. Trial pit backfilling with sand from 2.00m, no progress after 20mins. 4. Upon completion trial pit backfilled with arisings.							
Stability: Unstable from 2.00m								



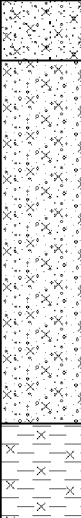
 Geot Environmental Group				Trial Pit Log			Trial Pit No TP03 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489762.15 - 99394.84 Level:		Date 25/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.90		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
				0.30			(Soft to firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
	1.00	HVP	74					
	1.00	HVP	74					1.0
	1.00	HVP	74					
				1.50			(Soft) greenish and yellowish brown sandy slightly gravelly clayey SILT. Gravel is medium sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)	1.5
				1.80			(Loose to medium dense) greenish brown clayey silty sandy fine to coarse GRAVEL of medium sub-rounded flint. (RIVER TERRACE DEPOSITS)	2.0
				3.50			Stiff greyish brown silty CLAY. (LONDON CLAY FORMATION)	3.5
				3.80			Firm dark brown CLAY. (LONDON CLAY FORMATION)	4.0
				4.00			End of Pit at 4.000m	4.5

Remarks: 1. Groundwater encountered at 2.00m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.								
Stability: Unstable from 2.00-3.50m								

 Geo Environmental Group				Trial Pit Log			Trial Pit No TP04 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489693.25 - 99368.88 Level:		Date 23/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.00 		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 3.20		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40				(Firm) orangish brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)	
	1.00	HVP	90			1.00-1.80m Becoming stiff			
	1.00	HVP	90						
	1.00	HVP	90						
				1.80			(Soft) orangish brown and greenish brown sandy slightly clayey SILT. (RIVER TERRACE DEPOSITS)		
				2.10				(Loose to medium dense) greenish brown and yellowish brown silty slightly gravelly SAND. Gravel is medium sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)	
						2.40-3.00m With occasional boulder-sized lenses of clay			
				3.00				(Stiff greyish brown CLAY. (LONDON CLAY FORMATION))	
				3.20		End of Pit at 3.200m			
Remarks: 1. Groundwater encountered at 2.80m as slow flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.									
Stability: Unstable from 2.10-2.40m									

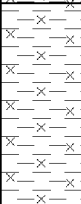
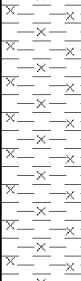
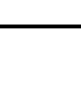


 Geot Environmental Group				Trial Pit Log			TrialPit No TP05 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489817.93 - 99367.95 Level:		Date 25/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50 		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	D		0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.30				(Soft to firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	
	1.00	HVP	56			1.00-1.50m Becoming firm			
	1.00	HVP	56						
	1.00	HVP	56						
	1.20	D							
	1.50	HVP	36				1.50-2.00m Becoming soft		
	1.50	HVP	36						
	1.50	HVP	36						
					2.00			(Medium dense) bluish grey and grey silty slightly gravelly SAND. Gravel is medium sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)	
					2.20			(Loose to medium dense) yellow and yellowish brown silty SAND & GRAVEL of medium sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)	
					3.40			Firm greyish brown silty CLAY. (LONDON CLAY FORMATION)	
	3.60	HVP	70						
	3.60	HVP	70						
					4.00		End of Pit at 4.000m		

Remarks: 1. Groundwater encountered at 2.50m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.50-3.50m



 GEG Environmental Group				Trial Pit Log			Trial Pit No TP06 Sheet 1 of 1				
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489768.64 - 99356.03 Level:		Date 25/10/2019			
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50		Scale 1:25			
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN			
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description				
	Depth	Type	Results								
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)				
				0.30						(Soft to firm) brown silty CLAY. (RIVER TERRACE DEPOSITS)	
	1.00	HVP	36				1.00-1.60m Becoming soft				
	1.00	HVP	36								
	1.00	HVP	36							(Soft) yellowish and orangish brown sandy gravelly clayey SILT. Gravel is coarse sub-rounded quartzite and flint. (RIVER TERRACE DEPOSITS)	
	1.20	LB					2.30-2.80m With occasional lenses of sand				
	1.60	HVP	56							(Stiff greyish brown CLAY. (LONDON CLAY FORMATION)	
	1.60	HVP	56				End of Pit at 4.000m				
	1.60	HVP	56								
									End of Pit at 4.000m		
							End of Pit at 4.000m				
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							End of Pit at 4.000m				

 Geo Environmental Group				Trial Pit Log			Trial Pit No TP08 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489781.24 - 99327.82 Level:		Date 23/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50 0.90		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 3.90		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.30				(Soft to firm) orangish brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)	
	1.00	HVP	50						
	1.00	HVP	50						
	1.00	HVP	50						
	1.50	HVP	110						
	1.50	HVP	110						
	1.50	HVP	110						
				1.80			(Firm) greenish brown clayey SILT. (RIVER TERRACE DEPOSITS)		
	2.40								
	2.50	PP	PP=0.00						
				2.80			Very soft greyish brown sandy gravelly SILT. Gravel is medium sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)		
2.50	PP	PP=0.00							
2.50	PP	PP=0.00							
			3.90			(Loose) yellowish brown silty gravelly SAND. Gravel is sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)			
						End of Pit at 3.900m			
Remarks: 1. Groundwater encountered at 2.50m as slow flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. PP = Pocket Penetrometer measurement in kPa. 4. Upon completion trial pit backfilled with arisings.									
Stability: Unstable from 2.50-3.90m									

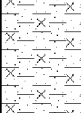
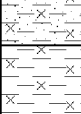
 Geo Environmental Group				Trial Pit Log			Trial Pit No TP09 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489713.66 - 99330.96 Level:		Date 23/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50 0.00 		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 3.90		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown silty slightly sandy CLAY. (TOPSOIL)		
				0.30			(Soft to firm) dark reddish brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)		0.5
	1.00	HVP	56				1.00-1.80m Becoming firm		1.0
	1.00	HVP	56						
	1.00	HVP	56						
	1.80	HVP	124				1.80-2.30m Becoming stiff		2.0
	1.80	HVP	124						
	1.80	HVP	130						
				2.30			(Medium dense) white and brown silty gravelly SAND. Gravel is fine chalk and flint. (RIVER TERRACE DEPOSITS)		2.5
				2.50			(Medium dense) greenish brown clayey silty gravelly SAND with occasional lenses of stiff pinkish brown clay. Gravel is medium sub-rounded flint. (RIVER TERRACE DEPOSITS)		3.0
			3.60			(Stiff) greyish brown CLAY. (LONDON CLAY FORMATION)		3.5	
3.65	HVP	102							
3.65	HVP	104							
			3.90			End of Pit at 3.900m		4.0	
								4.5	

Remarks: 1. Groundwater encountered at 3.00m as slow flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.

Stability: Sides Stable



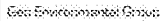
 Geo Environmental Group				Trial Pit Log			Trial Pit No TP10 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489756.04 - 99298.21 Level:		Date 23/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m):		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	D		0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40				(Firm) orangish brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
	0.80	HVP	90					0.80-1.50m Becoming stiff	
	0.80	HVP	90						1.0
	0.80	HVP	90						
	1.20	D					1.50-2.00m Becoming very soft to soft		
	1.50	HVP	20						1.5
	1.50	HVP	20						
	2.00	HVP	16	2.00			Very soft greenish brown and brown SILT/CLAY. (RIVER TERRACE DEPOSITS)	2.0	
	2.00	HVP	16						
	2.00	HVP	16						
					2.60			(Loose) yellowish brown slightly clayey silty gravelly SAND. Gravel is medium sub-angular flint and quartzite. (RIVER TERRACE DEPOSITS)	2.5
								3.0	
				4.00			End of Pit at 4.000m	4.0	
								4.5	

Remarks: 1. Groundwater encountered at 2.50m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.80-4.00m





TrialPit No
TP11
Sheet 1 of 1

Date
25/10/2019

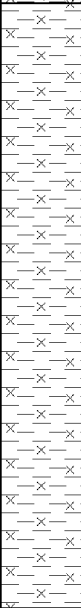
Logged
NN



Stability: Unstable from 2.80-3.50m

 Geo Environmental Group				Trial Pit Log			Trial Pit No TP12 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489739.04 - 99204.94 Level:		Date 25/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.00		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.30				(Soft to firm) yellowish brown silty CLAY. (RIVER TERRACE DEPOSITS)	
	0.80	HVP	44						
	0.80	HVP	44					0.80-1.50m Becoming firm	
	0.80	HVP	44						
	1.60	HVP	84						
	1.60	HVP	84						
	1.60	HVP	84						
	1.60	HVP	84						
				1.50					
1.60	HVP	84							
1.60	HVP	84							
			2.00						
									
									
									
									
									
									
									
									
									
									
									
									
									
Remarks: 1. Groundwater encountered at 2.00m as moderate inflow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.									
Stability: Unstable from 1.80-3.60m									

 Geot Environmental Group				Trial Pit Log			Trial Pit No TP13 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489676.75 - 99224.55 Level:		Date 25/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.30				(Soft to firm) brown silty CLAY. (RIVER TERRACE DEPOSITS)	
	1.20	LB							
	1.20	HVP	36						
	1.20	HVP	36						
	1.20	HVP	36						
				1.80			(Soft) orangish brown and brown sandy gravelly SILT. Gravel is medium sub-rounded flint. (RIVER TERRACE DEPOSITS)		
				2.20			(Loose to medium dense) yellowish brown very silty gravelly SAND. Gravel is fine sub-rounded flint. (RIVER TERRACE DEPOSITS)		

 GEG Environmental Group				Trial Pit Log			Trial Pit No TP14 Sheet 1 of 1			
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489699.40 - 99190.31 Level:		Date 25/10/2019		
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.90		Scale 1:25		
Client: Brookbanks / Hallam Land Management						Depth 3.80		Logged NN		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
 	0.20	D		0.00			(Soft) dark brown slightly sandy silty CLAY. (TOPSOIL)			
				0.30						(Soft) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)
	0.90	HVP	40							
	0.90	HVP	40							
	0.90	HVP	40							
	1.00	D								
	1.20	HVP	50							
	1.20	HVP	56							
	1.20	HVP	56							
					2.30			(Loose to medium dense) white and yellowish brown silty gravelly SAND. Gravel is medium sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)		
				3.30			(Stiff) greyish brown CLAY. (LONDON CLAY FORMATION)			
3.50	HVP	130								
3.50	HVP	136								
				3.80			End of Pit at 3.800m			

Remarks: 1. Groundwater encountered at 2.00m and 2.30m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.30-3.50m

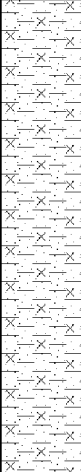
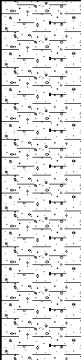


 Geot Environmental Group				Trial Pit Log			Trial Pit No TP15 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489634.39 - 99232.57 Level:		Date 22/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.00		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 3.90		Logged NN
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.00			(Soft) dark brown slightly sandy silty CLAY. (TOPSOIL)	
				0.30				(Firm) orangish brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)
	1.00	HVP	76			1.00-1.40m Becoming stiff		
	1.00	HVP	78					
	1.00	HVP	78					
	1.50	HVP	30				1.40-2.10m Becoming (soft)	
	1.50	HVP	30					
	1.50	HVP	30					
	2.20	HVP	64	2.10			Firm greenish grey and white very sandy clayey SILT. (RIVER TERRACE DEPOSITS)	
	2.20	HVP	64					
	2.20	HVP	64					
				2.80			(Loose to medium dense) brown and greenish brown silty gravelly SAND. Gravel is medium sub-angular flint. (RIVER TERRACE DEPOSITS)	
				3.60			(Stiff) greyish brown CLAY. (LONDON CLAY FORMATION)	
			3.90			End of Pit at 3.900m		

Remarks: 1. No groundwater encountered. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.80-3.60m



 Geot Environmental Group				Trial Pit Log			TrialPit No TP16 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489612.85 - 99191.05 Level:		Date 22/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 1.00 2.50		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 3.80		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40				(Soft to firm) orangish brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)	
	0.80	HVP	36			0.80-1.50m Becoming soft			
	0.80	HVP	36						
	0.80	HVP	42						
							1.50-2.00m Becoming firm		
	1.50	HVP	50						
	1.50	HVP	50						
							1.50-2.00m Becoming firm		
	1.50	HVP	50						
	1.50	HVP	50						
					2.00			Firm greenish brown and white very sandy slightly gravelly silty CLAY with occasional boulder-sized pockets of coarse sand. Gravel is coarse sub-angular flint. (RIVER TERRACE DEPOSITS)	
	2.30	HVP	50			1.50-2.00m Becoming firm			
	2.30	HVP	52						
	2.30	HVP	54						
						1.50-2.00m Becoming firm			
2.30	HVP	50							
2.30	HVP	50							
				3.20			Stiff greyish brown CLAY. (LONDON CLAY FORMATION)		
3.20	HVP	142			1.50-2.00m Becoming firm				
3.20	HVP	144							
3.20	HVP	144							
				3.80		End of Pit at 3.800m			

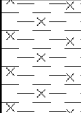
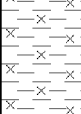
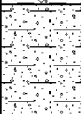
Remarks: 1. Groundwater encountered at 2.50m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Sides Stable



 GEG Environmental Group				Trial Pit Log			Trial Pit No TP17 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489662.43 - 99136.67 Level:		Date 22/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 1.00		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 3.90		Logged NN
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
				0.50				
	0.80	HVP	102	1.00			Soft brown clayey SILT. (RIVER TERRACE DEPOSITS)	
	0.80	HVP	104					
	0.80	HVP	104					
	1.00	HVP	30					
	1.00	HVP	32					
	1.00	HVP	32					
	2.20	HVP	96	2.10			Stiff white and grey sandy silty CLAY with numerous boulder-sized lenses of white gravelly sand. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	
	2.20	HVP	96					
2.20	HVP	96						
			2.80			(Loose to medium dense) white gravelly silty coarse SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)		
			3.90					End of Pit at 3.90m
Remarks: 1. Groundwater encountered at 2.80m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.								
Stability: Unstable from 1.50m								



 Geo-Environmental Group				Trial Pit Log			Trial Pit No TP18 Sheet 1 of 1			
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489693.00 - 99103.00 Level:		Date 24/10/2019		
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50 		Scale 1:25		
Client: Brookbanks / Hallam Land Management						Depth 3.60		Logged NN		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
▼				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)			
				0.40				Very soft brown silty CLAY. (RIVER TERRACE DEPOSITS)		0.5
	0.50	HVP	16							
	0.50	HVP	16							
	0.50	HVP	16							
	0.90	HVP	76					0.90-1.50m Becoming stiff 		1.0
	0.90	HVP	76							
	0.90	HVP	76							
				1.50				Firm brown slightly gravelly clayey SILT. (RIVER TERRACE DEPOSITS)		1.5
		1.60	HVP	56						
	1.60	HVP	56							
	1.60	HVP	56							
			1.90			(Loose) white clayey gravelly medium SAND. Gravel is medium sub-angular flint, chalk and quartzite. (RIVER TERRACE DEPOSITS)		2.0		
								2.5		
								3.0		
								3.5		
				3.60		End of Pit at 3.600m		4.0		
								4.5		

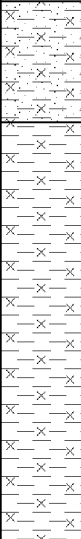
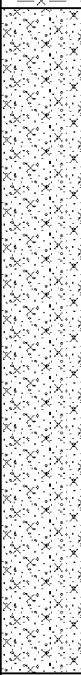
Remarks: 1. Groundwater encountered at 1.80m as slow flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 1.50m. Collapsing to 2.50m at 3.50m



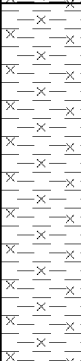
 GEG Environmental Group				Trial Pit Log			Trial Pit No TP19 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489576.63 - 99143.85 Level:		Date 22/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 3.50		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40				(Soft to firm) brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)	
	0.80	HVP	50			0.80-2.00m Becoming firm			
	0.80	HVP	50						
	0.80	HVP	50						
			2.00			(Soft) light brown, white and yellowish brown sandy gravelly SILT. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)			
			3.50			End of Pit at 3.500m			
Remarks: 1. Groundwater encountered at 2.00m as slow flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.									
Stability: Unstable from 1.00m, becoming very unstable from 2.00-3.50m									



 Geot Environmental Group				Trial Pit Log			Trial Pit No TP20 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489621.37 - 99030.71 Level:		Date 25/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.00		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.20	D		0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40			(Soft to firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)		
	1.00	HVP	64				1.00-1.80m Becoming firm		
	1.00	HVP	64						
	1.00	HVP	64						
	1.20	D		1.80			(Loose to medium dense) yellowish brown and white silty gravelly SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)		
					2.50-4.00m Becoming brown and grey				
				4.00			End of Pit at 4.000m		
Remarks: 1. Groundwater encountered at 1.80m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.									
Stability: Unstable below 1.80m									



 GEG Environmental Group				Trial Pit Log			Trial Pit No TP21 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489546.33 - 99075.71 Level:		Date 24/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.90		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 3.90		Logged NN

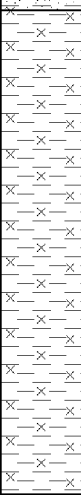
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.30				(Soft to firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
	1.00	D							
	1.00	HVP	76						
	1.00	HVP	76					1.0	
	1.00	HVP	76						
				1.50			(Medium dense) yellowish brown silty SAND. (RIVER TERRACE DEPOSITS)	1.5	
				1.80				(Loose to medium dense) white and grey silty gravelly SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	2.0
								3.0	
								3.5	
				3.50			Stiff greyish brown CLAY. (LONDON CLAY FORMATION)		
	3.60	HVP	78						
	3.60	HVP	78						
				3.90			End of Pit at 3.900m	4.0	
								4.5	

Remarks: 1. Groundwater encountered at 2.40m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.40-3.50m



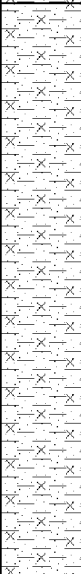
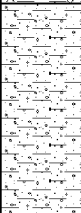
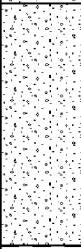
 Geo Environmental Group				Trial Pit Log			Trial Pit No TP22 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489499.44 - 99123.46 Level:		Date 24/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.00		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN

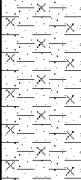
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40				(Firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
	1.00	HVP	36			0.90-2.00m Becoming soft			1.0
	1.00	HVP	36						
	1.50	HVP	36					1.5	
	1.50	HVP	36						
	1.50	HVP	36						
				2.00			(Soft) yellowish brown sandy SILT. (RIVER TERRACE DEPOSITS)	2.0	
				2.50				(Loose to medium dense) yellowish brown and white silty gravelly SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	2.5
						2.80-3.60m Becoming brown			3.0
			3.60				(Firm to stiff) greyish brown CLAY. (LONDON CLAY FORMATION)	3.5	
			4.00				End of Pit at 4.000m	4.0	
								4.5	

Remarks: 1. Groundwater encountered at 2.40m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.00-3.60m



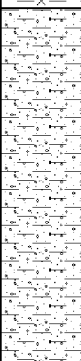
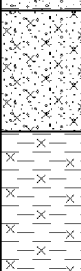
 Geo Environmental Group				Trial Pit Log			Trial Pit No TP23 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489526.07 - 99190.49 Level:		Date 22/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 9.00		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.00	D		0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5
				0.30			(Soft to firm) orangish brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)	
				2.20			(Firm) greyish brown sandy gravelly silty CLAY. Gravel is medium sub-angular flint. (RIVER TERRACE DEPOSITS)	
				2.90			(Loose to medium dense) white and brown gravelly coarse SAND. Gravel is fine angular flint and occasional chalk. (RIVER TERRACE DEPOSITS)	
				3.70			(Stiff) greyish brown CLAY. (LONDON CLAY FORMATION)	
				4.00		End of Pit at 4.000m		
Remarks: 1. Groundwater encountered at 2.80m as slow flow. 2. Upon completion trial pit backfilled with arisings.								
Stability: Unstable from 2.00-3.60m								

 ARUN DISTRICT COUNCIL				Trial Pit Log			Trial Pit No TP24 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489577.47 - 99178.89 Level:		Date 22/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.00		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	D		0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
				0.30				(Soft) brown slightly sandy silty CLAY. (RIVER TERRACE DEPOSITS)
	1.00	D						
	1.00	HVP	16			1.00-1.50m Becoming very soft		
	1.00	HVP	16					
	1.00	HVP	16			1.50-1.80m Becoming (firm)		
	1.80	HVP	116			1.80-2.00m Becoming stiff		
	1.80	HVP	116					
	1.80	HVP	116					
	2.10	HVP	110	2.00			Stiff greyish brown sandy gravelly silty CLAY. Gravel is coarse sub-angular flint and quartzite. (RIVER TERRACE DEPOSITS)	
	2.10	HVP	110					
	2.10	HVP	110					
				2.60			(Loose to medium dense) grey and brown silty low cobble content coarse SAND. Cobbles are sub-angular flint. (RIVER TERRACE DEPOSITS)	
			3.60			Stiff greyish brown CLAY. (LONDON CLAY FORMATION)		
3.70	HVP	130						
3.70	HVP	130						
			4.00			End of Pit at 4.000m		

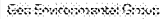
Remarks: 1. No groundwater encountered. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.00-3.20m



 Geot Environmental Group				Trial Pit Log			Trial Pit No TP25 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489555.93 - 99224.79 Level:		Date 22/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.00		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 3.90		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.30				Firm brown silty CLAY. (RIVER TERRACE DEPOSITS)	
	1.00	HVP	56						
	1.00	HVP	56						
	1.00	HVP	56						
				1.80				Firm yellowish brown and white sandy slightly gravelly silty CLAY. Gravel is medium sub-angular flint. (RIVER TERRACE DEPOSITS)	
	2.00	HVP	58						
	2.00	HVP	62						
				2.00			76		
				3.00			2.80-3.00m With occasional boulder-sized pockets of silt and sand		
			3.40				(Loose to medium dense) brown clayey silty gravelly SAND. Gravel is medium sub-angular flint and quartzite. (RIVER TERRACE DEPOSITS)		
3.50	HVP	130							
3.50	HVP	130							
			3.90			End of Pit at 3.900m			
Remarks: 1. Groundwater encountered at 2.50m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.									
Stability: Sides Stable									

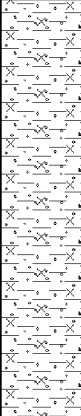




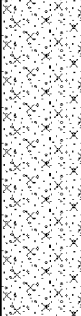
TrialPit No
TP26
Sheet 1 of 1

Date
22/10/2019

Logged
NN

 GEG Environmental Group				Trial Pit Log			Trial Pit No TP27 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489558.06 - 99309.74 Level:		Date 22/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 1.00		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	D		0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
				0.40				(Firm) orangish brown slightly gravelly silty CLAY. Gravel is fine sub-rounded quartzite. (RIVER TERRACE DEPOSITS)
	1.00	D						
	1.00	HVP	90					
	1.00	HVP	90					
	1.00	HVP	90					
	1.85	HVP	64	1.80			Firm brown, white and yellowish brown sandy slightly gravelly silty CLAY. Gravel is medium sub-rounded quartzite and flint. (RIVER TERRACE DEPOSITS)	
	1.85	HVP	64					
	1.85	HVP	70	2.00				(Loose) yellowish brown and white clayey silty gravelly SAND with occasional cobble-sized pockets of (soft) clay. Gravel is medium sub-rounded quartzite. (RIVER TERRACE DEPOSITS)
3.20	HVP	90	3.20			Stiff greyish brown CLAY. (LONDON CLAY FORMATION)		
3.20	HVP	90						
3.20	HVP	90						
				3.80			(Stiff) dark grey CLAY. (LONDON CLAY FORMATION)	
			4.00					
						End of Pit at 4.000m		
Remarks: 1. No groundwater encountered. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.								
Stability: Unstable from 2.50-3.20m								

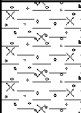
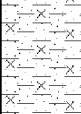
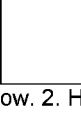
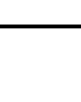


 Geot Environmental Group				Trial Pit Log			Trial Pit No TP28 Sheet 1 of 1				
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489568.72 - 99278.44 Level:		Date 22/10/2019			
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.00 2.50		Scale 1:25			
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN			
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description				
	Depth	Type	Results								
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)				
				0.30						(Soft to firm) orangish brown slightly gravelly silty CLAY. Gravel is fine sub-angular quartzite and flint. (RIVER TERRACE DEPOSITS)	
	1.00	HVP	16								
	1.00	HVP	24								
	1.00	HVP	30								
				1.60			(Loose) greenish grey clayey silty slightly gravelly medium SAND. Gravel is medium sub-angular flint. (RIVER TERRACE DEPOSITS)				
				2.40						(Medium dense) dark brown very clayey silty gravelly medium SAND. Gravel is medium sub-angular flint and quartzite. (RIVER TERRACE DEPOSITS)	
				3.50							
	3.60	HVP	110				Stiff greyish brown CLAY. (LONDON CLAY FORMATION)				
	3.60	HVP	110								
3.60	HVP	110				Stiff dark brown CLAY. (LONDON CLAY FORMATION)					
			4.00								
						End of Pit at 4.000m					

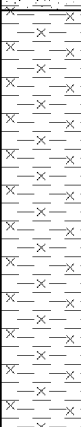
Remarks: 1. Groundwater encountered at 1.60m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 1.60-2.40m



 East Devon Council				Trial Pit Log			Trial Pit No TP29 Sheet 1 of 1				
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489559.58 - 99349.87 Level:		Date 22/10/2019			
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 1.50		Scale 1:25			
Client: Brookbanks / Hallam Land Management						Depth 3.60		Logged NN			
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description				
	Depth	Type	Results								
				0.00			(Soft) brown slightly gravelly silty CLAY. Gravel is fine sub-angular quartzite and flint. (TOPSOIL)				
				0.40						(Soft to firm) orangish brown sandy silty CLAY. (RIVER TERRACE DEPOSITS)	
	0.80	HVP	36				0.80-1.50m Becoming soft				
	0.80	HVP	36								
	0.80	HVP	38								
	1.50	HVP	16								
	1.50	HVP	16								
	1.50	HVP	16								
	2.40										
	2.60										
	2.80	HVP	130								
	2.80	HVP	130								
	2.80	HVP	130								
	3.00										
	3.20	HVP	110								
3.20	HVP	110									
3.20	HVP	110									
3.60											

 Geot Environmental Group				Trial Pit Log				Trial Pit No TP30 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489505.01 - 99016.90 Level:		Date 24/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50 		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN	

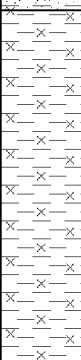
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	D		0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40				(Firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
	1.00	D				0.80-1.80m Becoming (soft)		1.0	
	1.20	B						1.5	
				1.80			(Loose to medium dense) white and yellowish brown silty gravelly medium SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	2.0	
							2.50-3.50m Becoming brown		2.5
									3.0
				3.50			Stiff greyish brown CLAY. (LONDON CLAY FORMATION)	3.5	
	3.60	HVP	76						
	3.60	HVP	76						
			4.00			End of Pit at 4.000m		4.0	
								4.5	

Remarks: 1. Groundwater encountered at 2.00m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.00-2.50m



 Geot Environmental Group				Trial Pit Log			Trial Pit No TP31 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489481.43 - 99074.66 Level:		Date 24/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.00 2.50		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN

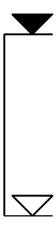
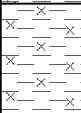
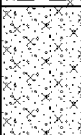
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40				(Firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
	0.80	HVP	16						
	0.80	HVP	20						
	0.80	HVP	24						
							0.80-1.60m Becoming very soft to soft		
								1.0	
								1.5	
					1.60			(Loose to medium dense) white silty gravelly SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	
	1.50	HVP	36						
1.50	HVP	36							
							2.00-3.40m Becoming orangish brown and brown		
								2.0	
								2.5	
								3.0	
				3.40			Stiff greyish brown CLAY. (LONDON CLAY FORMATION)	3.5	
3.50	HVP	84							
3.50	HVP	84							
				4.00			End of Pit at 4.000m	4.0	
								4.5	

Remarks: 1. Groundwater encountered at 2.00m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.50-3.40m



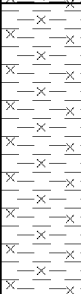
 GEG Environmental Group				Trial Pit Log			Trial Pit No TP32 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489449.73 - 99111.01 Level:		Date 24/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.90		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 3.90		Logged NN

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
				0.45			(Soft to firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
	0.80	HVP	72					
	0.80	HVP	76					
	0.80	HVP	76				0.80-1.10m Becoming firm	1.0
	1.10	HVP	30					
	1.10	HVP	32				1.10-1.50m Becoming soft	
	1.10	HVP	36					
	1.40	HVP	36					
	1.40	HVP	36					
	1.40	HVP	36	1.50			(Loose to medium dense) yellowish brown and brown very silty gravelly SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	1.5
				2.30			(Loose to medium dense) dark brown medium silty gravelly SAND. Gravel is medium sub-rounded flint. (RIVER TERRACE DEPOSITS)	2.5
							2.50-3.50m Becoming (loose)	
				3.50			Stiff greyish brown CLAY. (LONDON CLAY FORMATION)	3.5
	3.60	HVP	76					
3.60	HVP	76						
3.60	HVP	76						
			3.90				End of Pit at 3.900m	4.0
								4.5

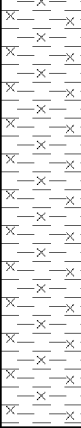
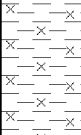
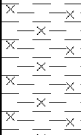
Remarks: 1. Groundwater encountered at 2.60m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.50-3.50m



 Geot Environmental Group				Trial Pit Log			TrialPit No TP34 Sheet 1 of 1			
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489571.53 - 98977.81 Level:		Date 25/10/2019		
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50 0.90		Scale 1:25		
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)			
				0.30						(Firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)
						0.70-1.30m Becoming soft				
	1.00	HVP	30							
	1.00	HVP	30							
	1.00	HVP	30							
				1.30			Very soft grey and brown sandy clayey SILT. (RIVER TERRACE DEPOSITS)			
	1.50	HVP	10							
	1.50	HVP	10							
	1.50	HVP	10							
			2.00			(Loose to medium dense) white and grey silty gravelly SAND. Gravel is medium sub-angular chalk and flint. (RIVER TERRACE DEPOSITS)				
			3.40			Stiff greyish brown CLAY. (LONDON CLAY FORMATION)				
3.50	HVP	90								
3.50	HVP	90								
			4.00		End of Pit at 4.000m					
Remarks: 1. Groundwater encountered at 2.00m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.										
Stability: Unstable from 2.00-3.60m										

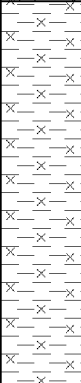


 Geo Environmental Group				Trial Pit Log			Trial Pit No TP35 Sheet 1 of 1							
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489469.52 - 98924.03 Level:		Date 24/10/2019						
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.00 		Scale 1:25						
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN						
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description							
	Depth	Type	Results											
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)							
				0.30						(Soft) yellowish brown SILT/CLAY. (RIVER TERRACE DEPOSITS)				
				0.50									Firm brown silty CLAY. (RIVER TERRACE DEPOSITS)	
	0.80	HVP	44				(Soft) white and yellowish brown gravelly sandy SILT. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)							
	0.80	HVP	44							Soft brown silty CLAY. (LONDON CLAY FORMATION)				
	0.80	HVP	46											
				2.00			Soft brown silty CLAY. (LONDON CLAY FORMATION)							
				2.70						3.20-4.00m Becoming stiff				
	2.80	HVP	18										End of Pit at 4.000m	
	2.80	HVP	36				End of Pit at 4.000m							
	2.80	HVP	42							End of Pit at 4.000m				
	3.20	HVP	76										End of Pit at 4.000m	
	3.20	HVP	76				End of Pit at 4.000m							
	3.20	HVP	76							End of Pit at 4.000m				
				4.00									End of Pit at 4.000m	
						End of Pit at 4.000m								
									End of Pit at 4.000m					

Remarks: 1. Groundwater encountered at 2.00m as slow flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.

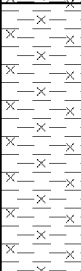
Stability: Unstable from 2.00m



 GEG Environmental Group				Trial Pit Log			Trial Pit No TP36 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489469.00 - 98980.00 Level:		Date 24/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50 0.00		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.30				(Soft) yellowish brown silty CLAY. (RIVER TERRACE DEPOSITS)	
	1.00	HVP	54			1.00-1.80m Becoming firm			
	1.00	HVP	54						
	1.00	HVP	54						
				1.80			(Loose to medium dense) white and yellowish brown silty gravelly SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)		
				2.30				(Soft to firm) greyish brown silty CLAY. (LONDON CLAY FORMATION)	
	2.50	HVP	58			2.50-3.60m Becoming firm			
	2.50	HVP	58						
	2.50	HVP	58						
	2.90	HVP	44						
	2.90	HVP	44						
	2.90	HVP	50						
	3.20	HVP	44						
	3.20	HVP	44						
3.20	HVP	44							
3.60	HVP	110		3.60		Stiff dark brown CLAY. (LONDON CLAY FORMATION)			
3.60	HVP	110							
3.60	HVP	110							
			4.00			End of Pit at 4.000m			
Remarks: 1. Groundwater encountered at 2.00m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.									
Stability: Unstable from 2.00-3.00m									



 GEG Environmental Group				Trial Pit Log			Trial Pit No TP37 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489437.00 - 99045.00 Level:		Date 24/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.90		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 3.90		Logged NN

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)	
				0.30			(Firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
	0.80	HVP	24					
	0.80	HVP	36					
	0.80	HVP	36					
				1.20			(Very soft) white and yellowish brown sandy slightly gravelly slightly clayey SILT. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)	1.5
				2.00			Firm greyish brown CLAY. (LONDON CLAY FORMATION)	2.0
	2.10	HVP	56					
	2.10	HVP	56					
	2.10	HVP	56					
	2.50	HVP	62					2.5
	2.50	HVP	62					
2.50	HVP	62						
			3.00			Stiff greyish brown CLAY. (LONDON CLAY FORMATION)	3.0	
3.00	HVP	84						
3.00	HVP	84						
3.00	HVP	84						
			3.90				End of Pit at 3.900m	4.0
								4.5

Remarks: 1. Groundwater encountered at 2.00m as slow flow. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.00m



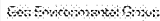
 Geot Environmental Group				Trial Pit Log			Trial Pit No TP38 Sheet 1 of 1	
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489401.64 - 99009.31 Level:		Date 24/10/2019
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 0.00		Scale 1:25
Client: Brookbanks / Hallam Land Management						Depth 3.80		Logged NN

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40				Firm orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)	0.5
	0.80	HVP	44						1.0
	0.80	HVP	44						
	0.80	HVP	44						
				1.20			(Medium dense) brownish grey silty slightly gravelly SAND. Gravel is medium sub-rounded flint and quartzite. (RIVER TERRACE DEPOSITS)	1.5	
				1.60				Firm greyish brown silty CLAY. (LONDON CLAY FORMATION)	2.0
	1.70	HVP	64						
	1.70	HVP	64						
	1.70	HVP	64						
	1.80	LB							
	2.50	HVP	80						
	2.50	HVP	84						
	2.50	HVP	84						
				3.00			Stiff dark brown CLAY. (LONDON CLAY FORMATION)	3.0	
	3.00	HVP	124						
	3.00	HVP	124						
	3.00	HVP	124						
				3.80			End of Pit at 3.800m	4.0	
								4.5	

Remarks: 1. No groundwater encountered. 2. HVP=Uncorrected Hand Vane Measurement. 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable from 2.00m



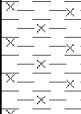
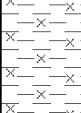
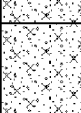
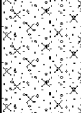
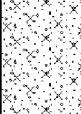
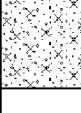


TrialPit No
TP39
Sheet 1 of 1

Date
24/10/2019

Logged
NN



 Geot Environmental Group				Trial Pit Log			Trial Pit No TP44 Sheet 1 of 1		
Project Name: Hook Lane, Pagham				Project No. GEG-19-623		Co-ords: 489612.93 - 99088.79 Level:		Date 24/10/2019	
Location: Hook Lane, Pagham, PO21 3PD						Dimensions (m): 2.50 0.00 		Scale 1:25	
Client: Brookbanks / Hallam Land Management						Depth 4.00		Logged NN	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.00			(Firm) dark brown slightly sandy silty CLAY. (TOPSOIL)		
				0.40			(Soft to firm) orangish brown silty CLAY. (RIVER TERRACE DEPOSITS)		
	0.80	HVP	50				0.80-1.30m Becoming firm		
	0.80	HVP	50						
	0.80	HVP	50						
	1.30	HVP	16				1.30-1.60m Becoming very soft		
	1.30	HVP	20						
	1.30	HVP	22						
				1.60			(Soft) orangish brown SILT. (RIVER TERRACE DEPOSITS)		
				1.80			(Loose to medium dense) light grey silty gravelly medium to coarse SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)		
			2.30			1.90-2.30m With occasional lenses of (soft) clay			
			4.00			(Loose) grey silty gravelly medium SAND. Gravel is fine sub-angular flint and chalk. (RIVER TERRACE DEPOSITS)			
						End of Pit at 4.000m			

Remarks: 1. Groundwater encountered at 2.00m as moderate flow. 2. HVP=Uncorrected Hand Vane Measurement.
 3. Upon completion trial pit backfilled with arisings.

Stability: Unstable below 1.00m. Sides collapsed to 2.50m at 4.00m





APPENDIX D

INFILTRATION TEST DATA

Appendix D

Infiltration Tests

Project Name: Hook Lane, Pagham
Project Ref.: GEG-19-623
Trial Pit: IT41
Test No.: Test 1 of 1

Depth of Pit (cm):	200.00
Depth of Water at Start of Depth (cm):	79.00
Date of Test:	23 October 2019

[illegible]

Parameter	Symbol	Calculation	Units	IT41
Effective Depth of Trial Pit	d_p		m	1.21
Width of Trial Pit	w		m	0.90
Length of Trial Pit	l		m	2.00
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	2.18
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	1.089
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	5.31
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	N/A

*To 50% Effective Depth (including base)

End of Test

With Reference to: **Figure D-1**

Engineer: NN

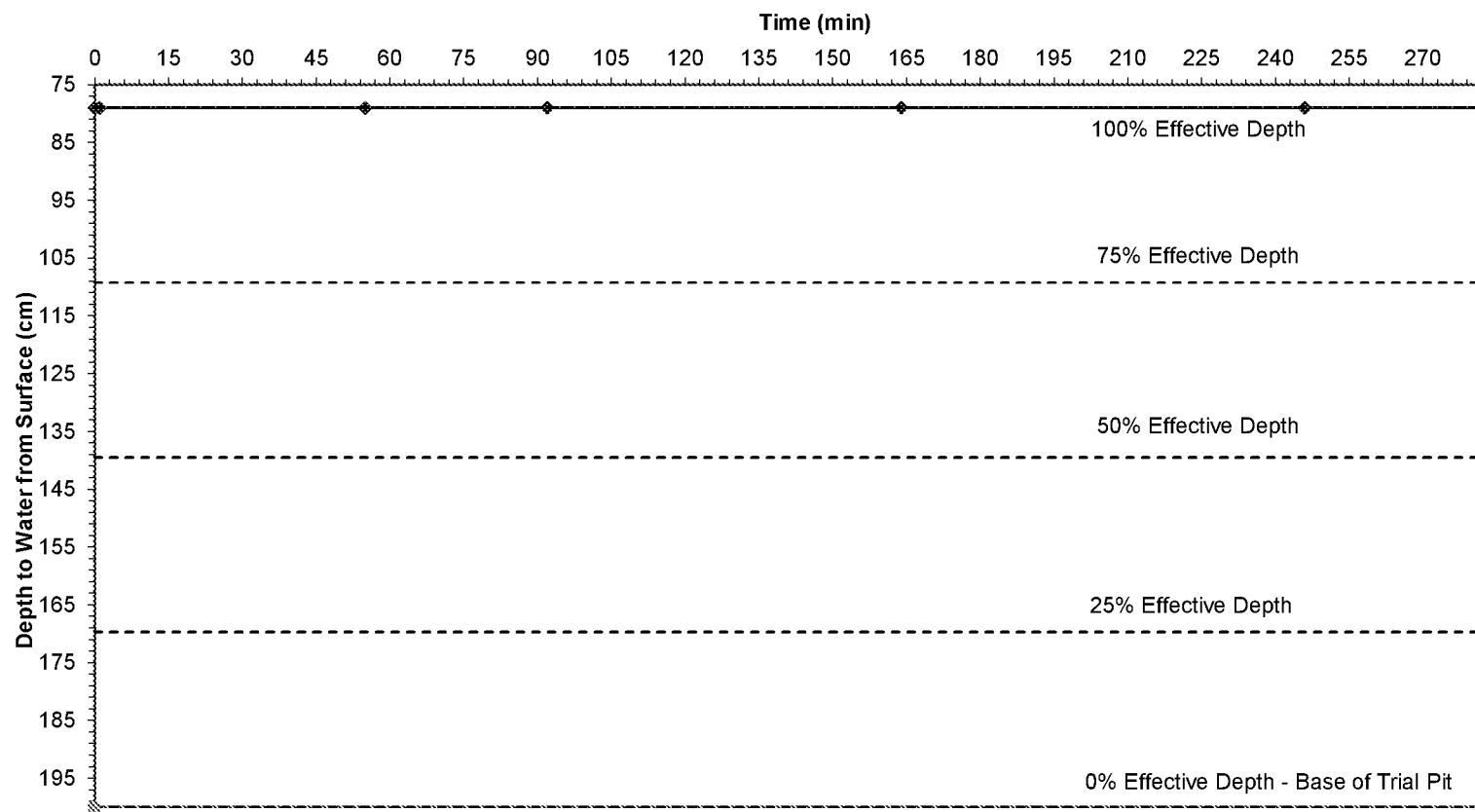
Checked: MP

Figure D-1

GEG-19-623

Hook Lane, Pagham

IT41



Appendix D

Infiltration Tests

Project Name: Hook Lane, Pagham
Project Ref.: GEG-19-623
Trial Pit: IT42
Test No.: Test 1 of 1

Depth of Pit (cm):	180.00
Depth of Water at Start of Depth (cm):	52.00
Date of Test:	23 October 2019

[illegible]

Parameter	Symbol	Calculation	Units	IT42
Effective Depth of Trial Pit	d_p		m	1.28
Width of Trial Pit	w		m	0.90
Length of Trial Pit	l		m	2.00
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	2.30
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	1.152
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	5.51
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	N/A

*To 50% Effective Depth (including base)

With Reference to: **Figure D-2**

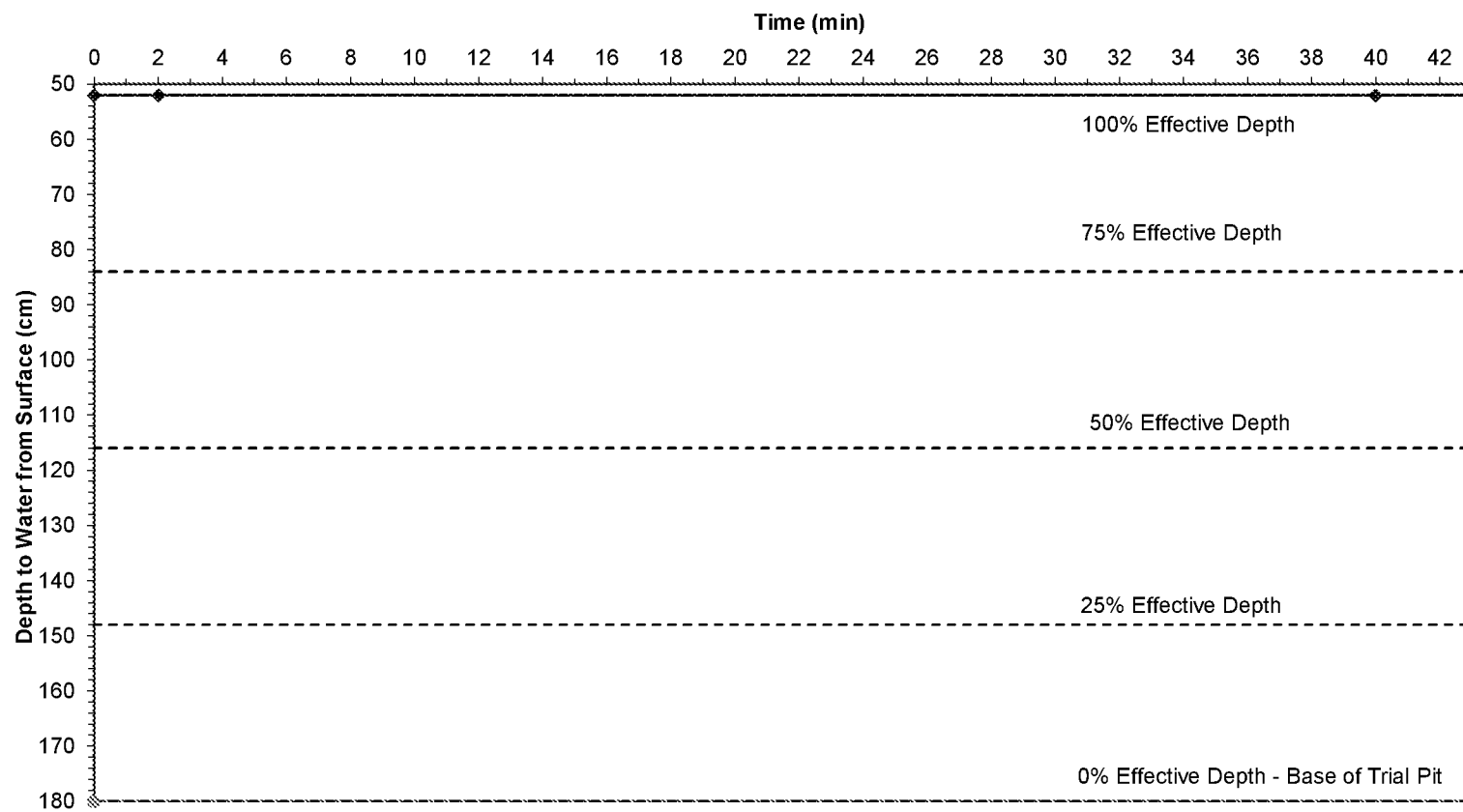
Engineer: NN
Checked: MP

Figure D-2

GEG-19-623

Hook Lane, Pagham

IT42



Appendix D

Infiltration Tests

Project Name: Hook Lane, Pagham
Project Ref.: GEG-19-623
Trial Pit: IT43
Test No.: Test 1 of 1

Depth of Pit (cm):	200.00
Depth of Water at Start of Depth (cm):	55.00
Date of Test:	23 October 2019

[illegible]

Parameter	Symbol	Calculation	Units	IT43
Effective Depth of Trial Pit	d_p		m	1.45
Width of Trial Pit	w		m	0.90
Length of Trial Pit	l		m	2.00
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	2.61
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	1.305
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	6.01
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	N/A

*To 50% Effective Depth (including base)

With Reference to: **Figure D-3**

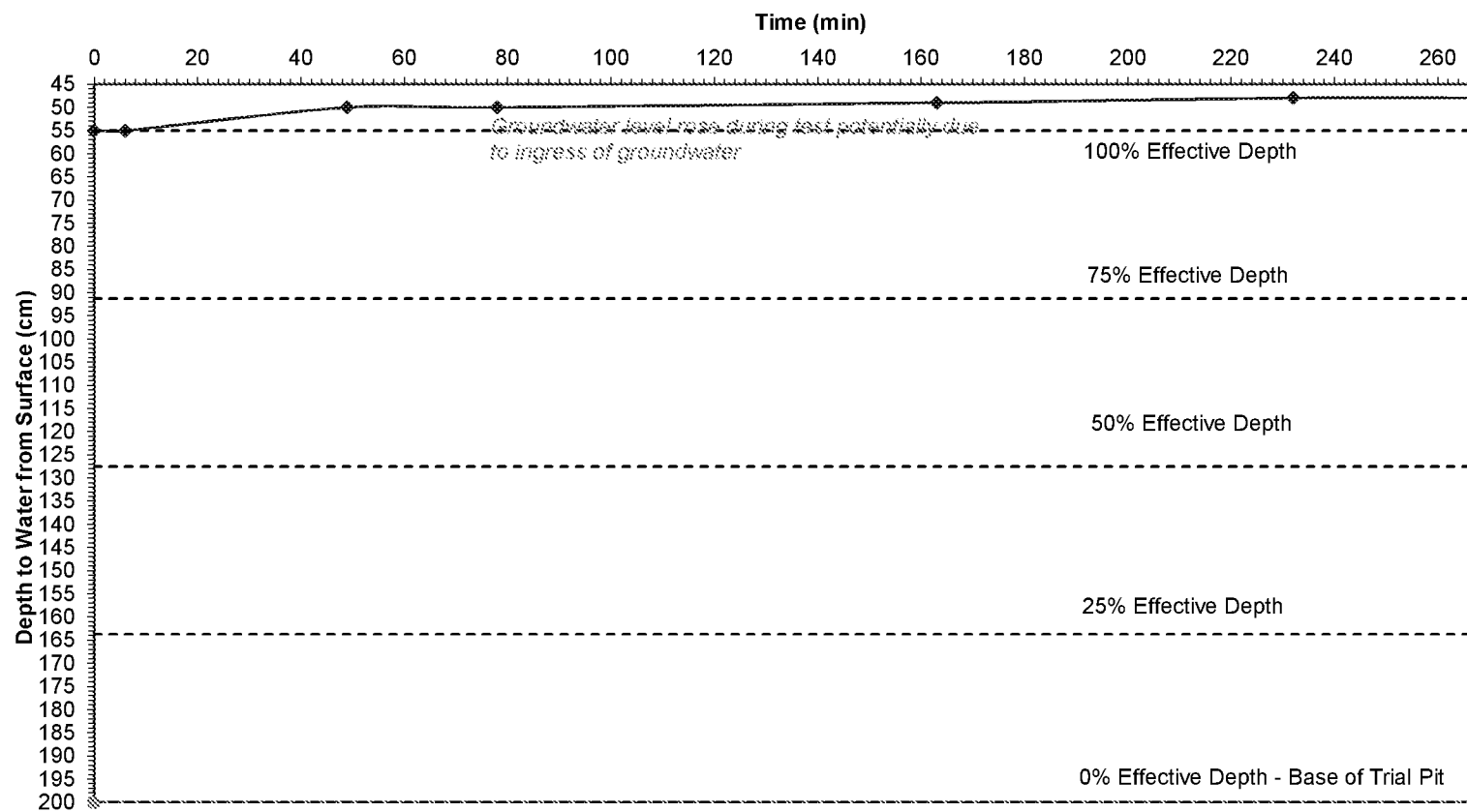
Engineer: NN
Checked: MP

Figure D-3

GEG-19-623

Hook Lane, Pagham

IT43





APPENDIX E

CHEMICAL ANALYSIS RESULTS



Nick Needham
Geo Environmental Group
GEG House,
17 Graham Road
Malvern
WR14 2HR

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent



DETS Report No: 19-15295

Site Reference: Hook Lane, Paqham

Project / Job Ref: GEG-19-623

Order No: 3531

Sample Receipt Date: 29/10/2019

Sample Scheduled Date: 29/10/2019

Report Issue Number: 2

Reporting Date: 10/12/2019

Authorised by:



Dave Ashworth
Technical Manager

This report supersedes 19-15295, issue no.1.
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DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate						
DETS Report No: 19-15295	Date Sampled	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hook Lane, Pagham	TP / BH No	TP01	TP05	TP05	TP10	TP10
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 3531	Depth (m)	0.20	0.20	1.20	0.10	1.20
Reporting Date: 10/12/2019	DETS Sample No	444342	444343	444344	444345	444346

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	6.2	5.9	7.9	6.1	7.2
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2		< 2	
Free Cyanide	mg/kg	< 2	NONE	< 2	< 2		< 2	
Total Sulphate as SO ₄	mg/kg	< 200	NONE	< 200	278		337	
Total Sulphate as SO ₄	%	< 0.02	NONE	< 0.02	0.03		0.03	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	12	13	< 10	16	17
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.01	0.01	< 0.01	0.02	0.02
Sulphide	mg/kg	< 5	NONE	< 5	< 5		< 5	
Organic Matter	%	< 0.1	MCERTS	< 0.1	1.8		1.6	
W/S Chloride (2:1)	mg/kg	< 1	MCERTS			16		15
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS			8.2		7.7
Antimony (Sb)	mg/kg	< 1	NONE	< 1	1.1		1.1	
Arsenic (As)	mg/kg	< 2	MCERTS	6	7		7	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1		< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	0.2		< 0.2	
Chromium (Cr)	mg/kg	< 2	MCERTS	8	21		18	
Chromium (III)	mg/kg	< 2	NONE	8	21		18	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2		< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	< 4	13		11	
Lead (Pb)	mg/kg	< 3	MCERTS	4	16		17	
W/S Magnesium	mg/l	< 0.1	NONE			1.9		2.8
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1		< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	5	12		10	
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3		< 3	
Zinc (Zn)	mg/kg	< 3	MCERTS	13	39		37	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2		< 2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

Subcontracted analysis (S)



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath



Soil Analysis Certificate						
DETS Report No: 19-15295	Date Sampled	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hook Lane, Pagham	TP / BH No	TP14	TP14	TP20	TP20	TP23
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 3531	Depth (m)	0.20	1.00	0.20	1.20	1.00
Reporting Date: 10/12/2019	DETS Sample No	444347	444348	444349	444350	444352

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	6.6	8.1	7.1	8.0	8.2
Total Cyanide	mg/kg	< 2	NONE	< 2		< 2		
Free Cyanide	mg/kg	< 2	NONE	< 2		< 2		
Total Sulphate as SO ₄	mg/kg	< 200	NONE	320		1552		
Total Sulphate as SO ₄	%	< 0.02	NONE	0.03		0.16		
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10	< 10	555	33	15
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01	< 0.01	0.56	0.03	0.01
Sulphide	mg/kg	< 5	NONE	< 5		< 5		
Organic Matter	%	< 0.1	MCERTS	2		2		
W/S Chloride (2:1)	mg/kg	< 1	MCERTS		18		14	14
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS		8.8		6.9	7.1
Antimony (Sb)	mg/kg	< 1	NONE	1.3		1.2		
Arsenic (As)	mg/kg	< 2	MCERTS	7		7		
W/S Boron	mg/kg	< 1	NONE	< 1		< 1		
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2		< 0.2		
Chromium (Cr)	mg/kg	< 2	MCERTS	20		22		
Chromium (III)	mg/kg	< 2	NONE	20		22		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2		< 2		
Copper (Cu)	mg/kg	< 4	MCERTS	11		12		
Lead (Pb)	mg/kg	< 3	MCERTS	19		15		
W/S Magnesium	mg/l	< 0.1	NONE		2.4		3.1	2.6
Mercury (Hg)	mg/kg	< 1	NONE	< 1		< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	12		13		
Selenium (Se)	mg/kg	< 3	NONE	< 3		< 3		
Zinc (Zn)	mg/kg	< 3	MCERTS	41		38		
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2		< 2		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath



Soil Analysis Certificate						
DETS Report No: 19-15295	Date Sampled	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hook Lane, Pagham	TP / BH No	TP24	TP24	TP27	TP27	TP30
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 3531	Depth (m)	0.20	1.00	0.10	1.00	0.20
Reporting Date: 10/12/2019	DETS Sample No	444353	444354	444355	444356	444357

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.5	7.5	7.1	7.5	7.3
Total Cyanide	mg/kg	< 2	NONE	< 2		< 2		< 2
Free Cyanide	mg/kg	< 2	NONE	< 2		< 2		< 2
Total Sulphate as SO ₄	mg/kg	< 200	NONE	395		393		315
Total Sulphate as SO ₄	%	< 0.02	NONE	0.04		0.04		0.03
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	12	1160	64	18	22
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.01	1.16	0.06	0.02	0.02
Sulphide	mg/kg	< 5	NONE	< 5		< 5		< 5
Organic Matter	%	< 0.1	MCERTS	1.8		1.6		1.6
W/S Chloride (2:1)	mg/kg	< 1	MCERTS		20		13	
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS		9.9		6.3	
Antimony (Sb)	mg/kg	< 1	NONE	< 1		1.1		1.1
Arsenic (As)	mg/kg	< 2	MCERTS	7		7		7
W/S Boron	mg/kg	< 1	NONE	< 1		< 1		< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2		0.2		0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	20		22		21
Chromium (III)	mg/kg	< 2	NONE	20		22		21
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2		< 2		< 2
Copper (Cu)	mg/kg	< 4	MCERTS	11		14		11
Lead (Pb)	mg/kg	< 3	MCERTS	15		17		16
W/S Magnesium	mg/l	< 0.1	NONE		6.5		2.1	
Mercury (Hg)	mg/kg	< 1	NONE	< 1		< 1		< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	11		13		13
Selenium (Se)	mg/kg	< 3	NONE	< 3		< 3		< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	40		42		40
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2		< 2		< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

Subcontracted analysis (S)



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath



Soil Analysis Certificate						
DETS Report No: 19-15295	Date Sampled	25/10/19	25/10/19	25/10/19		
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Hook Lane, Pagham	TP / BH No	TP30	TP39	TP39		
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 3531	Depth (m)	1.00	0.20	1.00		
Reporting Date: 10/12/2019	DETS Sample No	444358	444359	444360		

Determinand	Unit	RL	Accreditation			
pH	pH Units	N/a	MCERTS	7.9	6.8	8.2
Total Cyanide	mg/kg	< 2	NONE		< 2	
Free Cyanide	mg/kg	< 2	NONE		< 2	
Total Sulphate as SO ₄	mg/kg	< 200	NONE		302	
Total Sulphate as SO ₄	%	< 0.02	NONE		0.03	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	14	< 10	12
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.01	< 0.01	0.01
Sulphide	mg/kg	< 5	NONE		< 5	
Organic Matter	%	< 0.1	MCERTS		2.1	
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	12		15
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	6		7.7
Antimony (Sb)	mg/kg	< 1	NONE		1.1	
Arsenic (As)	mg/kg	< 2	MCERTS		7	
W/S Boron	mg/kg	< 1	NONE		< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS		0.2	
Chromium (Cr)	mg/kg	< 2	MCERTS		21	
Chromium (III)	mg/kg	< 2	NONE		21	
Chromium (hexavalent)	mg/kg	< 2	NONE		< 2	
Copper (Cu)	mg/kg	< 4	MCERTS		13	
Lead (Pb)	mg/kg	< 3	MCERTS		18	
W/S Magnesium	mg/l	< 0.1	NONE	2.2		2.2
Mercury (Hg)	mg/kg	< 1	NONE		< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS		13	
Selenium (Se)	mg/kg	< 3	NONE		< 3	
Zinc (Zn)	mg/kg	< 3	MCERTS		38	
Total Phenols (monohydric)	mg/kg	< 2	NONE		< 2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

Subcontracted analysis (S)



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone



Soil Analysis Certificate - Speciated PAHs

DETS Report No: 19-15295	Date Sampled	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hook Lane, Pagham	TP / BH No	TP01	TP05	TP10	TP14	TP20
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 3531	Depth (m)	0.20	0.20	0.10	0.20	0.20
Reporting Date: 10/12/2019	DETS Sample No	444342	444343	444345	444347	444349

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath



Soil Analysis Certificate - Speciated PAHs

DETS Report No: 19-15295	Date Sampled	25/10/19	25/10/19	25/10/19	25/10/19
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hook Lane, Pagham	TP / BH No	TP24	TP27	TP30	TP39
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 3531	Depth (m)	0.20	0.10	0.20	0.20
Reporting Date: 10/12/2019	DETS Sample No	444353	444355	444357	444359

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath



Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 19-15295	Date Sampled	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hook Lane, Pagham	TP / BH No	TP01	TP05	TP10	TP14	TP20
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 3531	Depth (m)	0.20	0.20	0.10	0.20	0.20
Reporting Date: 10/12/2019	DETS Sample No	444342	444343	444345	444347	444349

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
EPH Texas (>C8 - C10)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C10 - C12)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C12 - C16)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C16 - C21)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C21 - C40)	mg/kg	< 6	MCERTS	< 6	< 6	< 6	< 6	< 6
EPH Texas (C6 - C40)	mg/kg	< 6	NONE	< 6	< 6	< 6	< 6	< 6

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath



Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 19-15295	Date Sampled	25/10/19	25/10/19	25/10/19	25/10/19	
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hook Lane, Pagham	TP / BH No	TP24	TP27	TP30	TP39	
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 3531	Depth (m)	0.20	0.10	0.20	0.20	
Reporting Date: 10/12/2019	DETS Sample No	444353	444355	444357	444359	

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
EPH Texas (>C8 - C10)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C10 - C12)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C12 - C16)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C16 - C21)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C21 - C40)	mg/kg	< 6	MCERTS	< 6	< 6	< 6	< 6	< 6
EPH Texas (C6 - C40)	mg/kg	< 6	NONE	< 6	< 6	< 6	< 6	< 6

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Leekham Heath



Soil Analysis Certificate - PCB (12 Congeners)

DETS Report No: 19-15295	Date Sampled	25/10/19				
Geo Environmental Group	Time Sampled	None Supplied				
Site Reference: Hook Lane, Pagham	TP / BH No	PCB01				
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied				
Order No: 3531	Depth (m)	0.10				
Reporting Date: 10/12/2019	DETS Sample No	444341				

Determinand	Unit	RL	Accreditation				
PCB Congener 77	mg/kg	0.008	NONE	< 0.008			
PCB Congener 81	mg/kg	0.008	NONE	< 0.008			
PCB Congener 105	mg/kg	0.008	NONE	< 0.008			
PCB Congener 114	mg/kg	0.008	NONE	< 0.008			
PCB Congener 118	mg/kg	0.008	NONE	< 0.008			
PCB Congener 123	mg/kg	0.008	NONE	< 0.008			
PCB Congener 126	mg/kg	0.008	NONE	< 0.008			
PCB Congener 156	mg/kg	0.008	NONE	< 0.008			
PCB Congener 157	mg/kg	0.008	NONE	< 0.008			
PCB Congener 167	mg/kg	0.008	NONE	< 0.008			
PCB Congener 169	mg/kg	0.008	NONE	< 0.008			
PCB Congener 189	mg/kg	0.008	NONE	< 0.008			
Total PCB (12 Congeners)	mg/kg	< 0.1	NONE	< 0.1			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 19-15295

Geo Environmental Group

Site Reference: Hook Lane, Pagham

Project / Job Ref: GEG-19-623

Order No: 3531

Reporting Date: 10/12/2019

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
444341	PCB01	None Supplied	0.10	19.8	Brown clayey sand
444342	TP01	None Supplied	0.20	17.5	Brown clayey sand with stones
444343	TP05	None Supplied	0.20	15.3	Brown clayey sand
444344	TP05	None Supplied	1.20	13.3	Brown clayey sand
444345	TP10	None Supplied	0.10	14.9	Brown clayey sand
444346	TP10	None Supplied	1.20	16.3	Brown clayey sand
444347	TP14	None Supplied	0.20	15.8	Brown clayey sand
444348	TP14	None Supplied	1.00	14.3	Brown clayey sand
444349	TP20	None Supplied	0.20	17.8	Brown clayey sand
444350	TP20	None Supplied	1.20	10.8	Brown clayey sand
444352	TP23	None Supplied	1.00	11.7	Brown clayey sand
444353	TP24	None Supplied	0.20	15	Brown clayey sand
444354	TP24	None Supplied	1.00	17.1	Brown clayey sand
444355	TP27	None Supplied	0.10	16.9	Brown clayey sand
444356	TP27	None Supplied	1.00	12.5	Brown clayey sand
444357	TP30	None Supplied	0.20	14.6	Brown clayey sand with stones
444358	TP30	None Supplied	1.00	14.2	Brown clayey sand
444359	TP39	None Supplied	0.20	17.3	Brown clayey sand
444360	TP39	None Supplied	1.00	15	Brown clayey sand

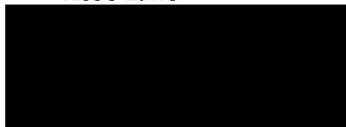
Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

Unsuitable Sample ^{1/5}



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 19-15295

Geo Environmental Group

Site Reference: Hook Lane, Pagham

Project / Job Ref: GEG-19-623

Order No: 3531

Reporting Date: 10/12/2019

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



Nick Needham
Geo Environmental Group
GEG House,
17 Graham Road
Malvern
WR14 2HR

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Leamington Spa

DETS Report No: 19-17654

Site Reference: Hook Lane, Paqham

Project / Job Ref: GEG-19-623

Order No: 3589

Sample Receipt Date: 20/12/2019

Sample Scheduled Date: 20/12/2019

Report Issue Number: 1

Reporting Date: 03/01/2020

Authorised by:

Dave Ashworth
Technical Manager

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DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN

Soil Analysis Certificate - Organochlorine Pesticides						
DETS Report No: 19-17654	Date Sampled	18/12/19	18/12/19	18/12/19	18/12/19	18/12/19
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hook Lane, Pagham	TP / BH No	TP01	TP10	TP14	TP20	TP24
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 3589	Depth (m)	0.20	0.20	0.20	0.20	0.20
Reporting Date: 03/01/2020	DETS Sample No	453742	453743	453744	453745	453746

Determinand	Unit	RL	Accreditation					
Aldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
alpha-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
beta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
cis-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
delta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dieldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Endosulfan A	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Endosulfan B	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Endrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
gamma-HCH (Lindane)	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Heptachlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Heptachlor epoxide	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Hexachlorobenzene (HCB)	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Isodrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Methoxychlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
o,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
o,p' - DDE	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
o,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
p,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
p,p' - DDE	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
p,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
trans-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Trifluralin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN

Soil Analysis Certificate - Organochlorine Pesticides						
DETS Report No: 19-17654	Date Sampled	18/12/19	18/12/19	18/12/19		
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Hook Lane, Pagham	TP / BH No	TP27	TP30	TP39		
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 3589	Depth (m)	0.20	0.20	0.20		
Reporting Date: 03/01/2020	DETS Sample No	453747	453748	453749		

Determinand	Unit	RL	Accreditation					
Aldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
alpha-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
beta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
cis-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
delta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Dieldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Endosulfan A	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Endosulfan B	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Endrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
gamma-HCH (Lindane)	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Heptachlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Heptachlor epoxide	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Hexachlorobenzene (HCB)	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Isodrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Methoxychlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
o,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
o,p' - DDE	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
o,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
p,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
p,p' - DDE	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
p,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
trans-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Trifluralin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN

Soil Analysis Certificate - Organophosphorus Pesticides						
DETS Report No: 19-17654	Date Sampled	18/12/19	18/12/19	18/12/19	18/12/19	18/12/19
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Hook Lane, Pagham	TP / BH No	TP01	TP10	TP14	TP20	TP24
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 3589	Depth (m)	0.20	0.20	0.20	0.20	0.20
Reporting Date: 03/01/2020	DETS Sample No	453742	453743	453744	453745	453746

Determinand	Unit	RL	Accreditation					
Azinphos-methyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chlorfenvinphos, alpha	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chlorfenvinphos, beta	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chlorpyrifos-methyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Diazinon	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dichlorvos	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dimethoate	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fenitrothion	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fenthion	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Malathion	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Mevinphos, E	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Mevinphos, (Z)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Parathion-ethyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Parathion-methyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phorate	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane



Soil Analysis Certificate - Organophosphorus Pesticides						
DETS Report No: 19-17654	Date Sampled	18/12/19	18/12/19	18/12/19		
Geo Environmental Group	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Hook Lane, Pagham	TP / BH No	TP27	TP30	TP39		
Project / Job Ref: GEG-19-623	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 3589	Depth (m)	0.20	0.20	0.20		
Reporting Date: 03/01/2020	DETS Sample No	453747	453748	453749		

Determinand	Unit	RL	Accreditation					
Azinphos-methyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Chlorfenvinphos, alpha	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Chlorfenvinphos, beta	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Chlorpyrifos-methyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Diazinon	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Dichlorvos	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Dimethoate	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Fenitrothion	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Fenthion	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Malathion	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Mevinphos, E	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Mevinphos, (Z)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Parathion-ethyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Parathion-methyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Phorate	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



DETS Ltd
Unit 1, Rose Lane Industrial Estate



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 19-17654	
Geo Environmental Group	
Site Reference: Hook Lane, Pagham	
Project / Job Ref: GEG-19-623	
Order No: 3589	
Reporting Date: 03/01/2020	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
453742	TP01	None Supplied	0.20	19.5	Brown clay with stones
453743	TP10	None Supplied	0.20	19.7	Brown clay
453744	TP14	None Supplied	0.20	20.4	Brown clay with stones
453745	TP20	None Supplied	0.20	20.2	Brown clay
453746	TP24	None Supplied	0.20	18	Brown clay
453747	TP27	None Supplied	0.20	17.7	Brown clay
453748	TP30	None Supplied	0.20	17.5	Brown clay
453749	TP39	None Supplied	0.20	18.5	Brown clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

Unsuitable Sample ^{1/5}



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JH

Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 19-17654

Geo Environmental Group

Site Reference: Hook Lane, Pagham

Project / Job Ref: GEG-19-623

Order No: 3589

Reporting Date: 03/01/2020

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 dphenylcarbazine followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

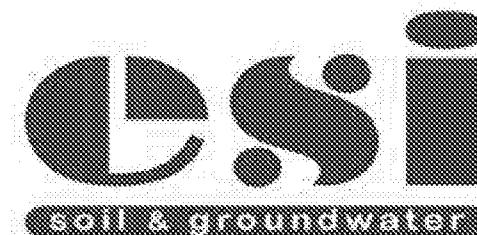


APPENDIX F

STATISTICAL ASSESSMENT OF CHEMICAL RESULTS

Client/client ref	Brookbanks / HLM
Project ref	GEG-19-623
Site ref	Hook Lane, Pagham
Data description	Natural Ground
Contaminant(s)	As to Phenol
Test scenario	Planning: is true mean lower than critical concentration ($\mu < C_c$)? ▼
Date	21 November 2019
User details	MP

Statistics calculator (version 1)



Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

ESI Ltd (ESI) do not promise that the spreadsheet will provide any particular facilities or functions. The user must ensure that the spreadsheet meets their needs and they remain solely responsible for the competent use of the spreadsheet. Users are entirely responsible for the consequences of any use of the spreadsheet, ESI do not provide any warranty about the fitness for purpose or performance of any part of the spreadsheet. We do not promise that the media will always be free from defects, computer viruses, software locks or other similar code or that the operation of the spreadsheet will be uninterrupted or error free. The user should carry out all necessary virus checks prior to installing on their computing system.

[illegible]

Client/client ref	Brookbanks / HLM
Project ref	GEG-19-623
Site ref	Hook Lane, Pagham
Data description	Natural Ground
Contaminant(s)	Cu, Zn, B & Sb
Test scenario	Planning: is true mean lower than critical concentration ($\mu < C_c$)? ▼
Date	21 November 2019
User details	MP

Statistics calculator (version 1)



Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

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[illegible]

Directions to Brooklands TIA
Project ref: 13220-14-023
Ref: 147 Brook Lane, Farnham
Data Collection Review Group
Convenor(s): Drs. Zs. S. & Ss.
Task Manager: Planning
Date: 21 November 2018
Case: B100-147

Crusher (mg/kg)	Zinc (mg/kg)	Boron (mg/kg)	Antimony (mg/kg)														
2330	3550	291	260														
Sample size (n)	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0
Sample mean (x)	10.68888889	36.44444444	0.5	1	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Sample standard deviation (s)	3.515837185	5.931840671	0	0.291547595													
Sample standard deviation (s)	1	0	9	2													
Statistical analysis method (p)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)	Half selection (m)
Analysis type	No	No	No	No													
Crusher (mg/kg)	Non-normal	Non-normal	Single value	Non-normal													
Statistical analysis	Auto Unbychev	Auto Unbychev	Auto Unbychev	Auto Unbychev	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto

Planning: data mean lower than critical concentration is < Lev

Confidence level (p)

95%

Use normal distribution to test for outliers

Statistic (m)	-1878.855381	-1180.122559	N/A	-2895.888613													
Statistic (m)	15.89728189	49.42210807	0.5	1.423606834													
Confidence level	100%	100%	100%	100%													
Statistic (m)	Statistic (m)	Statistic (m)	Statistic (m)														
Statistic (m)	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$													
Statistic (m)	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y	O Y

Back to data

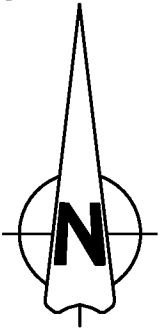
Go to outlier test

Go to normality test

Show individual summary

www.g-eg.co.uk

Appendix B— Drainage Strategy and Supporting Calculations



Surface Water Catchment 3	
Development Area (ha):	3.00
Impermeable Area 60% (ha):	1.80
Detention Feature:	Pond 3

Pond 3	
Downstream Control:	Hydrobrake
Total Storage Volume (m3):	1.423
Min top of bank level:	5.0mAOD
Bed Level:	3.7mAOD
Side Slopes:	1 in 4
Discharge rate (litres/sec):	6.30 (Qbar)
Outfall:	Watercourse

FW PS 1
CL 8.50mAOD
IL 4.30mAOD
95 Drawings
Emergency Storage Requirement
TBC on m
Emergency Storage Proposal: 16.2 cu m
Provide within 3m of wet well chamber &
upstream network up to lowest incoming lateral

Surface Water Catchment 2	
Development Area (ha):	1.88
Impermeable Area 60% (ha):	1.12
Detention Feature:	Pond 2

Pond 2	
Downstream Control:	Hydrobrake
Total Storage Volume (m3):	688
Min top of bank level:	5.4mAOD
Bed Level:	5.1mAOD
Side Slopes:	1 in 4
Discharge rate (litres/sec):	3.82 (Qbar)
Outfall:	Watercourse

Surface Water Catchment 1	
Development Area (ha):	5.30
Impermeable Area 60% (ha):	3.18
Care Home Impermeable Area (ha):	0.23
Total Catchment Area (ha):	3.41
Detention Feature:	Pond 1

Pond 1	
Downstream Control:	Hydrobrake
Total Storage Volume (m3):	2,856
Min top of bank level:	5.8mAOD
Bed level:	4.0mAOD
Side Slopes:	1 in 4
Discharge rate (litres/sec):	11.94 (Qbar)
Outfall:	Watercourse

- NOTES:
- Do not scale from this drawing.
 - All dimensions are in metres unless otherwise stated.
 - Brookbanks Consulting Ltd has prepared this drawing for the sole use of the client. The drawing may not be relied upon by any other party without the express agreement of the client and Brookbanks Consulting Ltd. Where any data supplied by the client or from other sources has been used, it has been assumed that the information is correct. No responsibility can be accepted by Brookbanks Consulting Ltd for inaccuracies in the data supplied by any other party. The drawing has been produced based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.
 - No part of this drawing may be copied or duplicated without the express permission of Brookbanks Consulting.
 - Details & locations of existing sewers are based on the topographical survey and utility recordings and should be considered indicative and approximate only. All sewers must be accurately located by the contractor prior to commencement of works.
 - This drawing has been prepared for planning purposes only it is not for tender of construction.
 - All finished floor levels shown are indicative and are subject to refinement following completion of the detailed design.
 - All drainage details are indicative and subject to refinement following completion of the detailed design.

KEY:	
	Site Boundary
	Existing Foul Water Sewers
	Proposed SW Catchment Areas
	Proposed Surface Water Sewers
	Proposed Foul Water Sewers
	Proposed foul pumping main
	Proposed surface water control chamber
	Proposed headwall
F	Latest site layout added. NJO SM 02.12.20
E	Basin details amended. NJO SM 28.11.20
D	Western swale profile amended, culvert crossings added. RM SM 28.10.20
C	Western swale profile amended. RM SM 20.10.20
B	Amended as per Urban Wilderness comments. BP SM 01.10.20
A	Watercourse diversion amended. LF RM 18.08.20
-	First Issue. LF RM 08.06.20



6150 Knights Court, Solihull Parkway, Birmingham, B37 7WY
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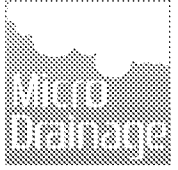


Hook Lane
Pagham

Surface & Foul Water
Drainage Strategy

Status		Status Date
Information		June 2020
Drawn	Checked	Date
LF	RM	10.06.20
Scale	Number	Rev
1:1000	10461-DR-001	F
0 20 40 60 80 100		
METRES		

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT HIS OWN RISK.

Brookbanks Consulting		Page 1
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Greenfield Run Off	
Date 26/11/2020 File	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage		Source Control 2020.1

IH 124 Mean Annual Flood

Input

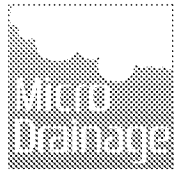
Return Period (years) 100 SAAR (mm) 718 Urban 0.000
Area (ha) 50.000 Soil 0.400 Region Number Region 7

Results l/s

QBAR Rural 175.2
QBAR Urban 175.2

Q100 years 559.0

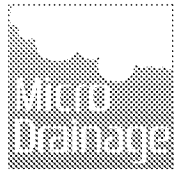
Q1 year 149.0
Q2 years 154.4
Q5 years 224.3
Q10 years 283.9
Q20 years 351.0
Q25 years 376.4
Q30 years 397.2
Q50 years 459.1
Q100 years 559.0
Q200 years 657.2
Q250 years 688.7
Q1000 years 904.3

Brookbanks Consulting		Page 1
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Basin 1	
Date 26/11/2020 File Pond 1.SRCX	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage		Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	4.569	0.569	11.9	783.9	O K
30 min Summer	4.722	0.722	11.9	1051.4	O K
60 min Summer	4.873	0.873	11.9	1340.0	O K
120 min Summer	5.016	1.016	11.9	1639.7	O K
180 min Summer	5.092	1.092	11.9	1807.0	O K
240 min Summer	5.139	1.139	11.9	1914.7	O K
360 min Summer	5.199	1.199	11.9	2056.5	O K
480 min Summer	5.237	1.237	11.9	2148.6	O K
600 min Summer	5.262	1.262	11.9	2209.8	O K
720 min Summer	5.278	1.278	11.9	2250.8	O K
960 min Summer	5.295	1.295	11.9	2293.6	O K
1440 min Summer	5.295	1.295	11.9	2291.4	O K
2160 min Summer	5.265	1.265	11.9	2217.0	O K
2880 min Summer	5.233	1.233	11.9	2138.3	O K
4320 min Summer	5.170	1.170	11.9	1986.3	O K
5760 min Summer	5.106	1.106	11.9	1838.7	O K
7200 min Summer	5.041	1.041	11.9	1692.7	O K
8640 min Summer	4.974	0.974	11.9	1547.6	O K
10080 min Summer	4.894	0.894	11.9	1382.6	O K
15 min Winter	4.625	0.625	11.9	879.4	O K
30 min Winter	4.791	0.791	11.9	1180.0	O K
60 min Winter	4.954	0.954	11.9	1505.9	O K

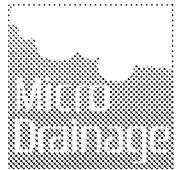
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	124.633	0.0	746.1	27
30 min Summer	83.789	0.0	953.8	41
60 min Summer	53.779	0.0	1349.0	72
120 min Summer	33.337	0.0	1654.9	130
180 min Summer	24.832	0.0	1807.5	190
240 min Summer	20.006	0.0	1852.7	250
360 min Summer	14.706	0.0	1833.3	368
480 min Summer	11.818	0.0	1808.3	488
600 min Summer	9.966	0.0	1787.6	606
720 min Summer	8.665	0.0	1770.5	726
960 min Summer	6.943	0.0	1743.5	964
1440 min Summer	5.071	0.0	1709.1	1440
2160 min Summer	3.696	0.0	3350.6	1816
2880 min Summer	2.949	0.0	3458.5	2192
4320 min Summer	2.142	0.0	3175.0	2988
5760 min Summer	1.705	0.0	4177.8	3816
7200 min Summer	1.427	0.0	4370.3	4680
8640 min Summer	1.235	0.0	4537.3	5464
10080 min Summer	1.093	0.0	4680.6	6256
15 min Winter	124.633	0.0	828.6	26
30 min Winter	83.789	0.0	989.7	41
60 min Winter	53.779	0.0	1505.9	70

Brookbanks Consulting		Page 2
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Basin 1	
Date 26/11/2020 File Pond 1.SRCX	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage		Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	5.108	1.108	11.9	1843.4	O K
180 min Winter	5.190	1.190	11.9	2034.0	O K
240 min Winter	5.241	1.241	11.9	2158.3	O K
360 min Winter	5.308	1.308	11.9	2324.6	O K
480 min Winter	5.351	1.351	11.9	2435.2	O K
600 min Winter	5.380	1.380	11.9	2511.5	O K
720 min Winter	5.400	1.400	11.9	2564.9	O K
960 min Winter	5.424	1.424	11.9	2628.2	O K
1440 min Winter	5.434	1.434	11.9	2656.1	O K
2160 min Winter	5.408	1.408	11.9	2585.0	O K
2880 min Winter	5.368	1.368	11.9	2479.1	O K
4320 min Winter	5.288	1.288	11.9	2274.2	O K
5760 min Winter	5.200	1.200	11.9	2059.0	O K
7200 min Winter	5.107	1.107	11.9	1841.4	O K
8640 min Winter	5.008	1.008	11.9	1621.9	O K
10080 min Winter	4.883	0.883	11.9	1360.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	33.337	0.0	1812.5	128
180 min Winter	24.832	0.0	1859.3	186
240 min Winter	20.006	0.0	1844.3	246
360 min Winter	14.706	0.0	1816.5	362
480 min Winter	11.818	0.0	1798.4	480
600 min Winter	9.966	0.0	1786.9	596
720 min Winter	8.665	0.0	1780.0	712
960 min Winter	6.943	0.0	1777.1	942
1440 min Winter	5.971	0.0	1783.1	1390
2160 min Winter	3.696	0.0	3622.2	2024
2880 min Winter	2.949	0.0	3531.0	2304
4320 min Winter	2.142	0.0	3282.8	3212
5760 min Winter	1.705	0.0	4678.9	4152
7200 min Winter	1.427	0.0	4894.1	5048
8640 min Winter	1.235	0.0	5080.4	5968
10080 min Winter	1.093	0.0	5243.6	6752

Brookbanks Consulting		Page 4
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Basin 1	
Date 26/11/2020 File Pond 1.SRCX	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 5.800

Tank or Pond Structure

Invert Level (m) 4.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1114.0	1.800	3223.0

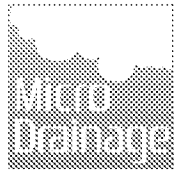
Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0150-1190-1500-1190
Design Head (m)	1.500
Design Flow (l/s)	11.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	150
Invert Level (m)	4.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	11.9	Kick-Flo®	0.943	9.6
Flush-Flo™	0.442	11.9	Mean Flow over Head Range	-	10.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

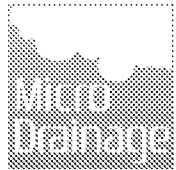
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.4	0.800	11.0	2.000	13.6	4.000	19.0	7.000	24.8
0.200	10.7	1.000	9.8	2.200	14.3	4.500	20.1	7.500	25.6
0.300	11.6	1.200	10.7	2.400	14.9	5.000	21.1	8.000	26.5
0.400	11.9	1.400	11.5	2.600	15.4	5.500	22.1	8.500	27.2
0.500	11.9	1.600	12.3	3.000	16.5	6.000	23.0	9.000	28.0
0.600	11.7	1.800	13.0	3.500	17.8	6.500	23.9	9.500	28.7

Brookbanks Consulting		Page 1
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Basin 2	
Date 26/11/2020 File Pond 2.SRCX	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage		Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	5.354	0.254	3.9	257.9	O K
30 min Summer	5.436	0.336	3.9	345.8	O K
60 min Summer	5.521	0.421	3.9	440.7	O K
120 min Summer	5.607	0.507	3.9	539.1	O K
180 min Summer	5.655	0.555	3.9	594.8	O K
240 min Summer	5.685	0.585	3.9	631.4	O K
360 min Summer	5.726	0.626	3.9	681.0	O K
480 min Summer	5.754	0.654	3.9	714.7	O K
600 min Summer	5.773	0.673	3.9	737.9	O K
720 min Summer	5.786	0.686	3.9	754.2	O K
960 min Summer	5.801	0.701	3.9	773.4	O K
1440 min Summer	5.808	0.708	3.9	781.8	O K
2160 min Summer	5.793	0.693	3.9	763.1	O K
2880 min Summer	5.774	0.674	3.9	739.5	O K
4320 min Summer	5.731	0.631	3.9	686.3	O K
5760 min Summer	5.682	0.582	3.9	627.5	O K
7200 min Summer	5.636	0.536	3.9	573.0	O K
8640 min Summer	5.594	0.494	3.9	523.4	O K
10080 min Summer	5.554	0.454	3.9	477.5	O K
15 min Winter	5.384	0.284	3.9	289.2	O K
30 min Winter	5.474	0.374	3.9	387.9	O K
60 min Winter	5.569	0.469	3.9	494.8	O K

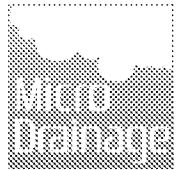
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	124.633	0.0	226.8	27
30 min Summer	83.789	0.0	293.3	41
60 min Summer	53.779	0.0	431.1	70
120 min Summer	33.337	0.0	529.0	130
180 min Summer	24.832	0.0	581.2	190
240 min Summer	20.006	0.0	609.1	250
360 min Summer	14.706	0.0	619.4	368
480 min Summer	11.818	0.0	608.1	488
600 min Summer	9.966	0.0	596.2	606
720 min Summer	8.665	0.0	585.3	726
960 min Summer	6.943	0.0	566.4	964
1440 min Summer	5.071	0.0	536.0	1442
2160 min Summer	3.696	0.0	1077.4	1888
2880 min Summer	2.949	0.0	1100.7	2280
4320 min Summer	2.142	0.0	1027.5	3068
5760 min Summer	1.705	0.0	1368.1	3808
7200 min Summer	1.427	0.0	1430.7	4608
8640 min Summer	1.235	0.0	1484.4	5368
10080 min Summer	1.093	0.0	1528.4	6152
15 min Winter	124.633	0.0	252.3	26
30 min Winter	83.789	0.0	314.3	41
60 min Winter	53.779	0.0	481.3	70

Brookbanks Consulting		Page 2
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Basin 2	
Date 26/11/2020 File Pond 2.SRCX	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage		Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	5.664	0.564	3.9	606.3	O K
180 min Winter	5.717	0.617	3.9	670.2	O K
240 min Winter	5.752	0.652	3.9	712.7	O K
360 min Winter	5.799	0.699	3.9	770.0	O K
480 min Winter	5.830	0.730	3.9	808.8	O K
600 min Winter	5.851	0.751	3.9	836.1	O K
720 min Winter	5.867	0.767	3.9	855.9	O K
960 min Winter	5.887	0.787	3.9	880.9	O K
1440 min Winter	5.900	0.800	3.9	897.8	O K
2160 min Winter	5.889	0.789	3.9	884.1	O K
2880 min Winter	5.863	0.763	3.9	851.0	O K
4320 min Winter	5.812	0.712	3.9	786.4	O K
5760 min Winter	5.751	0.651	3.9	711.1	O K
7200 min Winter	5.677	0.577	3.9	621.9	O K
8640 min Winter	5.609	0.509	3.9	541.6	O K
10080 min Winter	5.547	0.447	3.9	469.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	33.337	0.0	583.1	128
180 min Winter	24.832	0.0	621.5	186
240 min Winter	20.006	0.0	622.1	246
360 min Winter	14.706	0.0	607.9	362
480 min Winter	11.818	0.0	594.7	480
600 min Winter	9.966	0.0	583.9	596
720 min Winter	8.665	0.0	574.9	714
960 min Winter	6.943	0.0	560.4	944
1440 min Winter	5.971	0.0	539.9	1398
2160 min Winter	3.696	0.0	1153.2	2052
2880 min Winter	2.949	0.0	1122.5	2420
4320 min Winter	2.142	0.0	1035.9	3288
5760 min Winter	1.705	0.0	1531.8	4216
7200 min Winter	1.427	0.0	1601.9	5048
8640 min Winter	1.235	0.0	1662.1	5800
10080 min Winter	1.093	0.0	1712.8	6560

Brookbanks Consulting		Page 4
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Basin 2	
Date 26/11/2020 File Pond 2.SRCX	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 6.400

Tank or Pond Structure

Invert Level (m) 5.100

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	965.0	1.300	1514.0

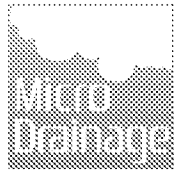
Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0094-3900-1000-3900
Design Head (m)	1.000
Design Flow (l/s)	3.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	5.100
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.9	Kick-Flo®	0.632	3.2
Flush-Flo™	0.297	3.9	Mean Flow over Head Range	-	3.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

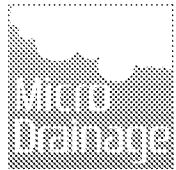
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	0.800	3.5	2.000	5.4	4.000	7.4	7.000	9.7
0.200	3.8	1.000	3.9	2.200	5.6	4.500	7.9	7.500	10.0
0.300	3.9	1.200	4.2	2.400	5.9	5.000	8.3	8.000	10.4
0.400	3.8	1.400	4.6	2.600	6.1	5.500	8.7	8.500	10.7
0.500	3.7	1.600	4.8	3.000	6.5	6.000	9.0	9.000	10.9
0.600	3.4	1.800	5.1	3.500	7.0	6.500	9.4	9.500	11.2

Brookbanks Consulting		Page 1
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Basin 3	
Date 26/11/2020 File Pond 3.SRCX	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage		Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	4.022	0.322	6.3	414.2	O K
30 min Summer	4.120	0.420	6.3	555.5	O K
60 min Summer	4.220	0.520	6.3	708.1	O K
120 min Summer	4.319	0.619	6.3	866.6	O K
180 min Summer	4.374	0.674	6.3	956.9	O K
240 min Summer	4.408	0.708	6.3	1015.5	O K
360 min Summer	4.453	0.753	6.3	1093.1	O K
480 min Summer	4.482	0.782	6.3	1144.0	O K
600 min Summer	4.501	0.801	6.3	1178.6	O K
720 min Summer	4.515	0.815	6.3	1202.4	O K
960 min Summer	4.529	0.829	6.3	1229.0	O K
1440 min Summer	4.533	0.833	6.3	1234.9	O K
2160 min Summer	4.515	0.815	6.3	1202.4	O K
2880 min Summer	4.494	0.794	6.3	1164.9	O K
4320 min Summer	4.449	0.749	6.3	1086.2	O K
5760 min Summer	4.403	0.703	6.3	1005.9	O K
7200 min Summer	4.353	0.653	6.3	921.8	O K
8640 min Summer	4.298	0.598	6.3	832.7	O K
10080 min Summer	4.249	0.549	6.3	753.2	O K
15 min Winter	4.057	0.357	6.3	464.6	O K
30 min Winter	4.165	0.465	6.3	623.3	O K
60 min Winter	4.275	0.575	6.3	795.2	O K

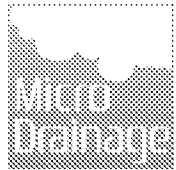
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	124.633	0.0	372.8	27
30 min Summer	83.789	0.0	482.2	41
60 min Summer	53.779	0.0	698.2	70
120 min Summer	33.337	0.0	856.3	130
180 min Summer	24.832	0.0	937.8	190
240 min Summer	20.006	0.0	976.7	250
360 min Summer	14.706	0.0	980.1	368
480 min Summer	11.818	0.0	965.0	488
600 min Summer	9.966	0.0	950.6	606
720 min Summer	8.665	0.0	937.9	726
960 min Summer	6.943	0.0	916.2	964
1440 min Summer	5.071	0.0	880.9	1440
2160 min Summer	3.696	0.0	1744.7	1824
2880 min Summer	2.949	0.0	1796.0	2200
4320 min Summer	2.142	0.0	1651.2	2992
5760 min Summer	1.705	0.0	2200.3	3856
7200 min Summer	1.427	0.0	2301.1	4680
8640 min Summer	1.235	0.0	2388.3	5440
10080 min Summer	1.093	0.0	2460.3	6160
15 min Winter	124.633	0.0	414.8	26
30 min Winter	83.789	0.0	515.1	41
60 min Winter	53.779	0.0	779.4	70

Brookbanks Consulting		Page 2
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Basin 3	
Date 26/11/2020 File Pond 3.SRCX	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage		Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	4.384	0.684	6.3	974.9	O K
180 min Winter	4.444	0.744	6.3	1076.8	O K
240 min Winter	4.482	0.782	6.3	1143.6	O K
360 min Winter	4.532	0.832	6.3	1233.4	O K
480 min Winter	4.565	0.865	6.3	1293.6	O K
600 min Winter	4.587	0.887	6.3	1335.6	O K
720 min Winter	4.603	0.903	6.3	1365.6	O K
960 min Winter	4.623	0.923	6.3	1402.2	O K
1440 min Winter	4.634	0.934	6.3	1422.8	O K
2160 min Winter	4.618	0.918	6.3	1392.7	O K
2880 min Winter	4.590	0.890	6.3	1341.1	O K
4320 min Winter	4.534	0.834	6.3	1237.0	O K
5760 min Winter	4.470	0.770	6.3	1122.6	O K
7200 min Winter	4.401	0.701	6.3	1003.1	O K
8640 min Winter	4.320	0.620	6.3	867.5	O K
10080 min Winter	4.239	0.539	6.3	738.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	33.337	0.0	940.6	128
180 min Winter	24.832	0.0	992.1	186
240 min Winter	20.006	0.0	988.5	246
360 min Winter	14.706	0.0	971.1	362
480 min Winter	11.818	0.0	957.1	480
600 min Winter	9.966	0.0	946.4	596
720 min Winter	8.665	0.0	937.8	712
960 min Winter	6.943	0.0	924.7	942
1440 min Winter	5.071	0.0	911.8	1392
2160 min Winter	3.696	0.0	1889.9	2032
2880 min Winter	2.949	0.0	1845.1	2308
4320 min Winter	2.142	0.0	1705.7	3240
5760 min Winter	1.705	0.0	2464.1	4152
7200 min Winter	1.427	0.0	2576.4	5056
8640 min Winter	1.235	0.0	2673.8	5888
10080 min Winter	1.093	0.0	2757.1	6648

Brookbanks Consulting		Page 4
6150 Knights Court Solihull Parkway Birmingham B37 7WY	Hook Lane, Pagham SW Strategy Basin 3	
Date 26/11/2020 File Pond 3.SRCX	Designed by Brookbanks Checked by N.J.Onions	
Micro Drainage	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 5.000

Tank or Pond Structure

Invert Level (m) 3.700

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1173.0	1.300	2240.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0118-6300-1000-6300
Design Head (m)	1.000
Design Flow (l/s)	6.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	118
Invert Level (m)	3.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	6.3	Kick-Flo®	0.652	5.2
Flush-Flo™	0.299	6.3	Mean Flow over Head Range	-	5.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	5.7	2.000	8.7	4.000	12.1	7.000	15.8
0.200	6.1	1.000	6.3	2.200	9.1	4.500	12.8	7.500	16.3
0.300	6.3	1.200	6.8	2.400	9.5	5.000	13.4	8.000	16.8
0.400	6.2	1.400	7.4	2.600	9.8	5.500	14.1	8.500	17.3
0.500	6.0	1.600	7.8	3.000	10.5	6.000	14.7	9.000	17.8
0.600	5.6	1.800	8.3	3.500	11.3	6.500	15.2	9.500	18.3



BROOKBANKS

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