

# Appendix C

## Site investigation and percolation testing report

# Infiltration and percolation testing: Ad Rhyd-Blawd Farm, Llandrindod Wells

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Appendix B	Infiltration test results (storm water drainage assessment)
Appendix C	Percolation test results (foul drainage assessment)

# 1 INTRODUCTION

## 1.1 Background

Planning approval has been sought from Powys County Council for the redevelopment of land at Rhyd-Blawd Farm, Llandrindod Wells, LD2 3TL (the 'Site'). Planning application reference 19/0643/FUL relates to the '*Formation of a motorcycle scramble track; erection of a building for use as Motor-Cross Experience Centre with associated parking area; use of land as overspill car parking area; siting of 7 no. holiday lodges and associated works; installation of 3 no. foul water drainage receptacles and soakaways; alterations to existing roadways and improvements to 2 no. highway entrances*'.

GeoSmart Information Ltd. has been appointed by the Site owner to produce a drainage design for two key areas of the Site; Site A (the proposed motocross centre and parking area) and Site B (the location of the proposed holiday lodges). The location of Site A and Site B are indicated on Figure 1.1.

The drainage design requires for the management of both storm water and foul drainage. The preliminary drainage strategy includes the use of infiltration SuDS, subject to demonstrating a suitable infiltration capacity within the sub surface.

## 1.2 Instruction

Ground First was instructed by GeoSmart Information Ltd. on 19<sup>th</sup> April 2021 to undertake infiltration and percolation testing as outlined in proposal reference 4196P1 in order to assess the prevailing ground conditions at Site A and Site B.

## 1.3 Objectives

The objective of the work was to undertake appropriate site investigations designed to determine both representative soil infiltration rates, in line with the requirements of BRE Digest 365 (Soakaway Design), and also representative percolation values, in line with the requirements of BS 6297:2007+A1:2008 (Code of practice for the design and installation of drainage fields for use in wastewater treatment).

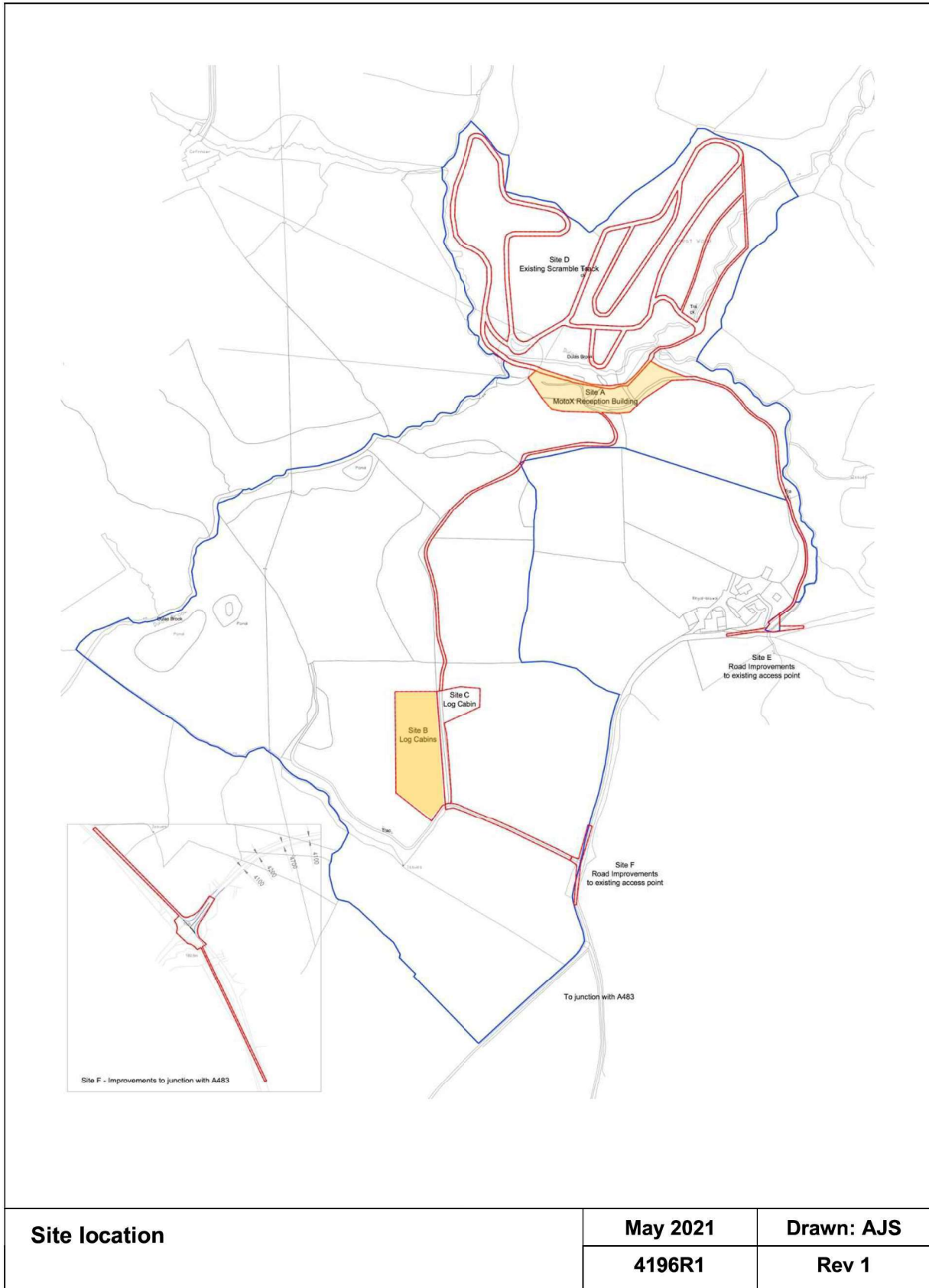
The infiltration rate and percolation value information will be provided to GeoSmart in order to further inform a suitable drainage design.

## 1.4 This report

This report provides factual records of all relevant fieldwork observations and test results undertaken by Ground First at the study Site.



**Figure 1.1 Site location plan**



## 2 SITE SETTING AND HISTORY

The following section provides a summary of the Site setting, land use history and local geological conditions.

### 2.1 Basic site information

Information relating to the Site location is summarised in Table 2.1.

**Table 2.1 Site details**

<b>Site Address</b>	Rhyd-Blawd Farm, Llandrindod Wells, LD2 3TL
<b>Site area</b>	Site A: c. 0.5 hectares Site B: c. 0.6 hectares
<b>General setting and ground coverage</b>	The Site is located within a rural setting c. 5 km south of Llandrindod Wells. Site A occupies an area of undeveloped ground to the south of the Dulas Brook (an incised stream channel). The original landform has previously been modified in order to create several levelled areas. The ground surface comprises natural clay and gravel. Site B is located within a grassed field (understood to be used for sheep grazing). The land area slopes gradually down to the west. Photographs showing the current Site condition are included in Appendix A.

### 2.2 Site history

Available historical land use mapping suggests that Site A and Site B have remained largely undeveloped since the late 1880s. Aerial photography from 2006 shows that the existing motocross track has been developed to the north of Site A, with a suspected parking area located in the central part of Site A. The parking area appears to have been sequentially extended between 2006 and 2020.

### 2.3 Geological setting

British Geological Survey mapping (BGS, 2021) indicates that Site A is partly underlain by superficial Till (comprising diamicton); the mapped Till deposits appear to be locally absent in the west of the Site. The bedrock geology comprises the Builth Mudstones Formation (mudstone and laminated hemipelagic mudstone). It is noted that previous groundworks undertaken across Site A may have altered the extents and thickness of the original Till deposits.

BGS mapping indicates that the whole of Site B is underlain by superficial Till and the Builth Mudstones Formation.

Note: there are no published BGS borehole records available within 1 km of the Site.



### 3 SITE INVESTIGATION WORKS

#### 3.1 Site investigation programme

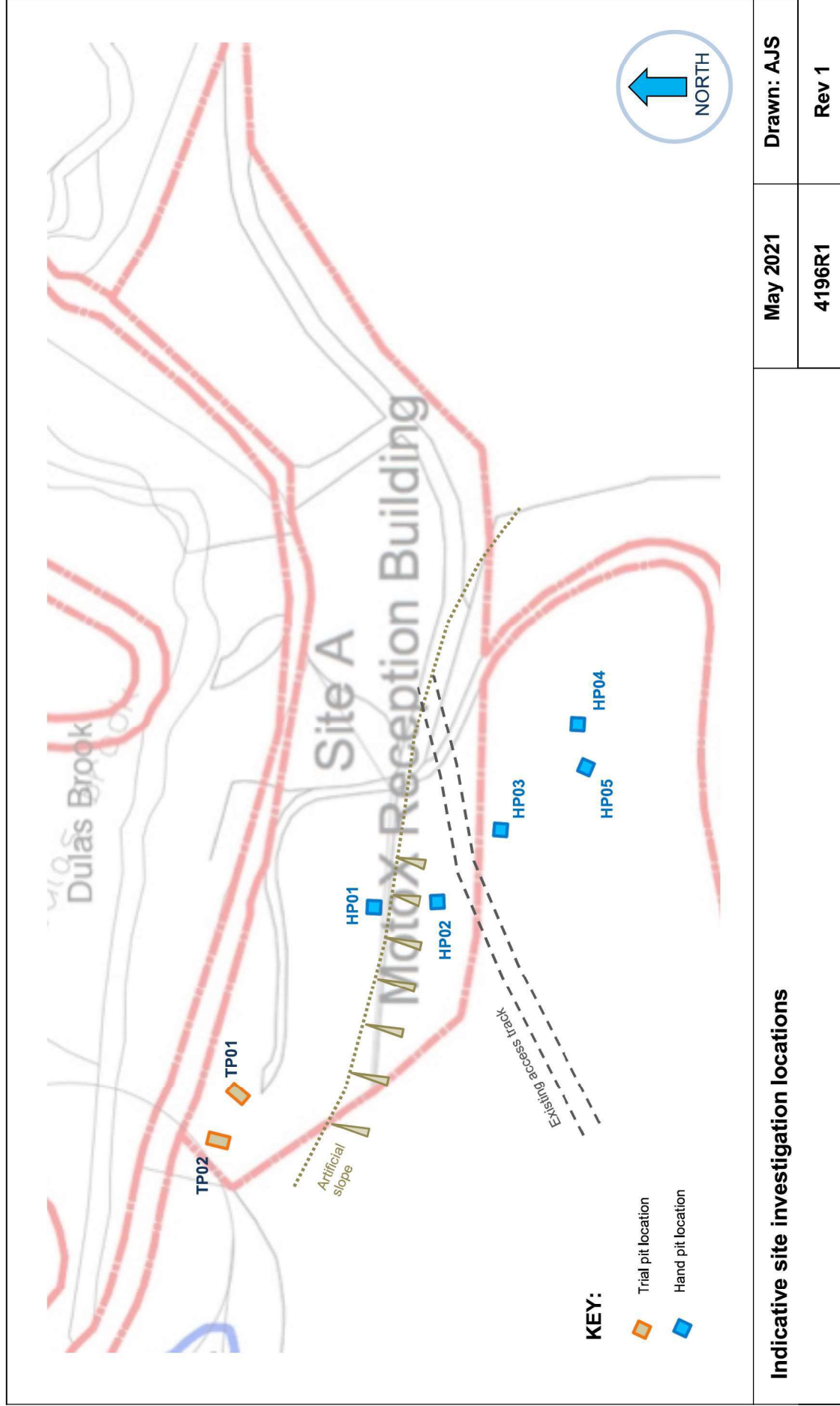
Trial pitting and infiltration / percolation testing was coordinated by Ground First at the study site on 28<sup>th</sup> April 2021. A summary of the site investigation activities undertaken is presented in Table 3.1. A photographic record of the Site works is provided in Appendix A.

**Table 3.1 Site investigation activities**

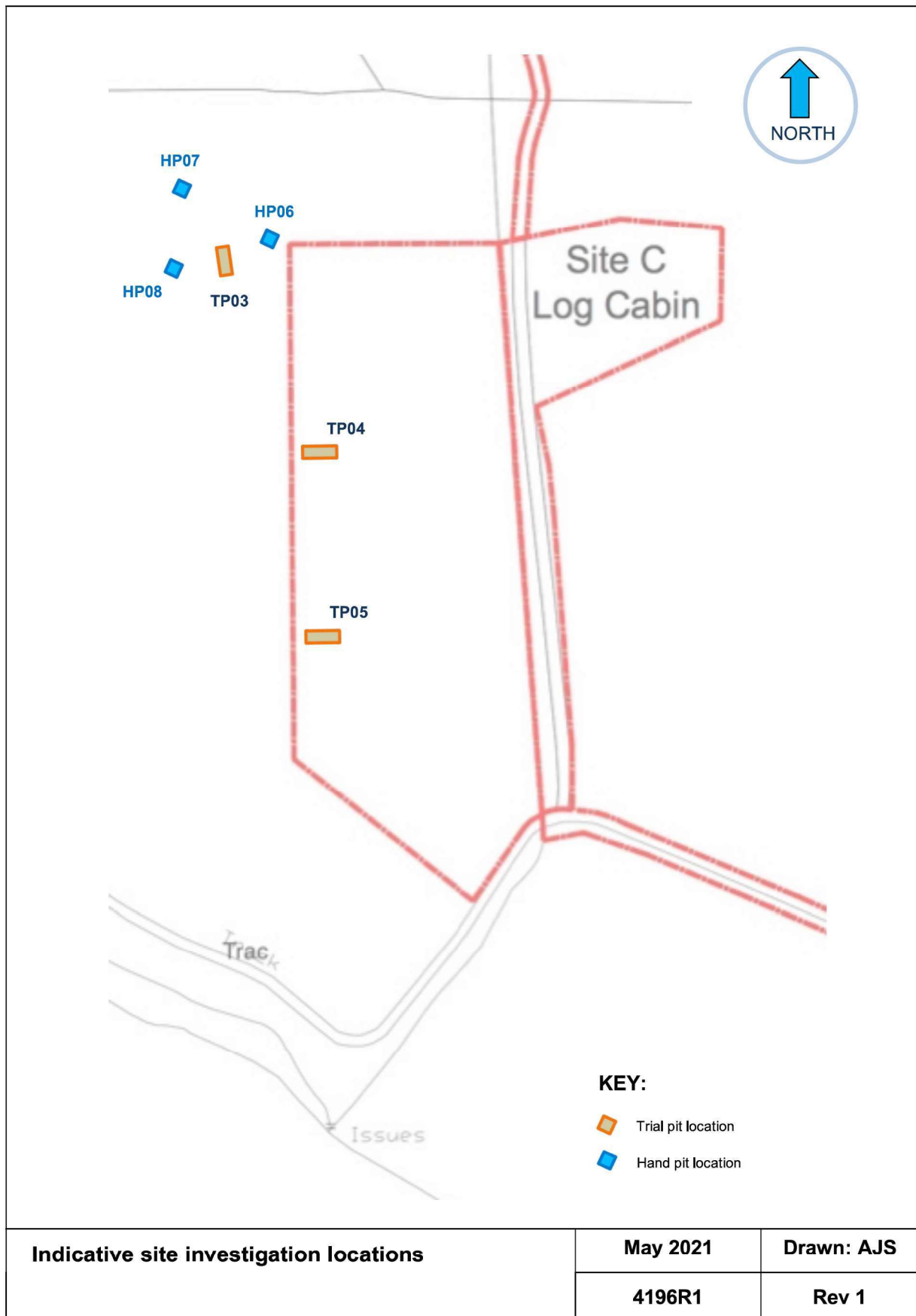
Element of investigation	Details	Comments / rationale
<b>Site A</b>		
Mechanical trial pitting and infiltration testing	<p>Two trial pits (TP01 and TP02) were excavated at Site A using a 5 tonne tracked excavator.</p> <p>The pits were positioned in the north-west of Site A in the area of a possible soakaway feature provisionally identified by GeoSmart (see Figure 3.1).</p> <p>The pits were excavated to a depth of 2.0 m bgl.</p> <p>All excavated materials were logged by an experienced site supervisor (see Appendix B).</p> <p>Infiltration testing was carried out in accordance with BRE digest 365: Soakaway Design (2016) at both trial pits. IBCs containing clean water were used to inundate the open excavations. Water levels within each pit were monitored in accordance with BRE 365.</p>	<p>To assess the extent, thickness and composition of any Made Ground.</p> <p>To assess the composition of the natural superficial geology.</p> <p>To make a visual assessment of any ground contamination.</p> <p>To enable a representative infiltration rate to be calculated.</p>
Hand trial pitting and percolation testing	<p>Five hand pits (HP01 to HP05) were excavated at Site A using both a tracked excavator and hand tools. The excavator was used to remove the upper c. 0.3 m of ground material prior to the construction of a square hand pit of typical dimensions 0.3 m width; 0.3 m length; and 0.25 m to 0.3 m depth.</p> <p>Note: HP05 was excavated by hand tools to a depth of 0.3 m bgl (i.e., in order to explore the drainage properties of the upper soil layer, opposed to the underlying clayey deposits).</p> <p>The pits were located in and to the south of Site A (i.e., remote from the Dulas Brook), as advised by GeoSmart (see Figure 3.1).</p> <p>All excavated materials were logged by an experienced site supervisor (see Appendix C).</p> <p>Percolation testing was carried out in accordance with BS 6297:2007+A1:2008 in all hand pits.</p>	<p>To assess the extent, thickness and composition of any Made Ground.</p> <p>To assess the composition of the natural superficial geology.</p> <p>To make a visual assessment of any ground contamination.</p> <p>To enable a representative percolation value to be calculated.</p>
<b>Site B</b>		
Mechanical trial pitting and infiltration testing	<p>Three trial pits (TP03 to TP05) were excavated at Site B using a 5 tonne tracked excavator.</p> <p>TP03 was positioned to the north-west of Site B in an area identified by GeoSmart as the location for a possible foul water drainage field (i.e., TP03 was designed to explore ground conditions in the area</p>	<p>To assess the extent, thickness and composition of any Made Ground.</p> <p>To assess the composition of the natural superficial geology.</p> <p>To make a visual assessment of any ground contamination.</p>

Element of investigation	Details	Comments / rationale
	<p>of the drainage field in line with the methodology advocated by BS 6297:2007+A1:2008).</p> <p>TP04 and TP05 were positioned along the western boundary of Site B along the line of a possible soakaway feature provisionally identified by GeoSmart (see Figure 3.2).</p> <p>The pits were excavated to depths of between 1.55 m and 1.6 m bgl.</p> <p>All excavated materials were logged by an experienced site supervisor (see Appendix B).</p> <p>Infiltration testing was carried out in accordance with BRE digest 365: Soakaway Design (2016) at trial pits TP04 and TP05. IBCs containing clean water were used to inundate the open excavations. Water levels within each pit were monitored in accordance with BRE 365.</p>	<p>To enable a representative infiltration rate to be calculated.</p>
Hand trial pitting and percolation testing	<p>Three hand pits (HP06 to HP08) were excavated at Site B using both a tracked excavator and hand tools. The excavator was used to remove the upper c. 0.3 m of ground material prior to the construction of a square hand pit of dimensions 0.3 m width; 0.3 m length; and 0.3 m depth.</p> <p>The pits were located to the north-west of Site B in an area identified by GeoSmart as the location for a possible foul water drainage field (see Figure 3.2).</p> <p>All excavated materials were logged by an experienced site supervisor (see Appendix C).</p> <p>Percolation testing was carried out in accordance with BS 6297:2007+A1:2008 in all hand pits.</p>	<p>To assess the extent, thickness and composition of any Made Ground.</p> <p>To assess the composition of the natural superficial geology.</p> <p>To make a visual assessment of any ground contamination.</p> <p>To enable a representative percolation value to be calculated.</p>

Figure 3.1 Site investigation location plan: Site A



**Figure 3.2 Site investigation location plan: Site B**





## 4 SITE INVESTIGATION RESULTS

### 4.1 Encountered ground conditions

#### **Site A**

The sequence of strata encountered within each of the trial pits is described in full in Appendix B and summarised below.

- Grey-brown slightly gravelly clay was encountered to depths of between 0.7 m and 1.6 m bgl within the mechanically excavated pits (TP01 and TP02). These cohesive deposits were underlain by apparent weathered mudstone (recovered as angular gravel and cobbles).
- An upper soil layer was observed in several of the hand pits, comprising mid-brown slightly gravelly clayey silt with roots and rootlets. This soil layer, which was more friable / aerated than the underlying clay horizon, was recorded in HP03 (to a depth of 0.4 m); HP04 (to 0.15 m) and HP05 (to 0.3 m+). The soil layer was underlain by firm to stiff brown to dark grey gravelly silty clay to depths of up to 0.65 m.

There was no obvious ingress of shallow groundwater into any of the Site A trial pits during the site works with the exception of HP01 (located on the lower terraced area in the west of Site A). A gradual water seepage was observed into HP01 prior to the commencement of percolation testing; c. 5 cm of water was recorded in base of the pit 20 minutes after excavation (prior to testing). Following the inundation of the hand pit for testing purposes the water level gradually rose above the top of the hand pit level (c. 3.5 cm above the starting level, 5 hours after the start of the percolation test).

#### **Site B**

The sequence of strata encountered within each of the trial pits is described in full in Appendix C and summarised below.

- The three mechanically excavated trial pits (TP03 to TP05) encountered a 0.15 m to 0.3 m thickness of brown silty clay with roots (soil layer) overlying firm to stiff grey-brown clay (0.25 m to 0.7 m thick) and firm to stiff brown gravelly clay (over 1.15 m thick).
- A mid brown slightly gravelly clayey silt (soil layer) was also observed at the three hand pits at thicknesses of between 0.05 m and 0.2 m. This was underlain by firm to stiff brown to grey clay.

There was no obvious ingress of shallow groundwater into any of the Site B trial pits during the site works.

### 4.2 Visual and olfactory evidence of ground contamination

The following site observations were recorded in relation to potential ground contamination:

- No man-made materials were observed within any of the trial pits.
- No staining, odours or other signs of ground contamination were recorded within any of the trial pits.

### 4.3 Infiltration test results (BRE 365)

A summary of the infiltration test results derived from Site A and Site B is presented in Table 4.1. The full test results are presented in Appendix B.

Table 4.1 indicates that all infiltration tests were unsuccessful with insufficient drainage observed in order to calculate representative infiltration rates.

**Table 4.1 Summary of infiltration test results**

Trial pit	Effective depth (m)	Infiltration rate (m/s)
<b>Site A</b>		
TP01	1.14 m	Test failed
TP02	0.79 m	Test failed
<b>Site B</b>		
TP04	1.13 m	Test failed
TP05	1.14 m	Test failed

Given the nature of the observed ground conditions and also the time taken for the initial testing, no repeat infiltration tests were undertaken.

#### 4.4 Percolation test results (BS 6297)

A summary of the percolation test results derived from Site A and Site B is presented in Table 4.2. The full test results are presented in Appendix C.

Table 4.2 indicates that all percolation tests were unsuccessful with insufficient drainage observed in order to calculate representative percolation values.

**Table 4.2 Summary of percolation test results**

Trial pit	Effective depth (m)	Percolation value (s/mm)
<b>Site A</b>		
HP01	0.3 m	Test failed
HP02	0.25 m	Test failed
HP03	0.25 m	Test failed
HP04	0.25 m	Test failed
HP05	0.3 m	Test failed
<b>Site B</b>		
HP06	0.3 m	Test failed
HP07	0.3 m	Test failed
HP08	0.3 m	Test failed

Given the nature of the observed ground conditions and also the time taken for the initial testing, no repeat percolation tests were undertaken.

#### 4.5 Other site observations

Salient observations made during the site investigation works included:

- No standing water was observed across the Site at the time of the infiltration testing. It is noted that no rainfall had occurred for several days prior to the site works. Light rain was observed for several hours at the start of the site investigations.
- A representative of the Site owner indicated that following heavy rainfall considerable ponding of water and overland run-off was evident at the Site. The near surface soils were also reported to become very 'sticky' following periods of rain (likely reflecting the high clay content).



- The exposed ground surface on the upper terraced area in the south-west of Site A was somewhat desiccated with numerous cracks evident at surface (see Photograph 7 in Appendix A).
- Several drainage rills were observed within the artificial slope engineered in the south-west of Site A (see Photograph 6 in Appendix A); this likely reflects the effects of previous rainfall run-off and may indicate the poor drainage characteristics of the local soils.

## 5 CONCLUSIONS

Infiltration testing was carried out within four trial pits located within two discrete areas of the Site (Site A and Site B). Inadequate drainage conditions were observed at all four locations. As such no infiltration rates have been derived.

Percolation testing was carried out within eight hand pits located within Site A and Site B. Inadequate drainage conditions were also observed at all of these locations. As such no percolation values have been derived.

## 6 REFERENCES

**BGS, 2021.** Geology of Britain Viewer. <https://www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/>. Accessed 1<sup>st</sup> May 2021.

**BRE, 2016.** BRE Digest 365. Soakaway design.

**British Standards Institute, 2008.** Code of practice for the design and installation of drainage fields for use in wastewater treatment. BS6297:2007+A1:2008.

# APPENDICES