



GEOTECHNICAL
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Geo-environmental Assessment

Richborough Estates

Station Road, Market Bosworth.

30th September 2021

Ref: PJSG20-21-RT-02

Executive Summary

Environmental Risk Assessment Summary

Human Health Risk Assessment	The ICSM identified the potential for localised PCB contamination to present on the west of the site associated with adjacent ESS. However, due to the risk associated with recovering samples near to electricity cables and also potentially damaging a mains sewer identified within the vicinity, no assessment of the underlying soils for the presence of PCBs has been undertaken. Whilst we consider the risk to the site from PCBs to be low, should the area become accessible (mains cables re-routed / sewer redirected) assessment of the underlying soils in the vicinity of the sub-station should be undertaken to assess for the presence of PCBs. Based on the contamination testing that has been carried out on the remainder of the site, the risk assessment has indicated that the site poses a negligible risk to Human Health receptors. The natural topsoil and subsoils are considered to be suitable for retention / re-use on site if geo-technically suitable, subject to compliance with a Materials Management Plan (MMP).
Controlled Waters Risk Assessment	The site is considered to be located in an area of low sensitivity in regard to the risk groundwater due to the absence of a sensitive potable groundwater supply. No significant on-site or off-site surface water receptors such as rivers or streams have been identified, except for an existing on-site pond. During the investigation, no significant evidence of contamination was identified below the site and no evidence of Made Ground was identified. The risk to groundwater / surface water associated with the site is considered very low to negligible and no further risk assessment considered to be warranted in that regard.
Ground Gas / Vapour Risk	Based on the gas monitoring undertaken to date, gas protection measures are not considered to be required for the site. Further monitoring may however be required prior to development. The requirement for further monitoring should be confirmed with the Local Authority. No evidence vapours have been identified on site; no further assessment or mitigation is therefore required in that regard.
Ecological Risk	Potential Impacts from contamination sources is considered negligible. However, the impact to ecological receptors from proposed construction activities should always be considered.

Geotechnical Assessment Summary

Ground Conditions Summary	Firm to stiff clays of the Bosworth Clay Member were encountered across the site proven to depths >3.20m below ground level. Glaciofluvial Deposits were encountered at two locations at shallow depths on site (< 1.0m). Bedrock geology (Gunthorpe Member) was not encountered in any location across site.
Foundations	Traditional strip / trenchfill foundations are generally considered appropriate for most of the proposed development bearing within the firm to stiff cohesive deposits encountered below the site, subject to consideration of the loads imposed. Piled foundations may be required, should ground levels be significantly raised.



<i>Floor Slabs</i>	Suspended floor slabs and beam and block floor construction is likely to be the most viable floor slab construction types. Beam and block floor slabs are recommended in areas of tree influence.
<i>Drainage</i>	Due to the presence of cohesive deposits predominantly encountered site wide, soakaways are not considered to be feasible for surface water drainage; an alternative drainage solution is therefore likely to be required. The advice of a drainage engineer should be sought to confirm this preliminary assessment prior to construction.
<i>Concrete</i>	Design Sulphate Class DS-3 and Aggressive Chemical Environment for Concrete Class AC-3 should be used for design purposes.
<i>Roads & Hardstanding</i>	A preliminary CBR design value of >3% should be achieved for road construction design purposes for the near surface cohesive Bosworth Clay Member deposits underlying the site.
Recommendations	
Further in-situ CBR testing is recommended at formation level once development proposals have been established.	
Assessment of the underlying soils in the vicinity of the sub-station should be undertaken to assess for the presence of PCBs.	



Document Issue Record

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Status	Revision	Date of Issue	Author	Checked	Approved	
Draft	-	30/09/21	Nicholas Brown MSc AMIEEnvSc	Adrian McVey (BSc Hons)	Martin Parker BSc (Hons) ICIOB	
						

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Drawings

PJSG20-21-DR-001 –Site Location Plan
PJSG20-21-DR-002A – Exploratory Hole Location Plan
30452_6 Proposed Illustrative Master Plan - SITE A 121119- Development Layout Plan



1. Introduction

1.1 Instruction

In August 2021, PJS Geotechnical Engineers Limited (PJSG) were instructed by Richborough Estates (the Client) to undertake a Geo-environmental Assessment at land off Station Road, Market Bosworth, Leicestershire (the site).

A site location plan (PJSG20-21-DR-001) is included within the drawings section of this report.

1.2 Proposed Development

Redevelopment proposals for the site are understood to comprise a residential development with gardens and areas of soft landscaping used as Public Open Space (POS).

A development layout plan (30452_6) has been provided by the client and is presented within the Drawings Section.

1.3 Objectives

The objectives of this assessment are detailed below:

Table 1-1 Objectives

Objectives
Confirm the suitability of the site for the proposed residential development, taking into account the ground conditions and contaminative status of the site.
Undertake a generic quantitative risk assessment to confirm the findings of the Initial Conceptual Site Model (ICSM).
Determine the ground gas regime beneath the site.
Revision and update of the ICSM.
Identify suitable foundation depths and sub-structure design solutions.
Identify any potential geo-environmental issues that may cause abnormal development costs.
Make recommendations for any further investigation / remediation deemed necessary.

1.4 Previous Reports

The table below provides details of the relevant information sources which have been made available to PJSG for review in preparation of this report:

Table 1-2 Information Sources

Report Reference	Produced By	Report Name	Date	Comments
PJSG20-21-R01	PJSG	Desk Study Report	10 June 2020	-



2. The Site

This section provides a brief overview of the site in its present condition, including the site's existing layout, general location and near surrounding land use.

A brief summary of the site's description is presented below in Table 2-1. The full details of the site are presented in the Phase 1 Desk Study Report referenced in Table 1-2. A site location plan is presented in the drawings section of this report.

Table 2-1 Summary of Site Information

Specifics	Details
<i>Location</i>	Land off Station Road, Market Bosworth, CV13 0PG.
<i>National Grid Reference</i>	439605E, 303226N.
<i>Approximate Site Area</i>	4.2 Hectares (Ha)
<i>Topography</i>	General flat with an incline in the eastern portion of the site.
<i>Current Land Use</i>	Agricultural grazing land. Cattle were present on the eastern site area at the time of the walkover.
<i>Existing Buildings / Retaining Structures</i>	None present.
<i>Services / Utilities</i>	Overhead cables are present on Station Road, which appear to cease at the top of the access road off Station Road.
<i>Identified Potential Contamination Sources from Reconnaissance</i>	No significant sources were identified during site reconnaissance as detailed in the Phase 1 desktop report. However, reconnaissance undertaken during the ground investigation has identified an ESS to be present on the west boundary of the site.
<i>Vegetation / Invasive Plants</i>	Assessment of invasive plant species is beyond the scope of this report.
<i>Site Boundaries</i>	The site is bounded by mature trees and hedgerows on the north, east and west. The site is bounded to the south by a wooden post and rail fence.
<i>Surrounding Land Use</i>	North – Former Golf Course East – Woodland / Residential South – Residential / Commercial West – Residential
<i>Surface Water Features (Site & Vicinity)</i>	A pond is located in the western portion of the site.



3. Site Setting

3.1 Summary of Desk Study Information

The desk study report (referenced in Table 1-2) has been reviewed to provide a summary of the sites setting as detailed in Table 3-1 below.

Table 3-1 Summary of Site Information

Historical Summary	
<i>Site</i>	The land use of the site has generally remained agricultural since the start of historical records (pre-1900) to the present day. A small-scale ground working was indicated on pre-1900 records in the eastern portion of the site; no evidence of this feature was noted during the site walkover. A pond was shown to be present in the western portion of the site from the start of historical records up until the present day. This has been confirmed to be present during the current investigation. An electricity sub-station (ESS) was located on the west boundary by 1969, which remains present. A second ESS is located to the south east within the residential properties across Station Road.
<i>Surrounding area</i>	Potential historical industrial contaminative land uses in the surrounding areas has comprised: • A gas works was present ~150m west from 1885 until ~1950. • A train station and railway lines were present ~150m south from 1885 until 1966. • Brickworks ~200m south-west from 1885 until ~1950. • Timber treatment factory ~150m west from 1990 until ~2000. • A council depot and works adjacent south between 1969 and 1990. • Industrial estate has replaced the depot to the south present from 1994 to the present day. • A garage was present ~85m west up until 1985.
Geological Summary	
<i>Made Ground</i>	None recorded.
<i>Superficial Geology</i>	Bosworth Clay Member (clay & silt) are recorded in the western portion of the site. Glaciofluvial Deposits (Sand & Gravel) are recorded in the eastern portion of the site.
<i>Bedrock Geology</i>	Gunthorpe Member (Mudstone).
<i>Faults</i>	None recorded.
Hydrogeology	
<i>Aquifers</i>	Secondary A (Bosworth Clay Member) Secondary Undifferentiated (Glaciofluvial Deposits) Secondary B (Gunthorpe Member)



<i>Source Protection Zones (SPZ)</i>	None recorded.
<i>Potable Abstractions</i>	None recorded.
<i>Groundwater Flow</i>	Groundwater is likely to flow towards the west.
Hydrology	
<i>Surface Water Features</i>	No rivers or streams recorded on site. On-site pond observed during reconnaissance.
<i>Surface water flow</i>	-

Mining & Ground Constraints

<i>Mining</i>	The site is at negligible risk from coal mining / non-coal mining.
<i>Potential for Natural Ground Subsidence</i>	- Compressible deposits –Moderate risk rating associated with the Bosworth Clay Member are recorded in western portion of the site. Compressibility and even settlement hazards are probably present. - Very low to negligible remaining ground stability hazard ratings have been identified on-site.
<i>Radon</i>	The site is not within a radon affected area as less than 1% of properties are above the action level. No radon protection measures are required.
<i>UXO</i>	A preliminary UXO report has been obtained which indicates a low risk level. No further assessment is considered necessary.

Environmental Records

<i>Regulatory Records</i>	None recorded.
<i>Landfills / waste sites</i>	An end-of-life (ELV) facility is located 63m south. No further permits and consents of concern to the site have been recorded.



4. Preliminary Contamination Risk Assessment

In accordance with CLR11, a preliminary risk assessment (PRA) was completed for the site as detailed in the Phase 1 Desk Study report referenced in Table 1-2. The PRA is the first tier of risk assessment that develops the initial conceptual site model (ICSM) to establish whether there are any potentially unacceptable risks associated with the site.

The ICSM was developed based on the commonly adopted source-pathway-receptor (S-P-R) model as detailed within ICRM 2020. This was carried out in the context of the proposed development and potential contaminant linkages which may represent a risk to identified receptors.

The ICSM contained within the Phase 1 Report has been reproduced and refined for the purpose of this assessment and is summarised in Table 4-3. A summary of the potential contamination sources identified is given in the table below.

4.1 Potential Sources of Contamination

Sources (S); These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g. fuel storage tanks). Sources relevant to the site identified within the ICSM are listed below:

The Phase 1 Desk Study report identified the following potential on-site and off-site sources (S) of contamination as detailed in Table 4-1.

Table 4-1 Potential Sources of Contamination

Source Number (S)	Potential Sources	Inorganic Contaminants	Organic Contaminants
S1	On-site: Possible areas of localised Made ground associated with unidentified ground workings and former structures (identified on historical mapping).	Common contaminants may include cadmium, chromium, copper, mercury, nickel, zinc, sulphate, sulphide, sulphur, pH, free cyanide and asbestos.	Depends on source of material; common contaminants may include PAHs.
S2	On-site: Natural Subsoils	Elevated sulphates	-
S3	On-site: Adjacent ESS to the west boundary.	n/a	Potential for oils which may contain PCBs.
S4	Off-Site: Multitude of historical industrial land uses located within ~250m of the site boundary. Potential for spills and leaks of fuels / oils / chemicals occurring.	Dissolved metals in groundwater.	Depends on source of contaminants may include PAHs, TPH & BTEX in groundwater.

The Desk Study report identified a pond located on site to be a possible contamination source. This has however been discounted as the pond still contains water and vegetation and has not been infilled.

4.2 Potential Sources of Ground Gas & Vapours

The Phase 1 Desk Study report identified the following potential sources of ground gas on site detailed in Table 4-2. No significant sources of ground gas were identified in the surrounding area. No potential sources of vapours were identified on site or the surrounding area.

Table 4-2 Potential Sources of Ground Gas & Vapours

Source Number (S)	Potential Sources	Details	Source Generation Potential (CIRIA C665)
S1	On-site: Localised areas of Made Ground associated with historical ground workings (identified on historical mapping).	Any Made Ground associated with the potential in-filled ground working in the eastern portion of the site may have the potential to act as a localised source of ground gas. Elevated concentrations of methane and carbon dioxide may be present. Low permeability clays will however limit the potential for ground gas migration from within any Made Ground.	Generally, very low and localised.

4.3 Potential Contaminant Linkages

In conclusion, it was considered that the site represents a Low Environmental Risk for future residential redevelopment from an environmental perspective.

Localised areas of contamination were considered possible to be present, most likely as a result for the potential for areas of Made Ground in the east of the site to be present underlying the area where former structures were present.

All plausible pathways (P) between the potential contaminant sources (S) and the receptors (R), i.e. S-P-R linkages, have been identified and are outlined in the ICSM presented in Table 4-3 overleaf using the information gathered within the Phase 1 Desk Study report.

Specific contaminants relevant to the identified source are listed in Table 4-1 and potential sources of ground gas are listed in Table 4-2 above.

Based on the identified sources of contamination and ground gas, the ICSM detailed in Table 4-3 (tabular form) provides details of the potential contaminant linkages that were identified during the PRA.

It was considered that the proposed development presented a **low to moderate** risk to Human Health and **very low** risk to Controlled Water receptors and recommended that a ground investigation be undertaken to quantify the contaminant linkages and identify appropriate mitigation measures should they be required.

Table 4-3 ICSM and Potential Contaminant Linkages

Contaminant Linkage	Source (S)	Pathway (P)	Receptor (R)	Probability	Consequence	Current Risk	Investigation
Human Health							
1	On Site: S1: Localised areas of Made Ground associated with historical ground workings and underlying former structure. S3: Electrical Sub-station. Off-Site S4: Adjacent off-site historical industrial land uses – Spills and leaks of fuels / oils occurring adjacent to site boundary impacting the site.	P1: Ingestion of contaminated particulates. P2: Dermal contact. P3: Inhalation of contaminated dust / particles.	R1: Site end users.	Low	Medium	Low / moderate	Site investigation recommended to establish current levels of contamination and risk.
2			R2: Construction workers / maintenance workers.	Low	Medium	Low / Moderate	Potential for localised boundary impact associated with the ESS on the west boundary and adjacent off-site industrial land uses.
3	On Site S1 & S3: as above.	P3: Inhalation of contaminated dust / particles.	R3: Members of the public and residential properties adjacent to the site during construction	Low	Medium	Low / Moderate	Dust suppression to be adopted during construction.
4	On Site	P8: Migration of asphyxiant and explosive/ harmful	R1: Site end users.	Low	Severe	Moderate	Site investigation & gas monitoring recommended to establish current risk across the site.
			R2: Construction workers /	Low	Severe	Moderate	

Contaminant Linkage	Source (S)	Pathway (P)	Receptor (R)	Probability	Consequence	Current Risk	Investigation
	S1: Ground gas arising from potential localised areas of Made Ground.	gasses into confined spaces.	maintenance workers in trenches.				Low level gas protection measure may be required.
Controlled Waters							
5	On Site S1 & S3.	P4: Leaching of contamination into groundwater.	R4: Secondary (A) / (B) Aquifer. R5: On-Site Pond	Unlikely	Mild	Very Low	Site investigation recommended to establish current levels of contamination and risk.
6		P5: Surface water on & off site via migration of contaminated groundwater and overland flow into surface water (run-off).		Unlikely	Mild	Very low	
7	Off-Site S4: Off-site historical industrial land uses – Spills and leaks of fuels / oils occurring impacting groundwater in the vicinity.	P5: Lateral migration of contaminated groundwater towards the site.	R4: Secondary (A) / (B) Aquifer under the site	Unlikely	Mild	Very Low	Site investigation recommended to establish current levels of contamination and risk. Groundwater likely to flow to the west; any potential source located west of the site is considered unlikely to impact the site.

Contaminant Linkage	Source (S)	Pathway (P)	Receptor (R)	Probability	Consequence	Current Risk	Investigation
Property and Infrastructure							
8	On Site S2 Natural subsoils with high sulphate concentrations.	P4: Leaching of sulphates, corrosive contaminants and / or acidic or alkaline leachate. P6: Direct contact with aggressive ground.	R6: Buried concrete & structures on-site and buried services.	Low	Mild	Low	Site investigation recommended to establish current levels of contamination.
Ecology							
9	On Site S1 & S3 detailed above	P7: Uptake of available phytotoxic contaminants via direct contact with contaminants.	R7: Ecological receptors Flora & Fauna on and off-site.	Low	Mild	Low	Site investigation recommended to establish current levels of contamination and risk.

5. Site Investigation

5.1 Summary of Site Works

The intrusive ground investigation works were undertaken on 4th August 2021 by PJSG to establish the ground conditions beneath the site.

The locations of the exploratory holes were positioned taking into consideration the proposed development. However, this involved working within the constraints of the site, which included access restrictions and sub-surface utilities which also run through the site. No intrusive investigation was undertaken along the road which runs centrally through the site. Additionally, no investigation works were carried out in the vicinity of the ESS on the west boundary due to the presence of a high voltage underground cable and mains sewer detected in the vicinity.

The ground investigation works were designed in general accordance with BS10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites'. Further details of the ground investigation work undertaken, including the rationale for the location of the exploratory holes are detailed below in Table 5-1.

An Exploratory Hole Location Plan (PJSG20-21-DR-002) is provided within the Drawings Section of this report.

Table 5-1 Summary of Site Investigation Works

Method / Activity	No.	Hole Reference	Depth Range (m)	Testing	Gas & Groundwater Ancillaries	Rationale
Investigation Method						
Window Sample Borehole (WS)	8	WS01 to WS08	3.0	*SPT's	WS01, WS02, WS04, WS05, WS07, WS08.	To determine ground conditions.
Machine Excavated Trial Pits (TP)	13	TP01 to TP13	3.00 - 3.20	Hand Shear Vanes (HSVs)	-	To determine ground conditions.
Dynamic Cone Penetration (DCP)	14	DCP01 to DCP14	-	-	-	To determine CBR %.
Gas & Groundwater Monitoring						
Gas data meter, flow meter and groundwater dip meter	1 visit	WS01, WS02, WS04, WS05, WS07, WS08.		-	See above	To determine the ground gas regime in accordance with CIRIA C665.

*SPTs undertaken in accordance with the guidance set out within BS EN 22476-3 2005 +A1:2011;

The exploratory logs are presented within Appendix A and the results of the SPT tests and HSVs are shown on the individual exploratory hole logs. The SPT hammer calibration certificate for the WS drilling rig is also included in Appendix A.

5.2 Laboratory Testing and Sampling

Representative soil samples of the various strata types present were collected during the site investigation works by a suitably qualified engineer. Samples were recovered using a stainless-steel trowel and disposable gloves.

Samples were stored in cooler boxes prior to being transported to an MCERTS accredited laboratory. A selection of these samples was tested for the presence of contaminants and for classification purposes. Chemical testing was undertaken by i2 Analytical Ltd and geotechnical testing was undertaken by Exploration & Testing Associates Ltd.

A summary of the laboratory testing carried out is presented below.

Table 5-2 Summary of Laboratory Testing

Quantity	Analysis
Chemical Testing - Soils	
10	PJS Contamination Suite comprising: Moisture content, pH, Organic matter, Speciated USEPA 16 PAHs, Metals: As, Cd, Cr III & VI, Cu, Pb, Hg, Ni, Se, Zn, Water soluble sulphate (SO ₄).
8	Asbestos Identification (ID).
3	BRE Suite D
Geotechnical Testing	
11	Moisture Content
11	Liquid and Plastic Limits
1	Particle Size Distribution

Geotechnical laboratory testing was generally carried out in accordance with the relevant part of BS1377: 1990, *Methods of Test for Soils for Civil Engineering Purposes*, or, where superseded, by the relevant part of BS EN ISO 17892:2014+ *Geotechnical investigation and testing – Laboratory Testing of Soil*.

The laboratory results are included within Appendix B and C of this report.



6. Ground Conditions

6.1 Summary of Ground Conditions

The geology encountered during the intrusive investigation was generally consistent with that anticipated from the desk study. A summary of the general strata encountered across the site is provided in the Table 6-1 below, with more detailed description given in the following sections and on the exploratory hole logs presented within Appendix A.

Table 6-1 Summary of Ground Conditions

Stratum Description	Depth to base of Strata (mbgl)	Strata Thickness (Range, m)
Topsoil	0.30	0.20 – 0.30
Bosworth Clay Member	3.20	0.30 – 3.20
Glaciofluvial Deposits	0.80	0.30 – 0.80
Gunthorpe Member	-	-

6.2 Summary of Geological Descriptions

The geology encountered below the site is described below.

Table 6-2 Geological Descriptions

Made Ground / Topsoil	Made Ground	None encountered on site.
	Topsoil	Encountered at all locations as either a clayey gravelly Topsoil or a sandy gravelly Topsoil.
Superficial Geology	Bosworth Clay Member	Encountered at all exploratory hole locations as a firm to stiff reddish brown / greyish brown slightly gravelly occasionally sandy clay in the upper horizons and comprising a stiff to very stiff grey / brownish grey mottled blue slightly gravelly clay with depth. Possible gypsum crystals and occasional fragments of lignite's and coal were also encountered within the strata at depth. The Bosworth clay was proven to a maximum depth of between 3.10m and 3.20m within all trial pit locations and 3.00m within all window sample locations.
Superficial Geology	Glaciofluvial Deposits	Encountered at 2 No. locations – within TP09 proven to 0.8m recovered as an orange brown very clayey sandy gravel and within WS08 proven to 0.5m recovered a light brown mottled orange gravelly sand.
Bedrock Geology	Gunthorpe Member	Not encountered at any exploratory hole location on site.



6.3 Summary of Field Observations

The following field observations were made during the intrusive investigation works.

Table 6-3 Field Observations

	Location Encountered	Observation	Depth Range (m)
Groundwater	WS08	Damp strata causing no recovery.	2.30m – 3.00m
Instability / Trench Collapse	-	Not observed	-
Running Sands	-	Not observed	-
Contamination	-	Not observed	-

6.4 Summary of SPT Testing within Boreholes.

A summary of the uncorrected SPT N Values recorded in the boreholes advanced across the site in relation to the Bosworth Clay geology is summarised below in Table 6-4.

Table 6-4 SPT Summary in relation to Ground Conditions

Borehole Ref:	SPT 'N' Value with Depth (m).		
	1m	2m	3m
WS01	13	23	50
WS02	13	27	50
WS03	17	22	50
WS04	14	26	50
WS05	19	23	50
WS06	15	25	50
WS07	17	27	50
WS08	17	32	50

SPTs were not undertaken in the bedrock geology comprising the Gunthorpe Member as this was not encountered in any exploratory hole location on site. Additionally, the localised Glaciofluvial Deposits encountered at TP09 and WS08 were encountered at shallow depths (proven to <1.0m in depth) which was above the required SPT test depth.

The implication of the low SPT N Values encountered is discussed further in Section 7.0. The recorded SPT N values are detailed on the exploratory hole logs presented within Appendix A.



6.5 Gas & Groundwater Monitoring

Gas and groundwater monitoring has been carried out on 1 No. monitoring visit on 13th August 2021.

A summary of the ground gas monitoring results obtained are displayed in the table below.

Table 6-5 Ground Gas Monitoring Summary

Ground Gas Monitoring Summary	Minimum	Maximum	Unit
Methane (CH₄)	< 0.1	< 0.1	% v/v
Carbon dioxide (CO₂)	0.2	1.9	% v/v
Oxygen (O)	18.9	20.4	% v/v
Carbon monoxide (CO)	0	0	ppm
Hydrogen sulphide (H₂S)	0	0	ppm
Atmospheric Pressure (mb)	1002	1004	mb
Flow Rates (m/s)	0	0	l/hr

A summary of the groundwater monitoring results obtained are displayed in the table below.

Table 6-6 Groundwater Monitoring Summary

Borehole Ref.	Depth bgl. (m)	Response Zone Flooded (Y/N)
WS01	2.81	N
WS02	Dry	N
WS04	Dry	N
WS05	Dry	N
WS07	Dry	N
WS08	Dry	N

The gas and groundwater monitoring results are contained within Appendix D.



7. Geotechnical Assessment

7.1 Introduction

Redevelopment proposals for the site are understood to comprise the construction of residential buildings with areas of hardstand and soft landscaping.

At this stage, a preliminary outline concept layout plan has been provided and is presented in the Drawings section of this report.

7.2 Material Properties

To assist with foundation design, in-situ testing and geotechnical classification testing has been undertaken on a selection of the soil samples recovered from site. The geotechnical properties of the soil types encountered across the site as summarised in the sections below.

Geotechnical analysis of the samples was carried out by Exploration & Testing Associates Ltd. Results are contained within the Appendix C.

7.3 Particle Size Distribution (PSD) Analysis

1 No. PSD analyses were undertaken on samples recovered from site to aid in the classification of soils. Classification was undertaken in accordance with BS1377: 1990 Part 2: Clause 9.2 and the results of the tests are summarised below:

Table 7-1 Summary of PSD Analysis

Sample Location	Depth (m)	Field Soil Description	Percentage Passing (%)			
			Very Coarse Soils (>63mm)	Gravel (63mm – 2mm)	Sand (2mm - 0.063mm)	Fines (<0.063mm)
TP09	0.50	Very clayey sandy GRAVEL.	0	35	38	27

The results of the PSD tests generally indicate that the deposits predominantly comprise granular material mostly consisting of gravels and sands with a significant portion of fines within the sample which generally confirms the field description.



7.4 Plasticity Index & Volume Change Potential

A total of 11 No. Plasticity Index (PI) tests were undertaken on soil samples in accordance with BS1377-2: 1990 Clause 3.2, to determine the Modified Volume Change Potential (VCP) in accordance with NHBC Standards (Chapter 4.2).

Results of the PI tests and the related VCP of the samples is summarised below.

Table 7-2 Summary of Plasticity Testing

Sample Location	Depth (m)	Strata	Plasticity Index (%)	Percentage Passing 425µm Sieve (%)	Modified Plasticity Index (%)	VCP
TP01	1.00	Bosworth Clay Member	54	100	54	High
TP01	2.00	Bosworth Clay Member	33	100	33	Medium
TP05	2.00	Bosworth Clay Member	34	99	34	Medium
TP06	0.80	Bosworth Clay Member	44	98	43	High
TP07	1.50	Bosworth Clay Member	37	100	37	Medium
TP11	1.80	Bosworth Clay Member	43	100	43	High
WS02	1.10	Bosworth Clay Member	40	100	40	High
WS05	2.70	Bosworth Clay Member	32	99	32	Medium
WS06	0.90	Bosworth Clay Member	40	100	40	High
WS07	1.10	Bosworth Clay Member	37	100	37	Medium
WS08	2.60	Bosworth Clay Member	5	100	5	Non-shrinkable

Geotechnical testing has determined the cohesive Bosworth Clay Member to range from medium to high VCP as indicated in the above table. Based on the results it is considered that high VCP should be assumed for foundation design purposes.

Where founding in high VCP deposits detailed foundation design will be required to determine the required founding level in accordance with NHBC Guidelines Chapter 4.2 – Building Near Trees. Heave precautions will also be required on the inside face of foundation trenches.



In accordance with NHBC standards, foundation depths should be a minimum of 1.00m below existing or reduced levels (where foundations are located outside the zone of influence of trees).

7.5 In-situ Standard Penetration Testing

Standard Penetration Tests were undertaken at regular intervals during drilling of the window sample boreholes and rotary borehole in accordance with the methodology outlined in British Standard BS EN 22476-3 2005.

The resulting N values have been converted into an N60 value in accordance with the British Standard, taking account of the energy ratio value of the SPT equipment.

A copy of the SPT calibration certificates for the window sample drilling rig is presented within Appendix A.

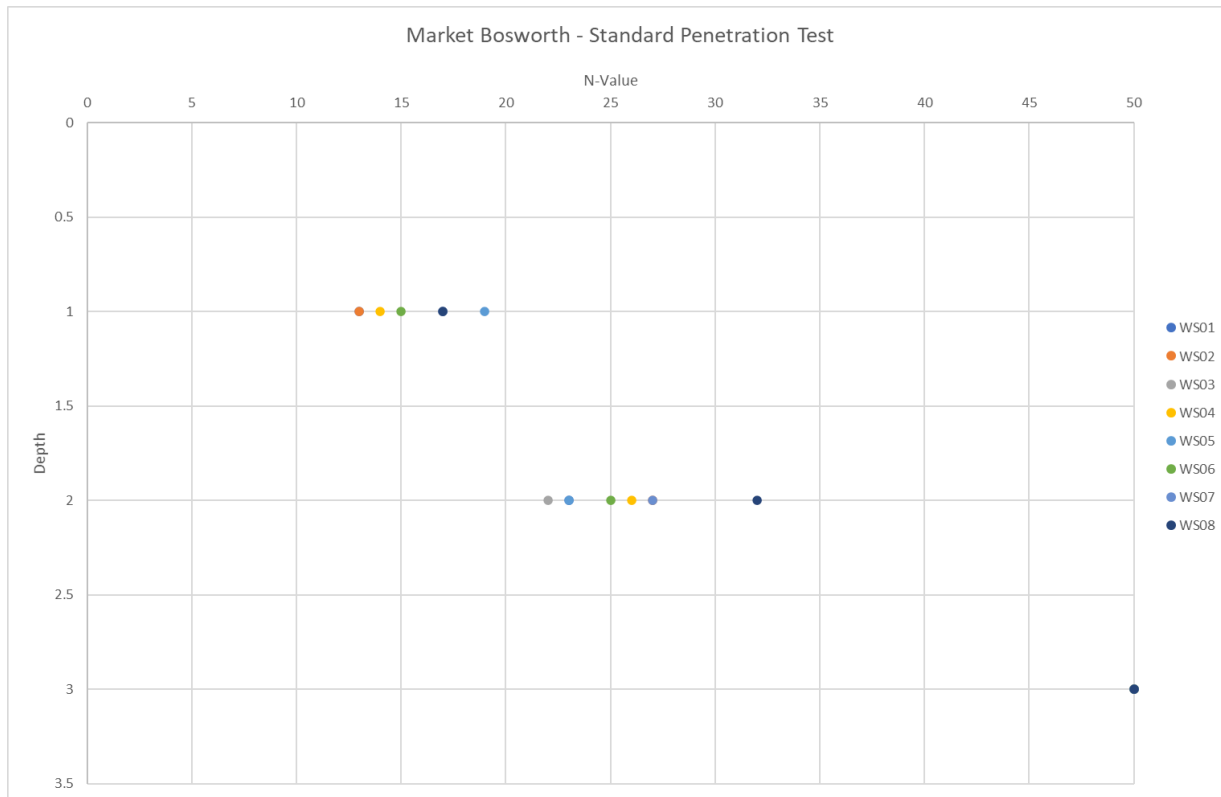


Figure 1 – Uncorrected SPT N Value with depth

Results of the SPT testing would indicate that the cohesive deposits generally comprise firm to stiff and very stiff strata noted to be increasing in strength with depth as shown in Figure 1.



7.6 Undrained Shear Strength

The undrained shear strength of the materials has been estimated from the SPT N Values by empirical correlation as described in CIRIA Report C143 (after Stroud and Butler, 1975):

$$c_u \approx N f_1 \text{ (kN/m}^2\text{)} \quad [1]$$

Where c_u is the undrained shear strength, N is the SPT N value and f_1 is an empirical correlation factor based on the soil plasticity index. The soil plasticity data obtained from soil samples recovered below the site during the investigation has been used. Based on the plasticity index testing carried out, the values in Table 7-3 have been assumed for the purpose of calculation.

Table 7-3 Calculated F1 Values

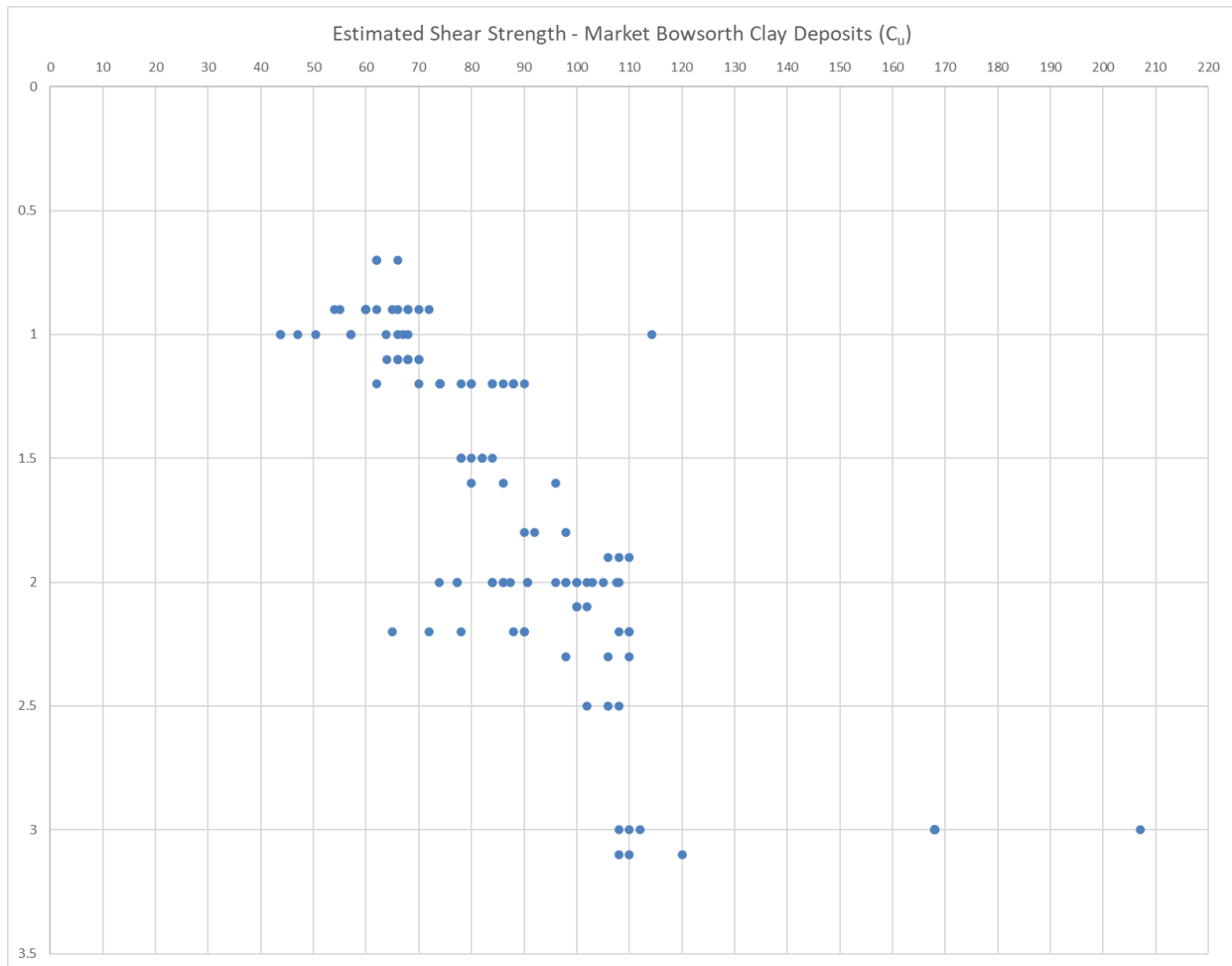
Strata	Average I'p	F ₁ Value
Bosworth Clay Member	36%	4.2

Calculated using corrected N60 value range of 10 – 50 the estimated undrained shear strength of the Bosworth Clay Member cohesive strata is between 42 kN/m² and 210 kN/m². It is noted to significantly increase in shear strength with depth.

Figure 2 presents a plot of the estimated undrained shear strength with depth beneath the site based on the soil plasticity testing as described above. The results show a clear trend of increasing shear strength with depth.



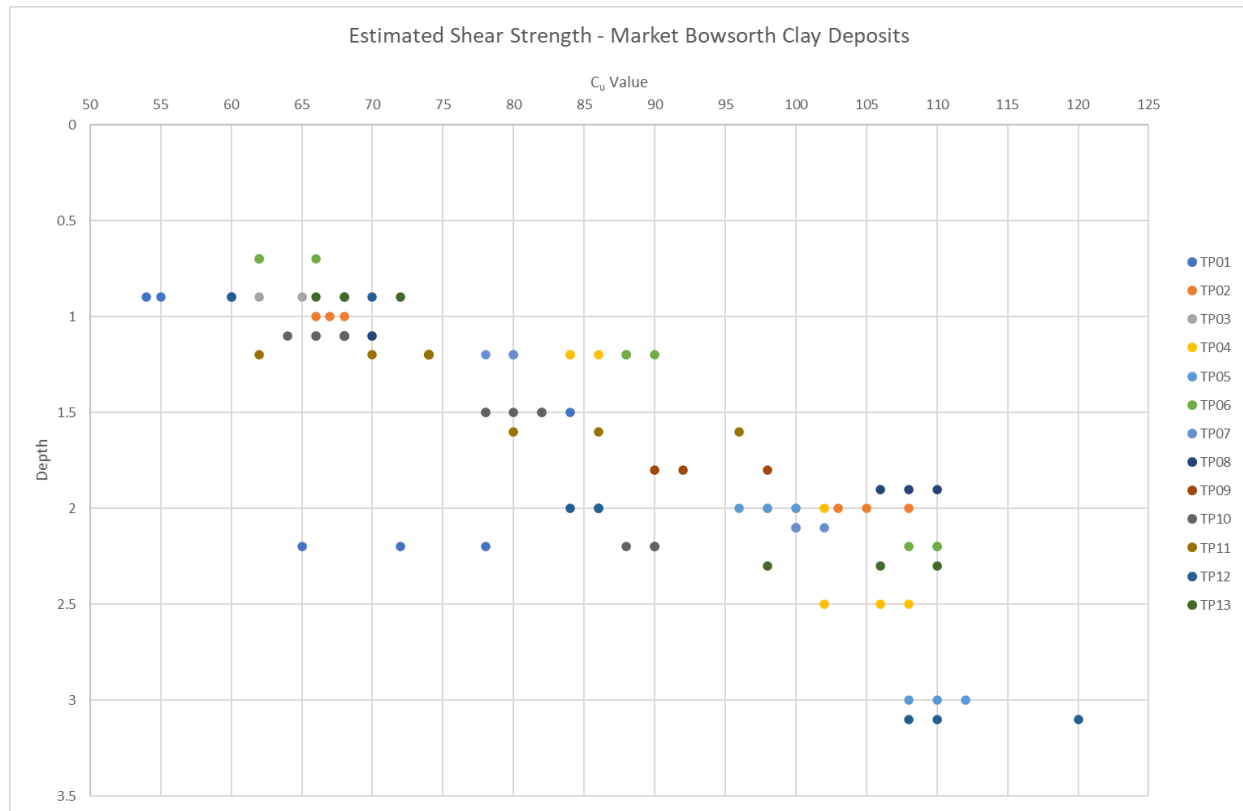
Figure 2 – Estimated Shear Strength with depth



In-situ Hand Shear Vane (HSV) tests were also carried out in the near surface cohesive Bosworth Clay Member deposits between depths of 0.70m and 3.10mbgl which ranged between 54 kPa and > 120 kPa (site average of ~85kPa) which indicates the cohesive deposits to be moderate to high strength as approximately estimated above.

Figure 3 presents a plot of the in-situ HSV test results in relation to the recorded undrained shear strength with depth of the materials beneath the site. The results show a clear trend of increasing shear strength with depth consistent with the estimated shear strength.

Figure 3 - HSV with depth



7.7 Material Properties Summary

A summary of the material properties / strength characteristics is presented below in Table 7-4.

Table 7-4 Material Properties Summary

Strata	Average N60 Value	Average Undrained Shear Strength (kPa) from N60.	VCP	Average Undrained Shear Strength (kPa) from HSV	Recommended Allowable Bearing Pressure (kPa)
1.00m	14	58	High based on worse case.	65	125
1.50m	-	-		81	125
2.00m	21	88		100	150
3.00m	41	172		111	150

7.8 Foundation Assessment.

The following section presents recommendations for foundations for the proposed development taking into consideration the ground conditions encountered and the material properties.

Traditional Foundations

Traditional strip / trenchfill foundations are generally considered appropriate for the majority of the proposed development bearing within the firm to stiff cohesive deposits encountered below the majority of the site, subject to consideration of the loads imposed.

An allowable design bearing pressure of 125kN/m² is recommended for trenchfill foundations (up to 1m wide), bearing uniformly in the firm to stiff Bosworth Clay Member cohesive deposits placed at a minimum depth of 1.0m, based on a high VCP clays. This value includes a factor of safety of 3.0 against general shear failure and should result in total settlements not exceeding 25mm for foundations up to 1m wide, keeping differential settlements within acceptable limits.

Foundations should be advanced beyond any localised granular deposits encountered in the vicinity of TP09 and WS08 (or any other shallow granular deposits potentially present) and be placed uniformly within the underlying cohesive deposits at a minimum depth of 1.0m.

Where any contrasting ground / localised soft spots are encountered at founding level, steel mesh reinforcement (B785 or similar) may be required in the base of foundations to span the different strata types / low strength material and counter any potential differential settlement. Should steel be required, RC35 concrete should be adopted.

Where plots are underlain by cohesive strata and within the influence of existing trees / hedges, foundations will require deepening in accordance with the NHBC guidelines. Foundations may also need to be stepped in the base of the foundations; any steps should be in accordance with the NHBC guidelines.

Where strip/trenchfill foundations are adopted and plots are affected by tree influence and within cohesive deposits, heave precautions to include for the provision of a 300mm void beneath beam and block floor slabs will be required. Further heave precautions include a requirement for a 35mm void on the inside face of all external foundations should foundation depths exceed 1.5m due to tree influence.

Care should be taken to avoid softening of the base of the foundation excavation during construction. Where necessary, a 100mm blinding of concrete should be constructed to protect the foundation level during bad weather. The excavation should not be left open for any extended period.

Foundation widths should be designed as part of detailed design by a structural Engineer, appropriate to the loads being imposed, however 0.6m wide foundations are likely to be appropriate for external walls and 0.75m wide for party walls and gable ends.

Foundations will need to be deepened through any made ground, it should be noted that no significant made ground was encountered within the site investigation.

Topsoil should be removed from beneath plot footprints.

It is recommended that foundation trenches should be inspected by an Engineer prior to pouring concrete to confirm that foundations are placed uniformly within firm to stiff cohesive clay deposits or medium dense granular deposits where appropriate. It is recommended that confirmation of the shear strength of the in-situ soils in the base of foundation excavations (using a HSV or similar) is also carried out to ensure that the allowable bearing pressure is achieved. A minimum shear strength of 65kPa should be determined before casting foundations.

It is recommended that detailed foundation design is undertaken prior to construction to confirm compliance with appropriate guidance and the most cost-effective foundation solution. A tree survey shall be required in order to facilitate detailed foundation design.

Piled Foundations

Piled foundations may be required in areas of the site should ground levels be raised significantly.

Piled foundations may also be required for any plots where foundations depths exceed 2.5m due to tree influence. No final site layout has been devised, based on the preliminary site layout a significant number of plots that are in close proximity to the northern and western boundaries may require an alternative foundation solution.

For piled plots reinforced ground beams will be required, which can be either pre-cast or cast in-situ depending on developer preference, and should be designed by a specialist contractor or Structural Engineer.

Where plots to be piled and are within the influence of existing or removed trees, heave precautions shall be required comprising a beam and block floor slab with 300mm sub-floor void, compressible material on the inside face (35mm) of external wall ground beams and underside of all groundbeams (150mm). The piling contractor should consider the risk of heave on the actual pile shaft / column.

An allowance should be made for a working platform to support a piling rig.

Based on the available ground information, concrete driven piles are likely to be suitable. Steel piles may be required if driving resistance is high or a reduction in ground vibration is required. Bored piles may be required if ground conditions are not conducive to driven piles or if detailed design demonstrates bored piles could be founded at shallower depths. A specialist piling contractor should be consulted for site specific pile type and design.

Further site investigation (deeper boreholes) may be required to determine pile depths should this foundation option be desired.



It is recommended that advice is obtained from specialist piling contractors to ascertain the most economical solution for the ground conditions encountered.

Ground Improvement

Ground improvement techniques (such as vibro stone column ground improvement) with reinforced concrete strip foundations are unlikely to be required. No deposits of loose, unstable or inferior ground conditions were encountered on site.

7.9 Floor Slab Construction

Suspended floor slabs and beam and block floor construction is likely to be the most viable floor slab construction types.

At this stage however it is anticipated that both ground bearing and suspended floor slabs may be suitable for the site, subject to developer preference and further assessment of proposed ground levels / tree influence. For plots founded within cohesive deposits and within the influence of trees, ground bearing slabs will not be suitable and a suspended floor slabs should be adopted.

The final specification of ground floor slabs will be subject to detailed design, taking into account existing and proposed levels and the impact of trees/vegetation.

7.10 Excavations

Excavations using backhoe excavators are expected to be suitable in the natural strata across the site. Mechanical breaking equipment is unlikely to be required given the type of material encountered below the site and observations made during the investigation works.

The requirement for shoring is therefore considered unlikely for the majority of excavations in the short term.

Excavations that remain open for long periods, particularly during inclement weather are expected to be prone to instability. Where personnel entry is required for inspection, excavations should be sufficiently enlarged and an assessment of safe temporary angles should be assessed; alternatively, temporary shoring should be provided.

No excavations should be entered until a full risk assessment is completed to assess the stability requirements and safety issues.

7.11 Obstructions

No significant obstructions are anticipated based on observations undertaken during the ground investigation works.

7.12 Drainage

The cohesive geology encountered across the site would suggest that soakaway drainage is not considered feasible; an alternative drainage solution is therefore likely to be required. The advice of a Drainage Engineer should however be sought to confirm this preliminary assessment prior to construction.

7.13 Roads & Hardstanding

In-situ Dynamic Cone Penetrometer (DCP) testing was undertaken at ten locations across the site, as shown on Exploratory Hole Location Plan (PJSG20-21-DR-002). The Transport Research Laboratory (TRL) DCP uses an 8kg hammer dropping through a height of 575mm and a 60° cone having a maximum diameter of 20mm. The penetration



and number of blows are recorded up to a maximum depth of 1.00m BGL. The penetration rate is recorded as the cone is driven into the subgrade and is used to calculate the strength of the material (CBR value) through which the cone is passing. A change in penetration rate indicates a change in strength between materials, thus allowing layers to be identified and the thickness and strength of each to be determined.

Exceptionally high or low CBR results which deviate from the expected best fit line are most likely due to the driving of coarse gravel or cobble sized particles or encountering localised very loose or soft unconsolidated strata. It should be noted that TRL DCP testing is not a test defined by British Standards. It is however, widely used and accepted in the industry for determination of equivalent CBR values. The below table illustrates CBR results obtained at a depth range considered typical of sub-formation levels (0.40 to 60m bgl).

Based on mean values, a preliminary CBR design value of >3% should be achieved for road construction design purposes for the cohesive near surface Bosworth Clay Member deposits underlying the site. Any soft or otherwise unsuitable material should be removed and replaced by engineered stone to an appropriate specification prior to construction. Formation levels should be thoroughly proof-rolled.

Further in-situ CBR testing is recommended at formation level once development proposals have been established.

A full copy of the DCP test results are presented within in Appendix C.

Table 7-5 DCP Testing

Ref.	CBR (%) Range		CBR (%) Mean
	Lowest CBR (%)	Highest CBR (%)	
DCP01	3.8	8.9	5.90
DCP02	4.4	6.0	5.26
DCP03	2.8	7.0	4.63
DCP04	2.4	3.3	2.85
DCP05	-	-	-
DCP06	3.1	4.5	3.98
DCP07	6.1	16.1	11.44
DCP08	7.4	10.5	8.95
DCP09	4.8	10.5	6.80
DCP10	3.5	5.2	4.27
DCP11	4.0	6.3	4.93
DCP12	3.1	5.3	3.90
DCP13	3.9	6.1	4.73



Ref.	CBR (%) Range		CBR (%) Mean
	Lowest CBR (%)	Highest CBR (%)	
DCP14	5.4	8.0	6.54
Site Wide	2.4	16.1	5.71

7.14 Concrete Classification

The laboratory results have been assessed against the BRE Special Digest 1 2005: 3rd Edition Aggressive Chemical Environment for Concrete (ACEC) Site classification. The Site has been designated as Greenfield ground with mobile groundwater.

Water soluble sulphate concentrations in soils varied from 0.02 mg/l to 2.1 mg/l with soil pH values ranging from 7.1 to 8.4. Total sulphur concentration ranged from 0.042 % to 0.276 %. Due to the presence of elevated sulphur, a classification of DS-3 AC-3 should be adopted.

Full results are available within Appendix B.



8. Generic Quantitative Risk Assessment

In accordance with Land Contamination Risk Management (LCRM EA, 2020), a Generic Quantitative Risk Assessment (GQRA) has been undertaken to determine the significance of the measured concentrations of contaminants identified during the ground investigation.

This involves undertaking an assessment of each potential contaminant linkage identified within the ICSM by comparing the contaminant concentrations against appropriate Generic Assessment Criteria (GAC).

GACs are screening criteria which are derived using a standard set of generic assumptions. They are designed to be broadly applicable to a wide range of site conditions and exposure scenarios. They must be appropriate and suitable for your site. The GACs used in this assessment represent “trigger values” that, if exceeded, could indicate a possibility of significant harm. However, these criteria do not represent the threshold at which there is a significant possibility of significant harm; this determination will normally require further investigation and / or Detailed Quantitative Risk Assessment (DQRA) is required and evaluation of risk to human health and controlled waters

8.1 Human Health Risk Assessment

8.2.1 Assessment Criteria

Contaminant data has been compared to the Land Quality Management (LQM) / Chartered Institute of Environmental Health (CIEH) values published within ‘The LQM/CIEH Suitable for Use Levels (S4ULs) for Human Health Risk Assessment’ 2015. In brief, the document provides assessment criteria which have been derived in accordance with UK legislation, national as well as EA policy and using a modified version of the CLEA software and available guidance.

The S4ULs are considered appropriate for use in this assessment for organic contaminants and the Soil Organic Matter (SOM) content has been taken into consideration where appropriate.

Criteria for a limited number of contaminants have been derived by the Department for Environment, Food and Rural Affairs (DEFRA; UK government) in their document entitled SP1010: Development of Category 4 Screening Levels (C4SL) for Assessment of Land Affected by Contamination, April 2014. The National Planning Policy Framework states that ‘after development, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990’. Therefore, by inference, the C4SLs are appropriate for use in the planning context. It is generally accepted that assessment criteria for metals are not sensitive to changes in soil organic content (SOM). The C4SLs have therefore been adopted as assessment criteria in this report for the listed metals within the SP1010.

8.1.2 Soil Chemical Data in Comparison to GACs

The soil samples recovered from the site have been compared to appropriate GACs for a residential end use with plant uptake. When in comparison, none of the samples of topsoil or natural subsoils identified any exceedances of the GAC and will therefore not be considered further.

8.1.3 Asbestos

A total of 8 No. samples recovered from the topsoil on site were screened for the presence of asbestos. Although CC’s are not available for asbestos, the results indicate that no trace of asbestos was identified in any samples tested and will therefore not be considered further.



8.2 Controlled Waters Risk Assessment

The controlled waters risk assessment considers the potential impact of on-site contamination to the relevant controlled water receptors identified within the ICSM. These are summarised as follows:

- Secondary Undifferentiated Aquifer – Glaciofluvial Deposits
- Secondary B Aquifer – Gunthorpe Member
- Secondary A Aquifer – Bosworth Clay Member
- On-site pond.

8.2.1 Assessment Criteria

The approach adopted to assessing risks to Controlled Waters is based principally on considering the concentrations of contaminants identified within the groundwater / leachate samples obtained in comparison to relevant GAC.

Several Water Quality Standards (WQS) have been applied as Generic Assessment Criteria (GAC), these include Water Framework Directive standards and thresholds (WFD), the Freshwater Environmental Quality Standards (EQS), the UK Drinking Water Quality Standards (DWQS) and WHO Guidelines for Drinking Water Quality values which have been used as initial conservative GAC to assess whether further assessment or discussion in terms of the risks to controlled waters is required.

Contaminant concentrations that exceed the applied GAC are then considered in the context of the site's environmental setting as to whether further qualitative or quantitative assessment is required.

8.2.4 Evaluation of Risk to Controlled Waters

The site is considered to be located in an area of low sensitivity in regard to the risk groundwater due to the absence of a sensitive potable groundwater supply. No significant on-site or off-site surface water receptors such as rivers or streams have been identified.

During the investigation, no significant evidence of contamination was identified below the site and no evidence of Made Ground was identified.

Based on the above, no specific leachate testing, groundwater analysis or risk assessment has been included as part of this assessment. The risk to groundwater associated with the site is considered very low and no further risk assessment or discussion is considered to be warranted in that regard.

As a measure of good practice, any materials excavated and stockpiled on site should be positioned to take into consideration the potential for surface water / leachate run-off to impact the pond on site / surface water drains. Control measures should comprise keeping the sides of stockpiles at a low gradient to minimise surface water run-off and appropriate measures to prevent the ingress of suspended solids into surface waters.

8.3 Property and Infrastructure Risk Assessment

8.3.1 Building Materials

Risks to building materials associated with aggressive ground conditions is addressed in Section 7.15 and should be designed accordingly.



8.3.2 Potable Water Supply Pipes

Contamination testing has not identified chemical contaminant concentrations within soils on the site in terms of a residential end use.

The investigation requirements for the selection of potable water pipe material are set out in UKWIR Report 10/WM/03/21 "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (UKWIR, 2010)".

This report has specific investigation requirements and as such detailed investigation of proposed utility routes was not within the scope of this investigation. However, based on current information conventional plastic water supply pipes are likely to be suitable

It is however recommended that the contamination test results are made available to the relevant water company to allow design of any required potable water supply pipe work to be undertaken and to confirm requirements for any further assessment.

8.4 Ecological Risk Assessment

Soil results were compared to phytotoxic guideline values as outlined in Table 1 within BS3882:2007. No elevated contaminants were identified therefore the probability of phytotoxic contaminants affecting vegetation is considered unlikely.

The risk to ecological receptors is anticipated to be negligible given the concentrations encountered in the soils. However, the impact to ecological receptors from proposed construction activities should always be considered



9. Ground Gas & Vapour Risk Assessment

9.1 Ground Gas Monitoring

Gas and groundwater monitoring has been carried out on a single monitoring visit to date on 13th August 2021 at atmospheric pressures of between 1002mb and 1004mb, the results of which are summarised in Section 6-7.

The ground gas risk assessment and recommendations are presented below.

9.2 Ground Gas Risk Assessment Methodology

The risk to end users from ground gas has been assessed in accordance with the methodology presented in the following referenced documents:

- British Standard BS8576:2013 – Guidance on investigations for ground gas – permanent gases and Volatile Organic Compounds (VOCs).
- British Standards BS8485+A1:2019 – Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
- CIRIA C665: Assessing risks posed by hazardous ground gas to buildings, 2007.

A single ground gas monitoring visit has been undertaken for confirmatory purposes to assess if gas generation sources are present.

9.3 Gas Screening Value (GSV)

Both the CIRIA Report and the British Standard require the calculation of a Gas Screening Value (GSV). This is calculated as the maximum recorded percentage gas concentrations multiplied by the maximum gas flow rate. Where concentrations or flow rates less than the limit of detection on the analyser have been recorded, the limit of detection has been used (0.1% for gas concentration, 0.1 l/hr for gas flow rates).

The GSVs within CIRIA C665 are based upon all buildings other than standard residential houses. The NHBC GSVs are based upon standard residential houses with precast concrete floors (beam and block). The CIRIA 665 report author (Steve Wilson) since provided further clarification regarding which guidance should be adopted for residential houses that have suspended cast in-situ concrete floor slab: for the avoidance of doubt, it was confirmed that the GSVs within the CIRIA 665 guidance should be adopted. The thresholds for GSVs based upon CIRIA guidance are therefore provided within the below table.

Table 9-1 Gas Screening Value Thresholds

CIRIA – No Sub-floor Void			NHBC – Sub-floor Void	
Characteristic Situation	GSV (CH ₄ & CO ₂)	Classification	GSV (CH ₄)	GSV (CO ₂)
CS1	<0.07	Green	<0.16	<0.78
CS2	<0.7	Amber 1	<0.63	<1.56
CS3	<3.5	Amber 2	<1.56	<3.13



CIRIA – No Sub-floor Void			NHBC – Sub-floor Void	
Characteristic Situation	GSV (CH ₄ & CO ₂)	Classification	GSV (CH ₄)	GSV (CO ₂)
CS4	<15	Red	>1.56	>3.13
CS5	<70	-	-	-
CS6	>70	-	-	-

However, it should also be recognised that the GSV thresholds are guideline values and not an absolute threshold and that the guideline GSV can be exceeded in certain circumstances should the CSM indicate it is safe to do so.

Gas screening values have been calculated using maximum values from the entire gas monitoring data set. The calculated GSVs are presented in the table below. A GSV has been calculated that represents the gas hazard present for the whole Site. This is based on similar ground conditions having been identified across the site. The data is presented below.

Table 9-2 Calculated GSV.

Chg Methane (% v/v)	Chg Carbon Dioxide (% v/v)	Gas Flow Rate (l/hr)	Hazardous Gas Flow Rate, Q _{hg} CH ₄ (l/hr)	Hazardous Gas Flow Rate, Q _{hg} CO ₂ (l/hr)	NHBC Traffic Light System	Wilson & Card Classification
0.1	1.9	0.1	0.0001	0.0019	Green	CS1

9.4 Ground Gas Protection Recommendations

Based on the gas monitoring undertaken to date, the calculated gas screening value for the site would indicate a 'Green' classification under the NHBC Traffic Light System and CS-1 in accordance with BS8485:2015+A1:2019. Therefore, at this stage, it is considered that gas protection measures will not be required for the site. Further monitoring beyond this period may be required prior to development. The requirement for further monitoring should be confirmed with the Local Authority.

Based on the gas monitoring results obtained, the concentrations of ground gases are not considered to be at a level which would pose any tangible risk to the health of construction workers working in an external environment at surface level. Working within confined spaces should however be avoided wherever possible, however if this work is unavoidable then the works should be carried out in strict accordance with the confined spaces regulations to include gas monitoring during the works.

9.5 Radon Protection Measures

Radon protection measures are not required.

9.6 Vapour Risk and Membranes

No evidence of vapours has been noted during the intrusive investigation, as such the risk associated with vapours arising from the site is considered negligible. No further assessment is considered warranted in that regard.

10. Revised Environmental Risk Assessment

In accordance with the requirements of LCRM 2020, the S-P-R potential contaminant linkages identified by the intrusive investigation are discussed below. All remaining contaminant linkages identified within the ICSM have been discounted as no plausible contaminant linkage has been identified.

A summary of the findings is presented below.

10.1 Identified Sources

Based on the GQRA that has been carried out within Section 7.0, potential sources of contamination that could impact on the identified receptors are summarised below.

- Low potential for PCBs to be present on site associated with adjacent sub-station west which may contain PCBs.
- Elevated concentrations of sulphates in sub-soils.

10.2 Identified Pathways

- Ingestion, dermal contact and inhalation of contaminated particulates.
- Direct contact of buried concrete with aggressive ground.

10.3 Identified Receptors

- Human health and users
- Construction workers
- Buried concrete.

10.4 Revised CSM and Potential Contaminant Linkages

Based on the above, the revised CSM is presented in Table 10-1 below.

Appropriate remedial / mitigation measures to break the potential contaminant linkages are discussed where required.

The revised CSM is provided in the table below.



Table 10-1 Revised CSM.

Contaminant Linkage	Source (S)	Pathway (P)	Receptor (R)	Probability	Consequence	Current Risk	Investigation / Mitigation Measures
Human Health							
1	On Site: S1: ESS which may have contain and leaked PCBs.	P1: Ingestion of contaminated particulates. P2: Dermal contact. P3: Inhalation of contaminated dust / particles.	R1: Site end users. R2: Construction workers / maintenance workers.	Unlikely	Medium	Low	Assessment of the underlying soils in the vicinity of the sub-station could be undertaken to assess for the presence of PCBs with in soils.
Property and Infrastructure							
2	On Site S2: Natural subsoils with high sulphate concentrations.	P6: Direct contact with aggressive ground.	R6: Buried concrete & structures	Unlikely	Mild	Very Low	Design Sulphate Class DS-3 and Aggressive Chemical Environment for Concrete Class AC-3 should be used for design purposes.

11. Conclusions & Recommendations

This Geo-Environmental Assessment is based upon the findings of an intrusive site investigation undertaken in August 2021.

It is understood that the site is proposed to be developed for a residential land use.

The Geo-environmental assessment has produced the following key conclusions and recommendations which should be implemented as part of the future redevelopment of the site to ensure suitability for the proposed end-use and to meet the requirements of planning.

Environmental Risk Assessment Summary	
<i>Human Health Risk Assessment</i>	The ICSM identified the potential for localised PCB contamination to present on the west of the site associated with adjacent ESS. However, due to the risk associated with recovering samples near to electricity cables and also potentially damaging a mains sewer identified within the vicinity, no assessment of the underlying soils for the presence of PCBs has been undertaken. Whilst we consider the risk to the site from PCBs to be low, should the area become accessible (mains cables re-routed / sewer redirected) assessment of the underlying soils in the vicinity of the sub-station should be undertaken to assess for the presence of PCBs. Based on the contamination testing that has been carried out on the remainder of the site, the risk assessment has indicated that the site poses a negligible risk to Human Health receptors. The natural topsoil and subsoils are considered to be suitable for retention / re-use on site if geo-technically suitable, subject to compliance with a Materials Management Plan (MMP).
<i>Controlled Waters Risk Assessment</i>	The site is considered to be located in an area of low sensitivity in regard to the risk groundwater due to the absence of a sensitive potable groundwater supply. No significant on-site or off-site surface water receptors such as rivers or streams have been identified, except for an existing on-site pond. During the investigation, no significant evidence of contamination was identified below the site and no evidence of Made Ground was identified. The risk to groundwater / surface water associated with the site is considered very low to negligible and no further risk assessment considered to be warranted in that regard.
<i>Ground Gas / Vapour Risk</i>	Based on the gas monitoring undertaken to date, gas protection measures are not considered to be required for the site. Further monitoring may however be required prior to development. The requirement for further monitoring should be confirmed with the Local Authority. No evidence vapours have been identified on site; no further assessment or mitigation is therefore required in that regard.
<i>Ecological Risk</i>	Potential Impacts from contamination sources is considered negligible. However, the impact to ecological receptors from proposed construction activities should always be considered.



Geotechnical Assessment Summary

Foundations	Traditional strip / trenchfill foundations are generally considered appropriate for most of the proposed development bearing within the firm to stiff cohesive deposits encountered below the site, subject to consideration of the loads imposed. Piled foundations may be required should ground levels be significantly raised.
Floor Slabs	Suspended floor slabs and beam and block floor construction is likely to be the most viable floor slab construction types. Beam and block floor slabs are recommended in areas of tree influence.
Drainage	Due to the presence of cohesive deposits predominantly encountered site wide, soakaways are not considered to be feasible for surface water drainage; an alternative drainage solution is therefore likely to be required. The advice of a drainage engineer should be sought to confirm this preliminary assessment prior to construction.
Concrete	Design Sulphate Class DS-3 and Aggressive Chemical Environment for Concrete Class AC-3 should be used for design purposes.
Roads & Hardstanding	A preliminary CBR design value of >3% should be achieved for road construction design purposes for the near surface cohesive Bosworth Clay Member deposits underlying the site.
Recommendations	
Further in-situ CBR testing is recommended at formation level once development proposals have been established.	
Assessment of the underlying soils in the vicinity of the sub-station should be undertaken to assess for the presence of PCBs.	



12. References

The following documents are referenced in the report;

1. Desk Study Report, (PJSG) dated June 2020.
2. Land Contamination Risk Management (LCRM) 2020 <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>
3. British Standards Institution (BSI) BS 10175:2015 Investigation of Potentially Contaminative Sites Code of Practice 2015.
4. BS 5930 'Code of Practice for Site Investigations' 2015+A1:2020.
5. BS EN ISO 22476-3:2005+A1:2011; Geotechnical investigation and testing. Field testing. Standard penetration test.
6. BS1377: 1990, Methods of Test for Soils for Civil Engineering Purposes.
7. BS EN ISO 17892:2014+ Geotechnical investigation and testing – Laboratory Testing of Soil.
8. BRE Digest 365 'Soakaway Design' 2016.
9. BS 8582:2013: Code of practice for surface water management for development sites.
10. CIRIA-R143-the-Standard-Penetration-Test-SPT-Methods-and-Use-1995.
11. BRE Special Digest 1 'Concrete in Aggressive Ground 2005'
12. BS3882:2015 Specification for Topsoil.
13. CL:AIRE SP1010 Development of Category 4 Screening Levels for Land Affected by Contamination (Rev 2) dated 24th September 2014.
14. The LQM/CIEH Suitable 4 Use Levels published 2015.
15. UKWIR Report 10/WM/03/21 "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (UKWIR, 2010)".
16. BS8576:2013 – Guidance on investigations for ground gas – permanent gases and Volatile Organic Compounds (VOCs).
17. BS8485:+A1:2019 – Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
18. Construction Industry Research and Information Association (CIRIA). 2008. Assessing the risk posed by hazardous gases to buildings. C665.



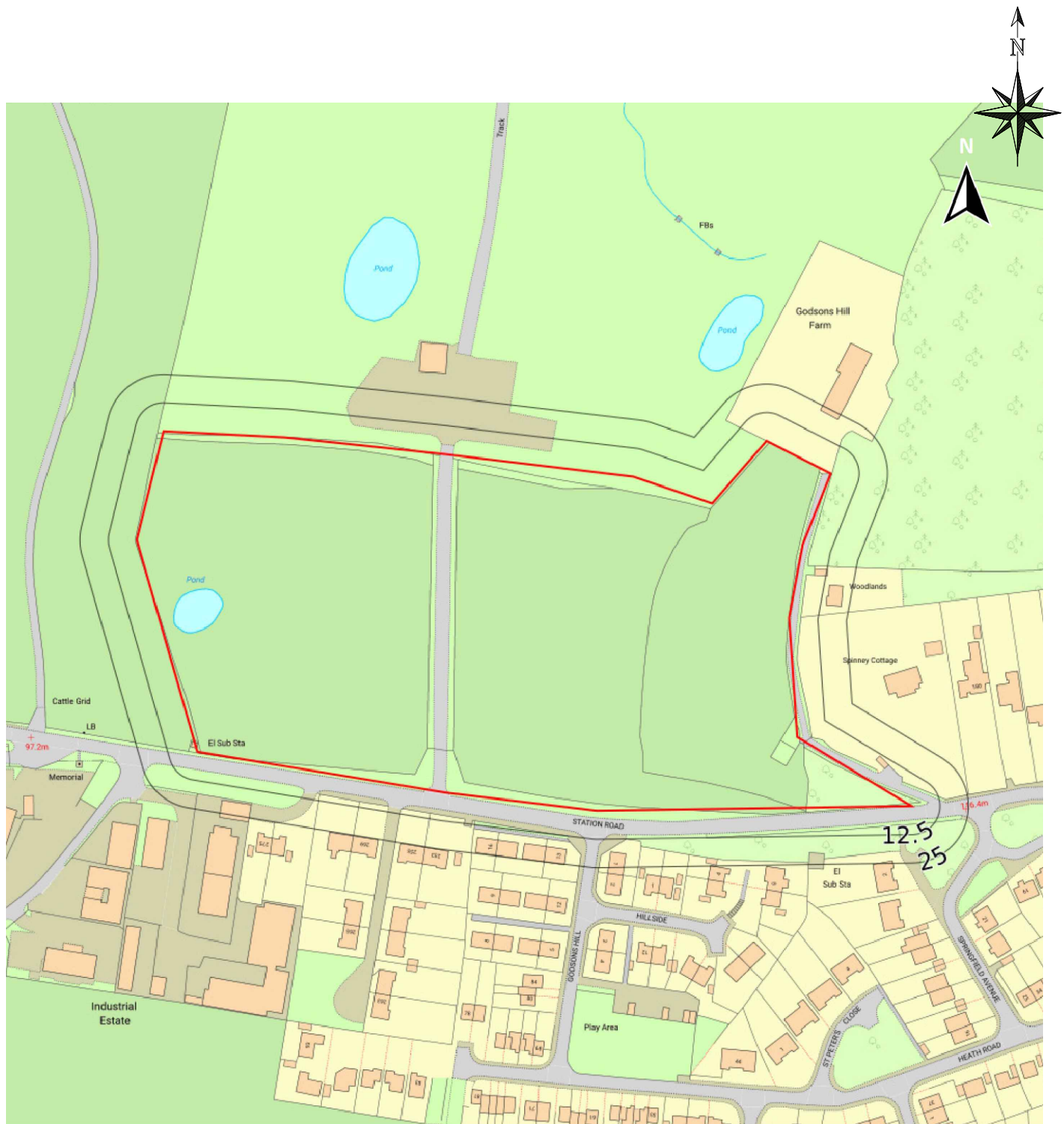
Drawings

PJSG20-21-DR-001 –Site Location Plan

PJSG20-21-DR-002 – Exploratory Hole Location Plan

30452_6 Proposed Illustrative Masterplan - SITE A 121119- Development Layout Plan





Client

RICHBOROUGH ESTATES

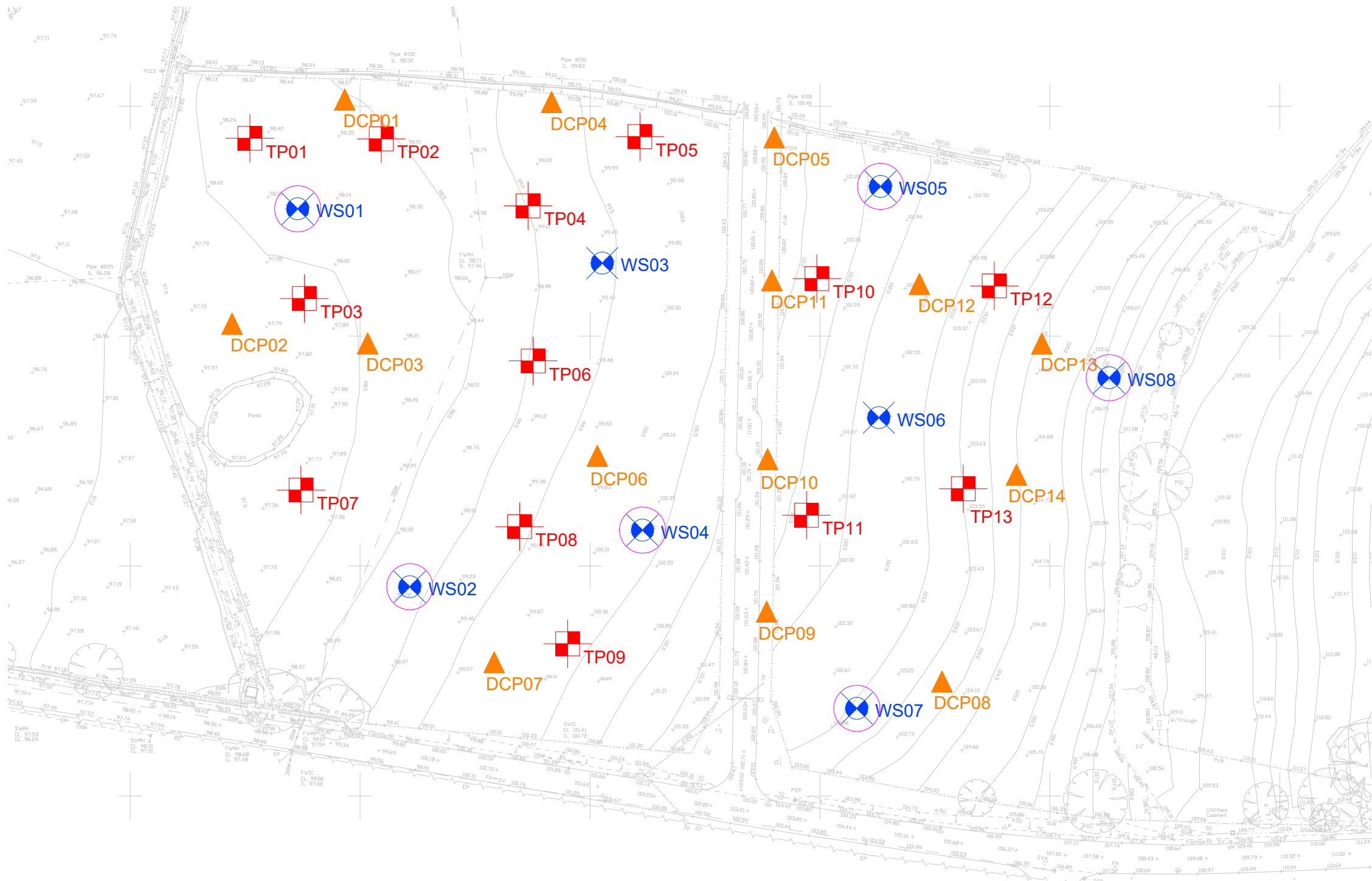
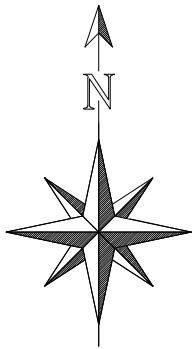
Project

**STATION ROAD
MARKET BOSWORTH**

Drawing Title

SITE LOCATION PLAN

	Drawn	Checked	Status	Scale
Initial	VH	DF	INFORMATION	NTS
Date	26.05.20	28.05.20		
Project				
			Drawing Number	Revision
PJSG20-21			DR-001	-



General Notes

- 1. Do not scale this drawing. If in doubt, ask.
- 2. This drawing is to be read in conjunction with all other relevant Engineers, Architects and specialist design drawings and details.
- 3. All dimensions are in metres unless noted otherwise. All levels are in metres unless noted otherwise.
- 4. Any discrepancies noted on site are to be reported to the Engineer immediately.

Key

**TP**

Location and reference of machine excavated trial pit dug under the supervision of PJSG.

**WS**

Location and reference of window sample sunk under the supervision of PJSG.

**DCP01**

Approximate location and reference of dynamic cone penetration test to be undertaken under the supervision of PJSG .



Indicates boreholes where gas and groundwater monitoring ancillaries have been installed.

A	08/09/2021	Amended to as dug locations	NB	AM
Rev	Date	Amendments	By	Chk

**GEOTECHNICAL ENGINEERS**
Delivering Innovative Solutions

PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm,
Kingston on Soar, Nottingham, NG11 0DP.
Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk

Client

Richborough Estates

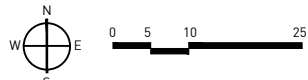
Project

Station Road, Market Bosworth

Drawing Title

Exploratory Hole Location Plan

	Drawn	Checked	Status	Scale
Initial	NB	AM	INFORMATION	1:1000
Date	09/07/21	09/07/21		
Project Number			Drawing Number	Revision
PJSG20-21			DR-002	A



KEY

- SITE A 10.42 Acres/
4.21 Hectares
Residential capacity: circa 70no. dwellings @ 34dph (net)
- SITE B 9.92 Acres/
4.02 Hectares
Residential capacity: 68no. dwellings @ 34dph (net)
- Proposed residential development
- Marker / focal buildings
- Landscaped public open space
- Existing trees and hedgerow (indicative)
- Main pedestrian routes
- Proposed landscape
- Community Orchard
- Natural/ equipped children's play
- Sustainable drainage (indicative)

DESIGN NOTES

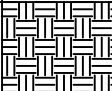
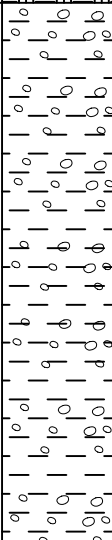
1. Vehicular and pedestrian accesses via Station Road (utilising existing access points);
2. Access maintained to existing/ adjoining Golf & Country Club and residential dwelling;
3. Potential vehicular link between developments;
4. Circular walk through public open space to new housing. Joins with existing footway provision and provides access to bus stops on Station Road;
5. Layout offsets to address existing (underground and overhead) services;
6. Gateway green space retaining existing hedgerow. Framed with new housing frontages and landscape.
7. Tapered building line and setback to retain longer distance views towards eastern (elevated) area of site and wooded ridge;
8. Lower building heights/ bungalows;
9. Existing hedgerows retained in green space and buffered from new development;
10. New pumping station and development offset;
11. Disused railway line;
12. Outward facing frontages to achieve natural surveillance;
13. Natural play trail; and
14. Soft landscaped edge.

Appendix A: Ground Logs



Dimensions:	Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)
-------------	--

 GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk	Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: TP02 Sheet 1 of 1
	Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:	
	PJSG20-21	04/08/2021	NB	VH	439504, 303294	98.42	1:25	

Samples & In-Situ Testing			Strata Details						
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description		Water	Backfill
0.10	ES1	68,67,66	98.12	(0.30) 0.30		Grass over brown TOPSOIL.			
0.40	ES2		105,103,108	96.32	(1.80) 2.10		Firm to stiff greyish brown slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz. [BOSWORTH CLAY MEMBER]		
1.00	HSV	Stiff brownish grey mottled blue slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz, siltstone, sandstone and coal. [BOSWORTH CLAY MEMBER]							
2.00	HSV	Possible gypsum crystals encountered in strata at 3.10m.							
						Trial Pit Terminated @ 3.10m			

General Remarks:

1) Excavation stable.

2) No groundwater encountered.

3) No evidence of contamination identified.

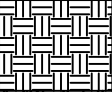
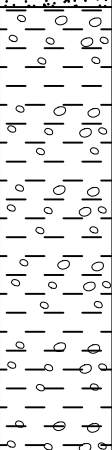
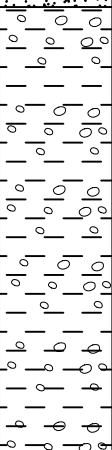
4) Trial pit terminated at 3.10m.

5) Excavation backfilled with arisings on completion.

Dimensions:	Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)
-------------	--

General Remarks: 1) Excavation stable. 2) No groundwater encountered. 3) No evidence of contamination identified. 4) Trial pit terminated at 3.20m. 5) Excavation backfilled with arisings on completion.	
Dimensions:	Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)

Dimensions:	Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)
-------------	--

 GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk			Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: TP05			
Job Number:		Date Logged:		Logged By:		Checked By:		Coordinates:		Ground Level:		Scale:	
PJSG20-21		04/08/2021		NB		VH		439560, 303292		99.86		1:25	
Sheet 1 of 1													
Samples & In-Situ Testing			Strata Details										
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description					Water	Backfill	
0.10	ES1	68,70,66	99.56	(0.30)		Grass over brown TOPSOIL.							
0.40	ES2			(1.30)		Firm brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz. [BOSWORTH CLAY MEMBER]							
1.00	D1	96,100,98	98.26	1.60		Stiff brownish grey mottled blue CLAY. [BOSWORTH CLAY MEMBER]							
1.10	HSV			(1.50)		Occasional fragments of coal and lignites and possible gypsum crystals encountered in strata 2.70m.							
2.00	D2	110,108,112	96.76	3.10		Trial Pit Terminated @ 3.10m							
2.00	HSV												
3.00	D3												
3.00	HSV												
General Remarks:													
1) Excavation stable. 4) Trial pit terminated at 3.10m.													
2) No groundwater encountered. 5) Excavation backfilled with arisings on completion.													
3) No evidence of contamination identified.													
Dimensions:						Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)							

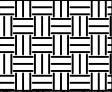
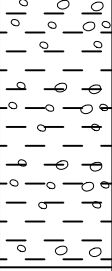
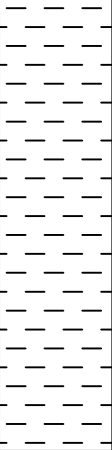
General Remarks: 1) Excavation stable. 2) No groundwater encountered. 3) No evidence of contamination identified.		4) Trial pit terminated at 3.00m. 5) Excavation backfilled with arisings on completion.	
Dimensions:		Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)	

General Remarks: 1) Excavation stable. 2) No groundwater encountered. 3) No evidence of contamination identified. 4) Trial pit terminated at 3.10m. 5) Excavation backfilled with arisings on completion.	
Dimensions:	Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)

PJS GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk			Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: TP08	
			Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:	Sheet 1 of 1	
			PJSG20-21	04/08/2021	NB	VH	439533, 303209	99.43	1:25		
Samples & In-Situ Testing			Strata Details								
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description	Water	Backfill			
0.10	ES1	68,70,68	99.13	0.30		Grass over brown TOPSOIL.					
0.40	ES2		97.63	(1.50)		Firm brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz. [BOSWORTH CLAY MEMBER]					
0.90	D1										
1.10	HSV	108,106,110	96.33	(1.30)		Stiff brownish grey mottled blue CLAY. [BOSWORTH CLAY MEMBER]					
1.90	HSV					Trial Pit Terminated @ 3.10m					
General Remarks: 1) Excavation stable. 2) No groundwater encountered. 3) No evidence of contamination identified. 4) Trial pit terminated at 3.10m. 5) Excavation backfilled with arisings on completion.											
Dimensions:						Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)					

 GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk	Site Name: Station Road, Market Bosworth		Client: Richborough Estates			Trial Pit ID: TP09	
	Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:
	PJSG20-21	04/08/2021	NB	VH	439545, 303183	100.43	1:25

Sheet 1 of 1

Samples & In-Situ Testing			Strata Details					
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description	Water	Backfill
0.10	ES1	74,74,74		(0.30)		Grass over brown TOPSOIL.		
0.40	ES2		100.13	0.30		Orangish brown very clayey sandy GRAVEL. Gravel is sub-angular to sub-rounded, fine to coarse of quartz.		
0.50	B1		99.63	0.80		Firm greyish brown slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz. [BOSWORTH CLAY MEMBER]		
1.20	HSV	90,92,98	98.73	(0.90)		Stiff brownish grey mottled blue CLAY. [BOSWORTH CLAY MEMBER]		
1.20	D1			1.70		Trial Pit Terminated @ 3.20m		
1.80	HSV			(1.50)				
1.80	D2		97.23	3.20				

General Remarks:

1) Excavation stable.

2) No groundwater encountered.

3) No evidence of contamination identified.

4) Trial pit terminated at 3.20m.

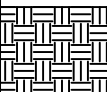
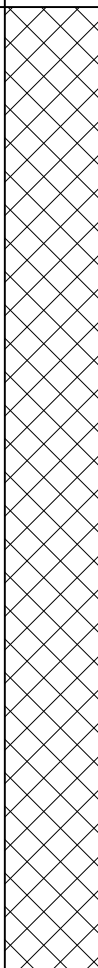
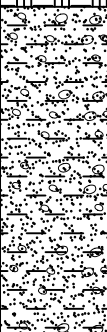
5) Excavation backfilled with arisings on completion.

Dimensions:	Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)
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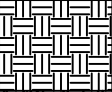
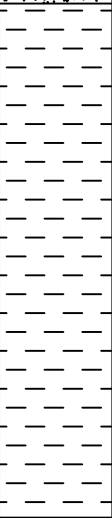
Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk

Sheet 1 of 1

Samples & In-Situ Testing			Strata Details									
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description		Water	Backfill			
0.10	ES1	66,68,64	100.95	(0.30)			Grass over brown TOPSOIL.					
0.40	ES2			(1.10)						1.0	Firm brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz. [BOSWORTH CLAY MEMBER]	
1.00	D1		99.85		1.40						2.0	Stiff brownish grey mottled blue CLAY. [BOSWORTH CLAY MEMBER]
1.10	HSV											
1.50	HSV	90,88,90	98.05	3.20		Trial Pit Terminated @ 3.20m						
2.00	D2											
2.20	HSV											
							</					

- 4) Trial pit terminated at 3.20m.
- 5) Excavation backfilled with arisings on completion.

Plant Used:
JCB - 3CX
(Maddock Geotechnical Support Ltd)

PJS GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk			Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: TP11	
			Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:		
			PJSG20-21	04/08/2021	NB	VH	439598, 303210	101.67	1:25	Sheet 1 of 1	
Samples & In-Situ Testing			Strata Details								
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description	Water	Backfill			
0.10	ES1	62,74,70		(0.30)		Grass over brown TOPSOIL.					
0.40	ES2		101.37	0.30		Firm brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz. [BOSWORTH CLAY MEMBER]					
1.10	D1		100.27	1.40		1.0					
1.20	HSV	Stiff brownish grey mottled blue CLAY. [BOSWORTH CLAY MEMBER]				2.0					
1.60	HSV	80,96,86		(1.70)		Possible gypsum crystals encountered in strata at 2.80m.					
1.80	D2					3.0					
3.00	D3		98.57	3.10		Trial Pit Terminated @ 3.10m					
						4.0					
General Remarks: 1) Excavation stable. 2) No groundwater encountered. 3) No evidence of contamination identified. 4) Trial pit terminated at 3.10m. 5) Excavation backfilled with arisings on completion.											
Dimensions:						Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)					



GEOTECHNICAL
ENGINEERS

Delivering Innovative Solutions

Site Name:

Station Road, Market Bosworth

Client:

Richborough Estates

Job Number:

PJSG20-21

Date Logged:

04/08/2021

Logged By:

NB

Checked By:

VH

Coordinates:

439640, 303262

Ground Level:

103.62

Scale:

1:25

Trial Pit ID:

TP12

Sheet 1 of 1

Samples & In-Situ Testing

Depths

Type

Test Results

Reduced Level

Depth (Thickness)

Legend

Strata Description

Water

Backfill

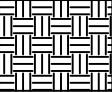
0.10

ES1

60,68,70

103.32

0.30



Grass over brown TOPSOIL.



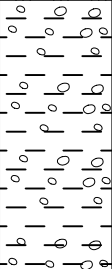
0.40

ES2

84,86,86

102.42

1.20



Firm brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz. **[BOSWORTH CLAY MEMBER]**

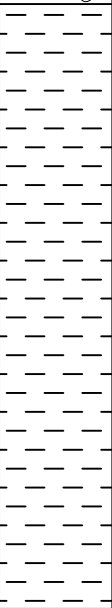
0.90

HSV

110,120,108

100.42

3.20



Stiff brownish grey mottled blue CLAY. **[BOSWORTH CLAY MEMBER]**

1.00

D1

Possible gypsum crystals encountered in strata at 2.80m.

2.00

D2

Trial Pit Terminated @ 3.20m

2.10

HSV

3.00

D3

3.10

B1

3.10

HSV

General Remarks:

1) Excavation stable.

2) No groundwater encountered.

3) No evidence of contamination identified.

4) Trial pit terminated at 3.10m.

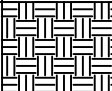
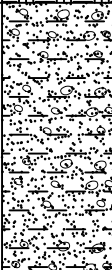
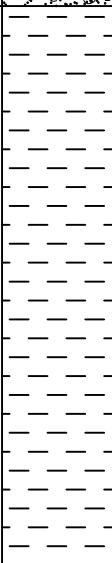
5) Excavation backfilled with arisings on completion.

Dimensions:

Plant Used:
JCB - 3CX
(Maddock Geotechnical Support Ltd)

 GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk	Site Name: Station Road, Market Bosworth		Client: Richborough Estates			Trial Pit ID: TP13	
	Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:
	PJSG20-21	04/08/2021	NB	VH	439630, 303217	103.52	1:25

Sheet 1 of 1

Samples & In-Situ Testing			Strata Details						
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description		Water	Backfill
0.10	ES1	66,72,68	103.22	(0.30)		Grass over brown TOPSOIL.			
0.40	ES2			102.32	(0.90)		Firm brown sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz. [BOSWORTH CLAY MEMBER]		
0.90	HSV		100.42		(1.90)		Stiff brownish grey mottled blue CLAY. [BOSWORTH CLAY MEMBER]		
1.10	D1			98,110,106					
2.20	D2	98,110,106	100.42	3.10		Trial Pit Terminated @ 3.10m			
2.30	HSV								

General Remarks:

1) Excavation stable.

2) No groundwater encountered.

3) No evidence of contamination identified.

4) Trial pit terminated at 3.10m.

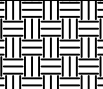
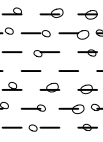
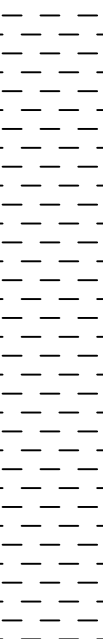
5) Excavation backfilled with arisings on completion.

Dimensions:	Plant Used: JCB - 3CX (Maddock Geotechnical Support Ltd)
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Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: WS01 Sheet 1 of 1
Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:	
PJSG20-21	04/08/2021	BH	VH	439486, 303278	98.19	1:25	

General Remarks: 1) Borehole stable. 2) No groundwater encountered. 3) No evidence of contamination identified. 4) Borehole terminated at 3.00m due to refusal. 5) Borehole installed with gas and groundwater monitoring ancillaries.		Plant Used: Premier Compact 110 (Regional Drilling Ltd)
Dimensions:		

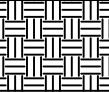
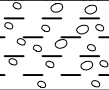
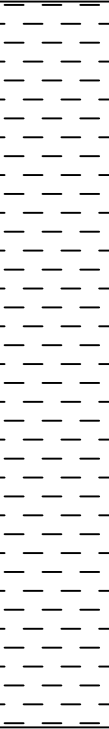
Samples & In-Situ Testing			Strata Details						
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description		Water	Backfill
0.15	ES1	N = 13 (2,2/2,3,3,5)	98.62	(0.30) 0.30		Grass over brown TOPSOIL.			
0.40	ES2		98.12	(0.50) 0.80		Firm to stiff greyish brown slightly gravelly CLAY. Gravel is rounded, medium of chert and sandstone. [BOSWORTH CLAY MEMBER]			
1.00 1.10	SPT D1					Firm becoming stiff brownish grey mottled blue CLAY. Occasional angular, coarse gravels of coal and lignite. [BOSWORTH CLAY MEMBER]			
2.00	SPT		2.0	Possible gypsum crystals encountered in strata at 2.50m.					
2.60	D2								
3.00	SPT		N = 50 (4,6/8,13,14,16)	95.92		3.00	3.0		
					4.0				

General Remarks:

- 1) Borehole stable.
- 2) No groundwater encountered.
- 3) No evidence of contamination identified.
- 4) Borehole terminated at 3.00m due to refusal.
- 5) Borehole installed with gas and groundwater monitoring ancillaries.

Dimensions:	Plant Used: Premier Compact 110 (Regional Drilling Ltd)
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 GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk	Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: WS03 Sheet 1 of 1
	Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:	
	PJSG20-21	04/08/2021	BH	VH	439553, 303266	99.49	1:25	

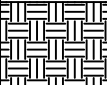
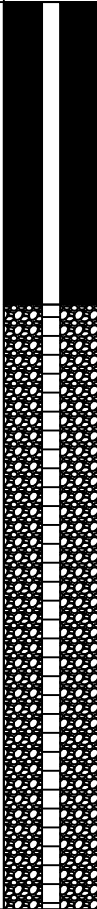
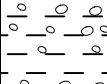
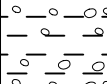
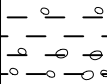
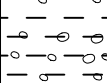
Samples & In-Situ Testing			Strata Details					
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description	Water	Backfill
0.075	ES1	N = 17 (2,2/4,4,4,5)	99.19	0.30		Grass over brown TOPSOIL.		
0.35	ES2		98.89	0.60		Firm orangish brown very gravelly CLAY. Gravel is rounded, medium to coarse of chert. [BOSWORTH CLAY MEMBER]		
0.90 1.00	D1 SPT			(2.40)		Stiff brownish grey mottled blue CLAY with occasional angular, fine to coarse gravel of coal and lignite. [BOSWORTH CLAY MEMBER]		
2.00	SPT	N = 22 (2,4/4,5,5,8)				Possible gypsum crystals encountered in strata at 2.80m.		
2.20	D2							
3.00	SPT	N = 50 (6,7/12,12,13,13)	96.49	3.00		Borehole Terminated @ 3.00m		

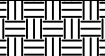
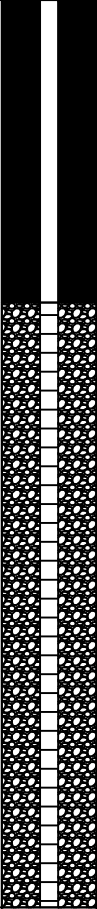
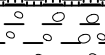
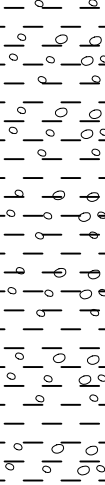
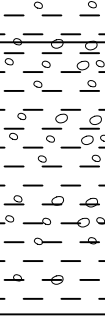
General Remarks:

- 1) Borehole stable.
- 2) No groundwater encountered.
- 3) No evidence of contamination identified.
- 4) Borehole terminated at 3.00m due to refusal.
- 5) Borehole backfilled on completion.

Dimensions:	Plant Used: Premier Compact 110 (Regional Drilling Ltd)
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 GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk	Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: WS04 Sheet 1 of 1
	Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:	
	PJSG20-21	04/08/2021	BH	VH	439561, 303207	100.36	1:25	

Samples & In-Situ Testing			Strata Details						
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description	Water	Backfill	
0.20	ES1	N = 14 (2,2/2,3,4,5)	100.06	(0.30)		Grass over brown TOPSOIL.			
0.40	ES2			0.30		Firm to stiff reddish brown mottled grey slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of chert and sandstone. [BOSWORTH CLAY MEMBER]			
0.80	D1		(2.10)						
1.00	SPT								
2.00	SPT	N = 26 (2,4/4,7,6,9)	97.96	2.40		Very stiff brownish grey mottled blue slightly gravelly CLAY. Gravel is fine to medium, sub-angular to angular of coal, lignite and sandstone. [BOSWORTH CLAY MEMBER]			
2.30	D2								
3.00	SPT	N = 50 (6,7/9,13,14,22)	97.36	3.00		Possible gypsum crystals encountered in strata at 2.90m.			
						Borehole Terminated @ 3.00m			

 GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk <td colspan="4">Site Name: Station Road, Market Bosworth</td> <td colspan="3">Client: Richborough Estates</td> <td colspan="2">Trial Pit ID: WS05</td>			Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: WS05			
Job Number: PJSG20-21		Date Logged: 04/08/2021		Logged By: BH		Checked By: VH		Coordinates: 439613, 303283		Ground Level: 101.67		Scale: 1:25	
Samples & In-Situ Testing			Strata Details										
Depths		Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description				Water	Backfill	
0.10		ES1		101.47	(0.20)		Grass over brown TOPSOIL.						
0.30		ES2		101.47	0.20		Stiff dark brown mottled grey slightly gravelly CLAY. Gravel is sub-rounded, fine to coarse of sandstone. [BOSWORTH CLAY MEMBER]						
0.90		D1	N = 19 (1,2/3,3,6,7)		(1.90)		1.0						
1.00		SPT											
2.00		SPT	N = 23 (2,3/4,5,6,8)	99.57	2.10		2.0						
2.70		D2	N = 50 (4,4/12,16,16,6)		(0.90)		Stiff to very stiff brownish grey mottled blue slightly gravelly CLAY. Gravel is angular, coarse of chert, coal and lignite. [BOSWORTH CLAY MEMBER]						
3.00		SPT					98.67	3.00		3.0			
							Borehole Terminated @ 3.00m						
							4.0						
							5.0						
General Remarks: 1) Borehole stable. 2) No groundwater encountered. 3) No evidence of contamination identified. 4) Borehole terminated at 3.00m due to refusal. 5) Borehole installed with gas and groundwater monitoring ancillaries.													
Dimensions:							Plant Used: Premier Compact 110 (Regional Drilling Ltd)						



Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk

Sheet 1 of 1

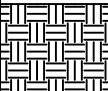
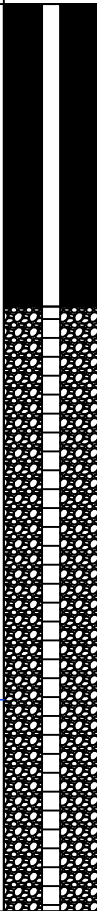
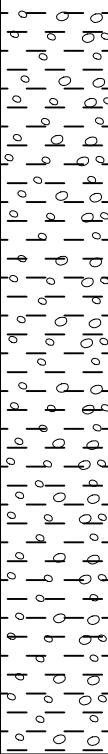
[illegible]

- 1) Borehole stable.
- 2) No groundwater encountered.
- 3) No evidence of contamination identified.
- 4) Borehole terminated at 3.00m due to refusal.
- 5) Borehole backfilled on completion.

Plant Used:
Premier Compact 110
(Regional Drilling Ltd)

PJS GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk			Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: WS07	
			Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:	Sheet 1 of 1	
			PJSG20-21	04/08/2021	BH	VH	439608, 303169	103.29	1:25		
Samples & In-Situ Testing			Strata Details								
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description	Water	Backfill			
0.10	ES1			(0.20)		Grass over brown TOPSOIL.					
0.30	ES2		103.09	0.20		Stiff orangish brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to coarse of quartz. [BOSWORTH CLAY MEMBER]					
			102.79	0.50		Stiff brownish grey mottled blue slightly gravelly CLAY. Gravel is angular, fine of sandstone. [BOSWORTH CLAY MEMBER]					
0.70	D1	N = 17 (1,2/4,4,4,5)		(1.70)		1.0					
1.00	SPT										
1.10	D2										
2.00	SPT	N = 27 (3,3/4,6,7,10)	101.09	2.20		2.0					
			(0.80)	3.0							
3.00	SPT	N = 50 (4,5/12,12,13,13)	100.29	3.00		Borehole Terminated @ 3.00m					
						4.0					
						5.0					
General Remarks: 1) Borehole stable. 2) No groundwater encountered. 3) No evidence of contamination identified. 4) Borehole terminated at 3.00m due to refusal. 5) Borehole installed with gas and groundwater monitoring ancillaries.											
Dimensions:					Plant Used: Premier Compact 110 (Regional Drilling Ltd)						

 GEOTECHNICAL ENGINEERS Delivering Innovative Solutions PJS Geotechnical Engineers Limited, Unit 4 Winking Hill Farm, Kingston on Soar, Nottingham, NG11 0DP. Registered Number: 11882468 Tel: 0115 704 3950 Email: Enquiries@pjs-geo.co.uk	Site Name: Station Road, Market Bosworth				Client: Richborough Estates			Trial Pit ID: WS08
	Job Number:	Date Logged:	Logged By:	Checked By:	Coordinates:	Ground Level:	Scale:	
	PJSG20-21	04/08/2021	BH	VH	439663, 303241	106.55	1:25	Sheet 1 of 1

Samples & In-Situ Testing			Strata Details						
Depths	Type	Test Results	Reduced Level	Depth (Thickness)	Legend	Strata Description	Water	Backfill	
0.15	ES1	N = 17 (1,2/3,4,4,6)		(0.30)		Grass over brown TOPSOIL.			
0.40	ES2		106.25	0.30		Light brown mottled orange gravelly SAND.			
			106.05	(0.20) 0.50		Stiff reddish brown mottled grey slightly gravelly CLAY. Gravel is rounded to sub-rounded, fine to coarse of sandstone. [BOSWORTH CLAY MEMBER]			
0.90	D1		N = 32 (2,3/7,8,8,9)	(2.50)		1.0			Becoming very stiff at 2.00m.
1.00	SPT					2.0			
2.00	SPT	2.60							
2.60	D2	N = 50 (4,5/5,7,9,29)	103.55	3.00		Strata becoming damp. 0% recovery below 2.80m.			
3.00	SPT					3.0			Borehole Terminated @ 3.00m
		</							

General Remarks: 1) Borehole stable. 2) Groundwater encountered at 2.80m. 3) No evidence of contamination identified. 4) Borehole terminated at 3.00m due to refusal. 5) Borehole installed with gas and groundwater monitoring ancillaries.	
Dimensions:	Plant Used: Premier Compact 110 (Regional Drilling Ltd)

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: 110.124
Test Date: 12/04/2021
Report Date: 12/04/2021
File Name: 110.124.spt
Test Operator: JL

Instrumented Rod Data

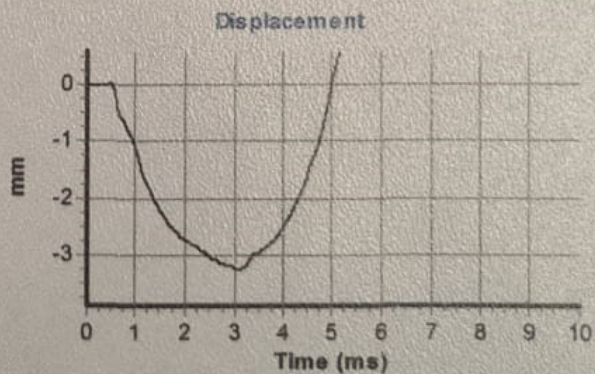
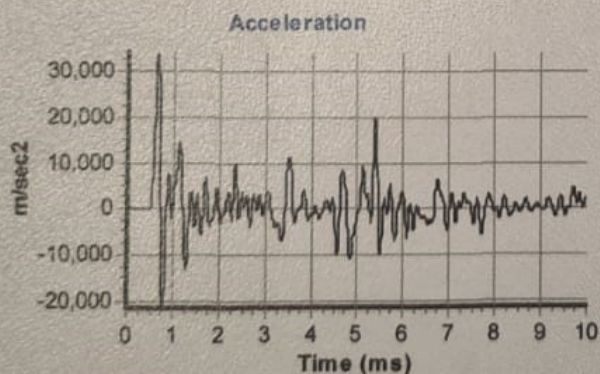
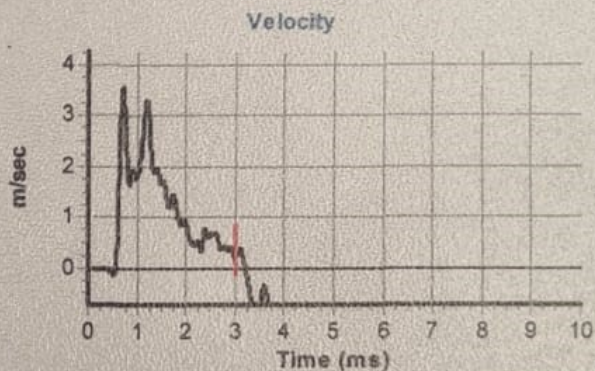
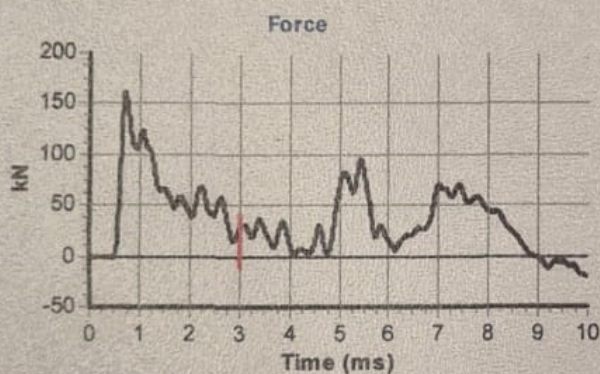
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.3
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 10.0

Comments / Location

REGIONAL DRILLING - 75089



Calculations

Area of Rod A (mm^2): 944
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 305

Energy Ratio E_r (%): **64**

Signed: J.LOCK

Title: FITTER

The recommended calibration interval is 12 months

Appendix B: Chemical Testing Results



Anthony Owen

Exploration & Testing Associates Limited
3 Siskin Drive
Middlemarch Business Park
Coventry
CV3 4FJ

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

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

e: results@explorationtesting.uk

Analytical Report Number : 21-91731

Project / Site name:	Market Bosworth	Samples received on:	06/08/2021
Your job number:	C10160	Samples instructed on/ Analysis started on:	09/08/2021
Your order number:	1413	Analysis completed by:	16/08/2021
Report Issue Number:	1	Report issued on:	16/08/2021
Samples Analysed:	13 soil samples		

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

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

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

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

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

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 21-91731
Project / Site name: Market Bosworth
Your Order No: 1413

Lab Sample Number				1965916	1965917	1965918	1965919	1965920
Sample Reference				TP01	TP05	TP06	TP07	TP09
Sample Number				1	1	1	1	1
Depth (m)				0.15	0.10	0.10	0.10	0.10
Date Sampled				04/08/2021	04/08/2021	04/08/2021	04/08/2021	04/08/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	11	8.2	11	9.2	8.2
Total mass of sample received	kg	0.001	NONE	1.7	1.0	0.40	1.4	0.80

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.5	6.7	6.0	6.7	6.2
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.014	0.031	0.12	0.015	0.056
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	-	-
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	-	-
Total Sulphur	%	0.005	MCERTS	-	-	-	-	-
Organic Matter (automated)	%	0.1	MCERTS	3.7	6.0	5.1	3.0	6.8
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	-	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.29	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.67	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.64	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.44	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.39	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.59	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.18	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.51	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.27	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.33	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	4.31	< 0.80	< 0.80	< 0.80
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Analytical Report Number: 21-91731
Project / Site name: Market Bosworth
Your Order No: 1413

Lab Sample Number				1965916	1965917	1965918	1965919	1965920
Sample Reference				TP01	TP05	TP06	TP07	TP09
Sample Number				1	1	1	1	1
Depth (m)				0.15	0.10	0.10	0.10	0.10
Date Sampled				04/08/2021	04/08/2021	04/08/2021	04/08/2021	04/08/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	9.3	10	11	8.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5	0.4	0.5	0.5	0.3
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	40	29	31	31	24
Copper (aqua regia extractable)	mg/kg	1	MCERTS	22	19	20	21	20
Lead (aqua regia extractable)	mg/kg	1	MCERTS	56	41	51	48	50
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	22	18	19	21	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	95	85	86	80	82

Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-91731
Project / Site name: Market Bosworth
Your Order No: 1413

Lab Sample Number				1965921	1965922	1965923	1965924	1965925
Sample Reference				TP12	TP13	WS04	WS06	WS07
Sample Number				1	2	2	1	1
Depth (m)				0.10	0.40	0.40	0.15	0.10
Date Sampled				04/08/2021	04/08/2021	04/08/2021	04/08/2021	04/08/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	5.9	6.6	8.0	5.0	5.6
Total mass of sample received	kg	0.001	NONE	0.80	0.90	0.80	0.90	0.90

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	Not-detected	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.8	7.1	7.4	7.1	6.8
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.042	0.020	0.021	0.023	0.036
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	-	-
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	-	-
Total Sulphur	%	0.005	MCERTS	-	-	-	-	-
Organic Matter (automated)	%	0.1	MCERTS	7.0	3.3	2.8	3.5	7.2
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	-	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
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Analytical Report Number: 21-91731
 Project / Site name: Market Bosworth
 Your Order No: 1413

Lab Sample Number				1965921	1965922	1965923	1965924	1965925
Sample Reference				TP12	TP13	WS04	WS06	WS07
Sample Number				1	2	2	1	1
Depth (m)				0.10	0.40	0.40	0.15	0.10
Date Sampled				04/08/2021	04/08/2021	04/08/2021	04/08/2021	04/08/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.3	9.8	12	14	11
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5	0.4	0.4	0.6	0.4
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	28	34	48	38	32
Copper (aqua regia extractable)	mg/kg	1	MCERTS	18	20	22	27	21
Lead (aqua regia extractable)	mg/kg	1	MCERTS	44	45	42	60	53
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	21	32	27	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	91	85	86	110	88
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-91731
Project / Site name: Market Bosworth
Your Order No: 1413

Lab Sample Number				1965926	1965927	1965928
Sample Reference				TP12	TP01	TP09
Sample Number				2	3	1
Depth (m)				2.00	3.00	1.20
Date Sampled				04/08/2021	04/08/2021	04/08/2021
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	9.8	9.5	13
Total mass of sample received	kg	0.001	NONE	1.1	0.80	0.90

Asbestos in Soil	Type	N/A	ISO 17025	-	-	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	7.9	8.2
Total Sulphate as SO ₄	%	0.005	MCERTS	0.120	0.840	0.053
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.51	2.1	0.12
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	511	2090	121
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	5.4	3.1	4.6
Total Sulphur	%	0.005	MCERTS	0.047	0.276	0.042
Organic Matter (automated)	%	0.1	MCERTS	-	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-
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Analytical Report Number: 21-91731
 Project / Site name: Market Bosworth
 Your Order No: 1413

Lab Sample Number				1965926	1965927	1965928
Sample Reference				TP12	TP01	TP09
Sample Number				2	3	1
Depth (m)				2.00	3.00	1.20
Date Sampled				04/08/2021	04/08/2021	04/08/2021
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-
Chromium (hexavalent)	mg/kg	4	MCERTS	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Magnesium (water soluble)	mg/kg	5	NONE	140	370	33
Magnesium (leachate equivalent)	mg/l	2.5	NONE	71	190	16

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 21-91731
Project / Site name: Market Bosworth

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1965916	TP01	1	0.15	Brown loam with gravel and vegetation.
1965917	TP05	1	0.1	Brown loam with gravel and vegetation.
1965918	TP06	1	0.1	Brown loam with gravel and vegetation.
1965919	TP07	1	0.1	Brown loam with gravel and vegetation.
1965920	TP09	1	0.1	Brown loam with gravel and vegetation.
1965921	TP12	1	0.1	Brown loam and clay with gravel and vegetation.
1965922	TP13	2	0.4	Brown loam and clay with gravel and vegetation.
1965923	WS04	2	0.4	Brown loam and clay with gravel and vegetation.
1965924	WS06	1	0.15	Brown loam and clay with gravel and vegetation.
1965925	WS07	1	0.1	Brown loam and clay with gravel and vegetation.
1965926	TP12	2	2	Brown clay.
1965927	TP01	3	3	Brown clay.
1965928	TP09	1	1.2	Brown clay.

Analytical Report Number : 21-91731
Project / Site name: Market Bosworth

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



Analytical Report Number : 21-91731
Project / Site name: Market Bosworth

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Appendix C: Geotechnical Testing Results



Laboratory Test Report

Client:	Exploration and Testing Associates Limited
Job Number:	C10160
Project:	Market Bosworth
Report Number:	L21-463
Date Received:	10.08.2021
Client Contact:	Anthony Owen
Address:	'number three' Siskin Drive, Middlemarch Business Park, Coventry, CV3 4FJ

Testing Required:	Moisture Content - BS EN ISO 17892-1:2014 Determination of the Liquid and Plastic Limit and Plasticity Index BS EN ISO 17892- 12:2018 Particle Size Distribution - BS EN ISO 17892-4:2016
Date Testing Started:	12.08.2021
Date Testing Finished:	23.08.2021

Date Report Issued:	23.08.2021
Reviewed By:	 N. O'Brien - Laboratory Manager
Authorised By:	 N. Hodson - Materials Director
Remarks:	(*) Denotes testing is outside of UKAS Accreditation Scope.

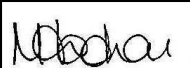
Samples will be stored for one month after the report has been issued before being disposed of.

The published results are appertaining only to the specimens tested.

Exploration & Testing Associates Limited, registered in England and Wales # 11803869 at 8B Bowburn South Ind Est,
Bowburn, Durham, DH6 5AD

Determination of Water Content, Liquid Limit, Plastic Limit and Derivation of Plasticity Index

Project No.				Project Name							
C10160				Market Bosworth							
Hole No.		Sample		Soil Description	Water Content %	Passing 425µm %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Remarks	
	Type	Ref	Depth								
TP06	D	1	0.80	Brown with Orange Mottling, Slightly Sandy CLAY	28	98	73	29	44	Sample tested in natural state - material passing 425um estimated by hand picking	
WS06	D	1	0.90	Brown, Slightly Sandy CLAY	24	100	62	22	40	Sample tested in natural state - material passing 425um estimated by hand picking	
TP01	D	1	1.00	Brown with Orange Mottling, Slightly Sandy CLAY	35	100	81	27	54	Sample tested in natural state - material passing 425um estimated by hand picking	
WS02	D	1	1.10	Brown, Slightly Sandy CLAY	27	100	64	24	40	Sample tested in natural state - material passing 425um estimated by hand picking	
WS07	D	2	1.10	Brown with Grey Mottling, Slightly Sandy, Slightly Gravelly CLAY CLAY	22	100	59	22	37	Sample tested in natural state - material passing 425um estimated by hand picking	
TP07	D	1	1.50	Brown, Slightly Sandy CLAY	26	100	60	23	37	Sample tested in natural state - material passing 425um estimated by hand picking	
TP11	D	2	1.80	Brown with Grey Mottling, Slightly Sandy CLAY	28	100	69	26	43	Sample tested in natural state - material passing 425um estimated by hand picking	
TP01	D	2	2.00	Brown with Orange and Grey Mottling, Slightly Sandy CLAY	28	100	58	25	33	Sample tested in natural state - material passing 425um estimated by hand picking	
TP05	D	2	2.00	Brown with Orange and Grey Mottling, Slightly Sandy CLAY	26	99	58	24	34	Sample tested in natural state - material passing 425um estimated by hand picking	
WS08	D	2	2.60	Brown with Orange Mottling, Slightly Sandy CLAY	32	100	29	24	5	Sample tested in natural state - material passing 425um estimated by hand picking	
WS05	D	2	2.70	Brown with Grey Mottling, Slightly Sandy CLAY	24	99	53	21	32	Sample tested in natural state - material passing 425um estimated by hand picking	

Water Content carried out in accordance with BS EN ISO 17892: Part 1: 2014: Clause 5.1 & 5.2	Date	Approved By	UKAS Accredited Laboratory No. 20632
		N Hodson	
Liquid Limit, Plastic Limit & Plasticity Index all performed in accordance with BS EN ISO 17892: Part 12: 2018 - Fall cone four point method - Cone 80g/30°	23/08/2021 11:42		

PARTICLE SIZE DISTRIBUTION

Job Ref

C10160

Borehole/Pit No.

TP09

Site Name

Market Bosworth

Sample No.

1

Soil Description

Brown, Sandy, Slightly Gravelly CLAY with Rootlets

Depth, m

0.50

Specimen
Reference

Specimen
Depth

m

Sample Type

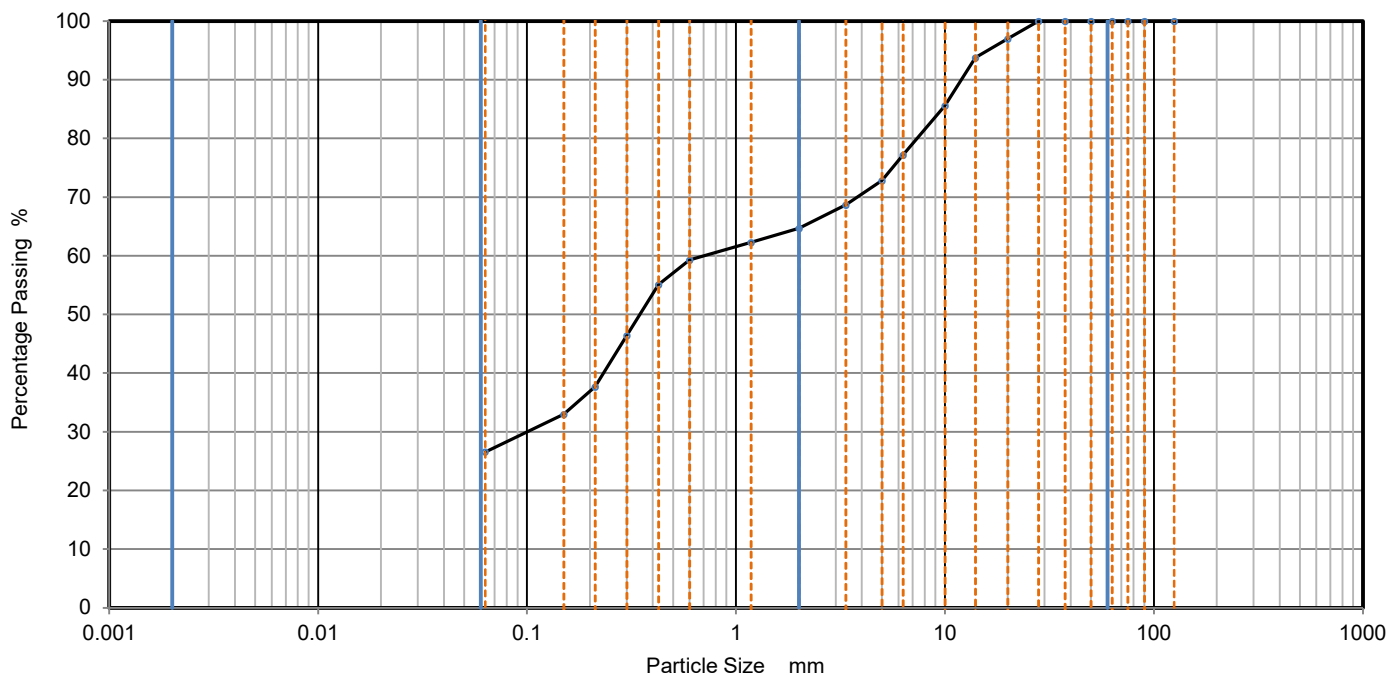
B

Test Method

BS EN ISO 17892-4:2016 - Wet & Dry Sieving

KeyLAB ID

EAT_2021080973



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	97		
14	94		
10	86		
6.3	77		
5	73		
3.35	69		
2	65		
1.18	62		
0.6	59		
0.425	55		
0.3	46		
0.212	38		
0.15	33		
0.063	26.6		

Sample Proportions	% dry mass
Very coarse	0
Gravel	35
Sand	38
Fines <0.063mm	27

Grading Analysis	
D ₁₀₀	mm
D ₆₀	mm
D ₃₀	mm
D ₁₀	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS EN ISO 17892-4:2016 unless noted below

Date

23/08/2021 11:34

Approved By

N O'Brien

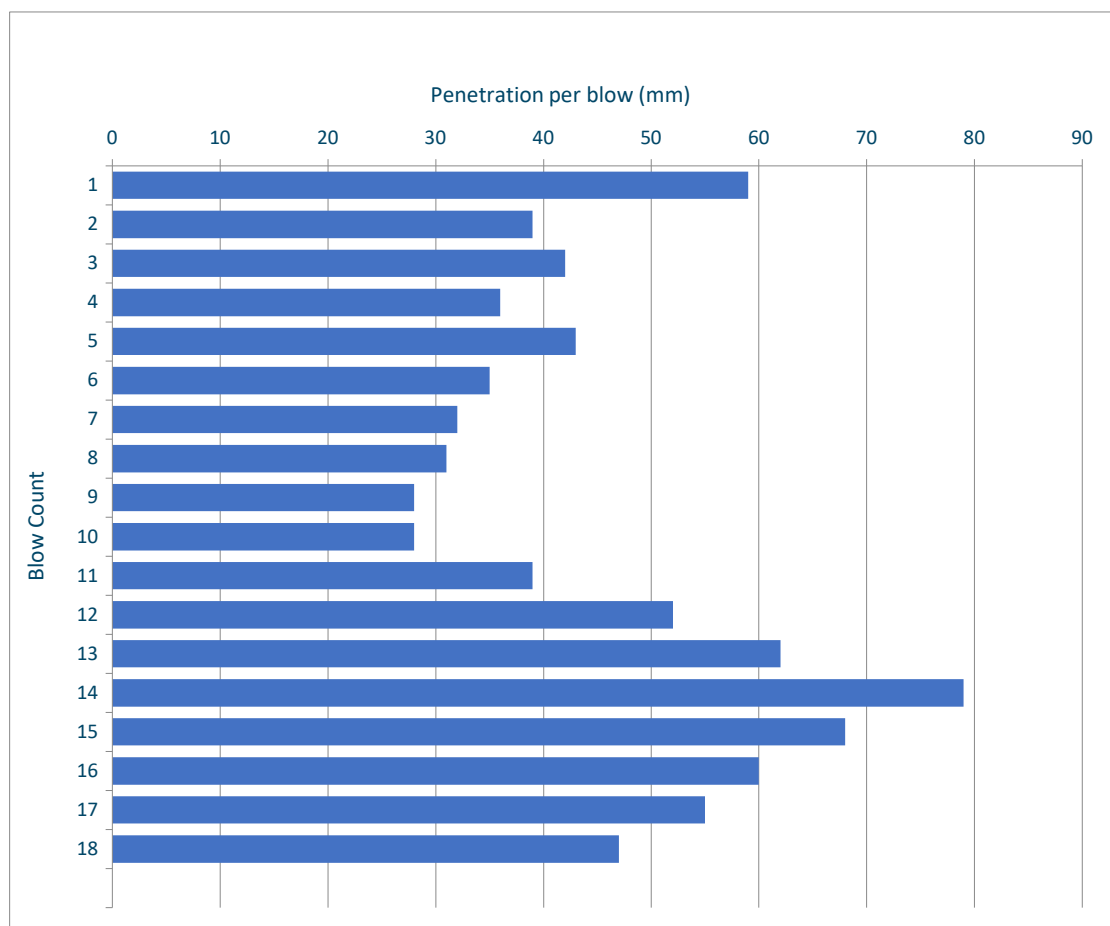
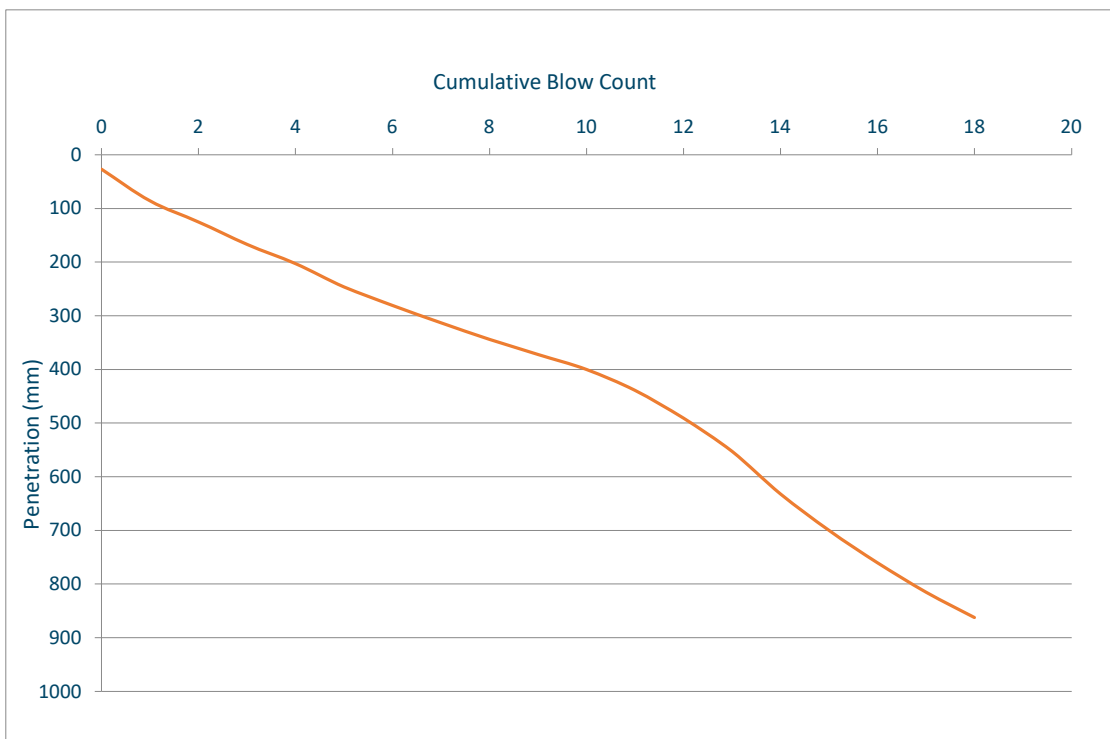
UKAS Accredited
Laboratory No. 20632

Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location DCP01		Zero (mm)			
Depth of cone at start of test (m)		35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/blow (mm)	CBR (%) [Ref. CS 229]
0	62	27	0.027	N/A	N/A
1	121	86	0.086	59	4.1
2	160	125	0.125	39	6.3
3	202	167	0.167	42	5.8
4	238	203	0.203	36	6.8
5	281	246	0.246	43	5.7
6	316	281	0.281	35	7.0
7	348	313	0.313	32	7.7
8	379	344	0.344	31	8.0
9	407	372	0.372	28	8.9
10	435	400	0.400	28	8.9
11	474	439	0.439	39	6.3
12	526	491	0.491	52	4.6
13	588	553	0.553	62	3.8
14	667	632	0.632	79	3.0
15	735	700	0.700	68	3.5
16	795	760	0.760	60	4.0
17	850	815	0.815	55	4.4
18	897	862	0.862	47	5.2
Remarks:					
				Easting	
				Northing	
				Level (mAOD)	

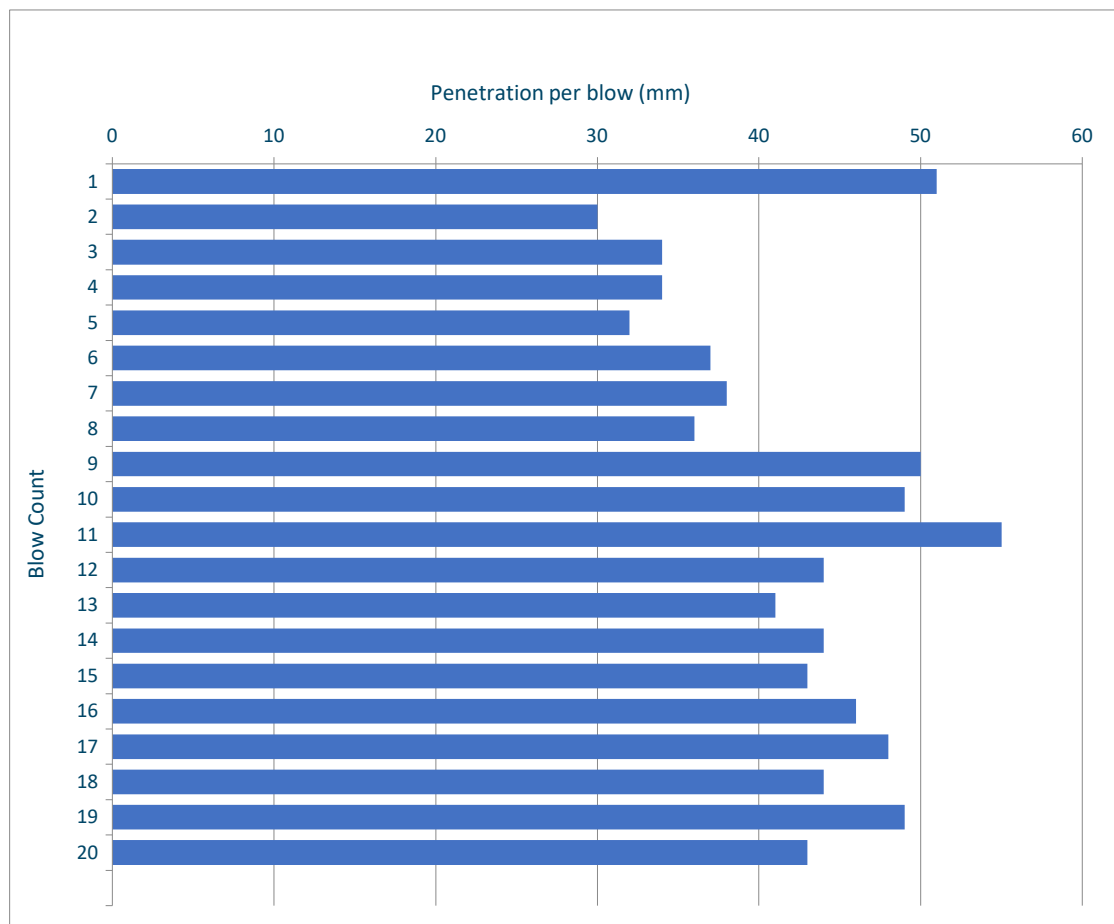
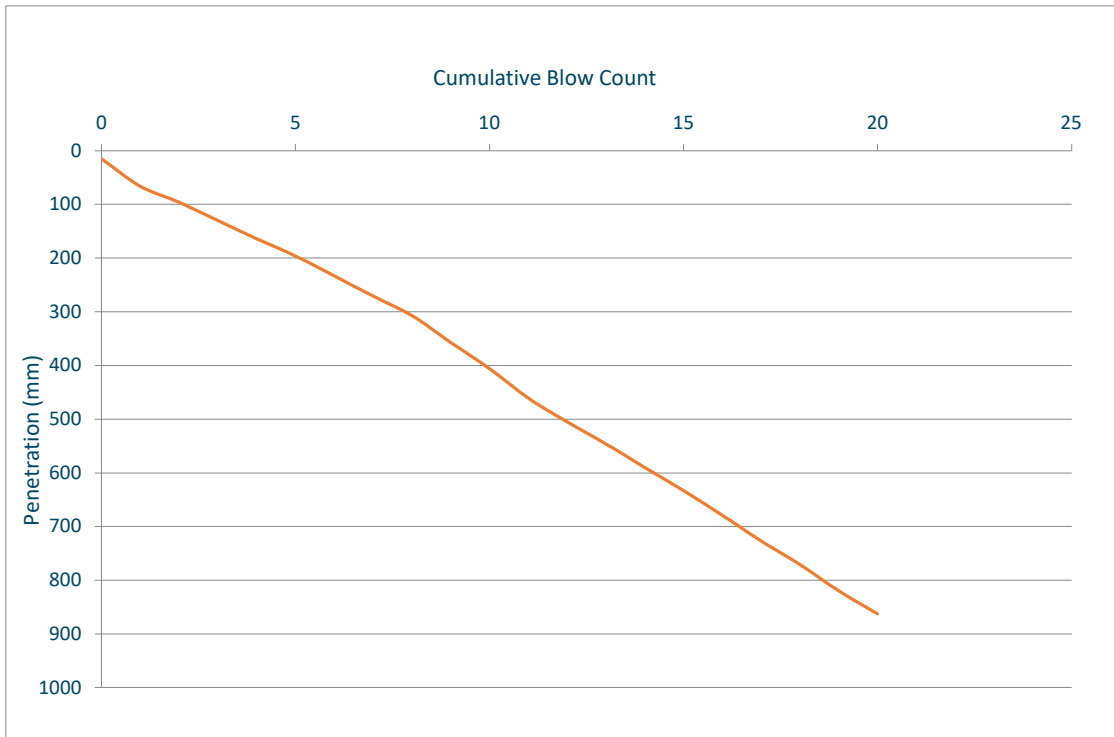


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location		DCP02	Zero (mm)		
Depth of cone at start of test (m)		0.015	35		
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/ blow (mm)	CBR (%) [Ref. CS 229]
0	50	15	0.015	N/A	N/A
1	101	66	0.066	51	4.7
2	131	96	0.096	30	8.3
3	165	130	0.130	34	7.3
4	199	164	0.164	34	7.3
5	231	196	0.196	32	7.7
6	268	233	0.233	37	6.6
7	306	271	0.271	38	6.5
8	342	307	0.307	36	6.8
9	392	357	0.357	50	4.8
10	441	406	0.406	49	4.9
11	496	461	0.461	55	4.4
12	540	505	0.505	44	5.5
13	581	546	0.546	41	6.0
14	625	590	0.590	44	5.5
15	668	633	0.633	43	5.7
16	714	679	0.679	46	5.3
17	762	727	0.727	48	5.0
18	806	771	0.771	44	5.5
19	855	820	0.820	49	4.9
20	898	863	0.863	43	5.7
Remarks:				Easting	
				Northing	
				Level (mAOD)	

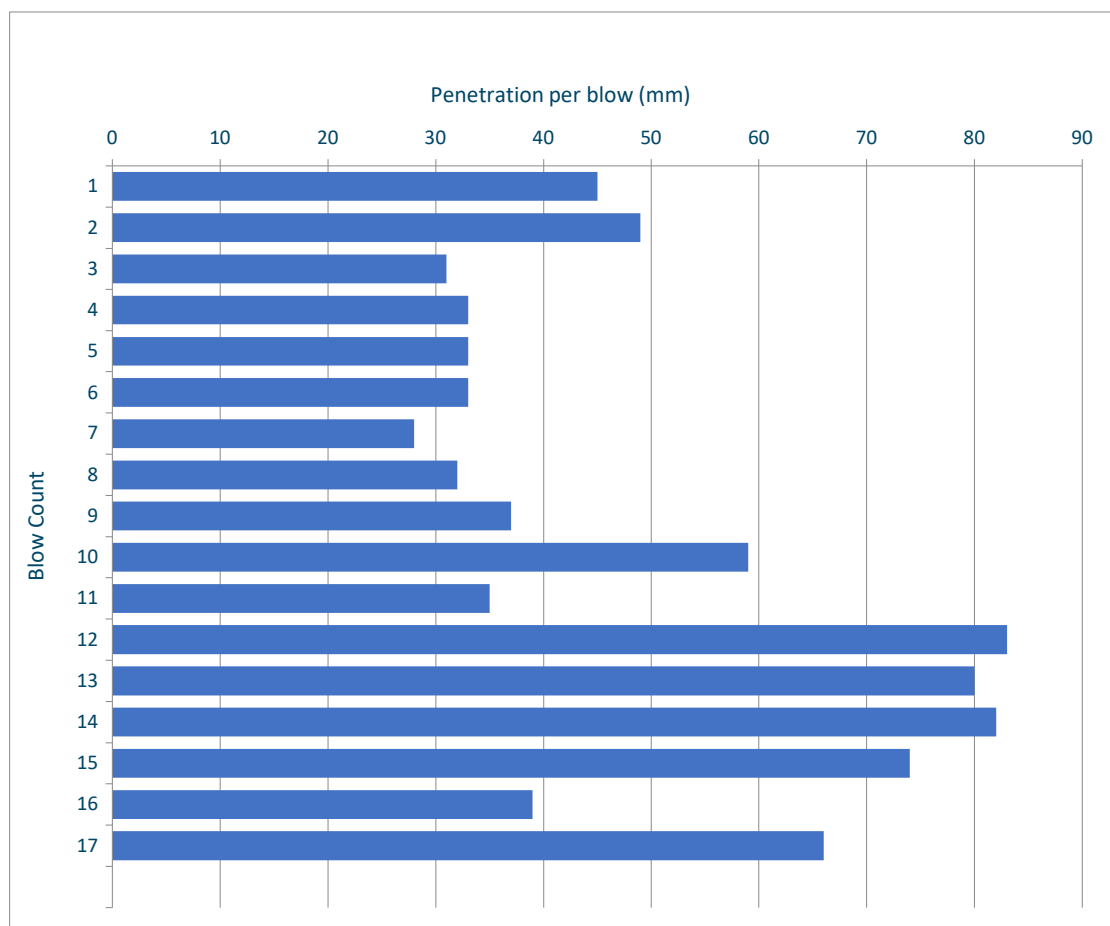
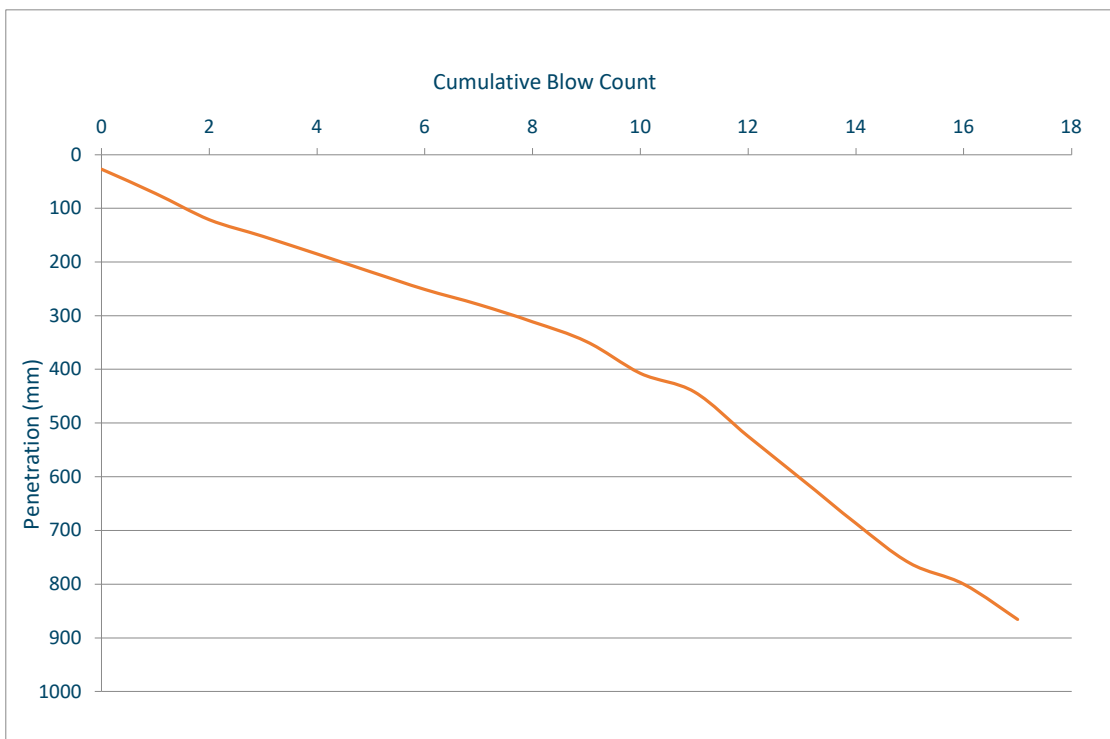


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location DCP03		Zero (mm)			
Depth of cone at start of test (m)		35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/blow (mm)	CBR (%) [Ref. CS 229]
0	62	27	0.027	N/A	N/A
1	107	72	0.072	45	5.4
2	156	121	0.121	49	4.9
3	187	152	0.152	31	8.0
4	220	185	0.185	33	7.5
5	253	218	0.218	33	7.5
6	286	251	0.251	33	7.5
7	314	279	0.279	28	8.9
8	346	311	0.311	32	7.7
9	383	348	0.348	37	6.6
10	442	407	0.407	59	4.1
11	477	442	0.442	35	7.0
12	560	525	0.525	83	2.8
13	640	605	0.605	80	2.9
14	722	687	0.687	82	2.9
15	796	761	0.761	74	3.2
16	835	800	0.800	39	6.3
17	901	866	0.866	66	3.6
Remarks:					
			Easting		
			Northing		
			Level (mAOD)		

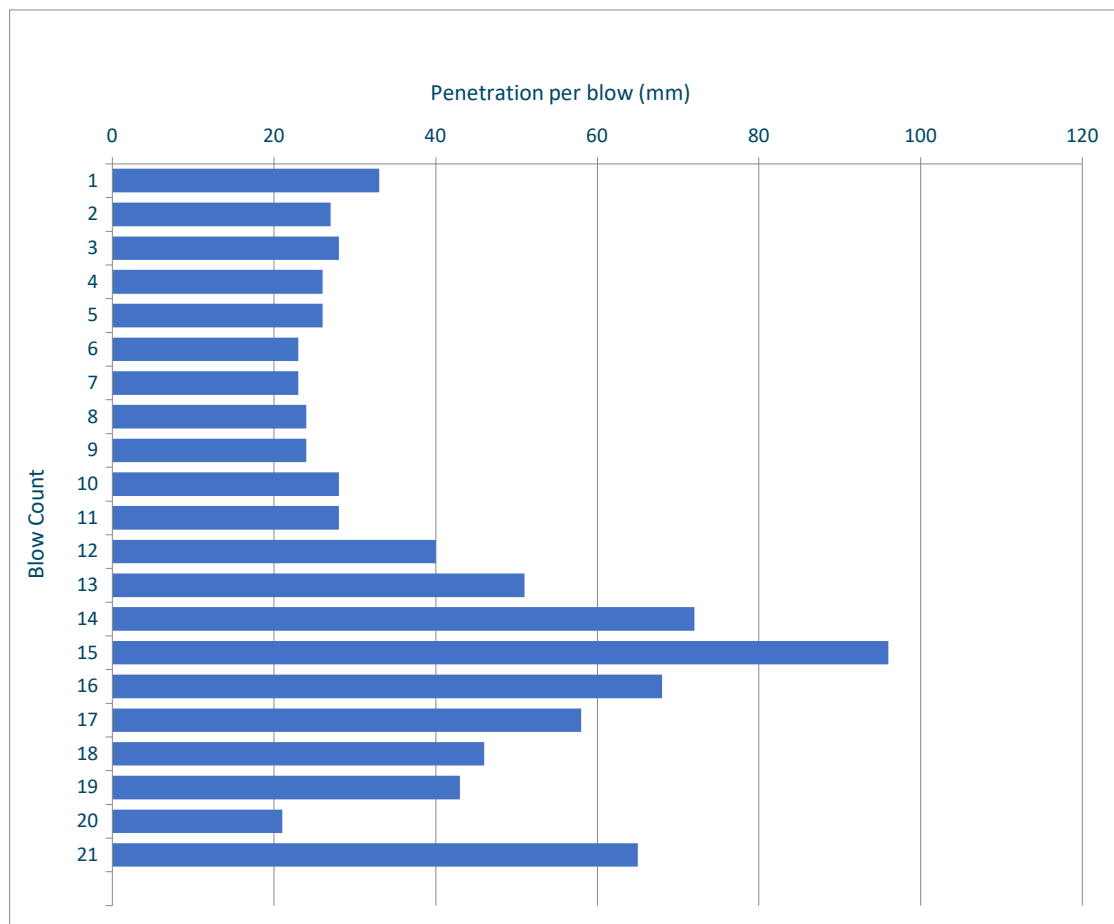
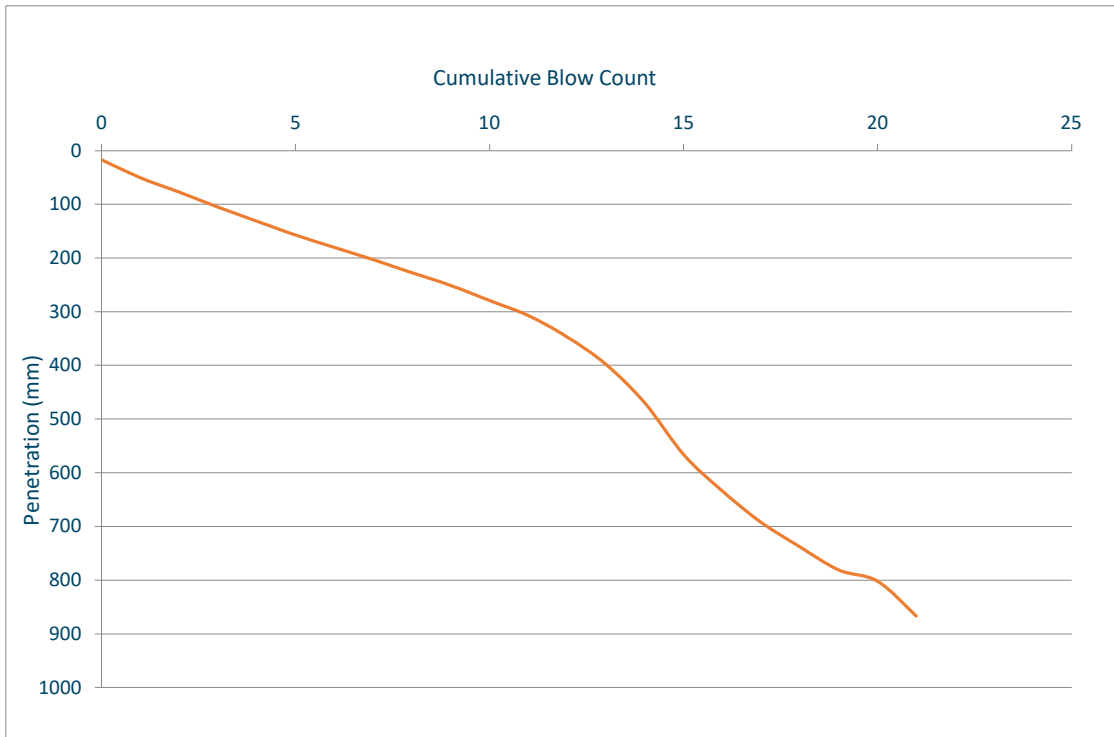


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location DCP04		Zero (mm)			
Depth of cone at start of test (m) 0.017		35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/blow (mm)	CBR (%) [Ref. CS 229]
0	52	17	0.017	N/A	N/A
1	85	50	0.050	33	7.5
2	112	77	0.077	27	9.3
3	140	105	0.105	28	8.9
4	166	131	0.131	26	9.6
5	192	157	0.157	26	9.6
6	215	180	0.180	23	11.0
7	238	203	0.203	23	11.0
8	262	227	0.227	24	10.5
9	286	251	0.251	24	10.5
10	314	279	0.279	28	8.9
11	342	307	0.307	28	8.9
12	382	347	0.347	40	6.1
13	433	398	0.398	51	4.7
14	505	470	0.470	72	3.3
15	601	566	0.566	96	2.4
16	669	634	0.634	68	3.5
17	727	692	0.692	58	4.1
18	773	738	0.738	46	5.3
19	816	781	0.781	43	5.7
20	837	802	0.802	21	12.1
21	902	867	0.867	65	3.7
Remarks:			Easting		
			Northing		
			Level (mAOD)		

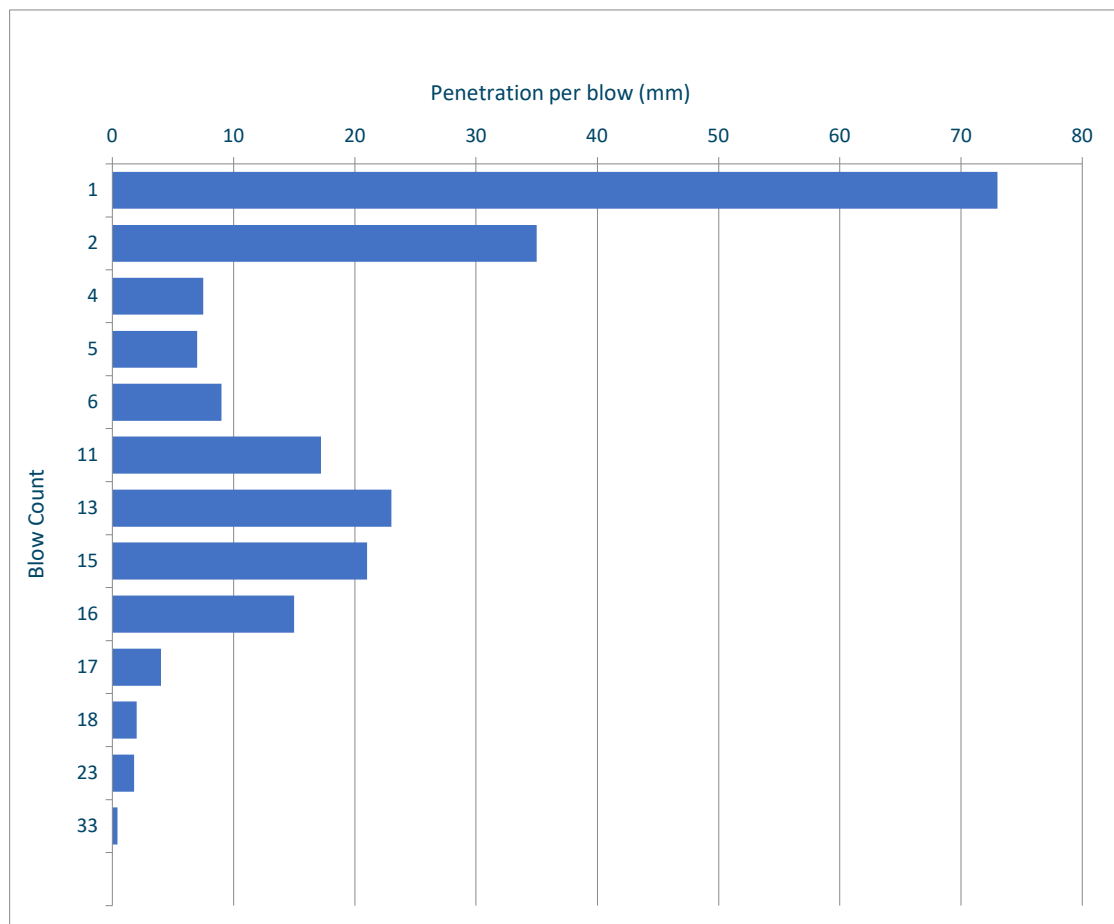
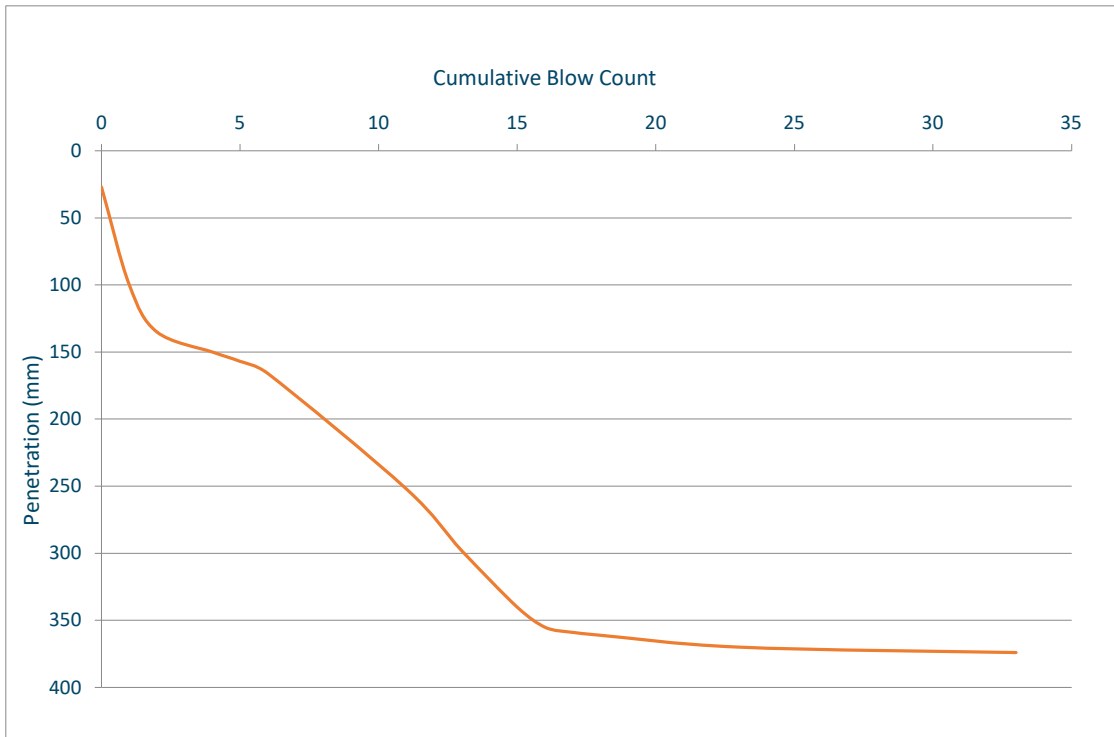


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location DCP05		Zero (mm)			
Depth of cone at start of test (m)		35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/blow (mm)	CBR (%) [Ref. CS 229]
0	62	27	0.027	N/A	N/A
1	135	100	0.100	73	3.2
2	170	135	0.135	35	7.0
4	185	150	0.150	8	35.9
5	192	157	0.157	7	38.6
6	201	166	0.166	9	29.6
11	287	252	0.252	17	14.9
13	333	298	0.298	23	11.0
15	375	340	0.340	21	12.1
16	390	355	0.355	15	17.3
17	394	359	0.359	4	69.8
18	396	361	0.361	2	145.1
23	405	370	0.370	2	162.2
33	409	374	0.374	0	795.5
Remarks:			Easting		
			Northing		
			Level (mAOD)		

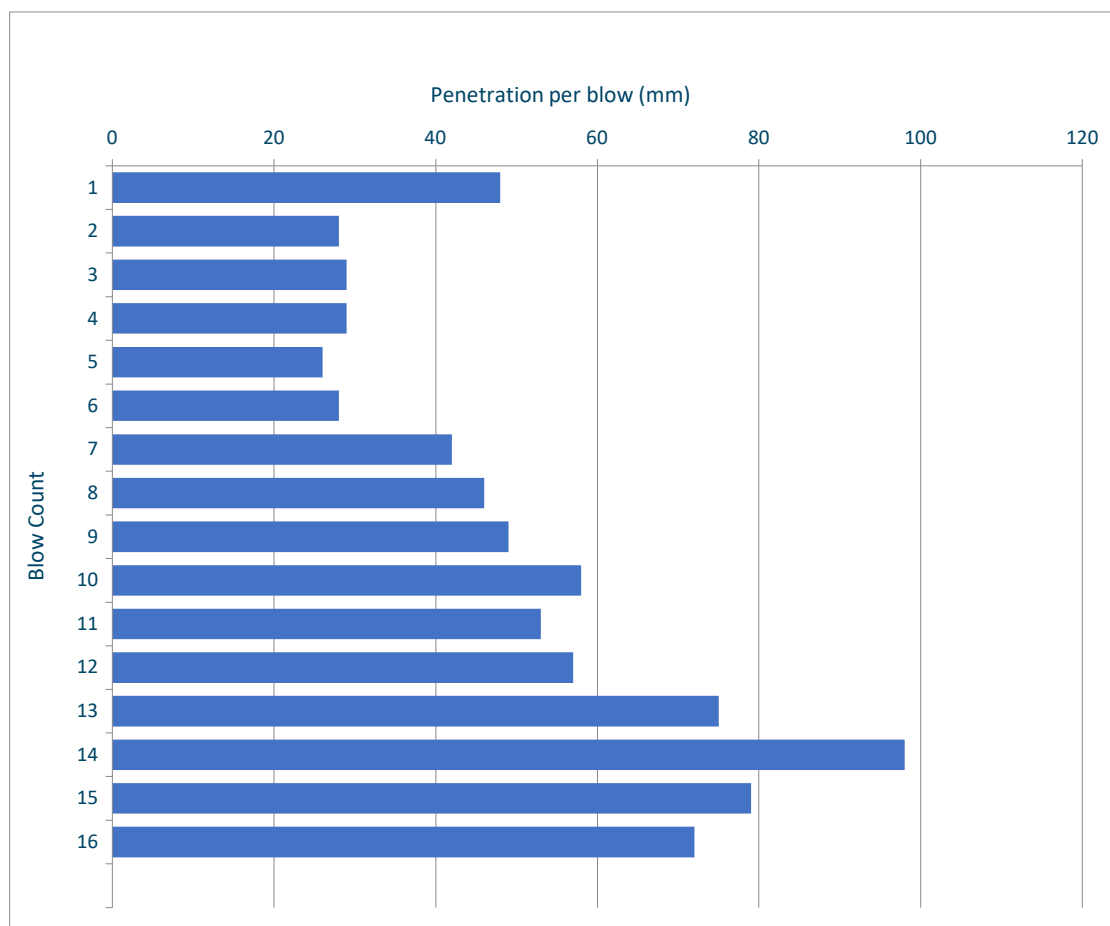
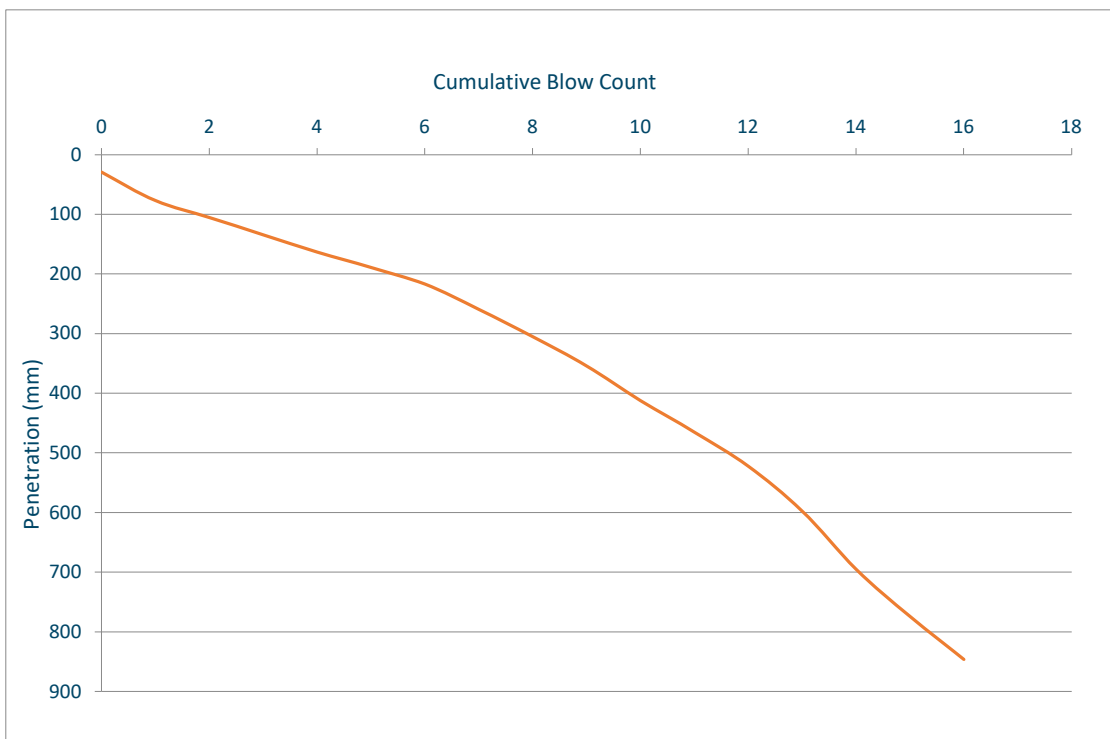


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location DCP06		Zero (mm)			
Depth of cone at start of test (m)		35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/blow (mm)	CBR (%) [Ref. CS 229]
0	64	29	0.029	N/A	N/A
1	112	77	0.077	48	5.0
2	140	105	0.105	28	8.9
3	169	134	0.134	29	8.6
4	198	163	0.163	29	8.6
5	224	189	0.189	26	9.6
6	252	217	0.217	28	8.9
7	294	259	0.259	42	5.8
8	340	305	0.305	46	5.3
9	389	354	0.354	49	4.9
10	447	412	0.412	58	4.1
11	500	465	0.465	53	4.5
12	557	522	0.522	57	4.2
13	632	597	0.597	75	3.1
14	730	695	0.695	98	2.4
15	809	774	0.774	79	3.0
16	881	846	0.846	72	3.3
Remarks:					
				Easting	
				Northing	
				Level (mAOD)	

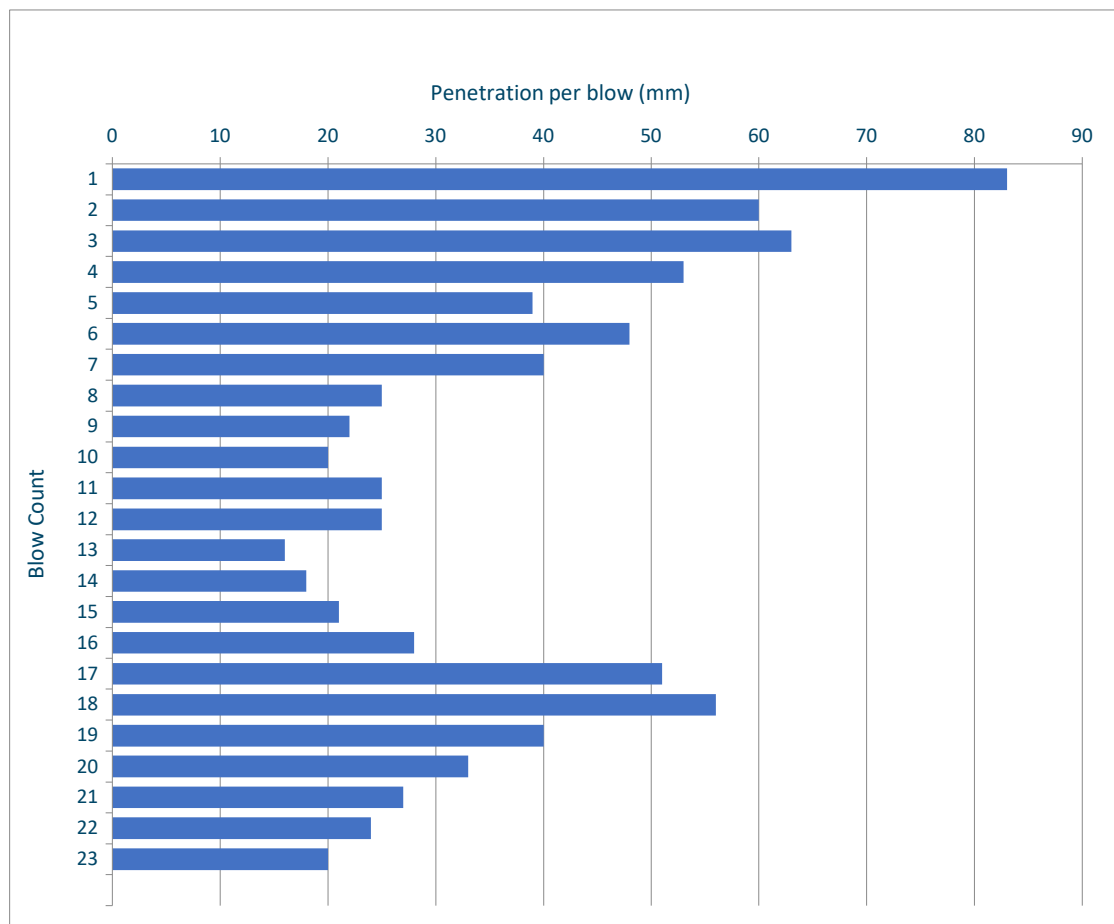
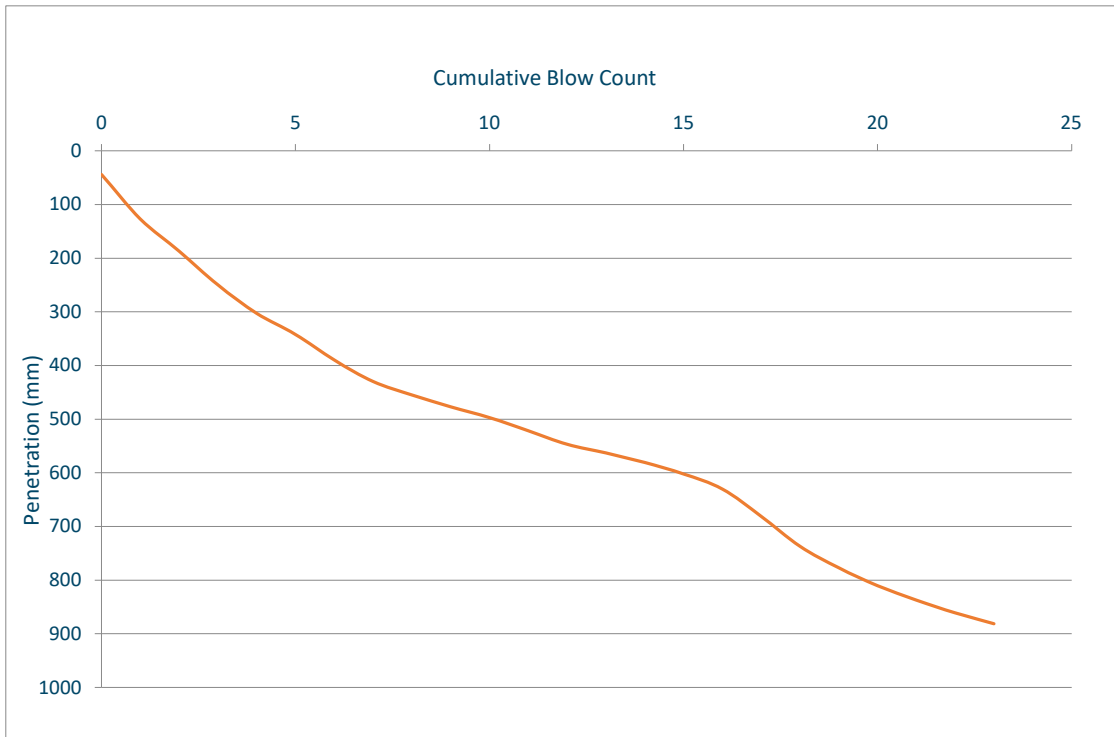


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location		DCP07	Zero (mm)		 EXPLORATION & TESTING ASSOCIATES
Depth of cone at start of test (m)		0.044	35		
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/ blow (mm)	CBR (%) [Ref. CS 229]
0	79	44	0.044	N/A	N/A
1	162	127	0.127	83	2.8
2	222	187	0.187	60	4.0
3	285	250	0.250	63	3.8
4	338	303	0.303	53	4.5
5	377	342	0.342	39	6.3
6	425	390	0.390	48	5.0
7	465	430	0.430	40	6.1
8	490	455	0.455	25	10.1
9	512	477	0.477	22	11.5
10	532	497	0.497	20	12.7
11	557	522	0.522	25	10.1
12	582	547	0.547	25	10.1
13	598	563	0.563	16	16.1
14	616	581	0.581	18	14.2
15	637	602	0.602	21	12.1
16	665	630	0.630	28	8.9
17	716	681	0.681	51	4.7
18	772	737	0.737	56	4.3
19	812	777	0.777	40	6.1
20	845	810	0.810	33	7.5
21	872	837	0.837	27	9.3
22	896	861	0.861	24	10.5
23	916	881	0.881	20	12.7
Remarks:				Easting	
				Northing	
				Level (mAOD)	

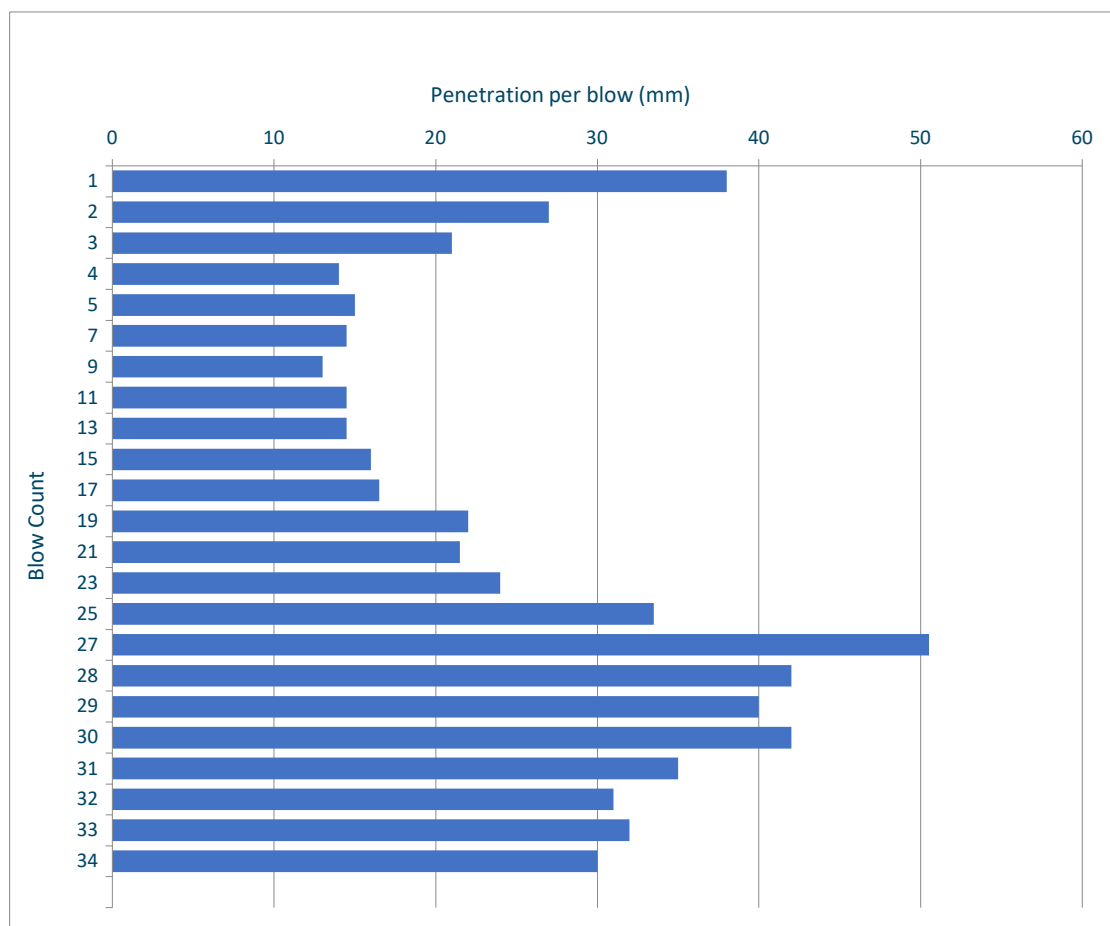


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location		DCP08	Zero (mm)	 EXPLORATION & TESTING ASSOCIATES	
Depth of cone at start of test (m)		0.017	35		
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/ blow (mm)	CBR (%) [Ref. CS 229]
0	52	17	0.017	N/A	N/A
1	90	55	0.055	38	6.5
2	117	82	0.082	27	9.3
3	138	103	0.103	21	12.1
4	152	117	0.117	14	18.6
5	167	132	0.132	15	17.3
7	196	161	0.161	15	17.9
9	222	187	0.187	13	20.1
11	251	216	0.216	15	17.9
13	280	245	0.245	15	17.9
15	312	277	0.277	16	16.1
17	345	310	0.310	17	15.6
19	389	354	0.354	22	11.5
21	432	397	0.397	22	11.8
23	480	445	0.445	24	10.5
25	547	512	0.512	34	7.4
27	648	613	0.613	51	4.8
28	690	655	0.655	42	5.8
29	730	695	0.695	40	6.1
30	772	737	0.737	42	5.8
31	807	772	0.772	35	7.0
32	838	803	0.803	31	8.0
33	870	835	0.835	32	7.7
34	900	865	0.865	30	8.3
Remarks:				Easting	
				Northing	
				Level (mAOD)	

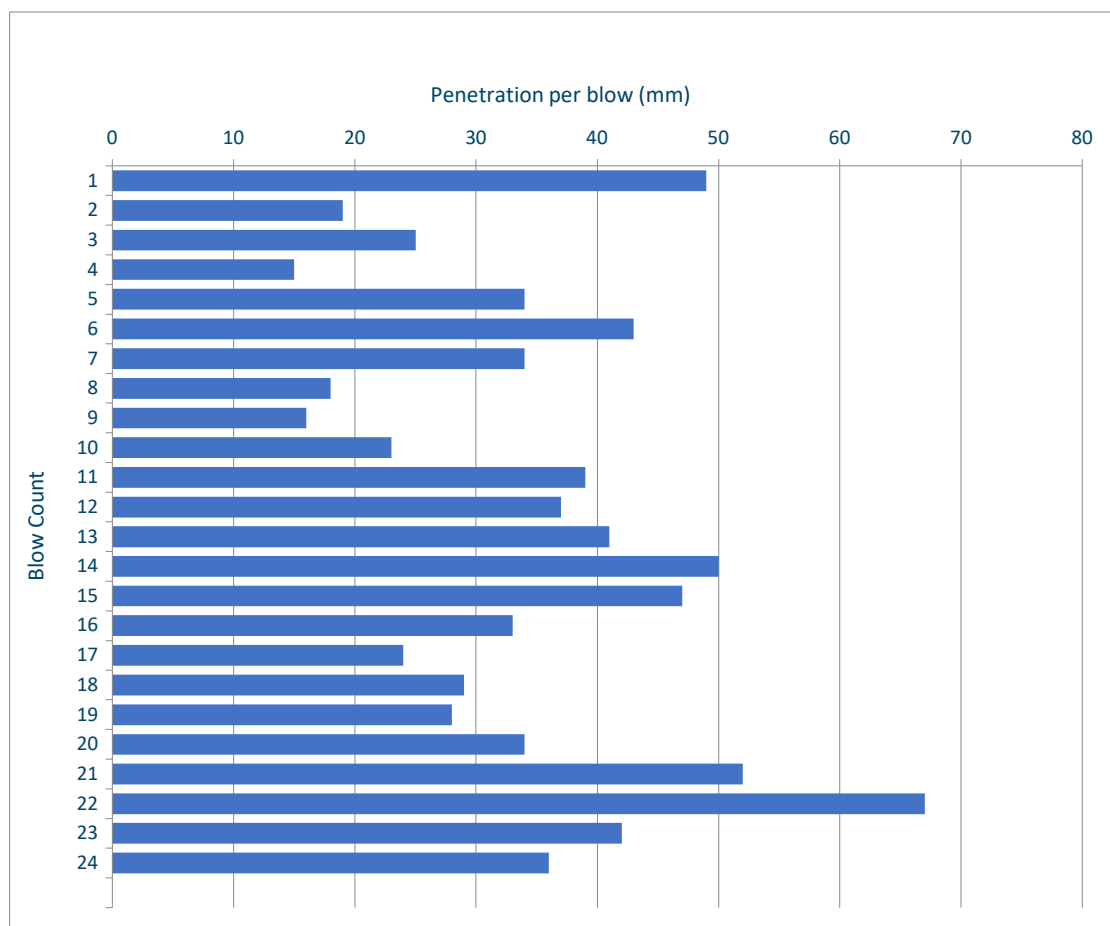
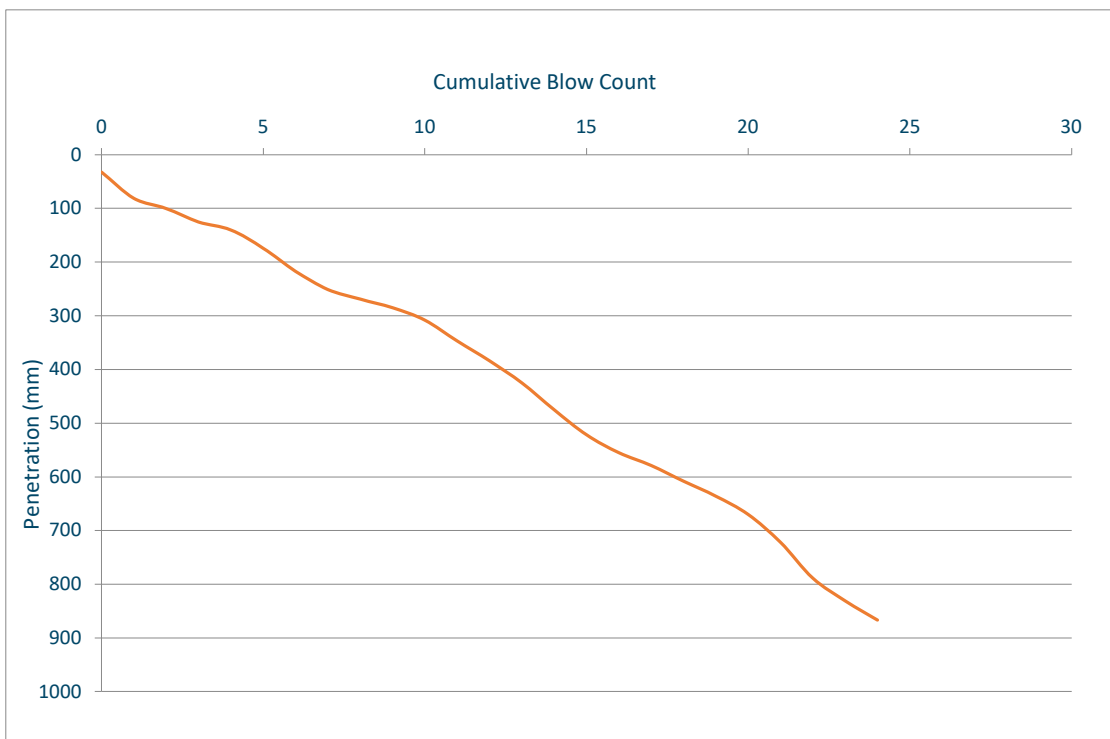


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location DCP09		Zero (mm)			
Depth of cone at start of test (m)		35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/ blow (mm)	CBR (%) [Ref. CS 229]
0	67	32	0.032	N/A	N/A
1	116	81	0.081	49	4.9
2	135	100	0.100	19	13.4
3	160	125	0.125	25	10.1
4	175	140	0.140	15	17.3
5	209	174	0.174	34	7.3
6	252	217	0.217	43	5.7
7	286	251	0.251	34	7.3
8	304	269	0.269	18	14.2
9	320	285	0.285	16	16.1
10	343	308	0.308	23	11.0
11	382	347	0.347	39	6.3
12	419	384	0.384	37	6.6
13	460	425	0.425	41	6.0
14	510	475	0.475	50	4.8
15	557	522	0.522	47	5.2
16	590	555	0.555	33	7.5
17	614	579	0.579	24	10.5
18	643	608	0.608	29	8.6
19	671	636	0.636	28	8.9
20	705	670	0.670	34	7.3
21	757	722	0.722	52	4.6
22	824	789	0.789	67	3.5
23	866	831	0.831	42	5.8
24	902	867	0.867	36	6.8
Remarks:			Easting		
			Northing		
			Level (mAOD)		

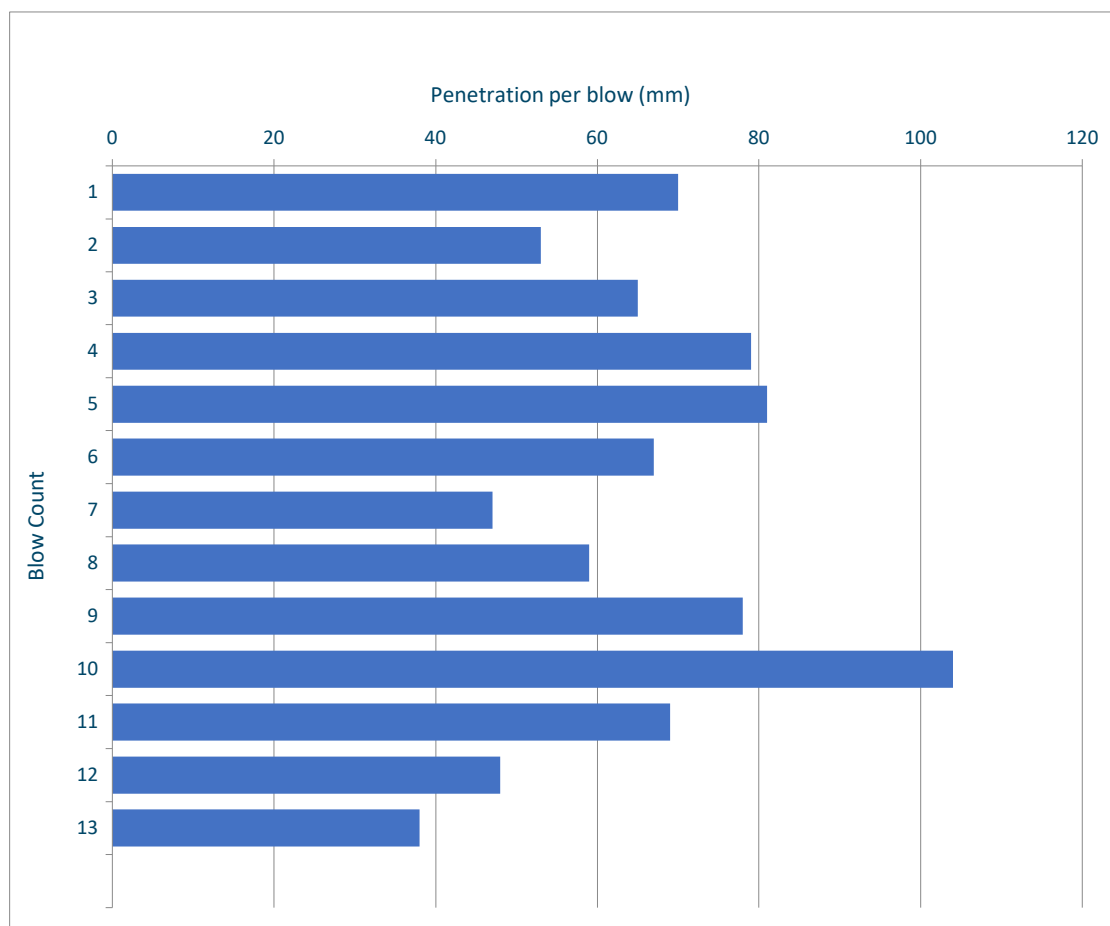
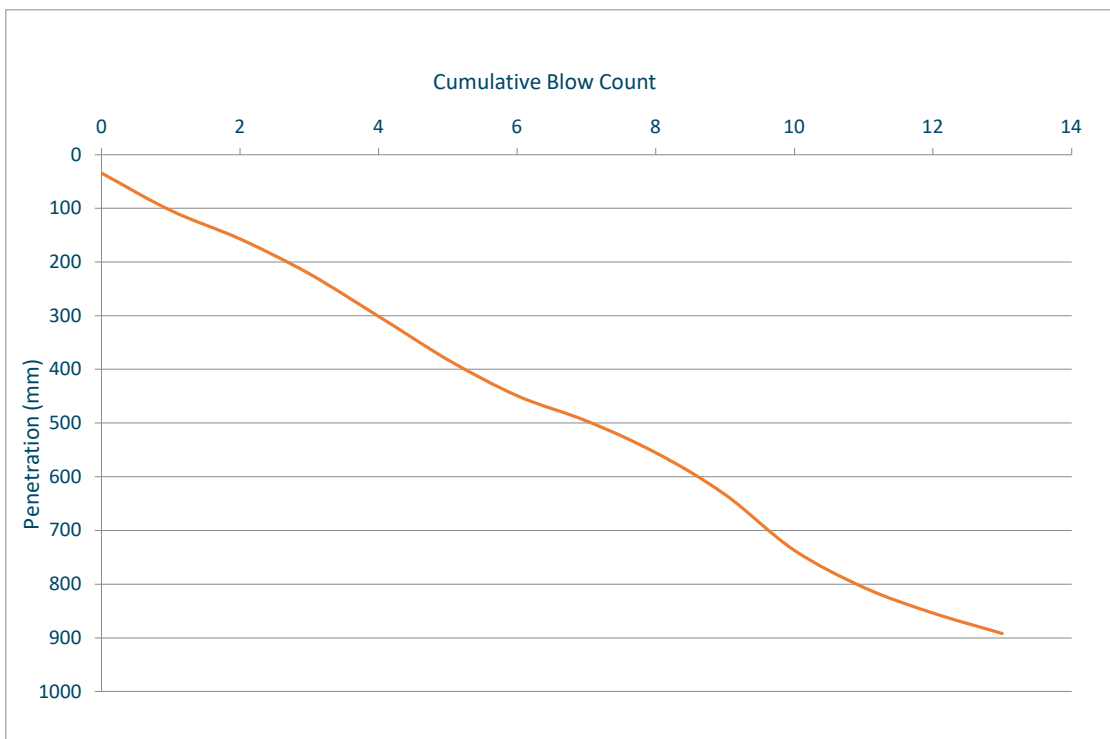


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location	DCP10	Zero (mm)			
Depth of cone at start of test (m)	0.034	35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/blow (mm)	CBR (%) [Ref. CS 229]
0	69	34	0.034	N/A	N/A
1	139	104	0.104	70	3.4
2	192	157	0.157	53	4.5
3	257	222	0.222	65	3.7
4	336	301	0.301	79	3.0
5	417	382	0.382	81	2.9
6	484	449	0.449	67	3.5
7	531	496	0.496	47	5.2
8	590	555	0.555	59	4.1
9	668	633	0.633	78	3.0
10	772	737	0.737	104	2.2
11	841	806	0.806	69	3.4
12	889	854	0.854	48	5.0
13	927	892	0.892	38	6.5
Remarks:			Easting		
			Northing		
			Level (mAOD)		

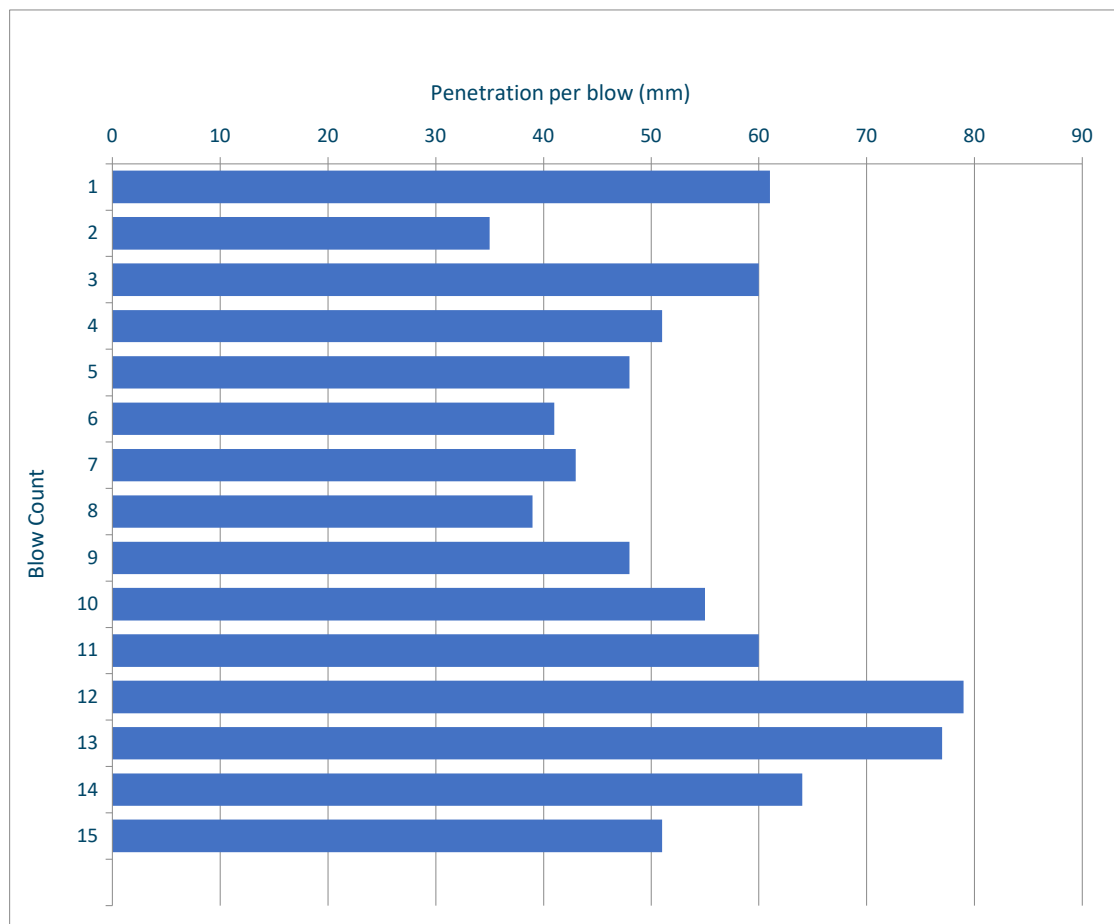
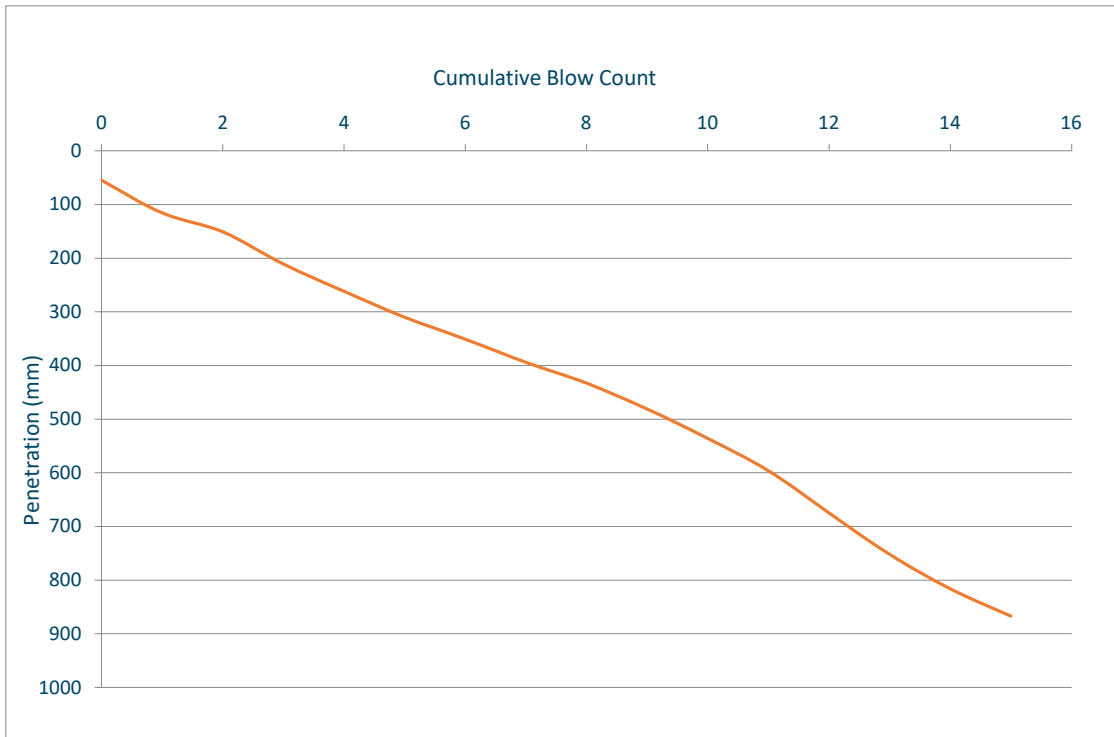


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location	DCP11	Zero (mm)			
Depth of cone at start of test (m)	0.055	35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/blow (mm)	CBR (%) [Ref. CS 229]
0	90	55	0.055	N/A	N/A
1	151	116	0.116	61	3.9
2	186	151	0.151	35	7.0
3	246	211	0.211	60	4.0
4	297	262	0.262	51	4.7
5	345	310	0.310	48	5.0
6	386	351	0.351	41	6.0
7	429	394	0.394	43	5.7
8	468	433	0.433	39	6.3
9	516	481	0.481	48	5.0
10	571	536	0.536	55	4.4
11	631	596	0.596	60	4.0
12	710	675	0.675	79	3.0
13	787	752	0.752	77	3.1
14	851	816	0.816	64	3.7
15	902	867	0.867	51	4.7
Remarks:				Easting	
				Northing	
				Level (mAOD)	

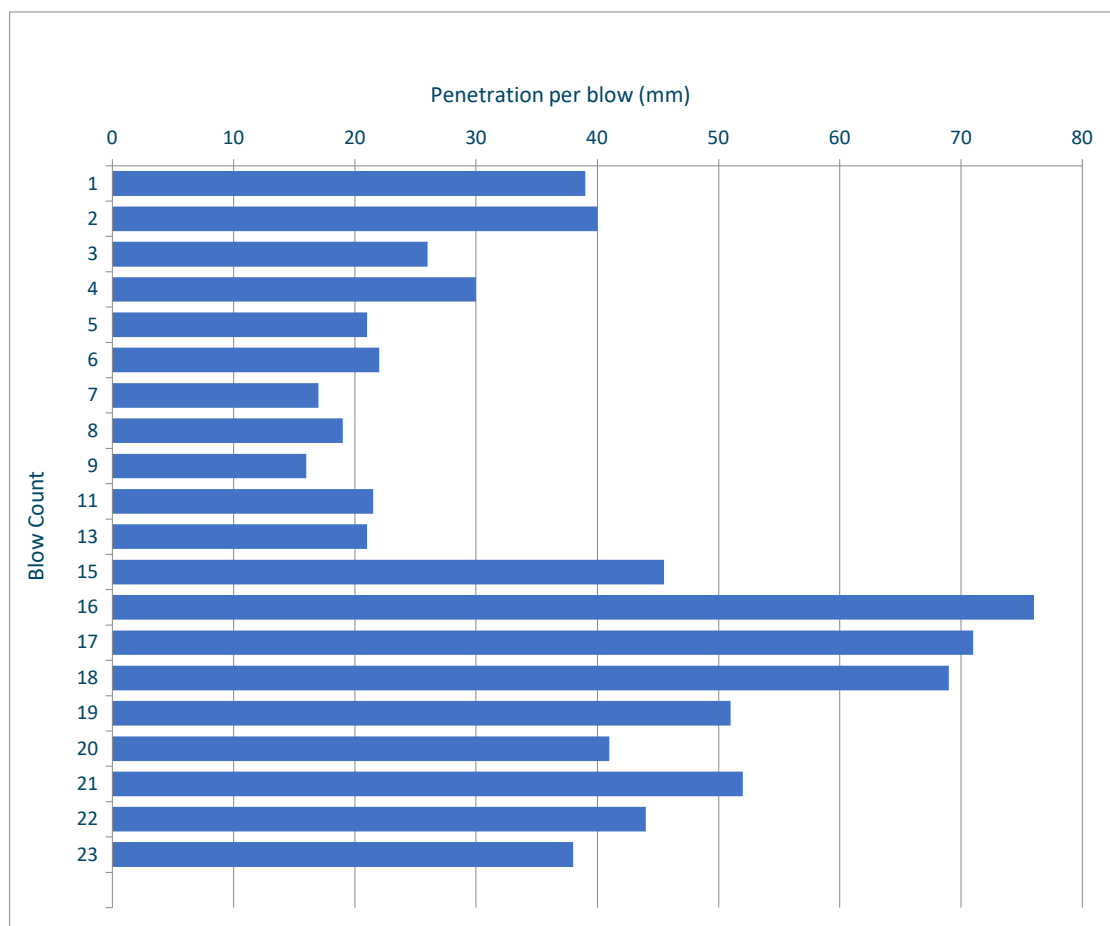
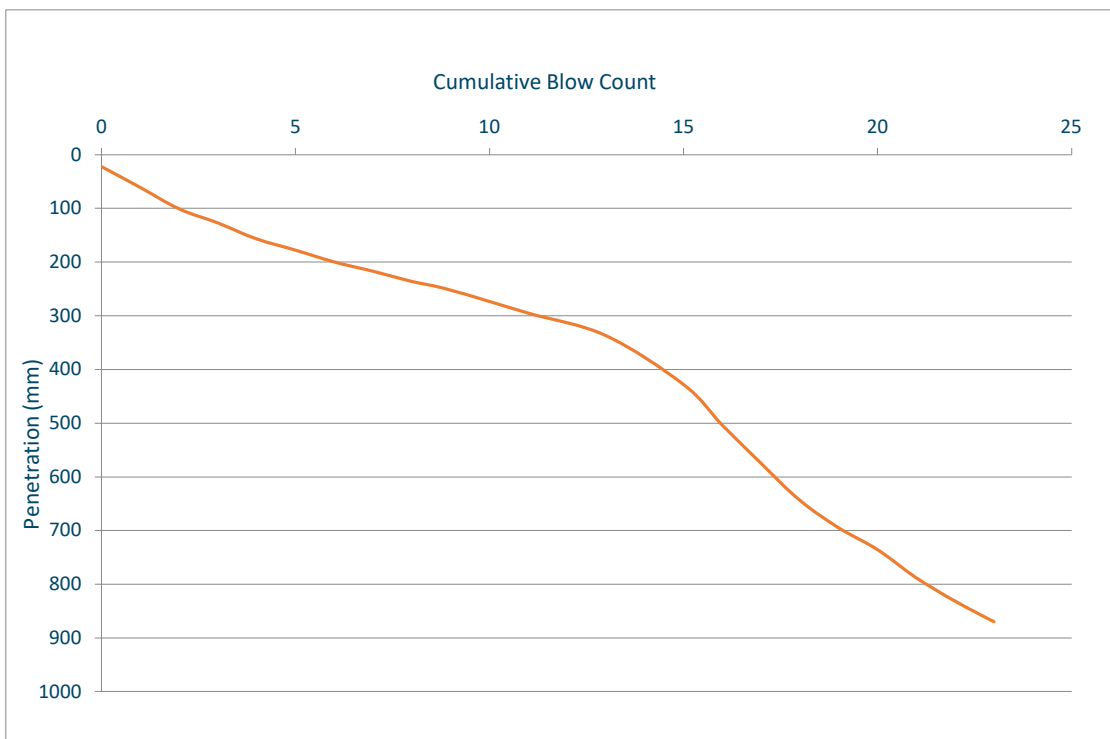


Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

Dynamic Cone Penetrometer (DCP)



Location		DCP12	Zero (mm)		
Depth of cone at start of test (m)		0.022	35		
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/ blow (mm)	CBR (%) [Ref. CS 229]
0	57	22	0.022	N/A	N/A
1	96	61	0.061	39	6.3
2	136	101	0.101	40	6.1
3	162	127	0.127	26	9.6
4	192	157	0.157	30	8.3
5	213	178	0.178	21	12.1
6	235	200	0.200	22	11.5
7	252	217	0.217	17	15.1
8	271	236	0.236	19	13.4
9	287	252	0.252	16	16.1
11	330	295	0.295	22	11.8
13	372	337	0.337	21	12.1
15	463	428	0.428	46	5.3
16	539	504	0.504	76	3.1
17	610	575	0.575	71	3.3
18	679	644	0.644	69	3.4
19	730	695	0.695	51	4.7
20	771	736	0.736	41	6.0
21	823	788	0.788	52	4.6
22	867	832	0.832	44	5.5
23	905	870	0.870	38	6.5
Remarks:				Easting	
				Northing	
				Level (mAOD)	



Date of Test: 03/06/2021
 Location: Market Bosworth
 Contract No: C10160

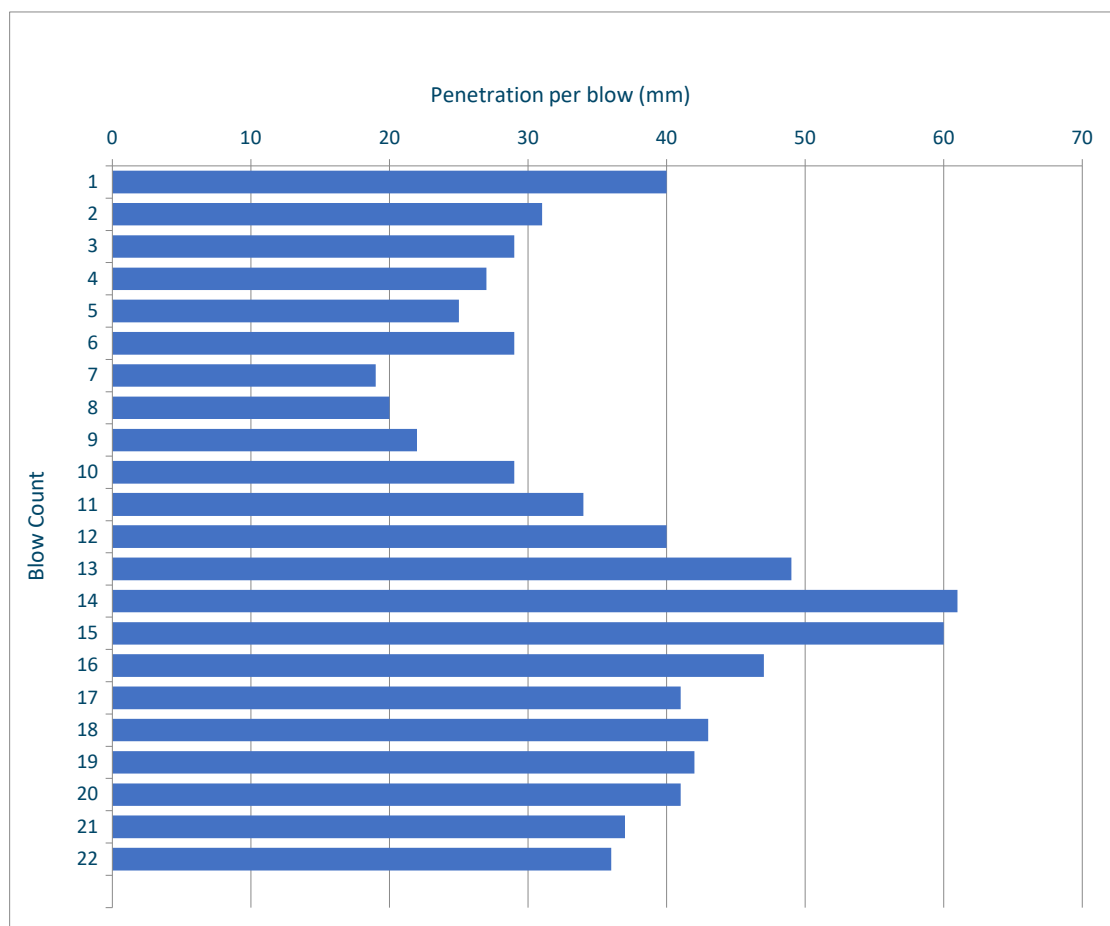
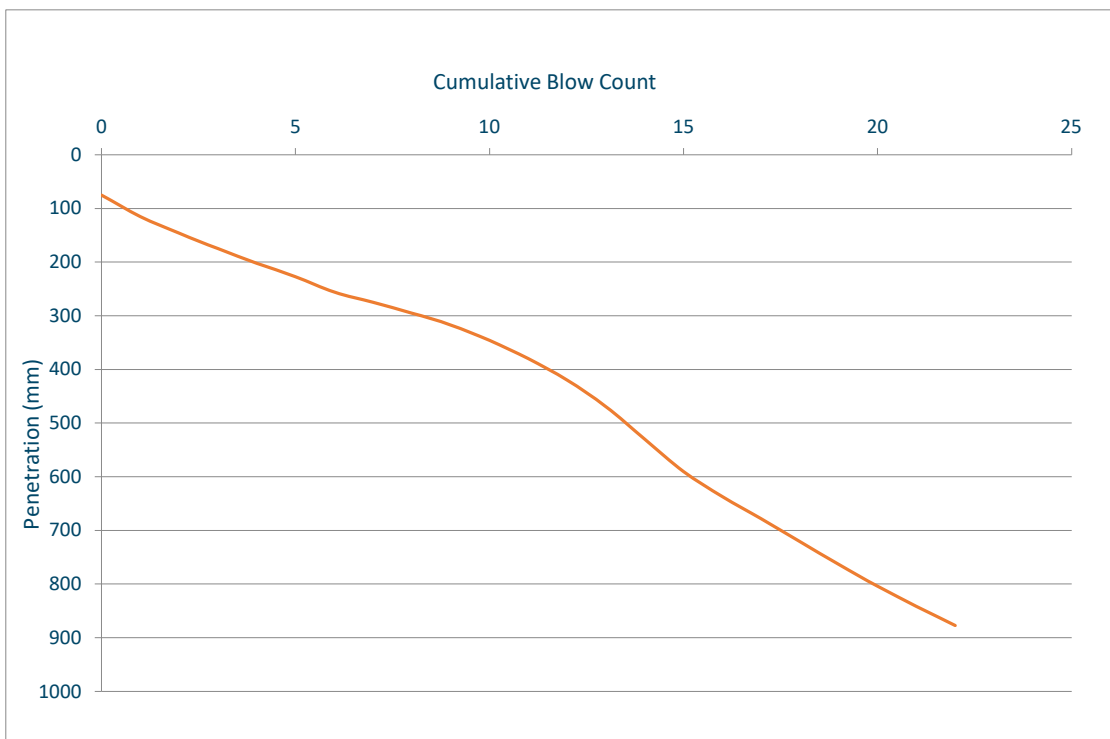
Dynamic Cone Penetrometer (DCP)



Location	DCP13	Zero (mm)			
Depth of cone at start of test (m)	0.075	35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/blow (mm)	CBR (%) [Ref. CS 229]
0	110	75	0.075	N/A	N/A
1	150	115	0.115	40	6.1
2	181	146	0.146	31	8.0
3	210	175	0.175	29	8.6
4	237	202	0.202	27	9.3
5	262	227	0.227	25	10.1
6	291	256	0.256	29	8.6
7	310	275	0.275	19	13.4
8	330	295	0.295	20	12.7
9	352	317	0.317	22	11.5
10	381	346	0.346	29	8.6
11	415	380	0.380	34	7.3
12	455	420	0.420	40	6.1
13	504	469	0.469	49	4.9
14	565	530	0.530	61	3.9
15	625	590	0.590	60	4.0
16	672	637	0.637	47	5.2
17	713	678	0.678	41	6.0
18	756	721	0.721	43	5.7
19	798	763	0.763	42	5.8
20	839	804	0.804	41	6.0
21	876	841	0.841	37	6.6
22	912	877	0.877	36	6.8

Remarks:

Easting	
Northing	
Level (mAOD)	



Date of Test: 04/08/2021
 Location: Market Bosworth
 Contract No: C10160

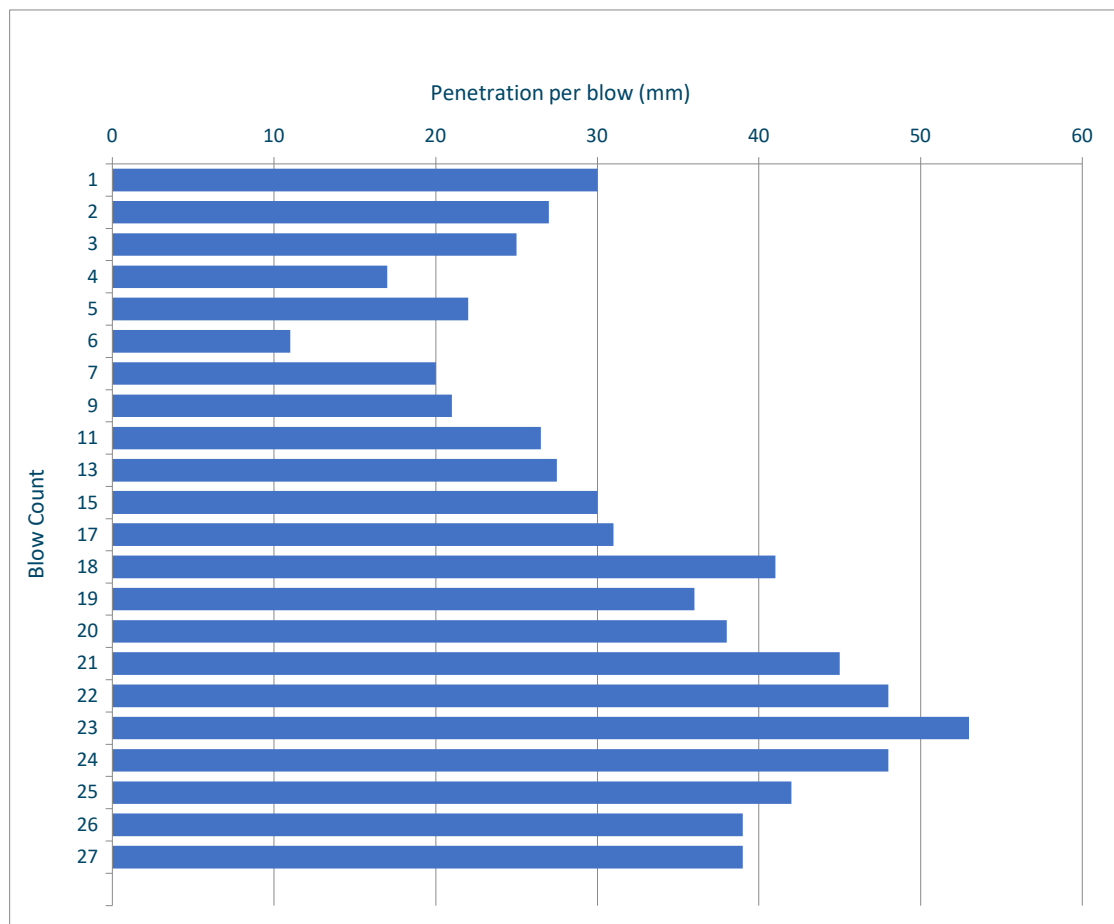
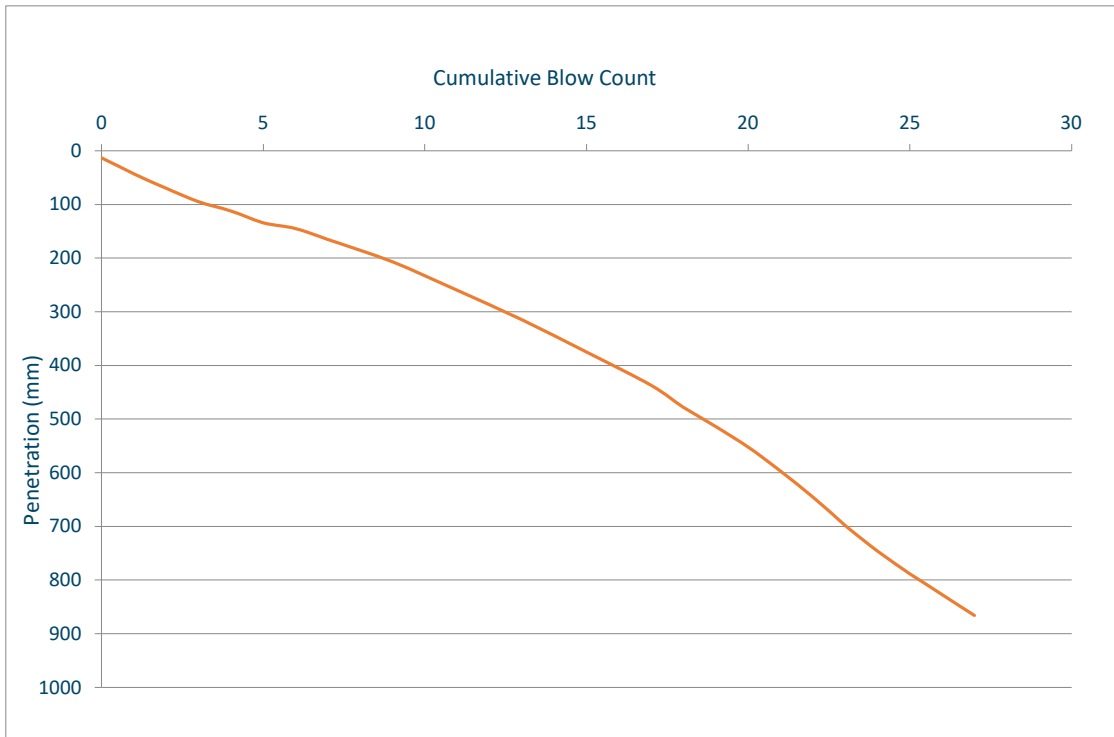
Dynamic Cone Penetrometer (DCP)



Location	DCP14	Zero (mm)			
Depth of cone at start of test (m)	0.013	35			
Cumulative Blow Count	Gauge Reading (mm)	Penetration (mm)	Depth below surface (m)	Penetration/blow (mm)	CBR (%) [Ref. CS 229]
0	48	13	0.013	N/A	N/A
1	78	43	0.043	30	8.3
2	105	70	0.070	27	9.3
3	130	95	0.095	25	10.1
4	147	112	0.112	17	15.1
5	169	134	0.134	22	11.5
6	180	145	0.145	11	23.9
7	200	165	0.165	20	12.7
9	242	207	0.207	21	12.1
11	295	260	0.260	27	9.5
13	350	315	0.315	28	9.1
15	410	375	0.375	30	8.3
17	472	437	0.437	31	8.0
18	513	478	0.478	41	6.0
19	549	514	0.514	36	6.8
20	587	552	0.552	38	6.5
21	632	597	0.597	45	5.4
22	680	645	0.645	48	5.0
23	733	698	0.698	53	4.5
24	781	746	0.746	48	5.0
25	823	788	0.788	42	5.8
26	862	827	0.827	39	6.3
27	901	866	0.866	39	6.3

Remarks:

Easting	
Northing	
Level (mAOD)	



Appendix D: Gas & Groundwater Monitoring Records



Gas & Groundwater Monitoring Record

Site Name:			Station Road, Market Bosworth				Job Number:		PJSG20-21					
Undertaken by:			NB				Date:		13.08.2021					
Equipment Used:			Gas Data (GFM 436)				Last Calibrated:		29 th September 2020					
Atmospheric Pressure Trend (previous 12hrs):			Steady				Time of Works:		AM					
Temperature:			18° C				Weather Conditions:		Light wind, warm, clear					

BH Ref.	Depth of BH (m BGL)	Depth of Water (m BGL)	Gas Flow (l/hr)		CH ₄ (% v/v)		CO ₂ (% v/v)		O ₂ (% v/v)		CO (ppm)	H ₂ S (ppm)	BH Pressure (Pa)	Atmospheric Pressure During Monitoring (mb)
			Peak	Steady	Peak	Steady	Peak	Steady	Low	Steady	Peak	Peak		
WS01	3.00	2.81	0.0	0.0	< 0.1	< 0.1	1.3	1.3	19.4	19.4	0	0	0	1003
WS02	3.00	DRY	0.0	0.0	< 0.1	< 0.1	1.9	1.9	18.9	18.9	0	0	0	1003
WS04	3.00	DRY	0.0	0.0	< 0.1	< 0.1	0.7	0.7	20.0	20.0	0	0	0	1004
WS05	3.00	DRY	0.0	0.0	< 0.1	< 0.1	0.6	0.6	19.9	19.9	0	0	0	1003
WS07	3.00	DRY	0.0	0.0	< 0.1	< 0.1	0.7	0.7	20.1	20.1	0	0	0	1002
WS08	3.00	DRY	0.0	0.0	< 0.1	< 0.1	0.2	0.2	20.4	20.4	0	0	0	1002

General remarks / observations:					

Background Readings:	O ₂ (% v/v)	CO ₂ (% v/v)	CH ₄ (% v/v)	CO (ppm)	H ₂ S (ppm)
	20.6	<0.1	<0.1	0	0

Appendix E: Site Photographs



Site Photographs.

PJSG20-21

Station Road, Market Bosworth

Richborough Estates



Photo no.

1

Date

04.08.2021



Description:

View of the southern portion of the western field viewed from the access gate.

Photo no.

2

Date

04.08.2021



Description:

View of the northern portion of the western field viewed from the access gate.

Site Photographs.

PJSG20-21

Station Road, Market Bosworth

Richborough Estates



Photo no.

3

Date

04.08.2021



Description:

View of the central road dividing site from the access gate.

Photo no.

4

Date

04.08.2021



Description:

Photograph of the secure access gate onto the Station Road site.

Site Photographs.

PJSG20-21

Station Road, Market Bosworth

Richborough Estates



Photo no.

5

Date

04.08.2021



Description:

View of the northern portion of the eastern field viewed from the access gate.

Photo no.

6

Date

04.08.2021



Description:

View of the southern portion of the eastern field viewed from the access gate.

Site Photographs.

PJSG20-21

Station Road, Market Bosworth

Richborough Estates



Photo no.

7

Date

04.08.2021



Description:

View of the southern boundary of the western field looking west from the access gate.

Photo no.

8

Date

04.08.2021



Description:

View of the southern boundary of the eastern field looking east from the access gate.

Site Photographs.

PJSG20-21

Station Road, Market Bosworth

Richborough Estates



Photo no.

9

Date

04.08.2021



Description:

Example of the Bosworth Clay Member from a Window Sample core.

Photo no.

10

Date

04.08.2021



Description:

Example of the Bosworth Clay Member from Trial Pit arisings.



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