GEO-ENVIRONMENTAL REPORT

REFORM STREET, CROWLAND

FOR LINCOLNSHIRE COUNTY COUNCIL

DELTA-SIMONS PROJECT NO. 16-1202.01

ISSUED: APRIL 2017

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GEOENVIRONMENTAL REPORT
REFORM STREET, CROWLAND PE6 0AN
FOR LINCOLNSHIRE COUNTY COUNCIL
DELTA-SIMONS PROJECT NO. 16-1202.01

1.0 INTRODUCTION

1.1 Authorisation

Delta-Simons Environmental Consultants Limited ('Delta-Simons') was instructed by Robert Doughty Consultancy on behalf of Lincolnshire County Council (the 'Client') to undertake Site investigation services for land off Reform Street, Crowland, Lincolnshire, PE6 0AN (hereafter referred to as the 'Site'). The location of the Site is shown on Figure 1 and a relevant features plan is included as Figure 2.

1.2 Context & Purpose

Delta-Simons has previously undertaken a Phase I Desk Study Report for the Site, (reference no. 16-1202.01, dated March 2017). The Phase 1 Report identified the requirement for an intrusive investigation to assess the soil and groundwater quality beneath the Site and assess potential hazardous ground gas, based on the previous Site use as a school and Made Ground associated with an infilled swimming pool. In addition, potential Asbestos Containing Materials (ACMs) were noted in the demolition debris across the current Site. Current Site proposals include the construction of twenty two (22 No.) low-rise residential properties with associated soft landscaping and infrastructure. A proposed development plan is included as Figure 3.

This report has been undertaken generally in accordance with British Standard BS 5930:2015 Code of practice for site investigations.

This Report has been based on a review of Delta-Simons previous Desk Study report together with fieldworks comprising soil sampling and laboratory chemical analysis. Three rounds of monitoring were carried out on the Site for water levels and concentrations of hazardous ground gas.

The sampling with the relevant laboratory work has been presented in the Appendices.

The methods of the fieldworks have been described in Section 2.

The interpretation of the results has been presented as a table in Section 3, a conceptual site model (CSM) and initial risk assessment based on the source-pathway-receptor principle and recommendations for aspects of planning design and construction.

1.3 Scope

The scope of works undertaken for this Report comprised the following:

- Soil sampling;
- Laboratory testing;
- Ground gas monitoring; and
- Contamination assessment.

This Report may exceed the minimum standards by inclusion of some quantitative data to support local knowledge and experience in making recommendations.

2.0 INVESTIGATION METHODOLOGY

2.1 Desk Study & Conceptual Site Model

A desk study was undertaken as part of Delta-Simons' previous Phase I Desktop Assessment (reference no. 16-1202.01, dated March 2017). This Report should be read in conjunction with the Desktop Assessment.

2.2 Planning, Setting Out & Services, Presentation

Unless otherwise stated, the investigation has been planned on a scope of works agreed with the Client which is typically based on multiples of one day on-Site with various drilling and sampling equipment, or a measured amount of drilling and testing.

Clients are requested to provide all service plans in original form from suppliers so a services risk assessment can be undertaken as part of a formal Site-specific Health and Safety Plan. The services risk assessment is based on guidance provided in HSG47 Avoiding danger from underground services.

Exploratory hole and subsequent sample locations were selected to provide suitable coverage of the Site, having regard for the likely presence of services and any other Site-specific constraints such as existing structures and finishes. Where applicable, suspected emissions locations, or geology variations may have been targeted.

Prior to any excavation, a cable detector was used at sampling positions to avoid electric cables and hand tools were used as though services were located close by.

The approximate locations of the boreholes are shown on Figure 4 and the field records are provided in Appendix I.

2.3 Dynamic Sampler Boreholes

Dynamic sampler borehole systems are not explicitly described in Eurocodes, or in the relevant British Standard BSENISO 22475-1:2006 Geotechnical investigation and testing – Sampling methods and groundwater measurements – Part 1: Technical principles for execution.

The dynamic sampler system comprises a series of varying diameter metal tubes of 1 m or 2 m length, which allows a liner to be inserted. The tubes are driven into the ground using a percussive weight falling through a standard drop onto an anvil attached to solid rods, and withdrawn by use of a hydraulic jack. The soil is pushed into the tube/liner during the driving, and samples are recovered from the tube once it has been split for description. Alternatively, liners are omitted and the metal tubes have slots or windows cut into the sides where samples can be taken directly by hand.

The liner method potentially offers a lower degree of sample disturbance.

The system can achieve typical depths of around 3 m to 5 m in favourable soil conditions. The system is limited by coarse gravel or other large fragments, and also in wet sands where the hole collapses. Some casing systems exist.

The details of the ground conditions encountered are presented on the relevant field record sheets, which also detail the type and depths of samples taken and the results of any in-situ tests. Other relevant information may also be recorded including groundwater levels and details of any standpipe installations.

2.4 Standpipe Installations

Two of the dynamic sampler boreholes have been fitted with a gas/water monitoring standpipe of 50 mm internal diameter UPVC slotted and plain casing to the required depth as appropriate, capped by a gas tap bung and cover generally in accordance with BSENISO 22475-1:2006 for an open standpipe. The locations of the monitoring installations are shown on Figure 4.

2.5 Monitoring Groundwater & Ground Gas

Groundwater monitoring is undertaken using an electronic dip meter, which records the depth to water in a standpipe.

Ground gas composition and flow monitoring is undertaken where standpipes have been installed. Both flow (litres per hour) and composition (%) are measured using an infra-red gas monitor, calibrated for methane, carbon dioxide & oxygen. Records are also taken of atmospheric pressure. The monitoring field records are presented in Appendix II.

2.6 Chemical Analysis

The results of the chemical analysis are presented in Appendix III.

2.7 Screening Assessment Criteria

In the absence of a complete regulatory set of screening values derived using the Contaminated Land Exposure Assessment (CLEA) Framework, Delta-Simons will refer to the following:

- The Soil Guidance Values (SGVs) published by the Environment Agency;
- Category 4 Screening Levels (C4SLs) published by Defra;
- Suitable for Use Levels for Human Health Risk Assessment (S4ULs) published by Land Quality Management (LQM)/Chartered Institute of Environmental Health (CIEH);
- The guidance values produced by the Environmental Industries Commission (EIC), the Association of Geotechnical and Geoenvironmental Specialists (AGS) and Contaminated Land: Application in Real Environments (CL:AIRE) in December 2009; and
- In house Generic Screening Values (DS-GACs) and other non UK values where considered relevant.

Delta-Simons has adopted the Human Health Generic Assessment Criteria for a residential with plant uptake end-use which are presented in Appendix IV.

The Delta-Simons methodology for soil screening assessment comprises comparison of limited chemical analysis results with the criteria for the most sensitive plausible end-use scenario in the likely proposed scheme.

Exceedance of criteria indicates that risk above “minimal” level may exist in a worst-case scenario across the whole Site. The precautionary principle is applied with respect to protection of human health recommending; further risk assessment (increased characterisation including extents/zones), or site-wide remediation.

Criteria such as C4SLs may be used to describe sites with a “low” level of risk that could be considered acceptable in a specific development scenario following further

assessment. Remediation is likely to be recommended where C4SL criteria is exceeded.

If no criteria exceedance is observed, the report may still recommend further risk assessment, or remediation due to uncertainty over full characterisation of the Site.

Post-report action should be Site-specific and based on a Client's resource/risk profile in undertaking developments in accordance with any regulatory requirements.

3.0 RESULTS & INTERPRETATION

3.1 Desk Study

This Report should be read in conjunction with Delta-Simons Previous Phase I Desktop Assessment, dated March 2017, project number 16-1202.01. However, a brief summary of the environmental Site setting is given below:

- At the time of the walkover the Site comprised a vacant plot of land which encompassed the demolished former South View Primary School. The Site surface predominantly comprised gravel, tarmac and limited soft landscaped areas. Across the Site construction and household debris was present, including potential Asbestos Containing Materials (ACMs) assumed to be associated with the previous demolition;
- According to BGS data the Site is underlain by superficial deposits of the Abbey Sand and Gravel (Sand and Gravel), underlain in turn by bedrock of the Oxford Clay Formation (Mudstone). Given the former development of the Site, Made Ground is anticipated;
- From the Environment Agency's (EA) online groundwater aquifer maps, the superficial geology is classified as a Secondary A Aquifer and the bedrock as Unproductive Strata;
- The nearest water feature is approximately 230 m south, associated with a small drain;
- The Site is not at risk of flooding from rivers and sea. However, is considered to be at risk from groundwater flooding and the surrounding area within 250 m of the Site area is considered to be at risk of flooding;
- Historically the Site has been occupied by South View Primary School since the earliest map edition dated 1886, where one large school building occupies the south west of the Site. By the 1975 map edition an additional four buildings and swimming pool are present in the south east. By the 1999 Historical Aerial Photography an additional playground and car park occupy the south of the Site and a recreational field is present in the north. The pool is understood to have been infilled with the demolition of the school in 2016;
- The review of historical maps for the surrounding area identified a fuel station present from the 1975 map edition approximately 30 m south of the Site. The

remaining surrounding area consisted predominantly of residential buildings; and

- Potential sources of on-Site contamination are limited to small-scale fuel spills, on-Site potential ACMs, and deep Made Ground associated with the possible infilled swimming pool.

3.2 Fieldworks Interpretation

Scope of Investigation	Dynamic sampler boreholes – 6 No. Standpipe installations – 2 No. Site Area = Approximately 0.68 hectares.
Geology from the Boreholes	Made Ground was encountered in all boreholes across the Site generally comprising orangish brown sandy gravel with frequent brick, polystyrene, clinker, asphalt and concrete gravel and varying proportions of flint, sandstone and limestone gravel to a maximum depth of 1.20 m bgl. Topsoil was encountered in DS103 to a maximum depth of 0.4 m bgl within the south east of the Site and comprised soft dark brown sandy clay with fragments of rare fine brick and rootlets. Soft orangish brown, sandy gravelly clay with rare brick and flint was encountered in DS101 - DS103 at depths between 0.40 m and 2.00 m bgl. The underlying natural soil across the Site generally comprised loose to medium dense orangish brown sandy slightly clayey gravel/gravelly sand to a maximum depth of 3.00 m bgl. Groundwater was encountered at depths between 1.30 m to 2.50 m bgl during the fieldwork. See Appendix I for further details.
Groundwater in Standpipe	Three monitoring visits were undertaken between the 2nd March and 17th March 2017: **Borehole** / **Minimum Depth to Groundwater (m bgl)** / **Maximum Depth to Groundwater (m bgl)** / **Depth to Base (m bgl)** DS103 / 1.14 / 1.30 / 2.10 DS105 / 1.28 / 1.37 / 1.84 See Appendix II for further details.
Gas in Standpipes	Three monitoring visits were undertaken between the 2nd March and 17th March 2017: Worst case scenario: **Borehole** / **Methane % v/v** / **Carbon Dioxide % v/v** / **Oxygen % v/v** / **Flow (l/hr)** DS103 / <0.1 / 4.3 / 14.2 / <0.1 DS105 / <0.1 / 4.9 / 13.5 / <0.1 Atmospheric pressure at ground level between 1006 and 1017 mb.

<table>
<tr><td></td><td>See Appendix II for further details.</td></tr>
<tr><td>Chemical Analysis</td><td>Eleven soil samples were scheduled for a selection of the following analytes: 10 heavy metals suite, TPH (total), speciated PAH (EPA-16) and asbestos screen.

A single elevated concentration of arsenic has been identified in a soil sample collected within DS102 from 1.50 m bgl at a concentration of 33 mg/kg, exceeding the LQM guidance value of 32 mg/kg. Concentrations of other heavy metals were identified above laboratory levels of detection, however were below the associated guidance values.

Elevated concentrations of individual sPAH compounds have been identified above the LQM guidance values for a residential with plant uptake end use in DS102 at 0.40 m bgl and 1.50 m bgl and are summarised below. One exceedance of dibenz(a,h)anthracene was also identified within DS103 at 0.60 m at a concentration of 0.27 mg/kg.

<table>
<tr><th>Contaminant</th><th>Guidance Value (mg/kg)</th><th>Number of Exceedances</th><th>Maximum Concentration (mg/kg)</th></tr>
<tr><td>Benzo[a]anthracene</td><td>7.2</td><td>1</td><td>24</td></tr>
<tr><td>Chrysene</td><td>15</td><td>1</td><td>24</td></tr>
<tr><td>Benzo[b]fluoranthene</td><td>2.6</td><td>1</td><td>19</td></tr>
<tr><td>Benzo[a]pyrene</td><td>2.2</td><td>1</td><td>21</td></tr>
<tr><td>Dibenz(a,h)anthracene</td><td>0.24</td><td>2</td><td>3.2</td></tr>
<tr><td>Napthalene</td><td>2.3</td><td>1</td><td>5.7</td></tr>
</table>

TPH was identified in four locations at a maximum concentration of 150 mg/kg in DS102 at 0.40 m bgl.

Asbestos fibres were not detected in the samples tested.

See Appendix III for further details.</td></tr>
<tr><td>Contamination</td><td>From Delta-Simons' previous Phase I Assessment, the Site comprised a vacant plot of land encompassing the former demolished South View Primary School. Across the Site various construction and household debris was present including potential Asbestos Containing Materials.

On-Site potential sources of contamination identified in the desktop assessment included:

Δ Possible ACMs in construction stockpiles on-Site;

Δ Previous demolitions associated with the former school;

Δ Infilled pool in the south-east of the Site; and

Δ Potentially contaminative unrecorded sources.

A single elevated concentration of arsenic has been identified in a soil sample collected within DS102 from 1.50 m bgl at a concentration of 33 mg/kg, exceeding the guidance values of 32 mg/kg. Concentrations of other heavy metals were identified above laboratory levels of detection, however were below the associated guidance values.

Elevated concentrations of individual sPAH compounds have been identified above the LQM guidance values for a residential with plant</td></tr>
</table>

	uptake end use in DS102 at 0.40 m bgl and 1.50 m bgl. One exceedance of dibenz(a,h)anthracene was also identified within DS103 at 0.60 m at a concentration of 0.27 mg/kg. TPH was identified in four locations at a maximum concentration of 150 mg/kg in DS102 at 0.40 m bgl. Asbestos fibres were not detected in the samples tested.
Fresh Water Pipes	The local water authority should be contacted at an early stage in order that any abnormal costs can be calculated, if required. Given the Made Ground and identified contamination, the requirement for upgraded pipes is considered likely.
Ground Gas	Plausible sources of ground gas on-Site principally include Made Ground from the infilled swimming pool and from previous demolitions of the former school. Gas monitoring did not identify concentrations of carbon dioxide above 5% v/v, therefore the Site can be characterised as a Characteristic Situation 1 (CS1) according to CIRIA C665 or Green according to NHBC guidance. In addition, significant Made Ground was not identified in the vicintity of the former swimming pool. As such, from provisional results ground gas protection measures are not considered to be required.
Materials Management	Excavated soils may be suitable for use elsewhere subject to suitability for use and any necessary regulator protocols. Additional testing may be required for optimised off-Site disposal of spoil.
Recommendations	The following actions are recommended at the Site: Δ Handpicking of any suspected ACMs on the Site surface; Δ A clean cover system should be installed in any proposed landscaped areas. This is likely to comprise 600 mm of clean certified topsoil underlain by a geotextile membrane; Δ Upgraded pipework, subject to confirmation from the Local Water Authority; and Δ Production of a Remediation Method Statement (RMS).

Table 1: Revised Conceptual Site Model & Risk Assessment

Source	Pathway	Receptor	Matrix Assessment	Assessment of Linkage Significance/Potential Mitigation Measures
Elevated concentrations of arsenic and sPAH in DS102 and DS103, and detectable TPH in shallow soils. Potential soil contamination in areas not directly investigated.	Ingestion, direct contact & inhalation of dust/ vapours.	Future Site users.	**Low Risk**	Elevated concentrations of contaminants have been identified, associated with arsenic from DS102 at 1.50 m bgl. Individual elevated sPAH concentrations were identified in soil samples from DS102 and DS103. TPH was identified at a maximum concentration of 150 mg/kg in DS102 at 0.40 m bgl. It is recommended that clean certified subsoil/topsoil is imported in to proposed private landscaped areas to act as an appropriate clean cover layer. The remainder of the Site is likely to be covered in hardstanding/buildings, further mitigating the risk of direct contact and future Site users. A "hotspot protocol" should also be in place for the duration of the developments works to help address any suspected contamination identified during groundworks.
		Construction workers.	**Low Risk**	Construction workers should be made aware of the possibility of encountering contamination and appropriate safe working methods should be in place with appropriate personal protective equipment (PPE) provided as and when necessary. Safe working practices, including a 'hotspot' protocol, to be implemented.
	Leaching and vertical & lateral migration.	Controlled waters.	**Very Low Risk**	Elevated concentrations of contaminants have been identified in soils. The Site is located within a superficial Secondary A Aquifer but is not within an SPZ and the nearest surface water is a small drain to the south. As such, the risk to controlled waters from infiltration of contaminants is considered very low.
	Direct infiltration in water supply pipes.	Service conduits.	**Low Risk**	It is recommended that the Local Water Authority is consulted prior to the installation of any potable water supply pipes in order to confirm their requirements, although upgraded water pipes should be anticipated.
	Plant uptake.	Vegetation within landscaped areas.	**Low Risk**	Elevated concentrations of contaminants have been identified at the Site. It is considered that a layer of clean certified subsoil/topsoil is required to act as an appropriate cover layer in landscaped areas. Existing topsoil may be suitable for use subject to further testing.
	Lateral migration through any groundwater beneath the Site.	Off-Site neighbouring properties.	**Very Low Risk**	Elevated concentrations of contaminants have been identified at the Site. The Site is located within a superficial Secondary A Aquifer but is not within an SPZ and no potable groundwater abstractions are within 500 m. Soil contamination has not been identified as volatile, as such, the risk to off-Site residential properties is very low.
Hazardous ground gas.	Vertical and lateral migration.	Human health and buildings.	**Very Low Risk**	Following three rounds of hazardous ground gas monitoring, the Site has been characterised as a CS 1 according to BS8485:2015 or a Green Classification in consideration of NHBC guidance. As such, basic ground gas protection measures

Source	Pathway	Receptor	Matrix Assessment	Assessment of Linkage Significance/Potential Mitigation Measures
				are required at the Site.
Potential ACMs within the existing construction debris on-Site.	Inhalation of dust from damaged/ fibrous ACMs.	Future Site user and demolition workers.	**Low to Moderate Risk**	Asbestos fibres were not detected in the soil samples tested, however possible ACM fragments were observed in construction debris on-Site. Construction workers should be made aware of the possibility of encountering contamination and appropriate safe working methods should be in place with appropriate personal protective equipment (PPE) and respiratory protective equipment (RPE) provided as and when necessary. Safe working practices, including a 'hotspot' protocol, to be implemented. A hand picking exercise of the potential fragments of Asbestos is recommended prior to groundworks by a licenced contractor and to be appropriately disposed of off Site.

Standard risk definitions and matrices are presented in Appendix V.

4.0 LIMITATIONS TO ENVIRONMENTAL ASSESSMENTS

This Report does not constitute a full site investigation, flood risk assessment, invasive plant assessment, waste classification exercise, contamination, geotechnical or asbestos survey to fulfil any particular specification except where stated explicitly.

Information was obtained, reviewed and evaluated in preparing this Report from various external sources. Our conclusions, opinions and recommendations are based upon this information and the information obtained during the walkover, the Consultant does not warrant the accuracy of the information provided and will not be responsible for any opinions expressed, or conclusions reached in reliance upon information which is subsequently proven to be inaccurate.

The recommendations contained in this Report represent our professional opinions. These opinions were arrived at in accordance with good practice at this time and location, and, as such, are not a guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

This Report was prepared for the sole and exclusive use of the Client and for the specific purpose instructed as defined in Section 1 of this Report. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than ourselves and the Client, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, this Report should not be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless the authors from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

This Report was prepared by:



Charlotte Walker Date 19th April 2017

Graduate

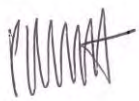
This Report was reviewed by:



Paul Huteson Date 19th April 2017

Principal

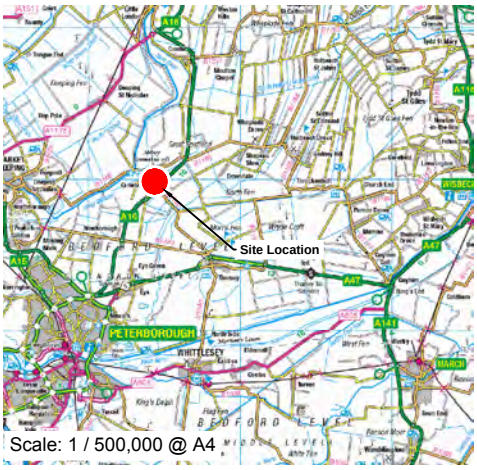
This Report was authorised by:



Paul Bennett Date 19th April 2017

Unit Director - Regions

Figures



LEGEND

Site Boundary

Recreation Ground
University Academy Holbeach
N
KEMP STREET
B1166
CLUTTON'S CLOSE
B1040
PW
AMBURY GD
HALL STREET
Pol Sta
CHURCH LANE
ST MARKS D
NORTH STREET
PO
B1040 EAST STREET
Liby
Car Pk
PW
ABBEY WALK
WEST STREET
ALBION STREET
REFORM STREET
PW
TRINITY CL
Sch
HEREWARD W
SOUTH ST
THORNEY ROAD B1040
Pav
Recreation Grou
BROADWAY
BROADWAY
ABBOTS DR
GLEBE G
CHAPEL STREET
THORNEY ROAD
MONKS MEADOW
ALDERLANDS CLOSE
Sports Field
Ppg Sta
F Sta
Warehouse
RENWALD C
BECCELM DR
TATWIN DRIVE
BARBERS DROVE NORTH
Depot

Scale: 1 / 5,000 @ A4

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deltasimons

TITLE:
Site Location Map
Former School, Reform Street
Crowland

DRAWN BY: PH	SCALE: To Scale@A4
CHECKED BY: AH	REVISION: 1
DATE: 23 February 2017	

PROJECT NO: 16-1202.01

FIGURE NO: 1

PH01: Northern Site area

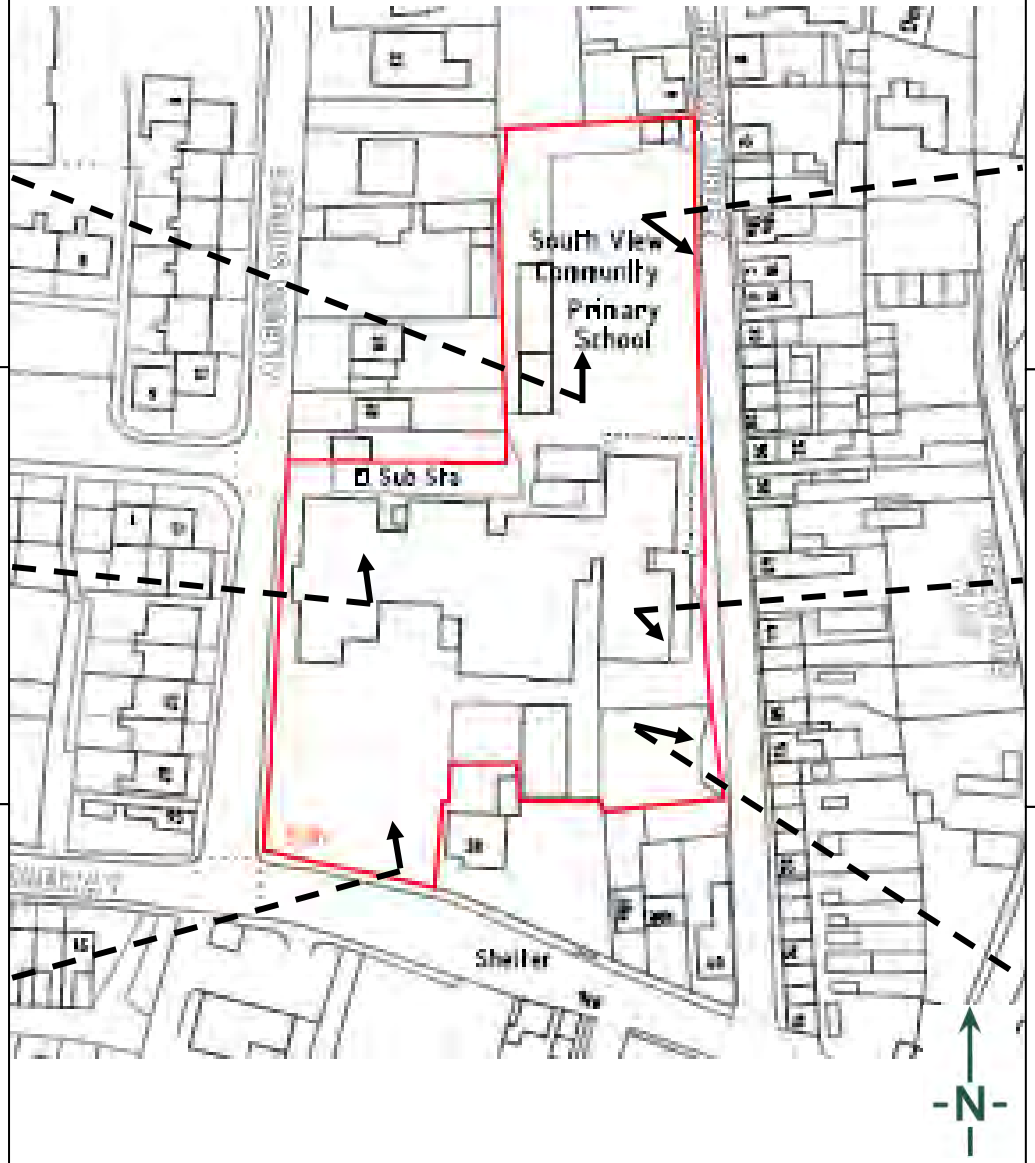


PH02: Electricity substation



PH03: Limited tarmac area





Note: There is uncertainty as unrecorded land use may have occurred and caused contamination that has not been identified by the observations,

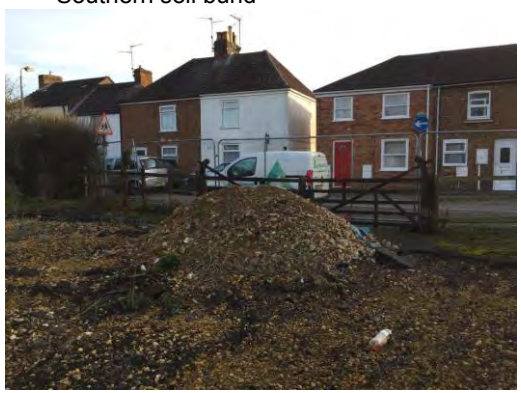
PH04: Soil bund with household debris



PH05: Area of raised vegetated ground



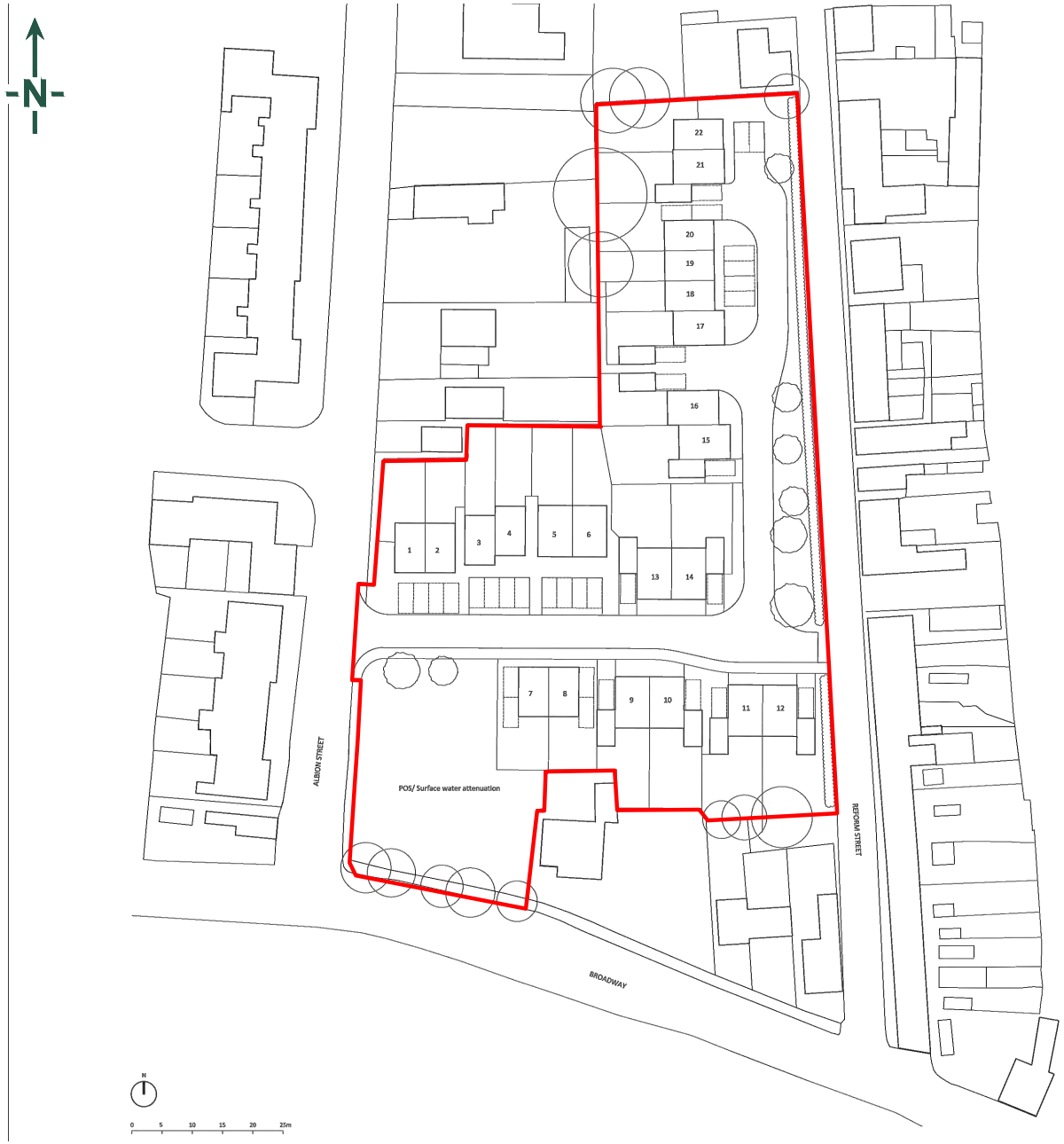
PH06: Southern soil bund



deltasimons

TITLE:
Relevant Features Plan
Former School, Reform Street
Crowland

DWN: CW	SCA: Not to scale	PROJECT NO.: 16-1202.01	
CHK: PH	REV: -	FIGURE NO.: 2	
DATE: March 2017			



Ordnance Survey Map
(c) Crown Copyright 2017. OS Licence No: AR 100010613

CDM 2015
This drawing is for illustrative purposes and/or obtaining the relevant planning permision only. It should not be used for construction and accordingly, risk identification under the Construction (Design & Management) Regulations 2015 has not been undertaken.

Existing Trees

Proposed Trees

Parking space

Rev	By	Notes	Date
A	WW	Site increased to 22 units	30.03.17

rdc Robert Doughty Consultancy
32 High Street, Helpringham
© Sleaford, Lincolnshire NG34 0RA
Tel: 01529 421646
Fax: 01529 421318
Email: admin@rdc-landplan.co.uk
Web: www.rdc-landplan.co.uk

Client: Lincolnshire County Council

Project: Land off Reform Street (Southview Primary School), Crowland

Drawing title: Site Plan

Drawing No	Rev	Drawn
480-36_SK_SP01	A	WW

Scale	Date	Checked
1:500 @ A2		

Site Plan Provided by Client

deltasimons
Environment - Health & Safety - Sustainability

TITLE:
Proposed Development Plan
Former School, Reform Street
Crowland

DRAWN BY:	SCALE:	PROJECT NO:
EN	Not to Scale	16-1202.01
CHECKED BY:	REVISION:	FIGURE NO:
AH	1	3
DATE: 03 April 2017		

LEGEND

- Site Boundary
- DSx — Dynamic Sampler Location
- SAx — Soakaway Location
- (s) — Installed Well
- DPTx — Dynamic Penetration Test

DS105(s)/DPT105

SA103

DS106/DPT106

DS102/DPT102

DS104/DPT104

SA102

DS103(s)/DPT103

SA101

DS101/DPT101

Site Plan Provided by Client

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Environment - Health & Safety - Sustainability

TITLE:
Approximate Intrusive Location Plan
Former School, Reform Street
Crowland

DRAWN BY: EN	SCALE: Not to Scale
CHECKED BY: AH	REVISION: 1
DATE: 03 April 2017	

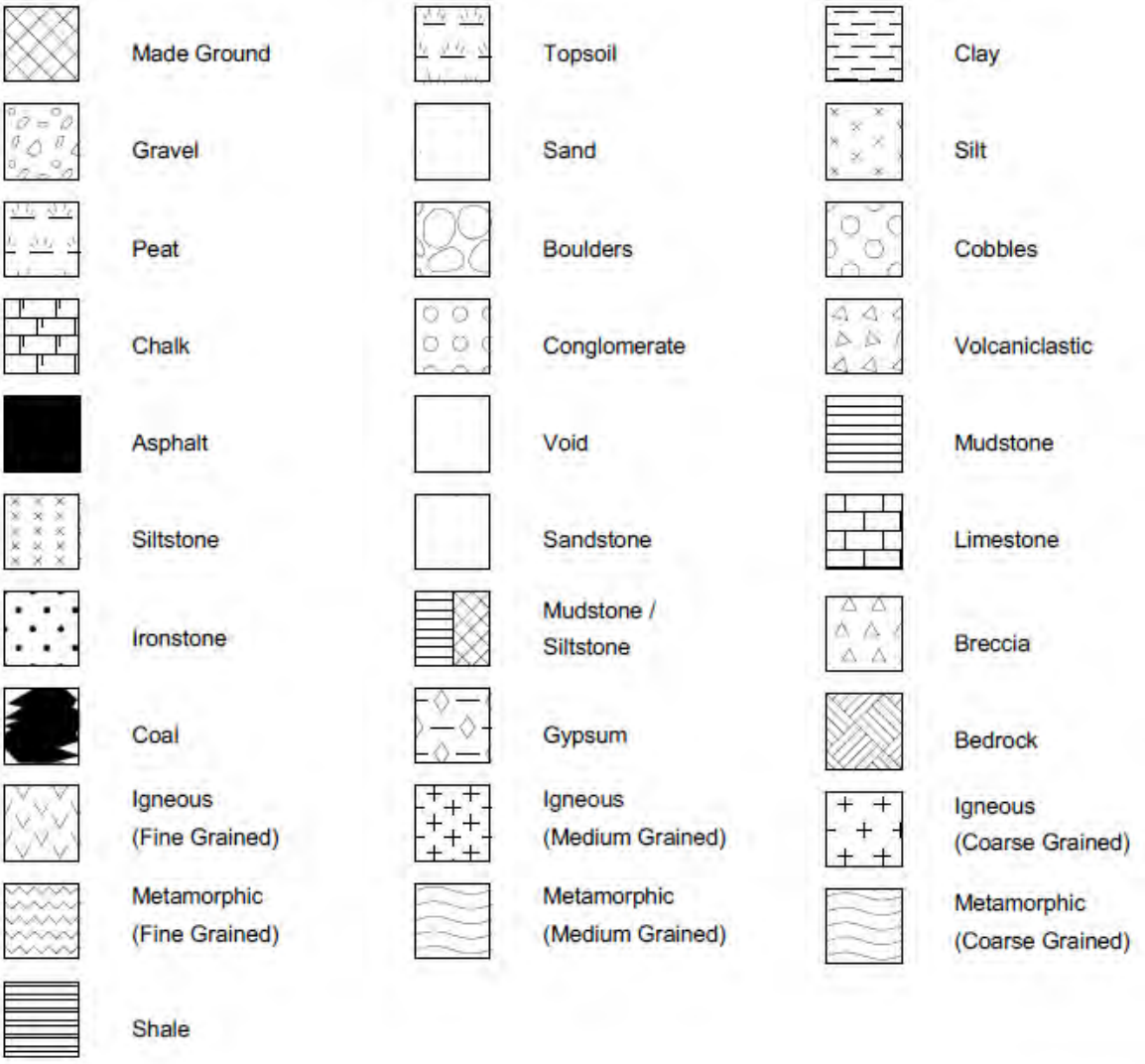
PROJECT NO: 16-1202.01

FIGURE NO: 4

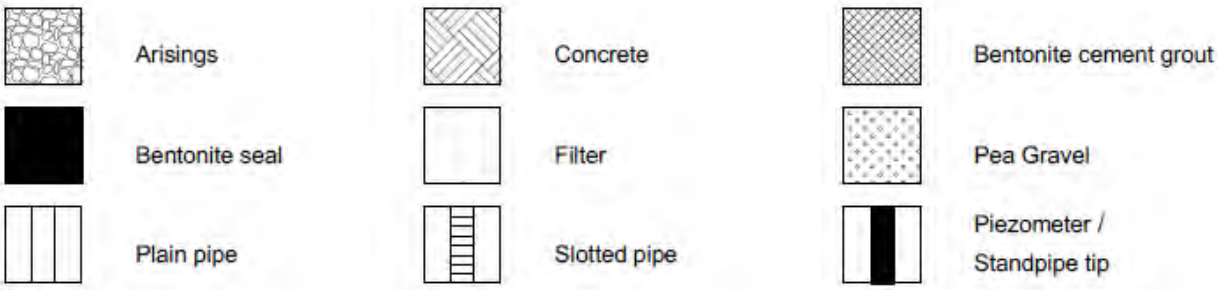
Appendix I

KEY TO BOREHOLE AND TRIAL PIT LOGS

MATERIAL LEGENDS



INSTALLATION/BACKFILL DETAILS



Note:
Legend symbols in accordance with BS 5930 (1999)

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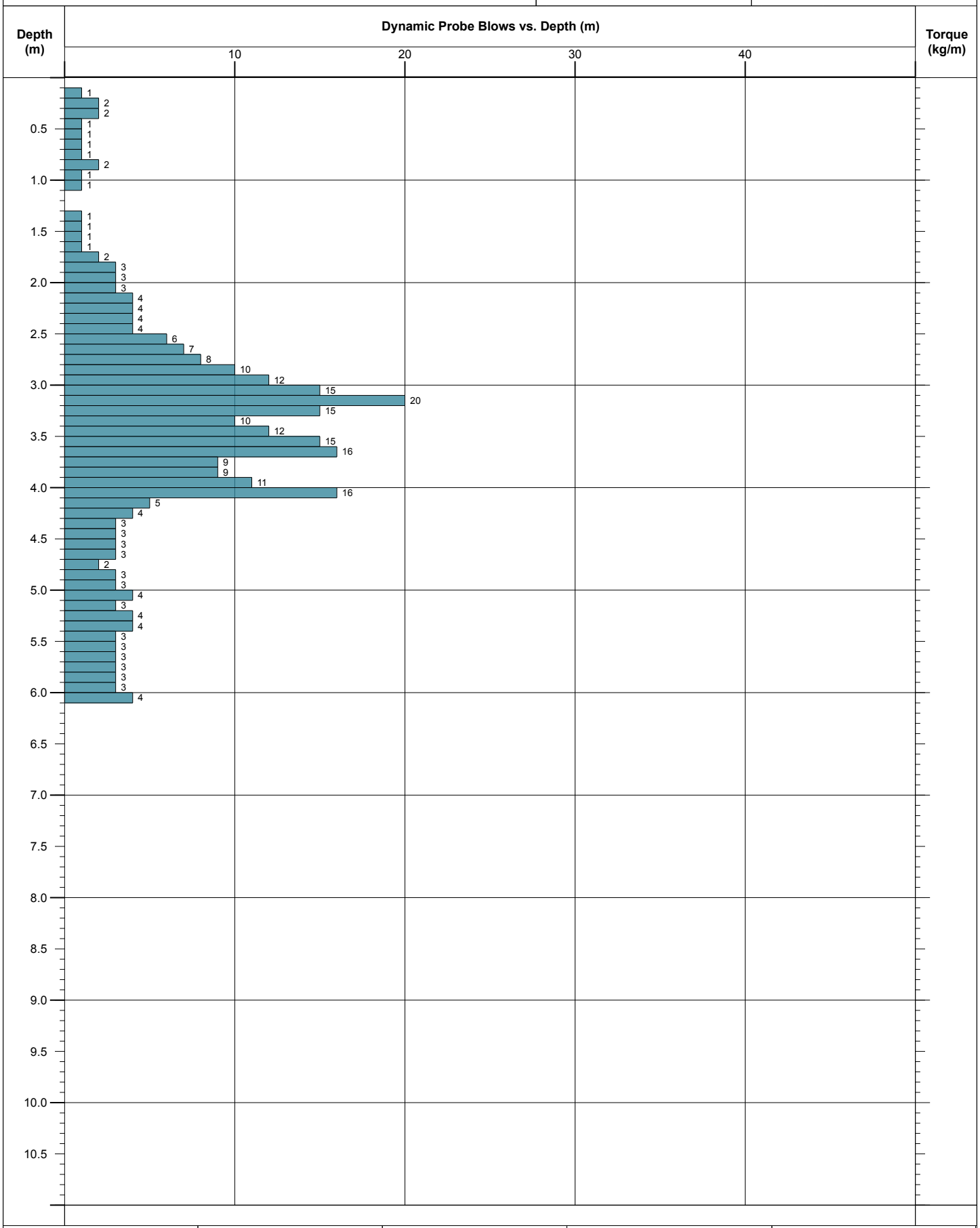
Project No:	Hole ID:	Page:
16-1202.02	DPT101	1 of 1

Project: **Reform Street, Crowland**

Dynamic Probe Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**



BS EN ISO 22476-2:2005	63.5 kg Hammer Mass	750 mm Standard Drop	50 mm Cone Base Diameter	35 mm Rod Diameter

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged By:	Checked By:	Approved By:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	MP	AH	PH	1:50

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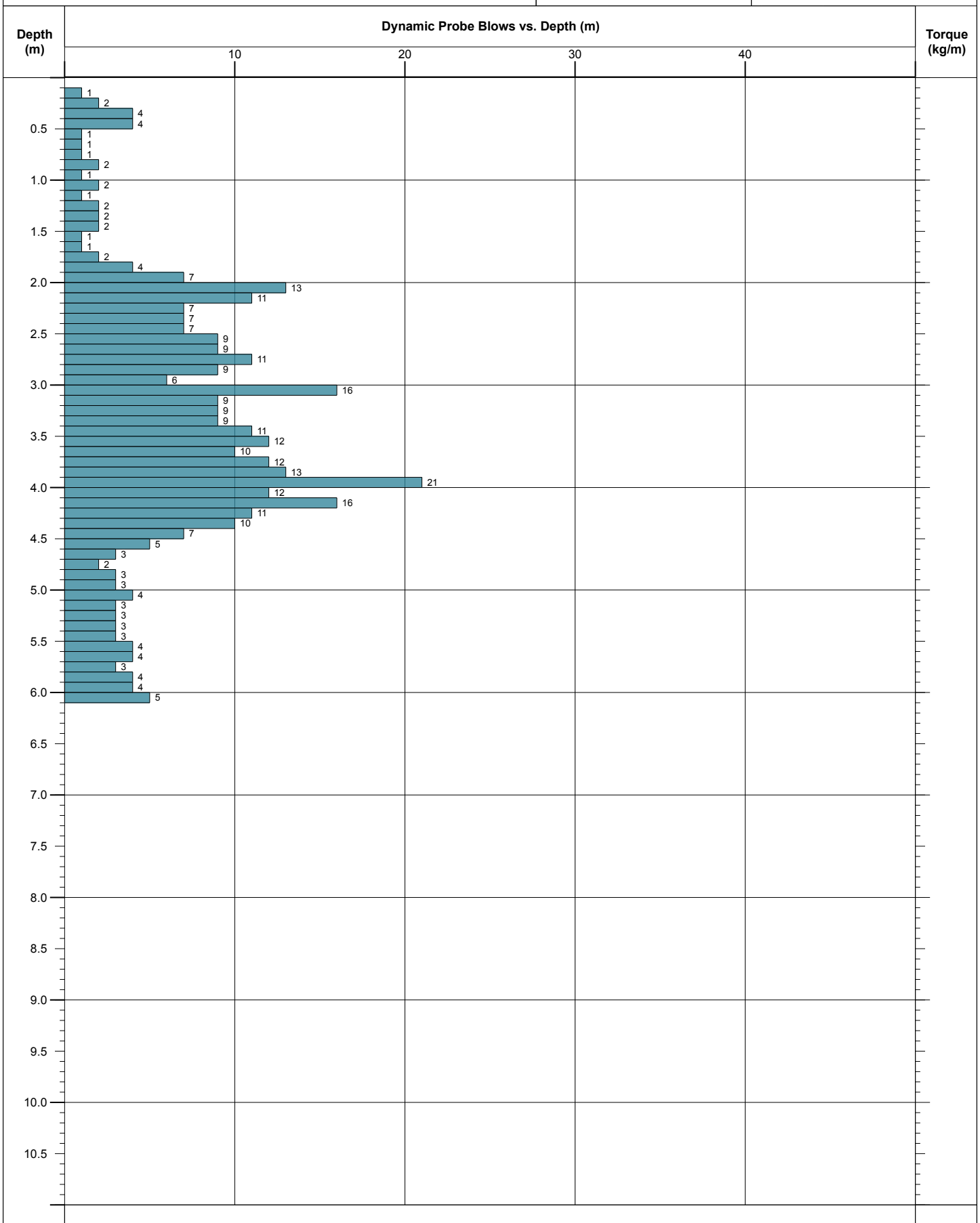
Project No:	Hole ID:	Page:
16-1202.02	DPT102	1 of 1

Project: **Reform Street, Crowland**

Dynamic Probe Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**



BS EN ISO 22476-2:2005	63.5 kg Hammer Mass	750 mm Standard Drop	50 mm Cone Base Diameter	35 mm Rod Diameter

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged By:	Checked By:	Approved By:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	MP	AH	PH	1:50

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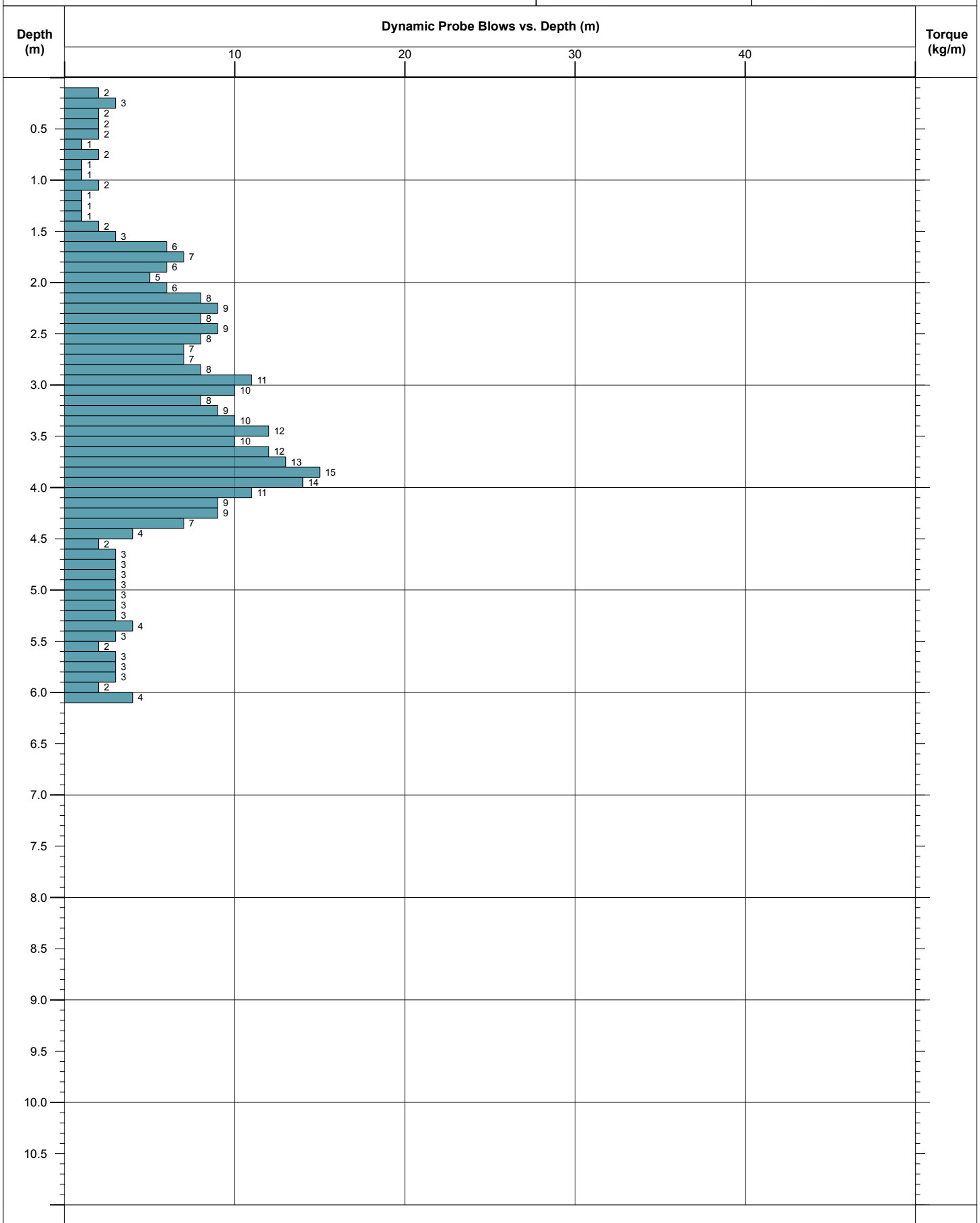
Project No:	Hole ID:	Page:
16-1202.02	DPT103	1 of 1

Project: **Reform Street, Crowland**

Dynamic Probe Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**



BS EN ISO 22476-2:2005	63.5 kg Hammer Mass	750 mm Standard Drop	50 mm Cone Base Diameter	35 mm Rod Diameter

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged By:	Checked By:	Approved By:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	MP	AH	PH	1:50

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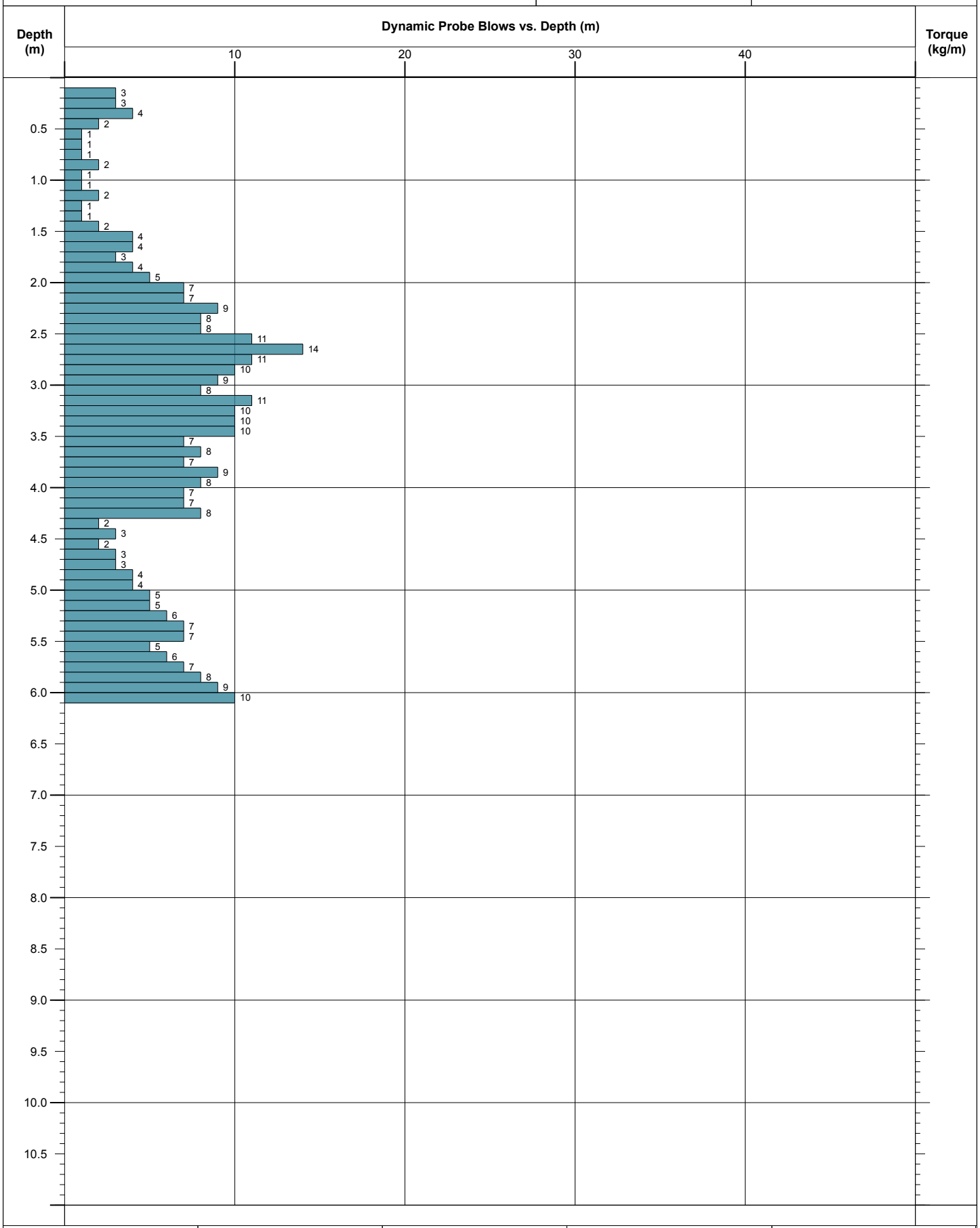
Project No:	Hole ID:	Page:
16-1202.02	DPT104	1 of 1

Project: **Reform Street, Crowland**

Dynamic Probe Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**



BS EN ISO 22476-2:2005	63.5 kg Hammer Mass	750 mm Standard Drop	50 mm Cone Base Diameter	35 mm Rod Diameter

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged By:	Checked By:	Approved By:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	MP	AH	PH	1:50

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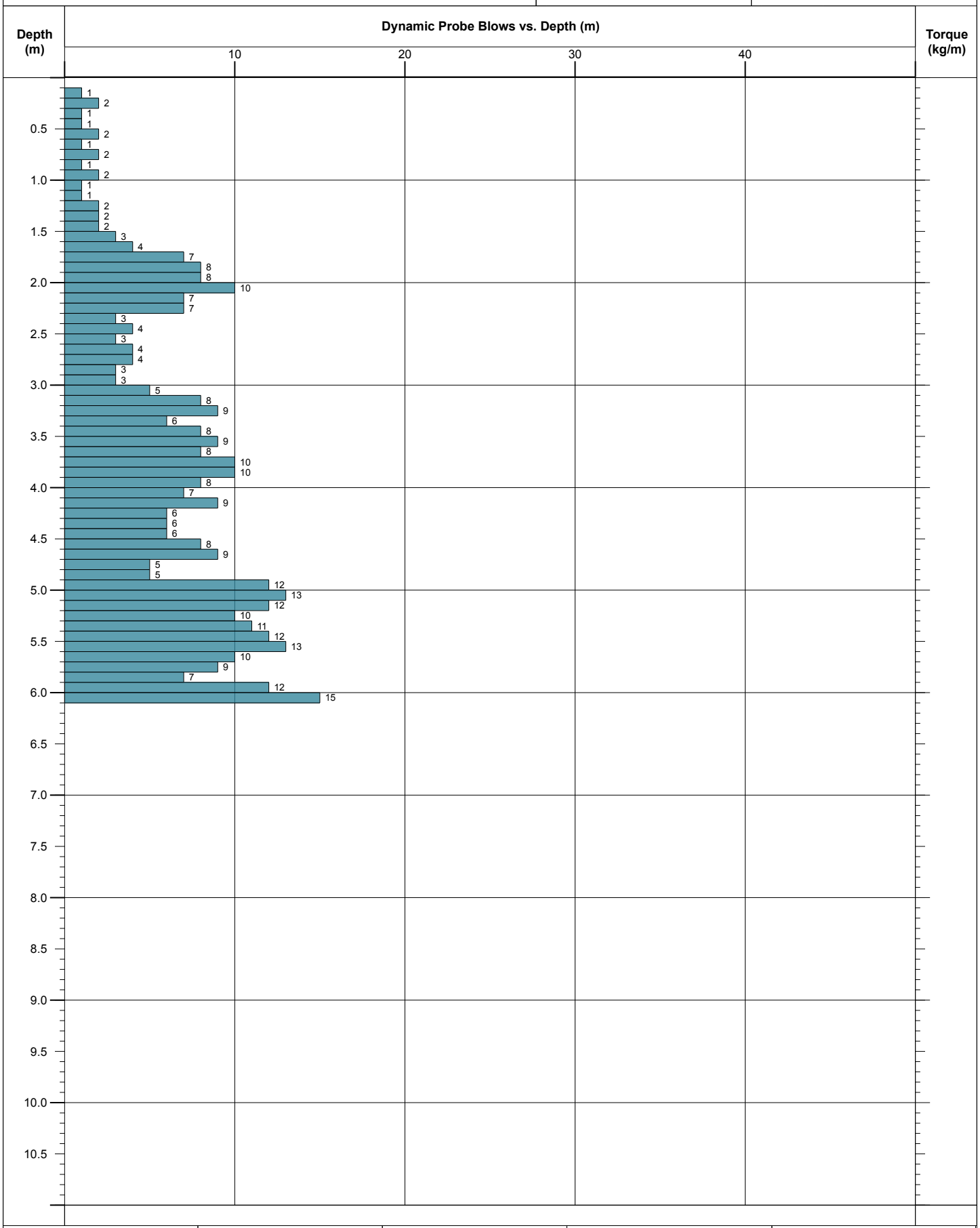
Project No:	Hole ID:	Page:
16-1202.02	DPT105	1 of 1

Project: **Reform Street, Crowland**

Dynamic Probe Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**



BS EN ISO 22476-2:2005	63.5 kg Hammer Mass	750 mm Standard Drop	50 mm Cone Base Diameter	35 mm Rod Diameter

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged By:	Checked By:	Approved By:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	MP	AH	PH	1:50

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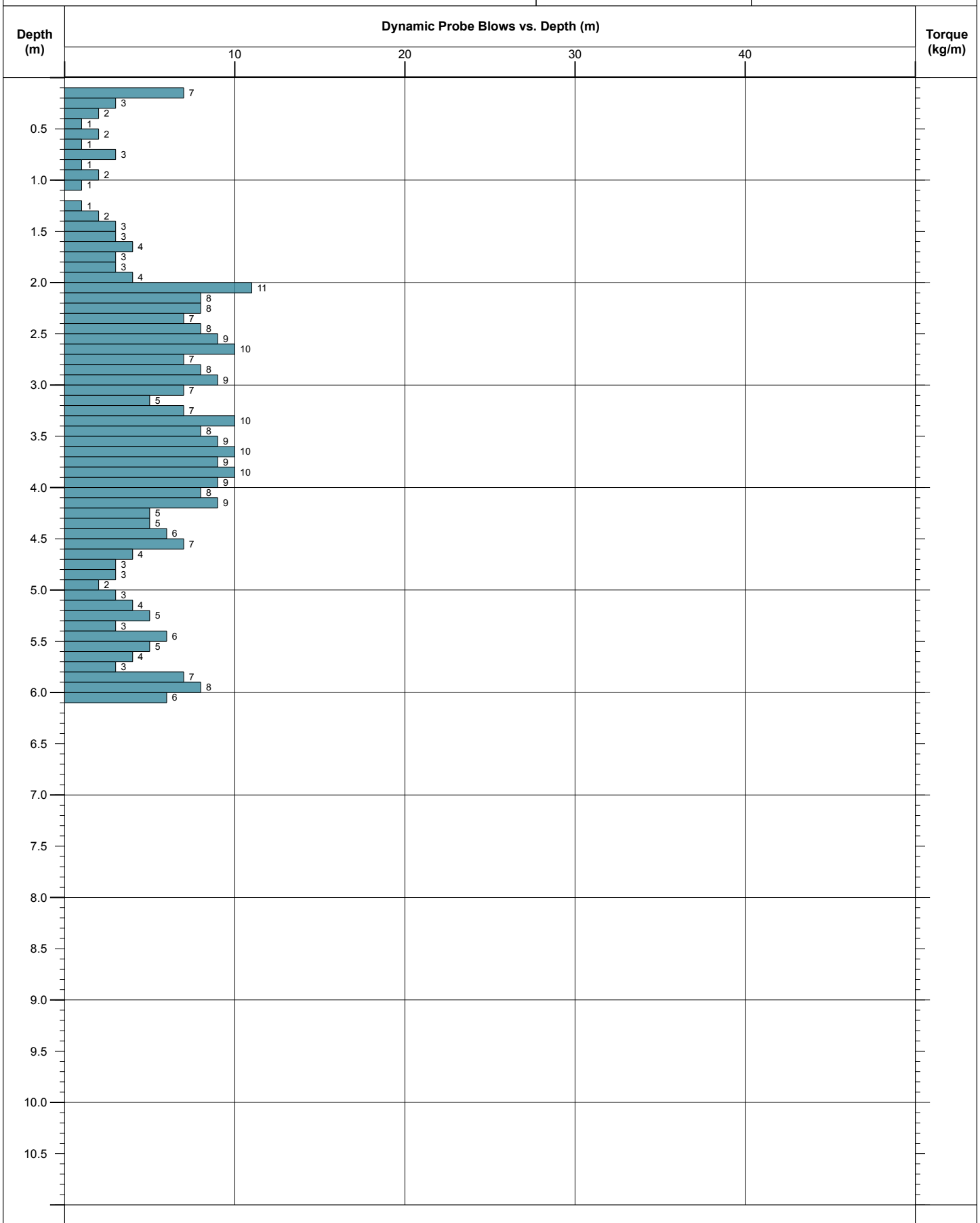
Project No:	Hole ID:	Page:
16-1202.02	DPT106	1 of 1

Project: **Reform Street, Crowland**

Dynamic Probe Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**



BS EN ISO 22476-2:2005	63.5 kg Hammer Mass	750 mm Standard Drop	50 mm Cone Base Diameter	35 mm Rod Diameter

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged By:	Checked By:	Approved By:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	MP	AH	PH	1:50

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Project No: 16-1202.02 | Hole ID: DS101 | Page: 1 of 1

Project: Reform Street, Crowland

Dynamic Sampler Log

Date: 21/02/2017 | Client: Lincolnshire County Council

Description of Strata	Legend	Strata Depth (m bgl)	Strata Thickness (m)	Reduced Level (mAOD)	Casing Diameter (mm)	Water	Sample Details: Depth (m)	Sample Details: Type	Sample Details: Ref	Test Details: Depth (m)	Test Details: Results	Backfill
MADE GROUND: Orangish brown gravelly clayey SAND. Gravel is subangular to subrounded fine to medium with clinker, brick and sandstone.		0.20	(0.20)				0.20	ES	1			
MADE GROUND: Soft dark brown sandy CLAY. Sand is fine to coarse subangular to subrounded with brick, plastic, sandstone and flint.		1.00	(0.80)				1.00	ES	2			
Firm orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium with flint and sandstone. (UNDIFFERENTIATED SUPERFICIAL DEPOSITS)		1.40	(0.40)				1.40	ES	3			
No recovery.		2.00	(0.60)			2.00 ▼	2.00	D	4			
Medium dense orangish brown sandy fine to medium subrounded to subangular flint GRAVEL. Sand is fine to coarse. (ABBEY SAND AND GRAVEL)		3.00	(1.00)				3.00	D	5			
Borehole complete at 3.00 m bgl.												

Remarks:
1. Logged in general accordance to BS 5930:2015.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 2.00 m bgl.
4. Backfilled with arisings.

Water Strike			Water Level		Borehole Diameter	
Date	Time	Depth Strike	Duration	Depth Water	Depth Base	Diameter
21/02/2017		2.00 m				

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	CW	AH	PH	1:30

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Project No: 16-1202.02 | Hole ID: DS102 | Page: 1 of 1

Project: Reform Street, Crowland

Dynamic Sampler Log

Date: 21/02/2017 | Client: Lincolnshire County Council

Description of Strata	Legend	Strata Depth (m bgl)	Strata Thickness (m)	Reduced Level (mAOD)	Casing Diameter (mm)	Water	Sample Details: Depth (m)	Sample Details: Type	Sample Details: Ref	Test Details: Depth (m)	Test Details: Results	Backfill
MADE GROUND: Orangish brown sandy subangular to subrounded fine to medium GRAVEL. Sand is fine to coarse. Frequent brick, clinker, sandstone and rare polystyrene fragments noted.		1.00	(1.00)				0.40	ES	1			
Loose yellowish brown and very sandy fine to medium subrounded to subangular flint and sandstone GRAVEL. Sand is fine to coarse. (ABBEY SAND AND GRAVEL)		1.50	(0.50)				1.50	D	2			
Firm dark orangish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium subangular to subrounded flint and sandstone. (ABBEY SAND AND GRAVEL)		2.00	(0.50)				1.50	ES	3			
Dense dark grey sandy fine to medium subangular to subrounded flint and sandstone GRAVEL. Sand is fine to coarse. Slight organic odour. (ABBEY SAND AND GRAVEL)		2.10	(0.10)			2.10 ▼	2.10	ES	4			
Medium dense orangish brown sandy fine to medium subangular to subrounded flint GRAVEL. Sand is fine to coarse. (ABBEY SAND AND GRAVEL)		3.00	(0.90)				2.50	D	5			
Borehole complete at 3.00 m bgl.												

Remarks:
1. Logged in general accordance to BS 5930:2015.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 2.10 m bgl.
4. Backfilled with arisings.

Water Strike			Water Level		Borehole Diameter	
Date	Time	Depth Strike	Duration	Depth Water	Depth Base	Diameter
21/02/2017		2.10 m				

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	CW	AH	PH	1:30

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Project No: 16-1202.02 | Hole ID: DS103 | Page: 1 of 1

Project: Reform Street, Crowland

Dynamic Sampler Log

Date: 21/02/2017 | Client: Lincolnshire County Council

Description of Strata	Legend	Strata Depth (m bgl)	Strata Thickness (m)	Reduced Level (mAOD)	Casing Diameter (mm)	Water	Sample Details: Depth (m)	Sample Details: Type	Sample Details: Ref	Test Details: Depth (m)	Test Details: Results	Backfill
MADE GROUND: Dark brown gravelly fine to coarse SAND. Gravel is fine to medium subrounded to subangular sandstone and flint with rare brick and rootlets. (TOPSOIL)		0.40	(0.40)				0.10	ES	1			
MADE GROUND: Firm dark grey sandy CLAY. Sand is fine to coarse with occasional brick and rootlets.		1.00	(0.60)				0.60	ES	2			
Soft dark grey slightly sandy CLAY with rare angular fine flint gravel. (UNDIFFERENTIATED SUPERFICIAL DEPOSITS)		1.40	(0.40)				1.00	ES	3			
Medium dense dark orangish brown clayey fine to medium subrounded to subangular GRAVEL. (ABBEY SAND AND GRAVEL)		2.00	(0.60)			1.50 ▼	1.40	ES	4			
Dense dark orangish brown sandy fine to medium subrounded to subangular flint and sandstone GRAVEL. (ABBEY SAND AND GRAVEL)		3.00	(1.00)				2.00	D	5			
Borehole complete at 3.00 m bgl.							3.00	D	6			

Remarks:
1. Logged in general accordance to BS 5930:2015.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 1.50 m bgl.
4. Installed with a 63 mm HDPE standpipe to 2.40 m bgl and flush cover.
5.0 Borehole collapsed to 2.4 m blgl.

Water Strike			Water Level		Borehole Diameter	
Date	Time	Depth Strike	Duration	Depth Water	Depth Base	Diameter
21/02/2017		1.50 m				

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	CW	AH	PH	1:30

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Project No: 16-1202.02 | Hole ID: DS104 | Page: 1 of 1

Project: Reform Street, Crowland

Dynamic Sampler Log

Date: 21/02/2017 | Client: Lincolnshire County Council

Description of Strata	Legend	Strata Depth (m bgl)	Strata Thickness (m)	Reduced Level (mAOD)	Casing Diameter (mm)	Water	Sample Details: Depth (m)	Sample Details: Type	Sample Details: Ref	Test Details: Depth (m)	Test Details: Results	Backfill
MADE GROUND: Orangish brown very gravelly slightly clayey fine to coarse SAND. Gravel is angular to subangular fine to medium brick, concrete and limestone.		0.10	(0.10)									
MADE GROUND: Dark greyish brown sandy clayey angular to subangular fine to coarse brick, concrete and limestone GRAVEL with rare concrete cobbles. Sand is fine to coarse.		0.70	(0.60)				0.30	ES	1			
Loose orangish brown slightly gravelly fine to coarse SAND. Gravel is very angular to subangular fine to medium flint. (ABBEY SAND AND GRAVEL)		2.00	(1.30)			2.00 ▼	0.80	ES	2			
							1.00	B	3			
Dense orangish brown very sandy very angular to rounded fine to medium flint GRAVEL. Sand is fine to coarse. (ABBEY SAND AND GRAVEL)		2.40	(0.40)				2.00	D	4			
No recovery.		3.00	(0.60)									
Borehole complete at 3.00 m bgl.												

Remarks:
1. Logged in general accordance to BS 5930:2015.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 2.00 m bgl.
4. Backfilled with arisings.

Water Strike			Water Level		Borehole Diameter	
Date	Time	Depth Strike	Duration	Depth Water	Depth Base	Diameter
21/02/2017		2.00 m				

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	CW	AH	PH	1:30

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Project No: **16-1202.02**

Hole ID: **DS105**

Page: **1 of 1**

Project: **Reform Street, Crowland**

Dynamic Sampler Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**

Description of Strata	Legend	Strata Depth (m bgl)	Strata Thickness (m)	Reduced Level (mAOD)	Casing Diameter (mm)	Water	Sample Details: Depth (m)	Sample Details: Type	Sample Details: Ref	Test Details: Depth (m)	Test Details: Results	Backfill
MADE GROUND: Dark brown sandy clay with fragments of wood, stone and polystyrene.		0.90	(0.90)				0.20	ES	1			
Loose orangish brown very sandy angular to rounded fine to medium flint GRAVEL. Sand is fine to coarse. (ABBEY SAND AND GRAVEL)		1.50	(0.60)				0.90 1.00	ES D	2 3			
Dense orangish brown gravelly fine to coarse SAND. Gravel is subangular to well rounded fine to medium flint. Gravel content decreasing with depth. (ABBEY SAND AND GRAVEL)		2.50	(1.00)			2.50 ▼	2.00	D	4			
Medium dense orangish brown sandy slightly clayey angular to rounded fine to medium flint GRAVEL. Sand is fine to coarse. (ABBEY SAND AND GRAVEL)		3.00	(0.50)				3.00	D	5			
Borehole complete at 3.00 m bgl.												

Remarks:
1. Logged in general accordance to BS 5930:2015.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 2.50 m bgl.
4. Installed with a 63 mm HDPE standpipe to 2.00 m bgl.

Water Strike			Water Level		Borehole Diameter	
Date	Time	Depth Strike	Duration	Depth Water	Depth Base	Diameter
21/02/2017		2.50 m				

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	AH	AH	PH	1:30

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Project No: 16-1202.02 | Hole ID: DS106 | Page: 1 of 1

Project: Reform Street, Crowland

Dynamic Sampler Log

Date: 21/02/2017 | Client: Lincolnshire County Council

Description of Strata	Legend	Strata Depth (m bgl)	Strata Thickness (m)	Reduced Level (mAOD)	Casing Diameter (mm)	Water	Sample Details: Depth (m)	Sample Details: Type	Sample Details: Ref	Test Details: Depth (m)	Test Details: Results	Backfill
MADE GROUND: Greyish brown sandy angular to subrounded fine to coarse limestone GRAVEL. Sand is fine to coarse. Underlain by geotextile membrane.		0.30	(0.30)									
MADE GROUND: Dark brown sandy CLAY with rare brick and flint gravel. Sand is fine.		0.70	(0.40)				0.40	ES	1			
MADE GROUND: Brown sandy CLAY with rare brick and limestone gravel. Sand is fine to coarse.		1.20	(0.50)				0.80	ES	2			
Loose orangish brown fine to medium SAND. (ABBEY SAND AND GRAVEL)		1.80	(0.60)			1.80 ▼	1.20	ES	3			
Dense orangish brown sandy slightly clayey angular to rounded fine to medium flint GRAVEL. (ABBEY SAND AND GRAVEL)		3.00	(1.20)				1.50	ES	4			
							2.50	B	5			
Borehole complete at 3.00 m bgl.												

Remarks:
1. Logged in general accordance to BS 5930:2015.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 1.80 m bgl.
4. Backfilled with arisings.

Water Strike			Water Level		Borehole Diameter	
Date	Time	Depth Strike	Duration	Depth Water	Depth Base	Diameter
21/02/2017		1.80 m				

Coordinates:	Elevation (mAOD):	Drilled By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
		Dynamic Sampling Ltd	Dando Terrier 2002	AH	AH	PH	1:30

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Project No:	Hole ID:	Page:
16-1202.02	TP101	1 of 1

Project: **Reform Street, Crowland**

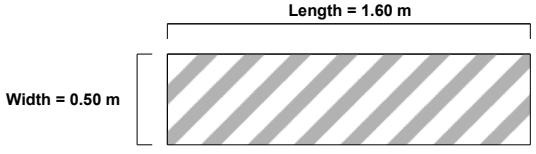
Trial Pit Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**

Description of Strata	Legend	Strata Depth (m)	Reduced Level (mAOD)	Water Strike (m)	Sample Details			Test Details	
					Depth (m)	Type	Ref	Depth (m)	Results
MADE GROUND: Brown sandy angular to subangular fine to medium brick, concrete, flint and limestone GRAVEL. Sand is fine to coarse.		0.20							
MADE GROUND: Soft orangish brown sandy CLAY. Sand is fine to medium.		0.60			0.60	ES	1		
MADE GROUND: Firm dark grey CLAY.		1.60							
Trial pit complete at 1.60 m bgl.									

Dimensions and Orientation:



Orientation:

Inclination:

Remarks:
1. Engineer verified logged in general accordance to BS 5930:2015.
2. Area CAT scanned prior to excavation.
3. Trial pit remained dry upon completion.
4. Backfilled with arisings.

Coordinates:	Elevation (mAOD):	Excavated By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
		Pammenter Plant Hire	Dando Terrier 2002	CW	AH	PH	1:30

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Project No:	Hole ID:	Page:
16-1202.02	TP102	1 of 1

Project: **Reform Street, Crowland**

Trial Pit Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**

Description of Strata	Legend	Strata Depth (m)	Reduced Level (mAOD)	Water Strike (m)	Sample Details: Depth (m)	Sample Details: Type	Sample Details: Ref	Test Details: Depth (m)	Test Details: Results
MADE GROUND: Brown sandy angular to subangular fine to medium brick, concrete, flint and limestone GRAVEL. Sand is fine to coarse.		0.20							
MADE GROUND: Dark brown gravelly CLAY. Gravel is angular to subrounded fine to medium brick and flint.		0.80							
Orangish brown fine to medium angular to subangular flint GRAVEL.		1.50		1.50 ▼					
Trial pit complete at 1.50 m bgl.									

Dimensions and Orientation:

Length = 1.60 m

Width = 0.40 m

Orientation:

Inclination:

Remarks:
1. Engineer verified logged in general accordance to BS 5930:2015.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 1.50 m bgl.
4. Backfilled with arisings.

Coordinates:	Elevation (mAOD):	Excavated By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
		Pammenter Plant Hire	Dando Terrier 2002	CW	AH	PH	1:30

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Project No:	Hole ID:	Page:
16-1202.02	TP103	1 of 1

Project: **Reform Street, Crowland**

Trial Pit Log

Date: **21/02/2017**

Client: **Lincolnshire County Council**

Description of Strata	Legend	Strata Depth (m)	Reduced Level (mAOD)	Water Strike (m)	Sample Details: Depth (m)	Sample Details: Type	Sample Details: Ref	Test Details: Depth (m)	Test Details: Results
MADE GROUND: Brown sandy angular to subangular fine to medium brick, concrete, flint and limestone GRAVEL. Sand is fine to coarse. Underlain by geotextile membrane.		0.30							
MADE GROUND: Dark brown gravelly CLAY. Gravel is angular to subrounded fine to medium brick and flint.		0.60							
Orangish brown slightly sandy angular to rounded fine to medium flint GRAVEL. Sand is fine to coarse.		1.30		1.30 ▼					
Trial pit complete at 1.30 m bgl.									

Dimensions and Orientation:



Orientation:

Inclination:

Remarks:
1. Engineer verified logged in general accordance to BS 5930:2015.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 1.30 m bgl.
4. Backfilled with arisings.

Coordinates:	Elevation (mAOD):	Excavated By:	Plant Used:	Logged:	Checked:	Approved:	Scale:
		Pammenter Plant Hire	Dando Terrier 2002	CW	AH	PH	1:30

Appendix II

GROUNDWATER AND GROUND GAS MONITORING RECORD SHEET

Sheet: 1 of 1

Project Name:	Crowland	Weather Conditions:	Sunny 8C
Project Number:	16-1202.01	Gas Kit Model:	GFM436
Personnel:	CW	Gas Kit Serial No:	

Date: 02/03/2017

LOCATION	Flow Peak (L/hr)	Flow Steady (L/hr)	CH_4 Peak (%v/v)	CH_4 Steady (%v/v)	CO_2 Peak (%v/v)	CO_2 Steady (%v/v)	O_2 Min. (%v/v)	O_2 Steady (%v/v)	Atmospheric Pressure (mb)	PID (ppm)	Well I.D. (mm)	Depth to Product (DTP) (m)	Product Thickness (m)	Depth to Water (DTW) (m)	Depth to Base (DTB) (m)	Height of Water Column (m)	NOTES
DS103	0.0	0.0	0.0	0.0	4.3	4.3	14.2	14.2	1006					1.30	2.10	0.80	
DS105	1.9	0.3	0.0	0.0	4.9	4.9	13.5	13.5	1006					1.37	1.86	0.49	

GUIDE TO PURGING VOLUMES

To calculate the number of litres to be purged from a well with a different diameter, use the formula $3\pi r^2 h$ (where r = radius of the well and h = height of the water column). Use the formula $\pi r^2 h$ to calculate the volume of a bailer. Please note that the standard bailers Delta-Simons use are typically 0.95 m in length.

Diameter of Casing (mm)	19	35	50	50	75	100
Diameter of Bailer (mm)	18	19	19	38	38	38
No. bails per m	4	12	22	6	13	23

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GROUNDWATER AND GROUND GAS MONITORING RECORD SHEET

Sheet:		
1	of	1

Project Name:	Crowland	Weather Conditions:	Sunny 8C
Project Number:	16-1202.01	Gas Kit Model:	GFM436
Personnel:	CW	Gas Kit Serial No:	

Date: 08/03/2017

LOCATION	Flow Peak (L/hr)	Flow Steady (L/hr)	CH_4 Peak (%v/v)	CH_4 Steady (%v/v)	CO_2 Peak (%v/v)	CO_2 Steady (%v/v)	O_2 Min. (%v/v)	O_2 Steady (%v/v)	Atmospheric Pressure (mb)	PID (ppm)	Well I.D. (mm)	Depth to Product (DTP) (m)	Product Thickness (m)	Depth to Water (DTW) (m)	Depth to Base (DTB) (m)	Height of Water Column (m)	NOTES
DS103	0.3	0.1	0.0	0.0	4.1	4.1	15.6	15.6	1013					1.14	2.10	0.96	
DS105	0.3	0.1	0.0	0.0	3.4	3.4	17.0	17.0	1012					1.28	1.84	0.56	

GUIDE TO PURGING VOLUMES

To calculate the number of litres to be purged from a well with a different diameter, use the formula $3\pi r^2 h$ (where r = radius of the well and h = height of the water column). Use the formula $\pi r^2 h$ to calculate the volume of a bailer. Please note that the standard bailers Delta-Simons use are typically 0.95 m in length.

Diameter of Casing (mm)	19	35	50	50	75	100
Diameter of Bailer (mm)	18	19	19	38	38	38
No. bails per m	4	12	22	6	13	23

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GROUNDWATER AND GROUND GAS MONITORING RECORD SHEET

Sheet:		
1	of	1

Project Name:	Crowland	Weather Conditions:	Cloudy, windy, 8C
Project Number:	16-1202.01	Gas Kit Model:	GFM436
Personnel:	DP	Gas Kit Serial No:	

Date: 17/03/2017

LOCATION	Flow Peak (L/hr)	Flow Steady (L/hr)	CH_4 Peak (%v/v)	CH_4 Steady (%v/v)	CO_2 Peak (%v/v)	CO_2 Steady (%v/v)	O_2 Min. (%v/v)	O_2 Steady (%v/v)	Atmospheric Pressure (mb)	PID (ppm)	Well I.D. (mm)	Depth to Product (DTP) (m)	Product Thickness (m)	Depth to Water (DTW) (m)	Depth to Base (DTB) (m)	Height of Water Column (m)	NOTES
DS103	0.0	0.0	0.0	0.0	3.0	3.0	17.3	17.3	1017					1.28	2.09	0.81	
DS105	0.0	0.0	0.0	0.0	3.3	3.3	17.5	17.5	1017					1.33	1.82	0.49	

GUIDE TO PURGING VOLUMES

To calculate the number of litres to be purged from a well with a different diameter, use the formula $3\pi r^2 h$ (where r = radius of the well and h = height of the water column). Use the formula $\pi r^2 h$ to calculate the volume of a bailer. Please note that the standard bailers Delta-Simons use are typically 0.95 m in length.

Diameter of Casing (mm)	19	35	50	50	75	100
Diameter of Bailer (mm)	18	19	19	38	38	38
No. bails per m	4	12	22	6	13	23

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Appendix III

deltasimons

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

Final Report

Report No.:	17-04552-1
Initial Date of Issue:	03-Mar-2017
Client	Delta Simons
Client Address:	3 Henley Office Park Doddington Road Lincoln Lincolnshire LN6 3QR
Contact(s):	Andrew Howells
Project	16-1202.01 Reform Street, Crowland

Quotation No.:		**Date Received:**	23-Feb-2017
Order No.:	DS32084	**Date Instructed:**	24-Feb-2017
No. of Samples:	11		
Turnaround (Wkdays):	5	**Results Due:**	02-Mar-2017
Date Approved:	03-Mar-2017		

Approved By:



Details: Robert Monk, Technical Development Chemist

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 16-1202.01 Reform Street, Crowland

Client: Delta Simons					**Chemtest Job No.:**	17-04552	17-04552	17-04552	17-04552	17-04552	17-04552	17-04552	17-04552
Quotation No.:					**Chemtest Sample ID.:**	416412	416414	416415	416416	416418	416419	416420	416421	416425
Order No.: DS32084					Client Sample Ref.:	DS101	DS101	DS102	DS102	DS102	DS103	DS103	DS103	DS105
					Client Sample ID.:	ES1	ES3	ES1	ES2	ES4	ES1	ES2	ES3	ES1
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.20	1.40	0.40	1.50	2.10	0.10	0.60	1.00	0.20
					Date Sampled:	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017
					Asbestos Lab:	COVENTRY					COVENTRY			COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
ACM Type	U	2192		N/A		-					-			-
Asbestos Identification	U	2192	%	0.001		No Asbestos Detected					No Asbestos Detected			No Asbestos Detected
Moisture	N	2030	%	0.020			15	19	14	4.4		32	44	24
Soil Colour	N	2040		N/A			Brown	Brown	Brown	Brown		Brown	Black	Black
Other Material	N	2040		N/A			Stones	Stones	Stones	Stones		Stones	Stones	Stones, Wood
Soil Texture	N	2040		N/A			Clay	Clay	Clay	Sand		Loam	Clay	Loam
pH	M	2010		N/A						11.4			7.7	
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40			0.46	0.92	0.72			2.0		2.4
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010						0.25			0.14	
Total Sulphur	M	2175	%	0.010						0.20				
Arsenic	M	2450	mg/kg	1.0			11	30	33			25		31
Cadmium	M	2450	mg/kg	0.10			0.21	0.16	0.25			< 0.10		0.42
Chromium	M	2450	mg/kg	1.0			29	40	35			64		42
Copper	M	2450	mg/kg	0.50			9.0	17	17			27		61
Mercury	M	2450	mg/kg	0.10			< 0.10	< 0.10	< 0.10			< 0.10		0.47
Nickel	M	2450	mg/kg	0.50			31	28	39			39		36
Lead	M	2450	mg/kg	0.50			12	28	14			33		190
Selenium	M	2450	mg/kg	0.20			< 0.20	< 0.20	< 0.20			< 0.20		< 0.20
Zinc	M	2450	mg/kg	0.50			45	62	74			81		210
Fuel Type	N	2670		N/A			N/A	PAH	PAH			PAH	N/A	PAH
Total TPH >C6-C40	M	2670	mg/kg	10			< 10	150	14			14	[C] < 10	43
Naphthalene	M	2700	mg/kg	0.10			< 0.10	5.7	0.76			0.21		0.19
Acenaphthylene	M	2700	mg/kg	0.10			< 0.10	3.2	0.10			0.33		< 0.10
Acenaphthene	M	2700	mg/kg	0.10			< 0.10	8.3	0.16			0.20		< 0.10
Fluorene	M	2700	mg/kg	0.10			< 0.10	11	1.3			0.60		0.12
Phenanthrene	M	2700	mg/kg	0.10			< 0.10	70	6.8			4.2		0.86
Anthracene	M	2700	mg/kg	0.10			< 0.10	20	1.8			1.3		0.25
Fluoranthene	M	2700	mg/kg	0.10			0.23	66	4.9			4.4		2.5
Pyrene	M	2700	mg/kg	0.10			0.21	60	5.4			4.3		3.0
Benzo[a]anthracene	M	2700	mg/kg	0.10			< 0.10	24	1.4			1.7		1.1
Chrysene	M	2700	mg/kg	0.10			< 0.10	24	1.6			2.0		1.5
Benzo[b]fluoranthene	M	2700	mg/kg	0.10			< 0.10	19	1.2			1.5		1.2
Benzo[k]fluoranthene	M	2700	mg/kg	0.10			< 0.10	10	0.60			1.1		1.0
Benzo[a]pyrene	M	2700	mg/kg	0.10			< 0.10	21	1.2			1.5		1.2
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10			< 0.10	14	0.68			0.76		0.58
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10			< 0.10	3.2	0.29			0.27		< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10			< 0.10	12	0.38			0.87		0.59

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 16-1202.01 Reform Street, Crowland

Client: Delta Simons			**Chemtest Job No.:**		17-04552	17-04552	17-04552	17-04552	17-04552	17-04552	17-04552	17-04552	17-04552
Quotation No.:			**Chemtest Sample ID.:**		416412	416414	416415	416416	416418	416419	416420	416421	416425
Order No.: DS32084			Client Sample Ref.:		DS101	DS101	DS102	DS102	DS102	DS103	DS103	DS103	DS105
			Client Sample ID.:		ES1	ES3	ES1	ES2	ES4	ES1	ES2	ES3	ES1
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.20	1.40	0.40	1.50	2.10	0.10	0.60	1.00	0.20
			Date Sampled:		21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017	21-Feb-2017
			Asbestos Lab:		COVENTRY					COVENTRY			COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Total Of 16 PAH's	M	2700	mg/kg	2.0		< 2.0	370	29			25		14

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 16-1202.01 Reform Street, Crowland

Client: Delta Simons			**Chemtest Job No.:**		17-04552	17-04552
Quotation No.:			**Chemtest Sample ID.:**		416427	416428
Order No.: DS32084			Client Sample Ref.:		DS106	DS106
			Client Sample ID.:		ES1	ES2
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.40	0.80
			Date Sampled:		21-Feb-2017	21-Feb-2017
			Asbestos Lab:			
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A		
Asbestos Identification	U	2192	%	0.001		
Moisture	N	2030	%	0.020	23	15
Soil Colour	N	2040		N/A	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones
Soil Texture	N	2040		N/A	Clay	Clay
pH	M	2010		N/A		8.5
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	2.7	0.56
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010		0.023
Total Sulphur	M	2175	%	0.010		0.010
Arsenic	M	2450	mg/kg	1.0	28	11
Cadmium	M	2450	mg/kg	0.10	0.22	0.24
Chromium	M	2450	mg/kg	1.0	31	18
Copper	M	2450	mg/kg	0.50	30	13
Mercury	M	2450	mg/kg	0.10	0.17	< 0.10
Nickel	M	2450	mg/kg	0.50	27	17
Lead	M	2450	mg/kg	0.50	66	11
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20
Zinc	M	2450	mg/kg	0.50	89	74
Fuel Type	N	2670		N/A		N/A
Total TPH >C6-C40	M	2670	mg/kg	10		< 10
Naphthalene	M	2700	mg/kg	0.10		
Acenaphthylene	M	2700	mg/kg	0.10		
Acenaphthene	M	2700	mg/kg	0.10		
Fluorene	M	2700	mg/kg	0.10		
Phenanthrene	M	2700	mg/kg	0.10		
Anthracene	M	2700	mg/kg	0.10		
Fluoranthene	M	2700	mg/kg	0.10		
Pyrene	M	2700	mg/kg	0.10		
Benzo[a]anthracene	M	2700	mg/kg	0.10		
Chrysene	M	2700	mg/kg	0.10		
Benzo[b]fluoranthene	M	2700	mg/kg	0.10		
Benzo[k]fluoranthene	M	2700	mg/kg	0.10		
Benzo[a]pyrene	M	2700	mg/kg	0.10		
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10		
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10		
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10		

Results - Soil

Project: 16-1202.01 Reform Street, Crowland

Client: Delta Simons			**Chemtest Job No.:**		17-04552	17-04552
Quotation No.:			**Chemtest Sample ID.:**		416427	416428
Order No.: DS32084			Client Sample Ref.:		DS106	DS106
			Client Sample ID.:		ES1	ES2
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.40	0.80
			Date Sampled:		21-Feb-2017	21-Feb-2017
			Asbestos Lab:			
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total Of 16 PAH's	M	2700	mg/kg	2.0		

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample ID:	Sample Ref:	Sample ID:	Sampled Date:	Deviation Code(s):	Containers Received:
416421	DS103	ES3	21-Feb-2017	C	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

Andrew Howells
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3 Henley Office Park
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LN6 3QR

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Croxley Green
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Watford,
Herts,
WD18 8YS

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

Analytical Report Number : 17-42089

Project / Site name:	Reform Street, Crowland	**Samples received on:**	08/03/2017
Your job number:	16-1202.01	**Samples instructed on:**	08/03/2017
Your order number:	DS32085	**Analysis completed by:**	13/03/2017
Report Issue Number:	1	**Report issued on:**	13/03/2017
Samples Analysed:	4 soil samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

Analytical Report Number: 17-42089

Project / Site name: Reform Street, Crowland
Your Order No: DS32085

Lab Sample Number				714598	714599	714600	714601	
Sample Reference				DS101	DS102	DS104	DS105	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				2.00	2.50	1.00	3.00	
Date Sampled				21/02/2017	21/02/2017	21/02/2017	21/02/2017	
Time Taken				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	28	
Moisture Content	%	N/A	NONE	16	7.0	14	6.7	
Total mass of sample received	kg	0.001	NONE	0.54	0.43	0.70	0.25	
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.7	8.3	8.0	8.2	
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.060	0.056	0.15	0.029	
Total Sulphur	mg/kg	50	MCERTS	210	270	190	240	
Total Sulphur	%	0.005	MCERTS	0.021	0.027	0.019	0.024	

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

Analytical Report Number : 17-42089

Project / Site name: Reform Street, Crowland

* 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 *
714598	DS101	None Supplied	2.00	Light brown clay.
714599	DS102	None Supplied	2.50	Light brown sandy gravel. **
714600	DS104	None Supplied	1.00	Light brown sand with gravel and vegetation.
714601	DS105	None Supplied	3.00	Light brown clay with stones.

** Non MCerts Matrix

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

Analytical Report Number : 17-42089

Project / Site name: Reform Street, Crowland

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
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
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
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 based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS

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

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

Appendix IV

deltasimons



Delta-Simons Adopted Human Health Generic Assessment Criteria

For

Residential End Use with Consumption of Home Grown Produce

Version 4.2 – September 2015

Guidance Notes – Using Human Health Soil Screening Values

A tiered risk assessment approach is used for the assessment of soil analysis results considering the 'pollutant linkages' on the basis of a 'source-pathway-receptor' relationship.

The following tables present conservative Tier 1 generic screening assessment criteria (GAC) used by Delta-Simons to provide an initial assessment of risk to Human Health in the context of the proposed redevelopment of the Site.

GACs are intended to assess:

- Chronic (long-term) on-site exposure risk to contaminants in the soil to future users and occupiers of the Site.
- Concentrations below the GAC considered tolerable or to pose a minimal risk to human health, or low risk in relation to the Category 4 Screening Levels (C4SLs).

GACs are not relevant for assessing:

- Acute (short-term) exposure risks (e.g. construction workers during development);
- Non-human receptors such as controlled waters, ecosystems, buildings and services, animals, domestic pets or plants;
- Aesthetic issues which may render a soil unsuitable for use such as odour or colour;
- GACs do not take account of other non-soil based sources of contamination such as contamination in groundwater or surface waters; and
- GACs are not suitable for assessing whether a soil provides a suitable growing medium for crops or plants.

Exceedences of Generic Assessment Criteria

An exceedence of a GAC:

- Is not an indicator of a significant risk to human health;
- Is an indication that the contaminant *may* pose a possibility harm to human health and, therefore, further consideration is required.

In assessing the significance of an exceedence consideration should be given to:

- The *nature* of the contaminant (e.g. volatile or non-volatile contaminants)
- Site design and potential exposure *pathways* (e.g. hard cover, buildings, landscaping)
- The *distribution* of exceedences (widespread or localised, numerous or few exceedences – ***NB: Consider data limitations – site coverage and gaps in data.***
- The *margin* of the exceedence(s);
- The *duration* and *frequency* of exposure; and
- Any other *site specific* factors.

Generic Assessment Criteria used by Delta-Simons

In the absence of a complete regulatory set of screening values derived using the CLEA Framework, Delta-Simons screening values are based on the following:

- The current Soil Guidance Values (SGVs) published by the EA;
- Category 4 Screening Levels (C4SLs) published by DEFRA;
- The 2014 Land Quality Management (LQM) / Chartered Institute of Environmental Health (CIEH) Suitable for Use Levels for Human Health Risk Assessment (S4ULs);
- The guidance values produced by the Environmental Industries Commission (EIC), the Association of Geotechnical and Geoenvironmental Specialists (AGS) and Contaminated Land: Application in Real Environments (CL:AIRE) in December 2009; and
- In house Generic Screening Values (DS-GACs) derived by Delta-Simons.

Contaminants for which Generic Assessment Criteria are Unavailable

Insufficient toxicological data is available to derive GAC for a number of potential contaminants of concern and GAC cannot be derived for derived for mixtures of compounds (e.g. total petroleum hydrocarbons). In such cases Delta-Simons will endeavour to use

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conservative surrogate GAC values to provide an initial screening assessment based on the known chemical and physical properties of the contaminant.

Notes and References used in the Tables

Generic Assessment Criteria Source	
SGV	Soil Guidance Values published by the EA
DS-GAC	Delta-Simons Generic Assessment Criteria derived using CLEA V.1.06.
C4SL	Category 4 Screening Levels, DEFRA December 2014
SGV v.1.05	Environment Agency Soil Guideline Values for dioxins, furans and dioxin-like PCBs calculated within CLEA V.1.05.
LQM	LQM/CIEH Suitable for Use Levels for Human Health Risk Assessment (S4UL), November 2014. (*Copyright Land Quality Management Limited, reduced with permission; Publication Number S4UL3087. All rights reserved*).
EIC	EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment derived using CLEA V.1.06.
Abbreviations	
Units	All values mg/kg unless otherwise stated.
SOM	Soil Organic Matter – GAC have been derived for a range of soil organic matter content – 1%, 2.5 or 3% and 6%. In the absence of site specific data or robust soil characterisation the most conservative value of 1% soil organic matter should be used as the initial screening value.
(##)	GAC exceed saturation/vapour concentration (given in brackets). Soil concentrations above the soil saturation may indicate that non-aqueous phase liquid (NAPL) is present. Risks from NAPL may need to be considered separately. Reference should always be made to the site investigation observations and soil logs were available.
ND	Not derived. It was considered beyond the scope of the EIC project to collate and review plant concentration factors for the metals and therefore GAC have only been produced for land-uses that do not involve plant uptake. GAC have been calculated for antimony, barium and molybdenum for the residential without plant uptake scenario.

Use of C4SLs as Screening Criteria

Only the lead C4SL should be used as an initial screening level, as there is no 'minimal risk' screening value available. Though primarily designed for assessing the risk of land being determined as 'contaminated' under Part 2A, Defra have confirmed[1] that the C4SL could be used under the planning regime. Where applicable, the 'minimal risk' level should be used as the initial screening level and where exceedances are identified reference to, and consideration of the C4SL levels may be made in the risk assessment process.

[1] Defra/Lord de Mauley letter to all Local Authorities dated 3rd September 2014.

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Metals

Compound	1% SOM	Source	2.5 - 3% SOM	Source	6% SOM	Source
Antimony	*ND*	-	*ND*	-	ND	-
Arsenic	*32*	*SGV*	*32*	*SGV*	32	SGV
Arsenic	*37*	*LQM*	*37*	*LQM*	37	LQM
Arsenic	*37*	*C4SL*	*37*	*C4SL*	37	C4SL
Barium	*ND*	-	*ND*	-	ND	-
Beryllium	*1.7*	*LQM*	*1.7*	*LQM*	1.7	LQM
Boron	*290*	*LQM*	*290*	*LQM*	290	LQM
Cadmium	*10*	*SGV*	*10*	*SGV*	10	SGV
Cadmium	*11*	*LQM*	*11*	*LQM*	11	*LQM*
Cadmium	*22*	*C4SL*	*22*	*C4SL*	22	C4SL
Chromium (III)	*910*	*LQM*	*910*	*LQM*	910	LQM
Chromium (VI)	*6*	*LQM*	*6*	*LQM*	6	LQM
Chromium (VI)	*21*	*C4SL*	*21*	*C4SL*	21	C4SL
Copper	*2400*	*LQM*	*2400*	*LQM*	2400	LQM
Lead	*200*	*C4SL*	*200*	*C4SL*	200	C4SL
Mercury (elemental)	0.17	DS-GAC	0.5	DS-GAC	1.0	SGV
Mercury (elemental)	-	-	-	-	1.2	LQM
Mercury (inorganic)	170	DS-GAC	170	DS-GAC	170	SGV
Mercury (inorganic)	40	LQM	40	LQM	40	LQM
Mercury (methyl)	7.4	DS-GAC	10	DS-GAC	11	SGV
Mercury (methyl)	-	-	-	-	11	LQM
Molybdenum	*ND*	-	*ND*	-	ND	-
Nickel	*130*	*LQM*	*130*	*LQM*	130	LQM
Selenium	*350*	*SGV*	*350*	*SGV*	350	SGV
Selenium	*250*	*LQM*	*250*	*LQM*	250	LQM
Vanadium	*410*	*LQM*	*410*	*LQM*	410	LQM
Zinc	*3700*	*LQM*	*3700*	*LQM*	3700	LQM

ND - GAC not derived. It was considered beyond the scope of the EIC project to collate and review plant concentration factors for the metals and therefore GAC have only been produced for land-uses that do not involve plant uptake. GAC have been calculated for antimony, barium and molydenum for the residential without plant uptake scenario.

Italics– These values were derived based on a 6% SOM, however, the supporting documentation indicates that SOM has a negligible influence for these metals.

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Petroleum Hydrocarbons

Compound	1% SOM	Source	2.5 - 3% SOM	Source	6% SOM	Source
Aliphatic EC5-EC6	42	LQM	78	LQM	160	LQM
Aliphatic >EC6-EC8	100	LQM	230	LQM	530	LQM
Aliphatic >EC8-EC10	27	LQM	65	LQM	150	LQM
Aliphatic >EC10-EC12	130 (48)	LQM	330 (118)	LQM	760 (283)	LQM
Aliphatic >EC12-EC16	1100 (24)	LQM	2400 (59)	LQM	4300 (142)	LQM
Aliphatic >EC16-EC35	65000 (8.48)	LQM	92000 (21)	LQM	110000	LQM
Aliphatic >EC35-EC44	65000 (8.48)	LQM	92000 (21)	LQM	110000	LQM
Aromatic >EC5-EC7	70	LQM	140	LQM	300	LQM
Aromatic >EC7-EC8	130	LQM	290	LQM	660	LQM
Aromatic >EC8-EC10	34	LQM	83	LQM	190	LQM
Aromatic >EC10-EC12	74	LQM	180	LQM	380	LQM
Aromatic >EC12-EC16	140	LQM	330	LQM	660	LQM
Aromatic >EC16-EC21	260	LQM	540	LQM	930	LQM
Aromatic >EC21-EC35	1100	LQM	1500	LQM	1700	LQM
Aromatic >EC35-EC44	1100	LQM	1500	LQM	1700	LQM
Aromatic and Aliphatic >EC44-EC70	1600	LQM	1800	LQM	1900	LQM

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Polycyclic Aromatic Hydrocarbons (PAH)

Compound	1% SOM	Source	2.5 - 3% SOM	Source	6% SOM	Source
Naphthalene	2.3	LQM	5.6	LQM	13	LQM
Acenaphthylene	170	LQM	420	LQM	920	LQM
Acenaphthene	210	LQM	510	LQM	1100	LQM
Fluorene	170	LQM	400	LQM	860	LQM
Phenanthrene	95	LQM	220	LQM	440	LQM
Anthracene	2400	LQM	5400	LQM	11000	LQM
Fluoranthene	280	LQM	560	LQM	890	LQM
Pyrene	620	LQM	1200	LQM	2000	LQM
Benzo[a]anthracene	7.2	LQM	11	LQM	13	LQM
Chrysene	15	LQM	22	LQM	27	LQM
Benzo[b]fluoranthene	2.6	LQM	3.3	LQM	3.7	LQM
Benzo[k]fluoranthene	77	LQM	93	LQM	100	LQM
Benzo[a]pyrene	2.2	LQM	2.7	LQM	3	LQM
Benzo[a]pyrene	*5.0*	*C4SL*	*5.0*	*C4SL*	5.0	C4SL
Indeno[123-cd]pyrene	27	LQM	36	LQM	41	LQM
Dibenz[ah]anthracene	0.24	LQM	0.28	LQM	0.3	LQM
Benzo[ghi]perylene	320	LQM	340	LQM	350	LQM

C4SL for benzo(a)pyrene is based on 6% SOM only, however, the published C4SL Final Project Report indicates that SOM has a negligible influence for this compound.

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Volatile Organic Compounds (VOC)

Compound	1% SOM	Source	2.5 - 3% SOM	Source	6% SOM	Source
BTEX/MTBE						
Benzene					0.33	SGV
Benzene	0.087	LQM	0.17	LQM	0.37	LQM
Benzene	0.2	C4SL	-	-	0.87	C4SL
Toluene					610	SGV
Toluene	130	LQM	290	LQM	660	LQM
Ethylbenzene					350	SGV
Ethylbenzene	47	LQM	110	LQM	260	LQM
Xylene – m					240	SGV
Xylene – m	59	LQM	140	LQM	320	LQM
Xylene – o					250	SGV
Xylene – o	60	LQM	140	LQM	330	LQM
Xylene – p					230	SGV
Xylene – p	56	LQM	130	LQM	310	LQM
Methyl *tert*-butyl ether	49	EIC	84	EIC	160	EIC
Chlorinated Solvents						
Vinyl Chloride (Chloroethene)	0.00064	LQM	0.00087	LQM	0.0014	LQM
Trichloromethane (Chloroform)	0.91	LQM	1.7	LQM	3.4	LQM
1,2-Dichloroethane	0.0071	LQM	0.011	LQM	0.019	LQM
Trichloroethene (TCE)	0.016	LQM	0.034	LQM	0.075	LQM
1,1,1-Trichloroethane	8.8	LQM	18	LQM	39	LQM
Tetrachloroethene (PCE)	0.18	LQM	0.39	LQM	0.9	LQM
1,1,1,2-Tetrachloroethane	1.2	LQM	2.8	LQM	6.4	LQM
1,1,2,2-Tetrachloroethane	1.6	LQM	3.4	LQM	7.5	LQM
Tetrachloromethane	0.026	LQM	0.056	LQM	0.13	LQM
1,1,2 Trichloroethane	0.6	EIC	1.2	EIC	2.7	EIC
1,1-Dichloroethane	2.4	EIC	3.9	EIC	7.4	EIC
1,1-Dichloroethene	0.23	EIC	0.4	EIC	0.82	EIC
Cis 1,2-Dichloroethene	0.11	EIC	0.19	EIC	0.37	EIC
Trans 1,2-dichloroethene	0.19	EIC	0.34	EIC	0.7	EIC
Benzenes						
Chlorobenzene	0.46	LQM	1	LQM	2.4	LQM
1,2,4-Trimethylbenzene	0.35	EIC	0.85	EIC	2.0	EIC
Iso-propylbenzene	11	EIC	27	EIC	64	EIC
Propylbenzene	34	EIC	82	EIC	190	EIC
Other						
Bromobenzene	0.87	EIC	2.0	EIC	4.7	EIC
Bromodichloromethane	0.016	EIC	0.03	EIC	0.061	EIC
Carbon Disulphide	0.14	LQM	0.29	LQM	0.62	LQM
Chloroethane	8.3	EIC	11	EIC	18	EIC
Chloromethane	0.0083	EIC	0.0098	EIC	0.013	EIC

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Compound	1% SOM	Source	2.5 - 3% SOM	Source	6% SOM	Source
Dichloromethane	0.58	EIC	0.98	EIC	1.7	EIC
1,2-Dichloropropane	0.024	EIC	0.042	EIC	0.084	EIC
Hexachlorobutadiene	0.29	LQM	0.7	LQM	1.6	LQM
Styrene	8.1	EIC	19	EIC	43	EIC

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Semi-Volatile Organic Compounds (SVOC) and Other Organic Compounds

Compound	1% SOM	Source	2.5 - 3% SOM	Source	6% SOM	Source
Chlorobenzenes						
1,2-Dichlorobenzene	23	LQM	55	LQM	130	LQM
1,3-Dichlorobenzene	0.4	LQM	1	LQM	2.3	LQM
1,4-Dichlorobenzene	61	LQM	150	LQM	350	LQM
1,2,3-Trichlorobenzene	1.5	LQM	3.6	LQM	8.6	LQM
1,2,4-Trichlorobenzene	2.6	LQM	6.4	LQM	15	LQM
1,3,5-Trichlorobenzene	0.33	LQM	0.81	LQM	1.9	LQM
1,2,3,4-Tetrachlorobenzene	15	LQM	36	LQM	78	LQM
1,2,3,5-Tetrachlorobenzene	0.66	LQM	1.6	LQM	3.7	LQM
1,2,4,5-Tetrachlorobenzene	0.33	LQM	0.77	LQM	1.6	LQM
Pentachlorobenzene	5.8	LQM	12	LQM	22	LQM
Hexachlorobenzene	1.8 (0.2)	LQM	3.3 (0.5)	LQM	4.9	LQM
Pthtalates						
Bis (2-ethylhexyl)phthalate	280 (8.68)	EIC	610 (21.6)	EIC	1,100 (51.7)	EIC
Diethyl phthalate	120 (13.7)	EIC	260 (29.1)	EIC	570 (65)	EIC
Di-*n*-butyl phthalate	13 (4.65)	EIC	31 (11.4)	EIC	67 (27.3)	EIC
Di-*n*-octyl phthalate	2300 (32.6)	EIC	2800 (81.5)	EIC	3100 (196)	EIC
Butyl benzyl phthalate	1400 (26.3)	EIC	3300 (64.7)	EIC	7200 (154)	EIC
Phenols						
Phenol					420	SGV
Phenol	120	LQM	200	LQM	380	LQM
2,4-Dimethylphenol	19	EIC	43	EIC	97	EIC
Total Cresols (2-, 3- and 4-methylphenol)	80	EIC	180	EIC	400	EIC
Chlorophenols						
Chlorophenols (except Pentachlorophenol)	0.87	LQM	2	LQM	4.5	LQM
Pentachlorophenol	0.22	LQM	0.52	LQM	1.2	LQM
Other						
Biphenyl	66 (34.4)	EIC	160	EIC	360	EIC
Bromoform	2.8	EIC	5.9	EIC	13	EIC
2-Chloronaphthalene	3.7	EIC	9.2	EIC	22	EIC
2,4-Dinitrotoluene	1.5	EIC	3.2	EIC	7.2	EIC
2,6-Dinitrotoluene	0.78	EIC	1.7	EIC	3.9	EIC
Hexachloroethane	0.2	EIC	0.48	EIC	1.1	EIC
Tributyl tin oxide	0.25	EIC	0.59	EIC	1.3	EIC

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PCBs, Furans and Dioxins

Compound	1% SOM	Source	2.5 - 3% SOM	Source	6% SOM	Source
Sum of PCDDs, PCDFs and dioxin-like PCBs	-	-	-	-	0.008	SGV v.1.05

Pesticides and Herbicides

Compound	1% SOM	Source	2.5 - 3% SOM	Source	6% SOM	Source
Aldrin	5.7	LQM	6.6	LQM	7.1	LQM
Dieldrin	0.97	LQM	2	LQM	3.5	LQM
Atrazine	3.3	LQM	7.6	LQM	17.4	LQM
Dichlorvos	0.032	LQM	0.066	LQM	0.14	LQM
Endosulfan (alpha)	7.4	LQM	18	LQM	41	LQM
Endosulfan (beta)	7	LQM	17	LQM	39	LQM
alpha-Hexachlorocyclohexanes	0.23	LQM	0.55	LQM	1.2	LQM
beta-Hexachlorocyclohexanes	0.085	LQM	0.2	LQM	0.46	LQM
gamma-Hexachlorocyclohexanes (inc. Lindane)	0.06	LQM	0.14	LQM	0.33	LQM

Explosives

Compound	1% SOM	Source	2.5 - 3% SOM	Source	6% SOM	Source
2,4,6 Trinitrotoluene (TNT)	1.6	LQM	3.7	LQM	8.1	LQM
RDX	120	LQM	250	LQM	540	LQM
HMX	5.7	LQM	13	LQM	26	LQM

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Appendix V

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Risk Definitions

The following methodology is based on the methodology presented in CIRIA C552 Contaminated Land Risk Assessment: A Guide to Good Practice 2001. It requires the classification of the:

- Magnitude of the potential consequence (severity) of the Risk occurring: and
- Magnitude of the Probability (likelihood) of the Risk occurring.

The classifications are then compared to indicate the risk presented by each pollutant linkage.

Consequence to Receptor Definition Matrix

	Human Health	Controlled Waters	Buildings/Services
Severe Consequence	Acute or chronic permanent impact on human health.	Sensitive controlled water pollution ongoing, or just about to occur.	Catastrophic collapse
Medium Consequence	Chronic permanent impact on human health	Gradual pollution of sensitive controlled water	Degradation of materials
Mild Consequence	Chronic temporary impact on human health	Gradual pollution of non-sensitive controlled water	Damage to building rendering it unsafe.to occupy (eg foundation damage resulting in instability).
Minor Consequence	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc).	Slight discoloration of water	Easily repairable effects of damage to buildings, structures and services, i.e discoloration of concrete

Probability Definitions

Probability	Definition in Context
Higher	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution. Positive evidence of source, pathway and receptor.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term. Suspect source, pathway, and receptor
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term No evidence of hazard, pathway, and receptor

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Standard Risk Matrix

		Consequence/ Magnitude of impact			
		Severe	Medium	Mild	Minor
Probability	**High**	Very High	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/low	Low
	Low Likelihood	Moderate	Moderate/low	Low	Very Low
	Unlikely	Moderate/low	Low	Very Low	Very Low

Classified risks and likely action

Significance Level	Definition/Comments
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required. Demonstrable contaminated land situation, highest threat & liability level, urgent action recommended.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term. Likely contaminated land situation, risk assessment and action recommended.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, if is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term. Plausible contaminated land situation, risk assessment and possible action recommended.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild. Unlikely contaminated land situation, possible risk assessment and possible action.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe. Negligible risk, no action recommended except vigilance for changes in conditions.

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