

GEOTECHNICAL REPORT

Site Address:	Rear of Maple House, St James Court, Therfield, Hertfordshire. SG8 9FN
Report Date:	June 2024
Project No.:	18964
Prepared for:	Amie Donne & John King



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SUMMARY

ADDRESS: Warden Nursery, Newgatestreet Road, Goffs Oak, EN7 5RY

SOILS PROFILE

Location	MADE GROUND	DEPTH	NATURAL GROUND	DEPTH
WS2	Loose brown sandy clayey TOPSOIL	0.20m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+
	Compact reworked aggregate FILL brick and concrete rubble with silty sandy clay	0.80m		
WS3	Loose brown sandy clayey TOPSOIL	0.30m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+
	Soft brown clay FILL with rare flint gravel and fine brick fragments	0.50m		
WS4	Loose brown sandy clayey TOPSOIL	0.30m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+
	Soft brown clay FILL with rare flint gravel and fine brick fragments	0.50m		
WS5	Loose brown sandy clayey TOPSOIL	0.30m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+
	Soft brown clay FILL with rare flint gravel and fine brick fragments	0.60m		
WS6	Loose brown sandy clayey TOPSOIL	0.10m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+
	Soft brown clay FILL with rare flint gravel and fine brick fragments	0.50m		

ROOT SYSTEM OVERVIEW

Location	Depth Recorded	Identification (If completed)
WS2	0.30m	
WS3	1.50m	
WS4	1.50m	
WS5	1.20m	
WS6	0.70m	

GROUNDWATER OVERVIEW

Location	Depth Water Struck	Depth of Standing Water	Rate of Inflow
WS2	NONE		
WS3	NONE		
WS4	NONE		
WS5	NONE		
WS6	NONE		

SOIL ANALYSIS: Cohesive Soils

Strength:	Hand Penetrometer tests 150+ kN/m²
Casagrande Plasticity Classification:	Intermediate to High
Plasticity Index:	16-29 %
NHBC Shrinkability Classification:	Medium
Significant Desiccation:	Significant desiccation between 1.00-1.50 meters in WS2
Sulphate Content:	DS-1/AC-1s

No granular soils were encountered upon the site.

1. Introduction

- 1.1 All site investigation works have been undertaken in accordance with BS5930:2015+A1:2020, (Code of Practice for Ground Investigations).
- 1.2 In accordance with your instructions, we visited the above site on the 28th May 2024.
- 1.3 The comments and opinions expressed are based purely on the soil and groundwater conditions identified within this report and the subsequent laboratory testing.
- 1.4 Some special condition may be present on site that, to date, has not been encountered within the scope of the site investigation works completed and therefore may not have been considered within the report. The findings of this report are based on the soil and groundwater sampling completed at the locations tested.
- 1.5 Unless otherwise stated, all groundwater recordings relate to short term observations and do not consider fluctuations in elevation due to seasonal, tidal, or other effects. It is possible that fluctuations in the groundwater elevation may have an impact on the proposed design and as such, it is recommended that long term monitoring is undertaken to obtain accurate information relevant to the proposed design in terms of the ground water elevation.

2. Description of Site

- 2.1 The site is formed by an existing yard which is associated with a farm storage barn. The site is essentially flat and laid to an aggregate within the main yard and grassed landscape to the remaining sections of the site. .
- 2.2 The site is surrounded by residential housing and some farm buildings as well as open land to the east and south.
- 2.3 The site is shown within the British Geological Survey Online Geology Viewer (Scale 1:50 000, Solid & Drift), which shows that the site situated with an area of Lowestoft Formation which in turn overlies London Clay Formation - Clay, Silt and Sand.

3. Fieldwork

- 3.1 In order to assess the site, the proposals have been made to assess both the shallow and deeper soils profiles to enable the design of potentially traditional foundations. To complete these works, the following site investigation works were implemented.
 - 5No Dynamic Competitor Rig boreholes were sunk to depths of ## meters - Date of Works – 28th May 2024.
 - Geotechnical Laboratory Testing – May & June 2024.
- 3.2 The location of these works is indicated on the site plan-forming Appendix 1.
- 3.3 The various strata encountered were noted and are recorded on the excavation logs forming Appendix 2.
- 3.4 Full ranges of samples were recovered as noted and retained for subsequent laboratory testing.

4. Laboratory Testing

- 4.1 Laboratory testing has been undertaken in accordance with BS 1377-2:2022, (Methods for Tests for Soils for Civil Engineering Purposes), the results of which are enclosed.

- 4.2 Selected samples were recovered to determine their Atterberg Limits, Hand Penetrometer Testing, Soluble Sulphate value and pH.
- 4.3 The results of this laboratory testing are enclosed and form Appendix 3.

5. Fieldwork Results

- 5.1 Based on the borehole logs which can be found forming Appendix 2 a reviewed of the geology within the site is as follows:-

Table 1 Geological Profile

Location	MADE GROUND	DEPTH	NATURAL GROUND	DEPTH
WS2	Loose brown sandy clayey TOPSOIL	0.20m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+
	Compact reworked aggregate FILL brick and concrete rubble with silty sandy clay	0.80m		
WS3	Loose brown sandy clayey TOPSOIL	0.30m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+
	Soft brown clay FILL with rare flint gravel and fine brick fragments	0.50m		
WS4	Loose brown sandy clayey TOPSOIL	0.30m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+
	Soft brown clay FILL with rare flint gravel and fine brick fragments	0.50m		
WS5	Loose brown sandy clayey TOPSOIL	0.30m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+
	Soft brown clay FILL with rare flint gravel and fine brick fragments	0.60m		
WS6	Loose brown sandy clayey TOPSOIL	0.10m	Stiff orange brown CLAY with fine to medium chalk fragment	3.00m+

Table 2 Groundwater Overview

Location	Depth Water Struck	Depth of Standing Water	Rate of Inflow
WS2	NONE		
WS3	NONE		
WS4	NONE		
WS5	NONE		
WS6	NONE		

- 5.2 Groundwater records, unless otherwise stated, are based on short-term observations, and do not allow for or consider seasonal or other fluctuations, global warming, or periods of excessive wet or dry weather. All groundwater records are noted at the time of the drilling works and any other subsequent groundwater readings taken which, if present, are shown. Should the development be reliant on groundwater impacting on either below ground excavations, basements or short- or long-term excavations, HESI would recommend the installation of standpipes to depths relevant to any proposed excavation works and a period of either short- or long-term monitoring. This can be completed on request.
- 5.3 Roots were encountered within the boreholes based on examination of the soil samples across the site as shown below and recorded within the attached sample logs in Appendix 2.

Table 3 Root Depths

Location	Depth Water Struck	Depth of Standing Water	Rate of Inflow
WS2	NONE		
WS3	NONE		
WS4	NONE		
WS5	NONE		
WS6	NONE		

6. Results

- 6.1 By inspection of the borehole logs and from a visual assessment of the samples recovered, a scheme of laboratory testing has been undertaken. The results are enclosed within Appendix 3 and prove the following:
- 6.2 Hand Penetrometer tests have been undertaken disturbed samples recovered from the site works. From the information gathered, it is recorded that cohesion values of between 150+ kN/m² were achieved.
- 6.3 Atterberg Limits tests proved the clay soils to be of Intermediate to High plasticity, (PI= 16-29 %), which indicates a medium susceptibility to movement associated with moisture content change.
- 6.4 A measurement of the potential desiccation has been completed using Driscoll's Method of Desiccation Analysis which uses a comparison of moisture content profiles measures against the liquid limit measured in the Atterberg Limits test. This makes an assumption as to the state of the soil moisture content against the state of the soil in its liquid state to assess desiccation. Driscoll makes a comparison that the soils would likely be in a state of slight desiccation if the moisture content of the soil was less than 0.5 multiplied by the liquid limit state of the soil, (slight desiccation being a level of desiccation at which overburden pressure may influence), and significant desiccation if the moisture content of the soil was less than 0.4 multiplied by the liquid limit, (significant desiccation being a level which would be un-natural to reduce to and therefore influenced by surrounding trees or vegetation). This is a mathematical representation of the state of the clay and does not consider overburden pressure which may form a factor in this calculation.
- 6.5 If the state of desiccation is a driving factor to consider foundation design, HESI would recommend the use of soil suction analysis utilising a control borehole as a comparison against desiccation levels which will provide a more accurate depiction of tree influence at that time.
- 6.6 Utilizing Driscoll's method of assessment, significant desiccation is identified at depths of between 1.00-1.50 meters in WS2 which would indicate that the underlying clay soils have been impacted on by the presence of the surrounding trees and vegetation to such an extent as to excessively dry out the soil. The materials identified as Significantly desiccated are not suitable for founding on and as such, would suggest that foundations must as a simple rule of thumb, extend to depths more than 1.50m meters.

7. Conclusion

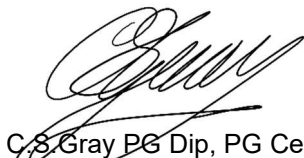
- 7.1 Any new foundations should be seated at a depth of as a minimum, 0.90 meters below the site level to overcome the impact of weathering. In order for foundations to be seated in materials suitable for the proposed foundations, factors will influence the design which are as follows, (although, this list is not exhaustive) :-

- Any new foundations should be seated in a uniform geotechnical material with regards possible volume change, future movements and differential settlements, where seated on variable soils.
 - Depth of made ground.
 - Allowable bearing capacity.
 - The proposed development.
 - Groundwater.
 - Trees.
 - Topography, and
 - Solution Features.
- 7.2 Any new foundations should be taken to depths in excess of the influence of any surrounding trees or vegetation, (recently removed, existing or proposed). An assessment has been recorded as to the depth of the existing root system within the site. This cannot be utilized across the site due to limited observations and as such, a guideline should be used to determine the depth of foundations required in order to overcome the influence of any surrounding vegetation.
- 7.3 Should trees be present on site, the influence of those trees needs to be considered. As such, we can confirm the following :-
- *Any new foundations should be taken to depths more than the influence of any surrounding trees or vegetation, (recently removed, existing or proposed). An assessment has been recorded as to the depth of the existing root system within the soils profiles completed. This cannot be utilized across the site due to limited observations and as such, a guideline should be used to determine the depth of foundations required to overcome the influence of any surrounding vegetation.*
 - *As a result, we would suggest that any new foundations should be taken to a minimum depth of 0.90m. The use of NHBC Chapter 4.2, (Building Near Trees), should be incorporated in the design of any foundations, which dictates species, clay type and, ultimately, foundation depth. This is only a guideline that should be implemented as a method of costing the substructure within the development. The depth of any root systems within the subsoil will dictate the actual in-situ depth of any foundations across the site. It is envisaged that NHBC Chapter 4.2 will provide a reasonable assessment of actual foundation depths.*
 - *Where trees are to be removed or have recently been removed from the site to provide new landscaping or to enable the development to take place, the existing height of the trees and vegetation to be/or that has been removed should be used in assessing the proposed foundation depths local to those specific trees.*
 - *Where trees are to remain and will undergo some degree of growth to reach maturity, the mature height of the tree should be used within NHBC Chapter 4.20m.*
 - *Strip foundations will vary in depth dependent upon the distance of the foundation from the trees within the area, (closer to the trees will increase foundation depth). This may also increase foundation depths to depths more than depths identified within this report. All foundations should be designed in accordance with the comments made above.*
- 7.4 For the soils to be suitable for use as a founding material, the following must be in place.
- NHBC Design guides as detailed above must be completed,
 - An assessment of the load bearing capacity of the soil should be made in comparison with a structural engineer's report in relation to loading of the proposed structure,
 - Any physical excavations should be undertaken under a watching brief to ensure no tree roots, variable ground or soft spots are in place,

- Any new foundations must exceed FILL or reworked ground and below existing features such as old foundations.
- 7.5 Based on the geology identified at the site, it is recorded that the upper soils have been adversely affected by surrounding trees and vegetation to such an extent as to over dry the soils to depth. This factor alone would suggest that any new foundations should be taken to depths in excess of the influence of trees or surrounding vegetation, beyond any significant desiccation as identified within this report and to depths where the allowable bearing capacity of the soils is suitably strong to support the loadings of the proposed structure, (soils profile strengths are shown in Appendix 3)
- 7.6 Considering the presence of significant desiccation and likely increased depths of tree influence based on highly shrinkable clay, (identified to a depth of 1.50 meters in WS2), we would suggest that a system of deep strip foundations would form the optimum foundation solution for the site.
- 7.7 Strip foundations will vary in depth dependent upon distance from the trees within the area, (closer to the trees will increase foundation depth). This may also increase foundation depths to depths in excess of 1.50 metres identified within this report. All foundations should be design in accordance with the comments made above.
- 7.8 Protection against heave and shrinkage should be included in any design in accordance with NHBC Chapter 4.2, (Building Near Trees) and include in any pile and also ground beam design.
- 7.9 A suspended floor should be included in any design guide where foundation depths exceed 1.50 meters due to the influence of trees or where made ground or compressible soil is in place to depths in excess of 0.60 meters unless it can be proven that these made ground is of a uniform density and consistency across the build.
- 7.10 All foundations should be designed by a suitably qualified structural engineer in terms of the proposed project and all aspects of the ground, groundwater, loadings of the proposed structure etc. Should any elements of this report be unclear, consultation with ourselves should be sought to clarify any elements prior to a final design being made. The final decision in terms of foundation options should be made by a structural engineer with full working knowledge of the site and site conditions.

I hope the foregoing is sufficient for your requirements, although please do not hesitate to contact us should require any further information regarding the above.

Yours Faithfully



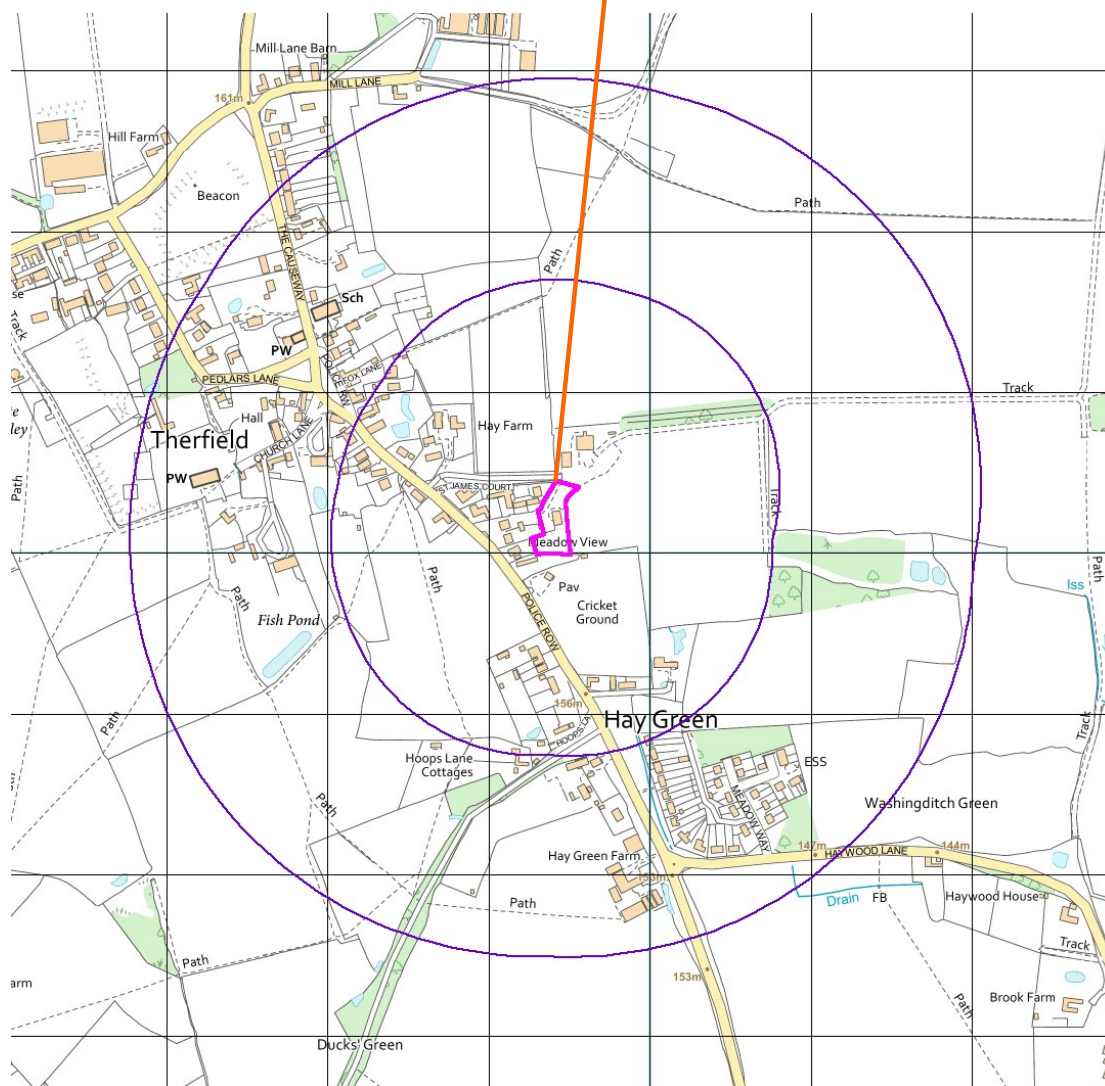
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Managing Director

Maple House, St James Court, Therfield, Hertfordshire. SG8 9FN

Location Plan

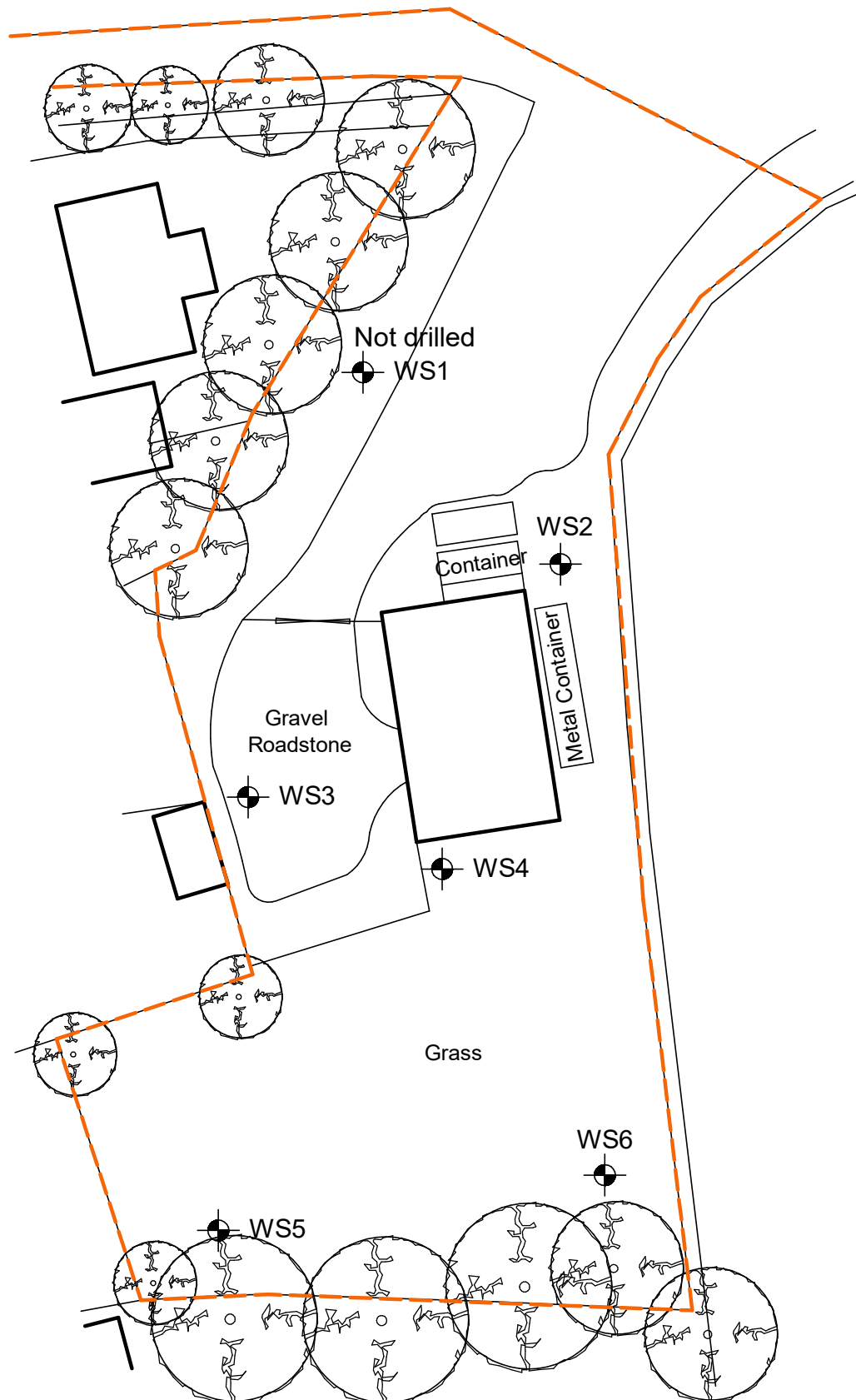


Site Plan



Maple House, St James Court, Therfield, Hertfordshire. SG8 9FN

Existing Site Plan



Not to Scale
Sketch No. : GEO / 18964 / 01 / 02

Maple House, St James Court, Therfield, Hertfordshire SG8 9FN

Window Sample Two

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
					No	Type	Depth (m)				
Loose brown sandy clayey TOPSOIL		0.20	0.20	DRY	1	U	GL - 1.00				
Compact reworked aggregate FILL brick and concrete rubble with silty sandy clay			0.60								
		0.80									
Stiff orange brown CLAY with fine to medium chalk fragment					2	U	1.00-2.00				1.00
			2.20		3	U	2.00 - 3.00				
Roots to 0.30m Borehole Complete at 3.00m		3.00									

Remarks

Key : U - Undisturbed Sample
(100mm diameter)

B - Bulk Sample
▼ - Water Struck

D - Disturbed Sample
≡ - Water Standing

W - Water Sample
T - Chemical Tub

N - SPT N-Value
V - Vane Test, (kN.m²)

Maple House, St James Court, Therfield, Hertfordshire SG8 9FN

Window Sample Three

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
					No	Type	Depth (m)				
Loose brown sandy clayey TOPSOIL		0.30	0.30	DRY	1	U	GL - 1.00				
Soft brown clay FILL with rare flint gravel and fine brick fragments		0.50	0.20								
Stiff orange brown CLAY with fine to medium chalk fragment											
					2	U	1.00-2.00				1.00
			2.50		3	U	2.00 - 3.00				
Loose band of SAND/SILTS from 2.40-2.60m											
Roots to 1.50m Borehole Complete at 3.00m		3.00									

Remarks

Key : U - Undisturbed Sample
(100mm diameter)

B - Bulk Sample
▼ - Water Struck

D - Disturbed Sample
≡ - Water Standing

W - Water Sample
T - Chemical Tub

N - SPT N-Value
V - Vane Test, (kN.m²)

Maple House, St James Court, Therfield, Hertfordshire SG8 9FN

Window Sample Four

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
					No	Type	Depth (m)				
Loose brown sandy clayey TOPSOIL		0.30	0.30	DRY	1	U	GL - 1.00				
Soft brown clay FILL with rare flint gravel and fine brick fragments		0.50	0.20								
Stiff orange brown CLAY with fine to medium chalk fragment											
					2	U	1.00-2.00				1.00
			2.50		3	U	2.00 - 3.00				
Roots to 1.50m Borehole Complete at 3.00m		3.00									

Remarks

Key : U - Undisturbed Sample
(100mm diameter)

B - Bulk Sample
- Water Struck

D - Disturbed Sample
- Water Standing

W - Water Sample
T - Chemical Tub

N - SPT N-Value
V - Vane Test, (kN.m²)

Maple House, St James Court, Therfield, Hertfordshire SG8 9FN

Window Sample Five

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
					No	Type	Depth (m)				
Loose brown sandy clayey TOPSOIL		0.30	0.30	DRY	1	U	GL - 1.00				
Soft brown clay FILL with rare flint gravel and fine brick fragments		0.60	0.30								
Stiff orange brown CLAY with fine to medium chalk fragment			2.40		2	U	1.00-2.00				1.00
					3	U	2.00 - 3.00				
Roots to 1.20m Borehole Complete at 3.00m		3.00									

Remarks

Key : U - Undisturbed Sample
(100mm diameter)

B - Bulk Sample
☒ - Water Struck

D - Disturbed Sample
☒ - Water Standing

W - Water Sample
T - Chemical Tub

N - SPT N-Value
V - Vane Test, (kN.m²)

Maple House, St James Court, Therfield, Hertfordshire SG8 9FN

Window Sample Six

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples			S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
					No	Type	Depth (m)				
Loose brown sandy clayey TOPSOIL		0.10	0.10	DRY	1	U	GL - 1.00				
Soft brown clay FILL with rare flint gravel and fine brick fragments			0.40								
		0.50									
Stiff orange brown CLAY with fine to medium chalk fragment											
					2	U	1.00-2.00				1.00
			2.50		3	U	2.00 - 3.00				
Roots to 0.70m Borehole Complete at 3.00m		3.00									

Remarks

Key : U - Undisturbed Sample
(100mm diameter)

B - Bulk Sample
 - Water Struck

D - Disturbed Sample
 - Water Standing

W - Water Sample
T - Chemical Tub

N - SPT N-Value
V - Vane Test, (kN.m²)



HESI

Herts & Essex Site
Investigations

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Geotechnical Assessments | Environmental Assessments | Desktop Studies | Contamination Analysis

APPENDIX

SHEET

JOB NUMBER

DATE

3

1

18964

May-24

LOCATION Maple House, St James Court, Therfield, Hertfordshire. SG8 9FN

HAND PENETROMETER STRENGTH TEST RESULTS

Excavation Location Number	Depth (m)	Sample	Natural Moisture Content (%)	Hand Penetrometer (Undrained)	Estimated Allowable Bearing Capacity (kN/m ²)	Notes
WS2	1.00	U	21	90	150+	
WS2	1.50	U	19	120	150+	
WS2	2.00	U	19	96	150+	
WS2	2.50	U	20	87	150+	
WS2	3.00	U	20	90	150+	
WS3	1.00	U	20	141	150+	
WS3	1.50	U	21	150+	150+	
WS3	2.00	U	20	135	150+	
WS3	2.50	U	23	105	150+	
WS3	3.00	U	22	93	150+	
WS4	1.00	U	20	150	150+	
WS4	1.50	U	20	150+	150+	
WS4	2.00	U	21	144	150+	
WS4	2.50	U	21	141	150+	
WS4	3.00	U	21	141	150+	
WS5	1.00	U	21	120	150+	
WS5	2.00	U	20	150+	150+	
WS5	3.00	U	23	120	150+	
WS6	1.00	U	21	150	150+	
WS6	2.00	U	20	150+	150+	
WS6	3.00	U	20	120	150+	

LOCATION Maple House, St James Court, Therfield, Hertfordshire. SG8 9FN

ATTERBERG LIMITS TEST DATA

Excavation Location Number	Depth (m)	Sample	Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Group Symbol	Ammended Plasticity Index (%)	Desiccation Profile	Percentage Retained on 425 Micron Sieve (%)
WS2	1.00	U	21	58	28	30	MH	29	Significant	4
WS2	1.50	U	19						Significant	
WS2	2.00	U	19						Slight	
WS2	2.50	U	20	40	16	24	CI	21	No	11
WS2	3.00	U	20						Slight	
WS3	1.00	U	20	41	21	20	MI	16	Slight	22
WS3	1.50	U	21						Slight	
WS3	2.00	U	20	41	21	20	MI	16	Slight	22
WS3	2.50	U	23						No	
WS3	3.00	U	22						No	
WS4	1.00	U	20						Slight	
WS4	1.50	U	20	44	20	24	MI	19	Slight	21
WS4	2.00	U	21						Slight	
WS4	2.50	U	21						Slight	
WS4	3.00	U	21	43	19	24	MI/CI	19	Slight	19

LOCATION Maple House, St James Court, Therfield, Hertfordshire. SG8 9FN

SULPHATE ANALYSIS

Excavation Location Number	Depth (m)	Sample	Concentrations of Soluble Sulphate			Classification	pH
			Soil		Groundwater		
			Total SO4 (%)	SO4 in 2:1 Water:soil (g/l)			
WS2	1.00	U		0.27		DS-1 / AC-1s	7.59
WS3	2.00	U		0.30		DS-1 / AC-1s	7.67
WS4	3.00	U		0.36		DS-1 / AC-1s	7.82