Airport City Limited Partnership

MIX Manchester

Phase 1 Desk Study

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RSK GEOSCIENCES

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RSK GENERAL NOTES

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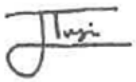
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Client: Airport City Limited Partnership

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Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by RSK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd. No part of this report may be copied or duplicated without the express permission of RSK and the party for whom it was prepared.

Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

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1 EXECUTIVE SUMMARY

Commissioning and purpose of assessment	RSK Environment Limited (RSK) was commissioned by ROC Consulting Ltd, acting on behalf of Airport City Limited Partnership, to carry out a Phase 1 Desk Study of the land at MIX Manchester, Enterprise Way, Manchester Airport, M90 4EG, at approximate grid reference SJ 81794 85873. The overall aim of the project was to assess geo-environmental and geotechnical constraints associated with the proposed development of the site for commercial office end uses.
DESK-BASED ASSESSMENT	
Site description and proposed development	The site is split into two parcels of land with Enterprise Way bisecting the site heading north to south through its centre. It currently comprises a Jetparks' car park in the western parcel of the site, a car park used for construction workers in the northeastern parcel of the site and vacant public open space in the southeastern parcel of the site. In total the site occupies an area of 12.016 hectares and is being considered for a Hybrid Planning Application seeking: 1) Full planning permission for development of mid-tech units (Use Class E.g. (i, ii, iii)) and multistorey car park (Use Class Sui Generis), alongside ancillary commercial uses (Class E) with associated access, servicing, public realm and landscaping. 2) Outline planning permission for development of a range of uses (comprising Use Class E.g., B2, C1) alongside a Multi-Storey Car Park (Use Class Sui Generis) and ancillary commercial uses (Class E), with associated access, servicing, public realm and landscaping. All matters reserved for future determination save for primary access.
History of site and surrounding area	The site formerly comprised farmland with several roads passing adjacent to and within the sites northern and eastern extent. Several farmsteads noted along the sites eastern boundary also with small pond features noted across the site. The site was developed as a car park in 2001 and a new road (Enterprise Way) appeared on 2025 mapping records following the demolition of the old road.
Previous site investigation (SI) reports	Two previous SI reports pertaining to the site have been provided. Please see section 4.4 for a summary of findings.
Geology and environmental setting	The site is underlain by Topsoil/made ground over Devensian Till deposits with relatively shallow bedrock of the Bollin Mudstone Formation encountered during previous site investigation in the eastern parcel of the site. There is also likely to be made/infilled ground associated with former pond in the western parcel of land. Environmental receptors identified comprise: • Groundwater within Devensian Till deposits classified as a secondary undifferentiated aquifer. • Groundwater within Bollin Mudstone Member classified as a secondary B aquifer. • Unnamed surface water feature located directly north from the western parcel of the site.

Site reconnaissance findings	• The western area of the site is an active car park with electronic barriers. This may provide a constraint to SI if locations are located on car parking bays. • The northern area in the eastern parcel of land is currently being used as a car park for construction workers at the Dakota Hotel, adjacent to the north. Various security cameras (assumably redundant), storage container style cabin and various construction materials. • The southern area in the eastern parcel of the site is accessible via a locked heras fencing gate.
Geotechnical constraints assessment	The majority of site soils are anticipated to comprise Devensian Till deposits (predominantly clay) with a few, localised, areas of made ground. Made ground is generally unsuitable for building foundations and there is potential for localised soft spots within the Devensian Till deposits, therefore further geotechnical assessment is required. There may be a localised area of infilled material within the former pond location in the western part of the site. Infill materials within this feature may not have been engineered and potential for weak and compressible materials may exist within this area.
Initial conceptual site model (CSM) and preliminary risk assessment (PRA)	Potentially complete contaminant linkages identified with a risk estimate of moderate to low or above include: • Made ground – Future site residents - Direct oral ingestion, inhalation and dermal contact with soil and soil-derived dust/Accumulation of ground gas leading to explosion or asphyxiation* - Low/Moderate risk. • Manchester Airport – Current/Future Site users - Direct oral ingestion, inhalation and dermal contact – Low/Moderate risk. Uncertainties and data gaps have been identified in the CSM at desk study stage and should be considered in the design of future intrusive investigation if proposed.
Recommendations including issues for further assessment	The following recommendations are made for further assessment of the site to address the risks identified above and/or* to address remaining uncertainties: • Review of existing ground investigation information to be completed in context of current development proposals to allow design of supplementary works to provide sufficient design information. • A Phase 2 Site Investigation should be completed. Any proposed ground investigations should target known or suspected sources of contamination as outlined in this report (namely former farmsteads to the east of the site, roads and infilled ponds). • Ground gas and water monitoring to be completed in tandem with works to assess risks posed.
The information given in this summary is necessarily incomplete and is provided for initial briefing purposes only. The summary must not be used as a substitute for the full text of the report.	

2 INTRODUCTION

2.1 Commissioning

RSK Environment Limited (RSK) were engaged by ROC Consulting Ltd, acting on behalf of Airport City Limited Partnership (herein referred to as the 'Client') to carry out Phase 1 Desk Study services at the land opposite Manchester Airport, Enterprise Way, Manchester Airport, M90 4EG.

The works were undertaken by means of email agreement (10/10/2025), which forms the appointment between ourselves and the Client.

References in this report to 'we', 'us', or 'our' shall mean RSK Geosciences as a trading name of RSK Environment Limited (company no.SC115530) at registered address 65 Sussex Street, Glasgow, G41 1DX.

The site location is provided in **Figure 1** and the site layout boundary to which this report refers is presented in **Figure 2**.

The report should be read and used in accordance with the limitations and constraints identified in the report text, and at **Appendix A – Service Constraints**.

2.2 Objectives

The site is being considered for development for industrial use.

The objective of the work is:

- To identify contamination and/or geotechnical constraints to the proposed development and, where relevant, to support discharge of planning conditions and building control requirements.
- To identify based on risk assessment whether additional investigation or remediation works may be required to support safe development to make the site suitable for use.
- To evaluate potential client environment liabilities as part of the due diligence process for acquisition/disposal.

2.3 Scope of works

The scope of works has been developed in accordance with relevant British Standards and authoritative technical guidance as referenced through the report. The assessment of the contamination status of the site is in line with the technical approach presented in Land Contamination Risk Management (LCRM) (Environment Agency, 2023) and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017). It is also compliant with relevant planning policy and guidance, i.e. national planning frameworks and policies.

The scope of the intrusive investigation has been designed in line with the recommendations of BS5930:2015+A1:2020 Code of practice for ground investigations (BSI, 2020), which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. It has also been developed in general accordance with BS 10175: 2011 + A2 2017. Ground gas assessment has been undertaken in general accordance with BS8576: 2013 and BS 8485:2015+A1:2019.

The scope of works for the assessment has included the following:

Desk study:

- Review of the history of development on the site and surroundings assessment of local geology, hydrogeology and hydrology.
- Review previous reports pertaining to the site condition where available.
- Completion of a site reconnaissance survey to assess the visual condition of the site development of an initial conceptual site model (CSM) and preliminary risk assessment.
- Preliminary consideration of geotechnical constraints and hazards provide recommendations for further works should this be required.

This report has been prepared in accordance with the National Quality Mark Scheme for Land Contamination (NQMS).

2.4 Existing reports

The following reports detailing previous works at the site were made available for review:

- RoC Consulting Ltd, Phase 2 Site investigation Report Airport City Bridge, MN/AS/p2 3590, October 2017.
- RoC Consulting Ltd, Phase 2 Site Investigation Airport City North, JB/AS/p2 3407, May 2016.

Pertinent information from these reports has been summarised in Section 4.2.

2.5 Sustainability considerations

One of RSK's guiding principles is 'promoting the concept of sustainability in all that we do'. The RSK Group Second Nature 2030 Sustainability Strategy (RSK, 2023) confirms our commitment to embedding sustainability throughout our business and creating lasting positive impact for our planet and its people by delivering sustainability in all that we do.

This is supported by RSK Geosciences' Sustainability Policy, which sets our aspiration to provide industry-leading site assessment services to our clients to achieve more sustainable and climate resilient development and to support circular economy, decarbonisation and nature-based solutions. We also recognise that we have a responsibility to reduce our own business-related emissions. In this way our business activities are aligned with and contribute to meeting several of the UN Sustainable Development Goals (SDGs), as well as supporting pathways to net zero and circular economy.

Sustainability considerations have therefore been taken into account during the design, planning and implementation stages of the project as described in this report. Our approach prioritises sustainability by integrating Sustainable Management Practices (SMPs) across the project lifecycle, to reduce our project-related emissions and help our client achieve more sustainable outcomes for their projects. SMPs were originally published by CL:AIRE (CL:AIRE, 2021a) and further developed by RSK Geosciences as an in-house tool. Further detail is provided in **Appendix B**.

Where applicable, consideration has made throughout this report to align the recommendations with circular economy, sustainable development and climate resilience. The following specific aspects have been identified to be relevant for this report:

Desk study:

- Evaluation of impacts of projected future climate change and extreme weather effects on relevant geo-based risks.

These sustainability-related aspects are considered where appropriate throughout this report. In addition, we seek to reduce our own emissions by:

- Measuring, monitoring and reducing our carbon emissions.
- Applying the waste hierarchy to reduce waste generation and increase recycling.
- Optimising intrusive site investigation projects and associated emissions.
- Engaging with our supply chain on sustainability.

2.6 Limitations

This report is subject to the RSK service constraints given in **Appendix A** and limitations that may be described below and throughout this document.

This report was prepared in accordance with good practice guidance and available datasets at the time of issue. Consideration should be considered in the light of changes in legislation, statutory requirements, or industry practices subsequent to the date of issue.

The opinions expressed in this report, and the comments and recommendations given, are based on the information obtained from the desk assessment and the site reconnaissance survey. No intrusive investigations have been undertaken to confirm the actual ground conditions and hence the environmental status of the site.

The study aims to principally identify and assess the potential risks and liabilities associated with contamination of the ground, on and in the vicinity of the site. While this includes consideration of current operations and housekeeping on the site, the report does not constitute a comprehensive environmental audit of the site, as covered under ISO 14001.

Although asbestos may not have been encountered as part of these works, asbestos could be present in soil in discrete areas and may be encountered in future ground investigation.

A detailed survey of invasive plant species is outside the scope of this investigation therefore detailed comments with regards to such species have been omitted from this report.

The comments given in this report and the opinions expressed are primarily based on third party data and investigations, while RSK have undertaken a review of the information provided RSK cannot be held liable for the quality of the data provided. There may be conditions pertaining to the site that have not been disclosed by the investigations and therefore could not be taken into account.

In particular, it should be noted that there may be areas of made ground and potential contamination not detected due to the limited nature of the investigations or the thickness and quality of made ground and concentrations of contamination across the site may be variable. In addition, groundwater levels and groundwater concentrations may vary from those reported due to seasonal, or other, effects.

3 SITE DETAILS

3.1 Site location

Site location details are presented in **Table 1** and a site location plan is provided on **Figure 1**.

Table 1 Site location details

Site name	MIX Manchester
Full site address and Post code	Manchester Airport, Enterprise Way, Manchester, M90 4EG
National Grid reference (centre of site)	381746 385894

3.2 Site description

The site boundary and current site layout are shown on **Figure 2**. The Site covers an area of c. 12.016 hectares. It is currently split into two distinct parcels of land (split by Enterprise Way). The western portion of the site is irregular in shape and occupied by the active Manchester Airport Jetpark car park; surface coverings comprise both soft cover (fenced off area) and hard cover with tarmacadam roadways. A culverted, unnamed, water course runs around the north of this part of the site around the eastern boundary beneath a retaining wall. The rest of the site is bound by mesh wire fencing with concrete posts.

The eastern area of the site is also irregular in shape and predominantly covered by soft standing in the southern area which comprises a vacant field with public footpath leading to pedestrian bridge across the M56. Hard cover aggregate material surfaces the northern area, which is currently being used as a car park for the construction of the Dakota Hotel to the north.

Enterprise way, which splits the site, runs north to south. There is an embankment in the southern area leading to a bridge over the M56. On either side, adjoining the site, are retaining walls forming the boundaries for both sites.

3.3 Surrounding land uses

The site is located to the north and east of Manchester Airport in the Ringway district of Manchester, within a predominantly residential/industrial setting. Immediate surrounding land uses are described in **Table 2**.

Table 2 Surrounding land uses

North	Residential houses and hotel.
East	Car parks and residential housing.
South	Manchester Airport and associated infrastructure and the A555 roadway.
West	Manchester Airport, car parks, M56 motorway and public open space.

3.4 Proposed development plans

It is proposed that the site will be redeveloped from its current state (airport Jetparks' 1 and 2) to an area of mixed industrial and commercial units utilising existing roadways. Specifically, the hybrid planning application being submitted will seek to achieve consent for the following :

- Full planning permission for development of mid -tech units (Use Class E.g.(i, ii, iii)) and multi -storey car park (Use Class Sui Generis), alongside ancillary commercial uses (Class E) with associated access, servicing, public realm and landscaping.
- Outline planning permission for development of a range of uses (comprising Use Class E.g., B2, C1) alongside a Multi -Storey Car Park (Use Class Sui Generis) and ancillary commercial uses (Class E), with associated access, servicing, public realm and landscaping. All matters reserved for future determination save for primary access.

The proposed layout of the site, at the time of preparing this report, is shown in **Appendix C**.

Manchester City Council planning portal has the following planning applications associated with/or adjacent to the site, listed below:

- Reference: 116021/NMC/2017 at the land adjacent to Thorley Lane/Bailey Lane, Manchester, M90 5AZ for the proposal of Non-Material Amendment to planning permission 100268/FO/2012/S" to allow for the replacement of gabion-retained grass bank with a decorated block wall. This planning application was approved on 09/05/2017.
- Reference: 100268/FO/2012/S2 at the land adjacent to Thorley Lane/Bailey Lane, Wythenshawe, Manchester, M90 5AZ for the proposal of a Diversion of part of Thorley Lane and Outwood Lane West through the creation of a new link road. This application was approved on 20/12/2012.
- References: 099732/FO/2012/S2 and 094336/FO/2010/S2 at Land adjacent to Thorley Lane/Bailey Lane, Wythenshawe, Manchester, M90 5AZ for the proposal of use of land for 3,155 vehicles for temporary periods validated on 28/06/2012 and 21/09/2010 respectively.
- Reference: 087396/OO/2008/S2 at land off Thorley Lane, Woodhouse Park, Wythenshawe, M90 5AZ for an outline application of (i) The erection of 6,038 square metres of office space (Class B1); three hotels (Class C1) of up to 500 bedrooms, with ancillary facilities including conference facilities, health and fitness club and bar and restaurant; 205 residential units (Class C3) (access only) (ii) The erection of a 6,300 square metres of car dealership (access, layout and scale only). This application was withdrawn on 12/01/2009.

4 DESK-BASED ASSESSMENT

The desk-based assessment was designed to generally meet the objectives of a preliminary or Phase 1 investigation, as defined by BS 10175:2011+A2:2017 (BSI, 2017) and BS 5930:2015, and is set in context of a Tier 1 preliminary risk assessment as defined in LCRM.

The "vicinity" of the site for the purposes of this report is defined as locations situated within an approximate 250 m radius of the site, although certain sources and/or sensitive targets further than 250 m distance from the site may also have been considered.

4.1 Site history

4.1.1 Historical development record

The development history of the site and surrounding area based upon assessment of historical plans and records is detailed in **Table 3** and **Table 4**, respectively.

The historical maps reviewed are shown within the environmental database report in **Appendix D**.

Table 3 Summary of historical development on site

Date from	Date to	Historical Land Use (on-site)	Area of site
1897	1976	Site predominantly comprises a series of agricultural fields with associated hedgerow boundaries. A small un-named water course is noted to the western boundary. Two farmsteads (Moss House Farm and Mayfield Cottage) are located on site to the western boundary. Outwood Lane forms the western boundary with Thornley Lane passing through the site through its northern and eastern extent.	Various
1976	1995	Farmsteads no longer present on mapping records. A pond is located in the central area of the site.	
1995	2001	Roundabout with associated embankment constructed on the southern site boundary.	
2001	2025	Site designated as a car park.	
2025	2025	Outwood Lane and Thornley Lane re-aligned to suit construction of Enterprise Way on site. Pedestrian bridge over M56 constructed around this time.	Central

Table 4 Summary of historical development in the vicinity of the site

Date from	Date to	Historical Land Use (off-site)	Distance (m) and orientation
1897	1954	Site surrounded by agricultural fields with some residential development along Thorley Lane, Bailey Lane and Outwood Lane.	
1954	1976	Increased development to the north/northwest of the site.	750 m N/NE
1976	1989	Boating Lake 200 m N. Increased residential development to the north and east 50 m N and 50 m E. Manchester Airport (south) with connection road (south and west). 500 m S.	
1989	1995	Connection road increased with a hotel development.	10 m E
1995	2025	Terminal 2 developed (20 m S). Railway line link (300 m SE). Increased link road developed (S).	
2025		Further expansion of Manchester Airport (SW). Further road improvements (N and E).	

The key potential contaminative land uses identified from the available historical maps include:

- Localised areas of made ground associated with former farmsteads to the west.
- Current site operation as a car park.
- Manchester Airport land directly to the south of the site.
- Former (infilled) pond located in the western area of the site.

4.1.2 Unexploded ordnance

A review of publicly available unexploded ordnance (UXO) risk maps indicates that the site is located in an area with medium potential for wartime bombs to be present (Zetica, 2025).

Due to the site being designated as a medium risk, a detailed desk based UXO risk assessment would be recommended for the site prior to an intrusive ground investigation.

4.2 Information from environmental database report

Relevant environmental permits and incidents detailed within the environmental database report (see **Appendix D**) are summarised below in **Table 5**.

Table 5 Summary of environmental permits, landfills and incidents

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
Agency and hydrological				
Environmental permits – incorporating Environmental Permitting Regulations (EPR) and/or Pollution Prevention and Control (PPC) permits; former Integrated Pollution Controls (IPC), Local Authority Pollution Control (LAPC)	0	0	0	N/a
Enforcement and prohibition notices	0	0	0	N/a
Pollution incidents to controlled waters, Prosecutions relating to controlled waters, Substantiated pollution incident register, Water Industry Act referrals	0	2	2	Offsite <250 m: Airport terminal 2, unloading of petrol into storage (historical permit) Offsite >250 m: Airport terminal 1, unloading of petrol into storage (historical permit)
Discharge consents	0	1	2	Offsite <250 m Ladbrokes hotels development, miscellaneous effluent type discharge into surface water (dated 16/05/1985 to 01/07/2025) Offsite >250 m: Manchester Airport Site Drainage for trade discharges (permit no: EPRCB3299EN, dated 30/10/2015. Revocation date: 14/02/2019).
Registered radioactive substances	0	0	0	N/a
Landfill and waste				
Active landfills	0	0	0	N/a

Data type	Entries on-site	Entries <250 m from site	Entries >250 m from site of relevance	Details
Historic/closed landfills	0	0	0	N/a
Other waste management licences	0	1	3	Laing O'rourke Site Office, Hale Top, Melbourne Avenue, Manchester, Manchester Airport, M90 4AF. Ref: WEX104525, treatment of waste aerosol cans.
Potentially in-filled land (pit, quarry, pond, marsh, river, stream, dock etc.)	1	27	0	Onsite: Former pond Offsite <250 m: Unspecified ground workings (1995, 12 m S) Unspecified Pit (1995, 18 m W) Various ponds
Hazardous substances/industrial land uses				
Control of Major Accident Hazards (COMAH) sites	0	0	0	N/a
Explosives sites, Notification of Installations Handling Hazardous Substances (NIHHS), Planning hazardous substance consents/enforcements	0	0	0	N/a
Contaminated land Part 2A register entries and notices	0	0	0	N/a
Fuel station entries	0	1	1	Offsite <250 m: Palma Avenue, Manchester Airport, OBSOLETE Offsite >250 m: 30 Outwood Lane, Terminal Road East, Manchester, OBSOLETE
Note: Entries have only been included within the table where they are located within a 250 m radius of the site or, where they fall outside of this radius but are considered to comprise a significant entry.				

4.2.1 Contemporary trade directory entries

Active potentially contaminative land uses identified in the contemporary trade directory and with potential to affect the site are identified as Etrop Grange Hotel and associated car park and airport transfers (directly north), Kingsley Hall offices (100 m north), Manchester Airport).

and associated infrastructure (205 m south), Carex manufacturing and Manchester Business Park (420 m east).

4.3 Information from regulatory authorities

4.3.1 Planning records

Planning records held by the Local Authority Planning Department pertaining to the site and relevant to the current assessment are summarised in section 5.4.

4.3.2 Local Authority environmental health department information

The Environmental Health Officer of the local authority (Manchester City Council) has been contacted to confirm whether they hold records of contamination in connection with the site. A copy of the response is included in **Appendix E**.

4.3.3 Site services

Service plans obtained from utility companies sourced either by RSK or provided by the client can be made available on request.

Buried utility services and their backfill can represent a constraint to development and act as preferential migration pathways for gas, vapour or groundwater towards a receptor.

4.4 Summary of previous reports

A summary of pertinent information from previous reports pertaining to the site is included below in **Table 6**.

Relevant information relating to the identified ground and groundwater conditions has not been included within the table below but has been incorporated into the relevant parts of Sections 4.5 - geology.

Table 6 Summary of previous reports

Report Details	1. Airport City Bridge for Airport City Limited Partnership, RoC Consulting, October 2017
Site coverage	The report details the eastern area of the site.
Summary scope of works	Two Cable Tool Boreholes between 5.32 m to 8.31 m bgl and two Rotary Core Boreholes to depths between 19.50 m to 20.00 m bgl. In addition to this, excavation and exposure of a high voltage electricity cable was also undertaken.

Does the client have reliance upon the report?	Yes
Key factual findings	The ground investigation outlined the strata underlying the site to consist of Made Ground/Topsoil over Clay with relatively shallow bedrock, encountered at 5.16 m bgl. Chemical analysis of soil samples concluded (when compared to "Public Open Space" end use scenario GAC) that no soil contamination was encountered within onsite strata. Geotechnical testing indicated a compressive strength between very weak to strong. A piled foundation solution for the bridge was considered the most effective and smaller lightly loaded structures associated with the bridge can be founded using conventional strip and pad foundations on the Clay soils.
Report Details	**2. Phase 2 Site Investigation on Airport City North for Airport City Partnerships, RoC Consulting, May 2016**
Site coverage	Across the site.
Summary scope of works	Site investigation between 11 and 22 March 2016 comprising: - Eight rotary cored boreholes ranging between 15.30 m to 21.00 m bgl. - Seventeen trial pits to depths ranging between 0.35m to 4.65m bgl. - Thirty-five cone penetration test holes to depths ranging between 1.96 m to 6.29 m bgl. - Nineteen TRL DCP test holes to determine CBR values within the upper 1.00 m of site soils.
Does the client have reliance upon the report?	Yes
Key factual findings	Made Ground was encountered in both car park areas, granular fill for parking surfaces (inert natural gravel). Additional Made Ground was also encountered across the southern and eastern portion of 'Goodmans site'. Drift soils e.g. loose sand mixtures and soft and soft-firm clay mixes. Near surface deposits overlie competent Cohesive Glacial Till stiff and very stiff. Bedrock of the Bollin Mudstone – weathered consisting of laminated reddish-brown and greenish-grey mudstone with siltstones. Characterised as weak to very weak with some beds described as being completely weathered. No evidence of contamination was noted during the ground investigation and no exceedances were noted within samples scheduled for subsequent testing (compared to a '*Commercial'* end use criterion. Additional protection of water supply pipes may be required in the area of the former farmstead. Small lightly loaded structures should be founded on conventional strip/pad foundation solutions. Larger, more heavily loaded, structures will require a piled foundation into the underlying Bollin Mudstone formation.

4.5 Site geology

4.5.1 Anticipated geological sequence

Published records (British Geological Survey, 2025) for the area and available historical borehole logs indicate the geology of the site to be characterised by the succession recorded in **Table 7**.

There are six publicly available BGS historical boreholes located on or within 250 m of the site, a selection of which are presented in **Appendix D**.

Table 7 Site geology

Strata	Description	Estimated thickness	Permeability
Topsoil	Locally identified within soft landscaped areas within the eastern area of the site consisting of brown silty gravelly sand.	0.02 m	
Made Ground	Described in the eastern area of the site as consisting of embankment fill, locally identified, in the southern part of the site (near M56) reworked clay and a gravelly clay with gravels consisting of brick, asphalt, concrete and mudstone.	0.60 m to 1.50 m (Variable)	
Devensian Till	Described in detail within the eastern area of the site consisting of Clay with variable quantities of sands and gravels, locally identified silt mixtures and Sand strata with variable quantities of clay and gravel.	4.20 m to 7.00 m	
Bollin Mudstone Member	Mudstone encountered at variable shallow depths.	18.00 m (proven thickness)	
Relevant information sources: BGS Geoindex ☒ BGS borehole logs ☒ Previous SI reports ☒			

With reference to the historical data there have clearly been some/several phases of construction and demolition on the site and therefore the presence of made ground should be expected.

Although no site investigation data is available for the western area of the site (currently Jetpark 1), it is likely that the geological succession mentioned in the table above will be encountered.

4.5.2 Radon

The environmental database report provides an assessment of site-specific radon risk. The report indicates that the estimated percentage of houses with radon above the Radon Action Level (200 200 Bq m^{-3}) is <1%.

A radon 'Affected Area' is where 1% or more homes are estimated to be above the radon Action Level of 200 Bq m^{-3}. Although the radon data used in production of the radon atlas comes from measurements in homes, the maps indicate the likely extent of the local radon hazard and is thus applied in all buildings.

The environmental database report indicates that the site is not located within a radon 'Affected Area' and therefore radon protection measures are not considered to be necessary in the construction of non-domestic buildings.

4.6 Mining and quarrying

Evidence has been sought to identify any mining, quarrying, landfilling and land reclamation operations, past and present, which have taken place within 500 m of the site. An initial site appraisal has been carried out based on the information provided on the Mining Remediation Authority Interactive Viewer of the UK Coalfield areas and the commercial environmental databased report for information on non-coal mining.

Use of the Mining Remediation Authority interactive viewer indicates the site lies outside their Coal Mining Reporting Area and therefore no further assessment of coal mining issues is required within this report.

4.7 Hydrogeology

A summary of the hydrogeological setting of the site, with respect to the anticipated geological sequence set out in Section 4.5 is presented below in **Table 8**.

Table 8 Summary of hydrogeological setting

Condition	Description
Aquifer characteristics	The site is underlain by a secondary undifferentiated aquifer relating to the superficial deposits of Devensian Clay and a Secondary B aquifer in relation to bedrock geology of the Bollin Mudstone Formation The presence of low permeability clay at relatively shallow depths beneath the site, while restricting downwards migration, may increase the potential for lateral migration of shallow groundwater (and therefore mobile contamination, if present).
Depth to groundwater and flow	It is also likely that shallow water may be present in any made ground deposits present on-site.
Groundwater flooding	The risk associated with groundwater flooding is unlikely.
Groundwater recharge/ attenuation	Most of the site is currently unsurfaced and will therefore drain to ground.
Historical implications for hydrogeology	Culverted stream identified on walkover directly to the north of the western part of the site and runs along the eastern boundary aside to enterprise way.
Licensed groundwater abstractions	The environmental database report indicates that there are no groundwater abstractions within a 1 km radius of the site.

Condition	Description
Source protection zones	Information available in the Envirocheck report/MAGIC website* indicates that the site does not lie within a currently designated groundwater Source Protection Zone (SPZ).

4.8 Hydrology

A summary of the hydrology within the site area is summarised in **Table 9**.

Table 9 Summary of hydrology in site area

Condition	Description
Surface watercourses/features	The nearest identified surface water feature to the site is an unnamed pond located in Painswick Park to the north of the site. A drainage channel from this pond is culverted to the area between Thorley Lane and the northern boundary of the western area of the site.
Surface water abstractions	There are no surface water abstractions identified by the environmental database, within a 1 km radius of the site.
Site drainage	Surface drainage from the majority of the site appears to be discharged into the public sewerage system or drain into natural ground. In the western part of the site, surface drainage likely outfalls to nearby culverted river.
Preliminary flood risk data	The site lies within flood zone 2 for river according to EA Flood Map for Planning data. A flood risk assessment is outside the scope of this report. Long term flood risks are considered in section 4.10.

4.9 Sensitive land uses

Table 10 provides a summary of any environmentally sensitive areas identified within 250 m of the site based on the environmental database report.

Table 6 Environmentally sensitive areas

Feature	Present within 250 m of site?	Details	Likely pathways from site?
International designations – Ramsar wetland, Special Area of Conservation (SAC), Special Protection Area (SPA)	No	Designation type, distance and direction from site	N/a
National designations – Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), ancient woodland	No	Designation type, distance and direction from site	N/a
Local designations – Local Nature Reserve, Site of Importance for Nature Conservation (SINC)	No	Designation type, distance and direction from site	N/a

Feature	Present within 250 m of site?	Details	Likely pathways from site?
Nearest high sensitivity development, e.g. residential	Nursery adjacent to the north of the western part of the site.	Designation type, distance and direction from site	Down gradient from site.

4.10 Future climate change impacts

In accordance with planning policies and guidance (e.g. LCRM), there is a need to consider the effects of future climate change and associated *extreme weather events* (EWE) on the CSM and identified potential contaminant linkages, along with the implications for risk assessment and *remediation*. Further background details are provided in **Appendix B**.

Table 11 contains a preliminary assessment of future projected climate change impacts that may be relevant to the site. As all parts of the UK are projected to experience temperature rises so this is not included in the table. Cascading effects of temperature rise are considered via changes in precipitation, flood, heatwaves and drought. This assessment is based on Met Office UK Climate Projections (UKCP18) Representative Concentration Pathway (RCP) 8.5 data for the far future, i.e. 2080s (Met Office, 2018 and 2021) and other relevant datasets. This is based on a 'reasonable worse case' scenario. Where considered necessary, qualitative consideration of climate change is provided for specific linkages in the risk assessment and as an uncertainty in the CSM.

Extreme weather has historically occurred and will always occur in the UK. Extreme weather can include extremes of precipitation, heat, drought and cold. As a result of climate change extreme events are anticipated to become more intense and frequent across the UK. RSK considers that sites that are likely to be more susceptible to climate change effects to be those located on or near to the coast and at risk of coastal flooding, or erosion and those located within the flood plain.

Table 7 Potentially relevant future projected climate change and EWE site impacts

Climate impact risk factors	Relevant to site?	Discussion
Projected significant changes in annual infiltration rates (+/- 5/10%)	N	Not anticipated to affect the site.
Future flood risk areas due to river and/or coastal flooding	N/A	
Future surface water flood risk (i.e. due to inundation of drainage systems)	N	The overall long term flood risk is anticipated to stay the same as a result of climate change.
Coastal erosion as a result of sea level rise	N/A	

Further details on climate risk screening are provided in **Appendix H**.

5 SITE RECONNAISSANCE FINDINGS

A site reconnaissance survey was completed on 17 October 2025 by RSK.

The key findings from the site reconnaissance survey were as follows:

- The western area of the site is an active car park with electronic barriers. This may provide a constraint to SI if locations are located on car parking bays.
- The northern area in the eastern parcel of land is currently being used as a car park for construction workers at the Dakota Hotel, adjacent to the north. Various security cameras (assumably redundant), storage container style cabin and various construction materials.
- The southern area in the eastern parcel of the site is accessible via a locked heras fencing gate.
- No potentially contaminative land uses were noted on or within close proximity to the sites boundary.

A site plan is provided in **Figure 2** and photographic records are included in **Appendix F**.

The notes recorded during the reconnaissance survey are provided in **Appendix G**.

6 PRELIMINARY GEOTECHNICAL CONSTRAINTS

6.1 Design class

BS EN 1997-1 defines three different Geotechnical Categories that structures may fall into, which are summarised as follows:

- Category 1: Small and relatively simple structures for which it is possible to ensure that the fundamental requirements will be satisfied on the basis of experience and qualitative geotechnical investigations; with negligible risk.
- Category 2: Conventional types of structure and foundation with no exceptional risk or difficult ground or loading conditions.
- Category 3: Structures or part of structures, which fall outside limits of Geotechnical Categories 1 and 2. Examples include very large or unusual structures; structures involving abnormal risks, or unusual or exceptionally difficult ground or loading conditions; structures in highly seismic areas; structures in areas of probable site instability or persistent ground movements that require separate investigation or special measures.

Based on the information provided above on the proposed development and in view of the anticipated ground conditions, a Geotechnical Category of Category 2 has been assumed for the purposes of designing the geotechnical investigation. This should be reviewed at all stages of the investigation and revised where necessary.

6.2 Preliminary geotechnical hazards assessment

A summary of commonly occurring geotechnical hazards associated with the anticipated geology outlined in Section 4.5 above is given in **Table 12** together with an assessment of whether the site may be affected by each of the stated hazards.

Table 8 Summary of preliminary geotechnical risks that may affect site

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Sudden lateral changes in ground conditions	☐	☒	N/a
Shrinkable clay soils[1)]	☐	☒	Very low chance and recorded as predominantly low plasticity.
Highly compressible and low bearing capacity soils, (including peat and soft clay)	☐	☒	Negligible risk recorded onsite.

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Silt-rich soils susceptible to rapid loss of strength in wet conditions[1)]	☐	☒	Silt soils not recorded to be present onsite.
Running sand at and below water table	☐	☒	Very low risk recorded onsite. Superficial deposits recorded to be clay across the site.
Karstic dissolution features (including 'swallow holes' in Chalk terrain) [1)]	☐	☒	Not recorded to be present onsite.
Evaporite dissolution features and/or subsidence [1)]	☐	☒	Not recorded to be present onsite.
Ground subject to or at risk from landslides[1)]	☐	☒	Site is topographically flat therefore risk unlikely to be present onsite.
Ground subject to peri-glacial valley cambering with gulls possibly present	☐	☒	N/a
Ground subject to or at risk from coastal or river erosion[1)]	☐	☒	No natural watercourse recorded on or nearby the site.
High groundwater table (including waterlogged ground) [1)]	☐	☒	Not observed on site walkover. The highest risk of groundwater flooding onsite is low.
Rising groundwater table due to diminishing abstraction in urban areas [1)]	☐	☒	N/a
Geological faults, fissures and break lines	☐	☒	Not recorded to be present onsite.
Underground mining including shafts and adits (e.g. coal, mineral)	☐	☒	No mining history recorded onsite.
Effects of extreme temperature (e.g. cold stores or brick kilns/furnaces)	☐	☒	None recorded historically onsite.
Existing sub-structures (e.g. tunnels, foundations, basements, and adjacent sub-structures)	☒	☐	Retaining wall along the sides of Enterprise Way running through the centre of the site. Former road appears to run beneath visible in the western parcel of the site.

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Filled and made ground (including embankments, infilled ponds and quarries)	☒	☐	Historic pond recorded onsite, likely infilled.
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	☐	☒	Not recorded to be present onsite.
Site topography, including presence of steep slopes	☒	☐	Retaining wall alongside Enterprise Way on both parcels of the site.
Note: Seismicity is not included in the above table as this is not normally a design consideration in the UK. [1)] The potential for these geohazards to impact the site may be exacerbated by climate change related fluctuations in temperature and precipitation.			

6.2.1 Clay shrink-swell

One of the likely geotechnical implications resulting from climate change impacts is that longer hotter summers will increase the zone of seasonal moisture variation in the upper soil horizon, leading to additional shrinkage. Furthermore, warmer wetter winters can cause rebound of soil moisture levels, leading to swelling. These changes will likely give rise to increases in subsidence and heave issues and hence insurance claims for existing buildings. The effects can also be exacerbated where building near trees resulting in desiccation (NHBC Standards Chapter, 2024). This and other potential climate change-related impacts are considered in NHBC report NF93 – Foundation solutions: future proofing against climate change (NHBC, 2023a).

The BGS GeoClimate UKCP18 study (BGS, 2023) considers the potential influence of climate change on the probability of subsidence. These BGS GeoClimate shrink–swell national datasets were developed by combining long-term UKCP scenarios for rainfall and temperature changes with the geotechnical properties of the ground, so as to identify areas projected to experience the largest increases in susceptibility to shrink-swell subsidence. The GeoClimate UKCP18 Open data is provided for two time periods, the 2030s and the 2070s with one projection provided for each time period, based on the average outcome for the UKCP18 higher emissions scenario and the most susceptible value (i.e. worst case) within the GeoSure grid cell.

This data is available on BGS Geoindex and the 2070 layer has been consulted for the proposed development at this site. This indicates that it is improbable that foundations will be affected by increased clay shrink-swell due to climate change' based on GeoClimateUKCP18.

The NHBC NF93 report (NHBC Foundation, 2023a) identified that foundations for new domestic structures should be designed to accommodate climate change resilience for the entire lifetime of a building.

7 INITIAL CONCEPTUAL SITE MODEL

In the UK land contamination is assessed using a risk-based approach taking account of the magnitude (severity of the hazard) and likelihood (probability) of occurrence. A 'receptor' is something that could be adversely affected by contamination (e.g. people, an ecological system, property or a water body). A 'pathway' is a route or means by which a receptor is or could be exposed to or affected by a contaminant. A 'contaminant source' is a hazard but it can only pose a risk to a receptor where a pathway is present.

The relationship between sources, pathways and receptors are referred to as a conceptual site model. A risk can only be realised where a contaminant source, pathway and receptor are all in place, referred to as a 'contaminant linkage'.

In line with LCRM (Environment Agency, 2023) and BS 10175: 2011 + A2 2017 (BSI, 2017), RSK has used information in the preceding sections to identify hazards (sources of contaminants), receptors that may be impacted and plausible linking pathways. Where all three are present this is termed a potentially complete contaminant linkage and a qualitative risk estimation is made.

The conceptual site model has been considered in context of the proposed development as understood at the time of writing this report. Should the site development proposals/conditions change, the CSM and the associated contaminant linkages identified may need to be revised.

7.1 Potential soil, soil vapour and groundwater linkages

7.1.1 Potential sources of contamination

Potential sources of soil and groundwater contamination identified from current activities and the history of the site and surrounding area are presented in **Table 13**.

Table 9 Potential sources of soil and groundwater contamination

Potential sources	Contaminants of concern
On-site	
Made ground (i.e. fill material) associated with former onsite pond and various farmsteads.	Unknown fill material but potentially including brick, ash and clinker and containing toxic and phytotoxic metals, inorganics, polycyclic aromatic hydrocarbons (PAHs), asbestos
Off-site	
Made ground (i.e. fill material)	Unknown fill material but potentially including brick, ash and clinker and containing toxic and phytotoxic metals, inorganics, polycyclic aromatic hydrocarbons (PAHs), asbestos
Airports, COMAH and EPR/PPC permitted sites/known fire-related incidents	Storage and use of firefighting chemicals containing and poly-fluoroalkyl substances (PFAS) and other potential persistent organic pollutants (POPs)
Former petrol station (i.e. storage of oils, chemicals and fuels)	Alcohols, ethers, organo-lead compounds, benzene, branched olefins, long chain aliphatic compounds, napthalenes, polycyclic aromatic hydrocarbons (PAHs), petrol additives, diesel (additives).

7.1.2 Sensitive receptors

Sensitive receptors identified at or in the vicinity of the site that could be affected by the potential sources identified above comprise:

- Current/future site users (residential/commercial etc.).
- Adjacent site users (residential/commercial workers etc.).
- Current/future buildings and services (i.e. foundations and potable water pipes).
- Vegetation.
- Groundwater in secondary undifferentiated aquifer.
- Groundwater in secondary B aquifer.
- Culverted unnamed surface water course.
- Ecological receptors.

7.1.3 Potential contaminant pathways

Exposure pathways applicable to human health receptors include:

- Direct ingestion, inhalation and dermal contact with soil and soil-derived dust and consumption of site-grown produce.
- Direct ingestion, inhalation and dermal contact with soil and soil-derived dust.
- Vapour migration followed by indoor and/or outdoor inhalation.
- Soil-derived dust migration followed by off-site deposition and ingestion, inhalation, and dermal contact.
- Asbestos fibre release followed by inhalation.
- Wind-blown dust and deposition off-site followed by direct ingestion, inhalation, and dermal contact.

Pathways applicable to environmental receptors include:

- Leaching from soil followed by migration in groundwater.
- Migration in groundwater.
- Migration via run-off through drainage.
- Discharge to surface water.
- Wind-blown dust and deposition off-site followed by direct ingestion, inhalation, and dermal contact.

Ecological receptors are only considered within the conceptual model in the context of statutory protected sites.

Please note that construction workers and future maintenance workers have not been identified in the conceptual model as receptors because risks are considered to be managed through health and safety procedures according to the Health & Safety at Work Act 1974 and associated regulations and guidance.

Where there are potential instances that construction methods may result in short term environmental impacts, these will need to be assessed at design stage, within a construction phase environmental management plan and mitigation measures put in place where required.

7.2 Potential ground gas linkages

7.2.1 Ground gas generation potential

Potential ground gas sources identified for the site and surrounding are shown in **Table 14**.

Table 104 Potential ground gas sources (excludes mine gas)

Potential sources	Indicative ground gas generation potential (CIEH, 2008)	Additional information
On-site		
Natural soil strata with a low degradable organic content, e.g. alluvium, peat	Low	Not recorded onsite in previous site investigations, however, may be encountered around former onsite pond in the western area of the site.
Infilled pond more than 15 m diameter, in-filled after 1977	Low	Infilled historic pond located on the western area of the site.
Made ground with low degradable organic content (e.g. up to 5% organic material and no easily degradable waste).	Very low	
Off-site		
Infilled unspecified ground workings	Very low	Historic records recorded 12 m to 18 m south/west of the site
Various infilled ponds surrounding the site less than 15 m diameter, last noted 1989	Very low	

No significant potential sources of ground gas generation have been identified therefore this potential issue has not been taken forward.

7.2.2 Radon

The site is in an area where the estimated percentage of homes exceeding the action level of 200 Bq m^3 is <1% as indicated on available radon potential mapping (UKHSA & BGS, 2022).

In accordance with BRE 211 guidance (2023) and associated building regulations/standards no protection measures are considered to be required in new developments.

7.2.3 Sensitive receptors and ground gas linking pathways

Sensitive receptors identified at or in the vicinity of the site that could be affected by the potential ground gas sources identified above comprise:

- On-site human receptors - migration and ingress of ground gases into buildings or confined spaces followed by explosion/asphyxiation.
- Adjacent site users – migration off-site and ingress of ground gases into buildings or confined spaces followed by explosion/asphyxiation.
- Future buildings and services - migration and ingress of ground gases into buildings or confined spaces followed by explosion.

The assessment has identified receptors to include building structures and proposed end-users.

Construction workers have not been identified as receptors for the purposes of this assessment. Risks may still be present to construction workers especially where works include the entry into excavations within the ground. Construction workers should undertake appropriate risk assessments and risks should be managed through health and safety procedures and the use of PPE.

7.3 Preliminary risk assessment

The preliminary risk assessment findings and potentially complete contaminant linkages are shown in **Table 15**.

The risk classification is based on the combination of hazard consequence and probability using a risk matrix from CIRIA C552 (Rudland et al., 2001). The requirement for a preliminary qualitative risk assessment is in accordance with LCRM (Environment Agency, 2023). A summary of the risk assessment process is in **Appendix H**.

Table 115 Risk estimation for potentially complete contaminant linkages

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Risk Rating	Justification
On-site made ground (i.e. fill material associated with historical site development)	Future site users	Direct oral ingestion, inhalation and dermal contact with soil and soil-derived dust	Low Likelihood	Medium	Moderate/ Low	The site likely contains localised areas of made ground associated with former farmsteads and other structures/roadways on site. Similarly current operations as airport car parking across the western portion may also have impacted soil quality via the release of fuel oils. Overall contaminative potential is deemed to be relatively low and proposed commercial end use will further reduce risks posed to future users.
		Accumulation of ground gas leading to explosion or asphyxiation *	Unlikely	Severe	Moderate/ Low	The potential for ground gas generation arising from infilled materials at the site is unknown, however this issue is limited on site to localised areas around former pond features or areas of previous development. Appropriate assessment via ground investigation works will be required.
	Groundwater (Secondary Undifferentiated superficial aquifer/Secondary B bedrock aquifer)	Leaching to groundwater *	Unlikely	Medium	Low	The groundwater as Secondary B aquifer is considered to be low sensitivity, but provide base-flow to rivers. However, the site is not in a source protection zone, and no potable abstractions have been identified within 2 km. The potential for leaching from made ground following development is considered unlikely due to the low permeability of underlying strata, the consequence to the aquifer is considered to be low.
	Surface water (Unnamed culverted surface water feature)	Leaching to groundwater followed by migration in groundwater *	Low Likelihood	Mild	Low	The potential for leaching and contamination in underlying groundwater is considered to be moderate, however adverse impact at the nearby drainage ditch is considered to be of low likelihood. The drainage ditch is also of low sensitivity.

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Risk Rating	Justification
Off-site sources						
Former petrol filling station (Approx. 100 m S of the site)	Current/Future site resident	Leaching to groundwater followed by migration in groundwater *	Unlikely	Medium	Low	An petrol station is historically noted nearby to the site however, this has since been removed and validated with a separate development currently present, therefore, the risk is considered low.
Manchester Airport (Approx. 250 m S of the site)	Current/Future site resident	Direct oral ingestion, inhalation and dermal contact.	Unlikely	Severe	Moderate/ Low	Manchester airport stores chemicals and fuels including jet fuel and fire suppression systems, however, given the distance to the site

Notes:

* denotes linkages that may be influenced by impacts of climate change and extreme weather events.

Risk matrix		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	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
	Very Unlikely	Low	Very Low	Negligible	Negligible

Potentially contaminative linkages identified in the conceptual site model include:

- Made Ground on site from former development, roads and infilled ponds – Future site users - Direct oral ingestion, inhalation and dermal contact with soil and soil-derived dust/Accumulation of ground gas leading to explosion or asphyxiation* - Low/Moderate risk.
- Manchester Airport – Current/Future Site users - Direct oral ingestion, inhalation and dermal contact – Low/Moderate risk.

In line with LCRM, any potentially complete contaminant linkages need to be assessed further through an appropriate scope of site investigation and/or mitigation incorporated into the development as may be appropriate.

7.4 Data gaps and uncertainties

Key data gaps and uncertainties identified in the CSM at desk study stage include:

- Site was developed before first published OS map and prior history not known.
- There are no previous investigations available for the western part of the site, therefore no information on actual ground conditions and the contamination status of this part of the site at this stage.
- Groundwater depth and flow direction are conceptual at this stage.

7.5 Geotechnical assessment

The key findings of the geotechnical assessment are as follows:

- The majority of site soils are anticipated to comprise Devensian Till deposits (predominantly clay) with a few, localised, areas of made ground. Made ground is generally unsuitable for building foundations and there is potential for localised soft spots within the Devensian Till deposits, therefore further geotechnical assessment is required.
- There may be a localised area of infilled material within the former pond location in the western part of the site. Infill materials within this feature may not have been engineered and potential for weak and compressible materials may exist within this area.

7.6 Recommendations

The following recommendations are made for further assessment of the site to investigate the risks identified above and/or* to address remaining uncertainties:

- Review of existing ground investigation information to be completed in context of current development proposals to allow design of supplementary works to provide sufficient design information.
- Completion of a Phase 2 Site Investigation Report. Any proposed ground investigations should target known or suspected sources of contamination as outlined in this report (namely former farmsteads to the east of the site, roads and infilled ponds).
- Ground gas and water monitoring to be completed in tandem with works to assess risks posed.
- Copies of this report to be submitted to local planning authority (Manchester City Council) and Environment Agency for consideration and comment as part of any planning process.

REFERENCES

Previous SI reports and other site related information

Airport City Bridge for Airport City Limited Partnership, RoC Consulting, October 2017

Phase 2 Site Investigation on Airport City North for Airport City Partnerships, RoC Consulting, May 2016

Standards and guidance

AGS (2021a), 'Assessment and Control of Asbestos Risk in Soil- Part 1: Protection of personnel working on Ground Investigations'.

AGS (May 2021b), 'Assessment and Control of Asbestos Risk in Soil- Part 2: Protection of Personnel working in Geotechnical and Geoenvironmental Laboratories.

AGS (2022), UK Specification for Ground Investigation (UKSGI), third edition, 2022.

Baker, K., Hayward, H., Potter, L., Bradley, D. and McLeod, C. (2009), CIRIA Report C682. The VOCs Handbook. Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination.

BGS GeoClimate UKCP18 dataset (bgs.ac.uk).

Boyle, R. A. and Witherington, P. J. (2007), 'Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present', National House-Building Council and RSK Group.

BRE (2023). Radon – Guidance on protective measures for new buildings, Chris Scivyer, BRE Report BRE 211. BRE Group, 2023.

British Standard Institution (BSI) (2014), 'BS EN ISO 17892:2014. Geotechnical investigation and testing. Laboratory testing of soil'.

British Standard Institution (BSI) (2018), 'BS EN ISO 146881:2018. Geotechnical investigation and testing. Identification and classification of soil: Identification and description'.

British Standard Institution (BSI) (2018), 'BS EN ISO 14688-2:2018. Geotechnical investigation and testing. Identification and classification of soil: Principles for a classification'.

British Standard Institution (BSI) (2018), 'BS EN ISO 14689:2018. Geotechnical investigation and testing. Identification, description and classification of rock'.

British Standard Institution (BSI) (2019), 'BS 8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

British Standards Institution (BSI) (1990), 'BS 1377:1990. Methods of test for soils for civil engineering purposes'.

British Standards Institution (BSI) (2004), 'BS EN 1997-1:2004. Geotechnical Design – Part 1: General rules'.

British Standards Institution (BSI) (2009), 'BS EN ISO 5667-11. Water Quality. Sampling – Guidance on sampling of groundwaters'.

British Standards Institution (BSI) (2013), 'BS EN 1997-2:2004+A1:2013. Geotechnical Design – Part 2: Ground investigation and testing'.

British Standards Institution (BSI) (2013), BS 8576:2013. Guidance on investigations for ground gas – permanent gases and volatile organic compounds (VOCs).

British Standards Institution (BSI) (2017), 'BS 10175:2011 + A2:2017. Investigation of potentially contaminated sites: Code of practice'.

British Standards Institution (BSI) (2018), 'BS EN ISO 18400-104-2018. Soil Quality. Sampling - Strategies'.

British Standards Institution (BSI) (2018), 'BS EN ISO 18400-202-2018. Soil Quality. Sampling – Preliminary Investigations'.

British Standards Institution (BSI) (2018), 'BS EN ISO 18400-203-2018. Soil Quality. Sampling – Investigation of potentially contaminated sites'.

British Standards Institution (BSI) (2020), 'BS 5930:2015+A1:2020. Code of practice for ground investigations'.

British Standards Institution (BSI) (2023), 'BS EN ISO 5667-1. Water Quality. Sampling – Guidance on the design of sampling programmes and sampling techniques'.

Building Research Establishment (2005), BRE Special Digest 1: Concrete in aggressive ground.

Card G, Wilson S, Mortimer S, (2012). A Pragmatic Approach to Ground Gas Risk Assessment. CL:AIRE Research Bulletin RB17. CL:AIRE, London, UK. ISSN 2047- 6450 (Online).

Chartered Institute of Environmental Health (CIEH), (2008), The Local Authority Guide to Ground Gas. Wilson, Card and Haines, September 2008.

CIRIA (1999). Piled foundations in weak rock. Report 181.

CIRIA (2014). Good practice on the testing and verification of protection systems for buildings against hazardous ground gases.

CIRIA (2019), 'C758 D. Abandoned Mine Workings Manual'.

CL:AIRE (2007), Climate Change, Pollutant Linkage and Brownfield Regeneration, March 2007.

CL:AIRE, SuRF-UK (2021a), Sustainable Management Practices for Management of Land Contamination, September 2021, **https://claire.co.uk/projects-and-initiatives/surf-uk/21-executing-sustainable-remediation/84-sustainable-management-practices**

CL:AIRE (2021b), Good practice for risk assessment for coal mine gas emissions. CL:AIRE, November 2021.

The Contaminated Land Regulations (England) 2006, **https://www.legislation.gov.uk/**

The Contaminated Land (England) (Amendment) Regulations 2012, **https://www.legislation.gov.uk/**

Defra (2009), Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, **https://assets.publishing.service.gov.uk/media/5b2264ff40f0b634cfb50650/pb13298-code-of-practice-090910.pdf**, 2011.

Defra (2012), Part IIA of the Environmental Protection Act 1990, Contaminated Land Statutory Guidance, April 2012.

Defra (2011), Guidance on applying the Waste Hierarchy, 2011, **https://assets.publishing.service.gov.uk/media/5a795abde5274a2acd18c223/pb13530-waste-hierarchy-guidance.pdf**

Environment Agency (2010), Managing and reducing land contamination: guiding principles (GPLC2) FAQ 8, Environment Agency, 2010.

Environment Agency (2023), Land contamination risk management, **https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm**, 2023.

Environment Agency (2021), 'Technical Guidance WM3. Guidance on the classification of and assessment of waste, v.1.2, 2021.

Chec Highways England (2020). Design for new pavement foundations. Design Manual for Road and Bridges. CD225, Revision 1.

National House Building Council (NHBC) (2016), Technical Extra, April 2016.

National House Building Council (NHBC) (2023a), NF93 – Foundation solutions: future proofing against climate change, February 2023.

National House Building Council (NHBC) (2023b), NF94 – Hazardous Ground Gas. An essential guide for housebuilders.

National House Building Council (NHBC) (2024), NHBC Standard, January 2024

Norbury, D. (2020), Soil and Rock Description in Engineering Practice. Whittles Publishing, 3rd Edition.

Part IIA of the Environmental Protection Act (Contaminated Land Regulations (England)) 2002.

RSK (2023), Second Nature: our 2030 sustainability strategy, 2023, **https://rskgroup.com/second-nature-our-2030-sustainability-strategy/**

Rudland, D. J., Lancefield, R. M. and Mayell, P. N. (2001), CIRIA C552. Contaminated Land Risk Assessment: A Guide to Good Practice.

SoBRA (2022), Guidance on Assessing Risk to Controlled Waters from UK Land Contamination Under Conditions of Future Climate Change, Version 1.0, August 2022.

Stone, K., Murray, A., Cooke, S., Foran, J., Gooderham, L., (2009) CIRIA C681, Unexploded Ordnance (UXO). A guide or the construction industry.

Tomlinson, M.J. (2001) Foundation Design and Construction. 6th Edition.

Transport and Road Research Laboratory, (1970), 'TRRL Road Note 29 (Appendix 1). Road pavement design'.

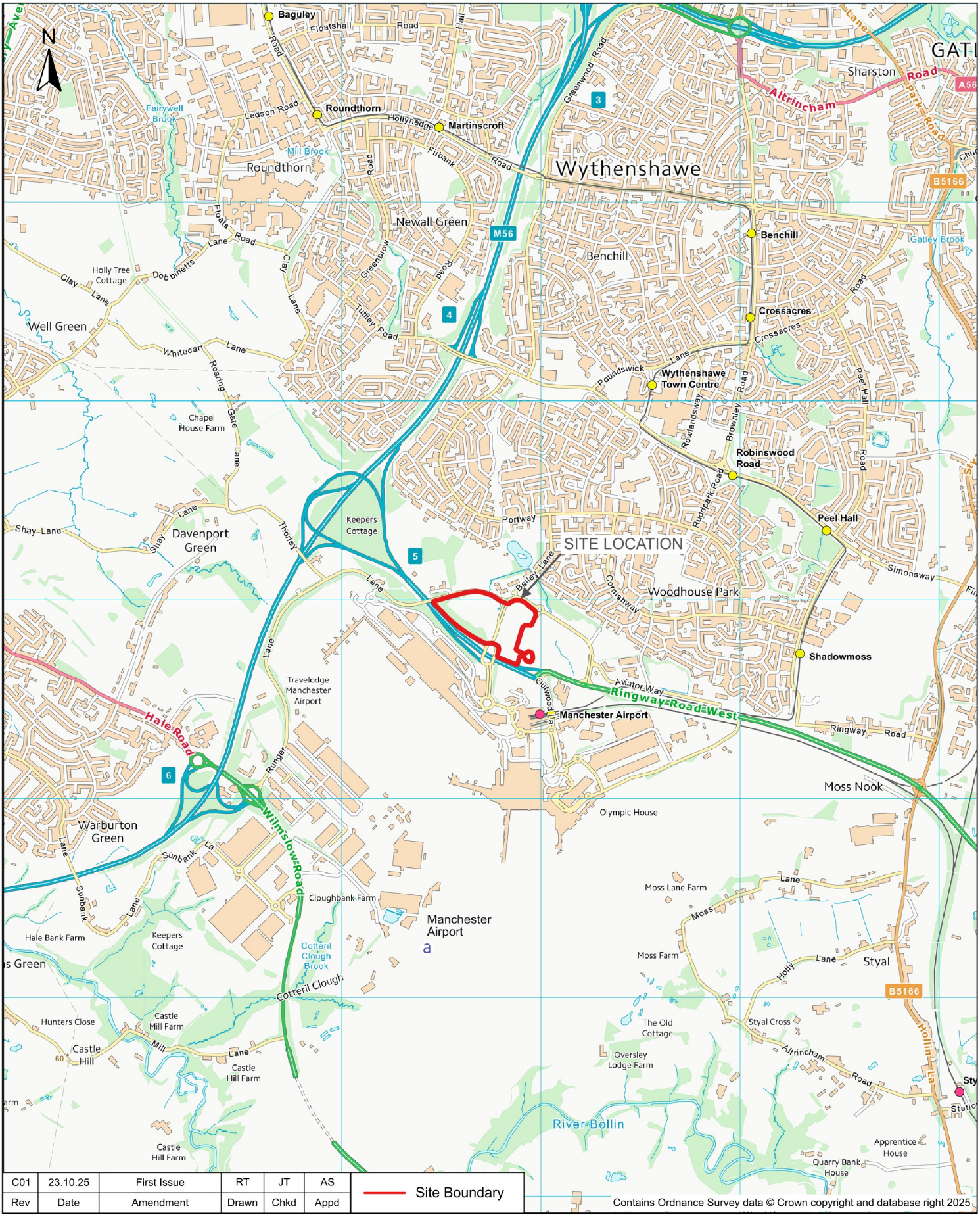
Transport and Road Research Laboratory (1984), 'TRRL Report LR1132 (Table C1)'.

UK Health Security Agency & British Geological Survey (2022), UK Radon Affected Area Map. Accessed from: **www.ukradon.org/information/maps**.

UK Water Industry Research, (2010), UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites.

FIGURES

Figure 1 SITE LOCATION PLAN



Rev	Date	Amendment	Drawn	Chkd	Appd
C01	23.10.25	First Issue	RT	JT	AS

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Client: RoC Consulting

Project Name: MIX Manchester

Description: Site Location Plan

Dimension	Size	Scale	Geolocation	Project ID	Drawing no	Rev	File name
m	A4	1:25,000	381767, 385883	12152	11101	C01	12152-MA-111-XX-D-G-11101-C01

Figure 2 SITE LAYOUT PLAN

DO NOT SCALE FROM THIS DRAWING

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LEGEND

Site Boundary

Notes:

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C01	23.10.25	First Issue	RT	JT	AS

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Client
RoC Consulting

Project Name
MIX Manchester

Description
Site Boundary Plan

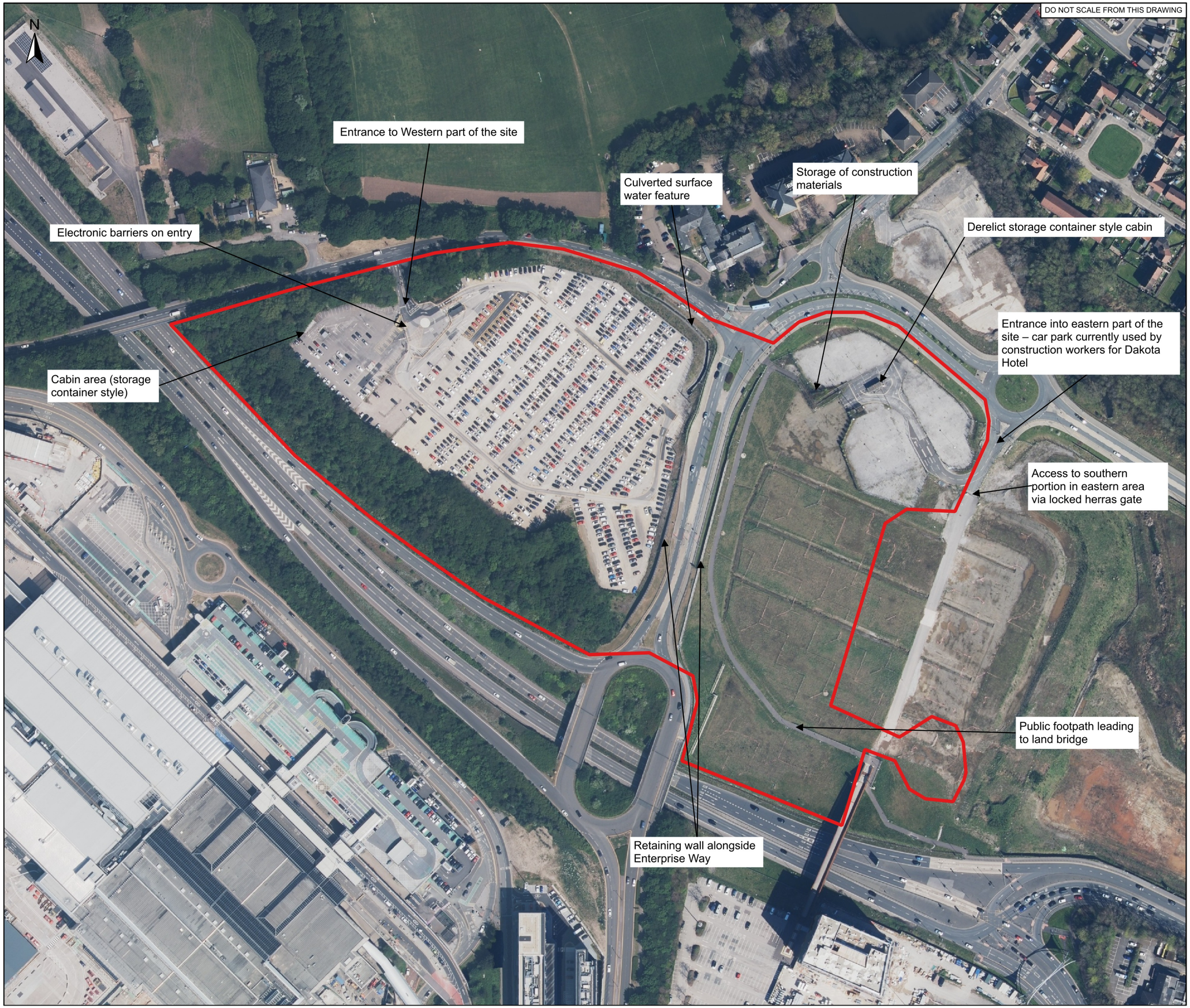
Project ID	Drawing no.	Revision
12152	11201	C01

File name
12152-MA-112-XX-D-G-11201-C01

Dimensions	Scale	Size
m	1:2,250	A3

0 20 40 60 80 100 m

Figure 3 **SITE FEATURES PLAN**



LEGEND

Site Boundary

Notes:

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C01	23.10.25	First Issue	RT	JT	AS

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Client
RoC Consulting

Project Name
MIX Manchester

Description
Site Features Plan

Project ID	Drawing no.	Revision
12152	12101	C01

File name
12152-MA-121-XX-D-G-12101-C01

Dimensions	Scale	Size
m	1:2,250	A3

0 20 40 60 80 100 m

Appendix A
SERVICE CONSTRAINTS

1. Service Constraints

1.1. This Report (the “Report”) and any study, inspection, investigation, sampling, testing and or interpretation carried out in connection with the Report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) trading as Leap Environmental or RSK Geosciences, for the Client named in the first paragraph of the Report (the "Client") in accordance with the terms of an RSK Fee Proposal including RSK Environment Standard Terms and Conditions (the “Appointment”) between RSK and the Client, unless otherwise stated in the first paragraph of the Report. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by a geo-environmental consultant at the time the Services were performed. Nothing in this Report shall be construed as imposing any fitness for purpose obligation. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the Client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.

1.2 Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services. RSK shall not be liable in respect of any action or proceedings arising out of or in connection with this Report whether in contract, in tort, for breach of statutory duty or otherwise after the expiry of six (6) years from either (i) the date of the Report or (ii) such earlier date as prescribed by law, unless varied in the terms of the Appointment.

1.3 Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent, or condone any party, other than the Client relying upon the Services. Should this Report or any part of this Report, or details of the Services or any part of the Services, be made known to any such party, and such party relies thereon, that party does so wholly at its own and sole risk, and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent geo-environmental consultant and/or lawyer.

1.4 The Client shall not, without the prior written consent of RSK, assign, transfer, charge, mortgage, subcontract, or deal in any other manner with all or any of the benefits provided in this Report. Unless specified in the Appointment, RSK shall not be obliged to assign the benefit of the Report whether by collateral warranty, third party rights pursuant to the Contracts (Rights of Third Parties) Act 1999, letter of reliance or otherwise. If RSK agrees to any assignment of the benefit of this Report, in whatever form, benefits to third parties through collateral warranties, third party rights or letters of reliance shall not be provided unless a fee for each right, warranty or letter is agreed. The form of wording used in the warranty or letter shall be provided by RSK for agreement by the Client. Any reasonable changes to the form of wording will be implemented by mutual agreement, however the terms in the warranty or letter cannot offer the third party any greater benefit than the Appointment offered to the Client.

1.5 It is the understanding of RSK that this Report is to be used for the purpose described in the introduction to the Report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the Report is used, or the proposed use of the site change, this Report may no longer be valid and any further use of or reliance upon the Report in those circumstances by the Client without the review and advice of RSK shall be at the Client's sole and own risk. RSK shall not be liable for any use of this Report for any purpose other than that for which it was provided.

1.6 The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the Report inaccurate or unreliable. The information and conclusions contained in this Report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the Report in the future shall be at the Client's own and sole risk.

1.7 The observations and conclusions described in this Report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out, or required by the Appointment between the Client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this Report, RSK did not seek to evaluate the presence on or off site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas, fuel storage, persistent bio-accumulative or toxic chemicals (including PFAS and related compounds) or other radioactive or hazardous materials, unless specifically identified in the Services.

1.8 The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of desk based publicly available information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services and the limitations below:

a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.

b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the Client or third parties, including laboratories and information services, during the performance of the Services.

d. The Client has identified in writing to RSK, the information, reports, findings, surveys and preliminary works RSK may not rely upon when providing the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK, and including the doing of any independent investigation of the information provided to RSK, save as otherwise provided in the terms of the Appointment between the Client and RSK.

1.9 Any site drawing(s) provided in this Report is (are) not meant to be an accurate base plan for scale measurement but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for accurate setting out and should be considered indicative only.

1.10 Should RSK be requested to review the Report after the date of issue of this Report, RSK shall be entitled to additional payment at the existing rates, or such other terms as agreed between RSK and the Client.

2. Service Constraints where the Report provides an intrusive assessment of ground conditions:

2.1 The intrusive environmental ground investigation aspects of the Services are a limited sampling of soil from the site, at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this Report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent

of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope agreed between the Client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species (not tested) are not present.

2.2 The comments given in this Report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. The extent of the exploratory holes, laboratory testing and monitoring undertaken may have been restricted due to a number of factors including accessibility, the presence of buried or overhead services, current development, site usage, timescales or the Client's specification. The exploratory holes only assess a small proportion of the site area with respect to the site as a whole, and as such may only provide an indicative assessment of ground conditions on site. There may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised. The presence of hotspots of undisclosed contamination or exceptional and unforeseen ground conditions cannot be discounted.

2.3 Where the Services include Investigation of an exploratory nature or relating to physical ground works, any costings and prices provided in the Report are estimated and provided for guidance purposes only. The actual cost and time quantities shall be remeasured and shall be dependent upon the ground or other conditions, constraints present, and number and depth of the investigation locations, which shall influence the number of samples and tests required, and the quantities of soil being classified.

2.4 Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works. However, this Report does not constitute an asbestos survey. On this basis, the presence of asbestos on site cannot be discounted and a full asbestos survey should be undertaken.

2.5 Unless stated otherwise, only preliminary geotechnical recommendations are presented in this Report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed. Eurocode 7 gives guidance on the type of sampling, sample quality, number and spacing of intrusive investigations, and number of laboratory tests required. It is intended that the Geotechnical Information section of this Report will fulfil the general requirements of the Ground Investigation Report as set out in section 6 of Eurocode7, although this is subject to the restrictions imposed on the investigation, as listed above. For geotechnical design, Eurocode 7 requires the Geotechnical Design Report to address both the geotechnical and structural aspects of the geotechnical design for both the limit and serviceability states. The Geotechnical Appraisal section of this Report will not meet the requirements of a Geotechnical Design Report (GDR) and should therefore be used for preliminary guidance only.

3. Service Constraints where the Report relates to Surface Water Management:

3.1 The Surface Water Management Inspection (SWMI) Report, documents provided, observations, actions, and recommendations, with respect to the management of potential pollution issues to surface waters, made during the site Inspection visit, are those present at the time of the visit, and may not represent those recorded by others on the same day.

3.2 The comments given in this Report and the opinions expressed are based on the weather, ground and ground water conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the inspection and therefore could not be taken into account. In addition, groundwater levels and flows, may vary from those Reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

3.3 RSK places a degree of dependence upon oral information provided by site representatives, which is not readily verifiable through visual inspection, or supported by any available written documentation. RSK shall not be held responsible for conditions or consequences arising from relevant facts that were not fully disclosed by facility or site representatives at the time this Report was prepared.

3.4 This Report is a live document, to be continually reviewed and updated as the development progresses or other changes occur on site. RSK can only maintain the currency of this Report through the Client requesting support with supplementary site visits or attendance at meetings ahead of key stages of the development in relation to surface water management. Our risk rating assesses a number of risk factors in line with the source-pathway- receptor model and is therefore subject to constant change.

3.5 Standard design drawings are indicative. Material types, dimensions and construction details will need to be adjusted by the Client to suit the specific conditions / flows on Site.

3.6 The full responsibly for implementing the site-specific protection and maintenance measures to protect the surface water system as stated in this Report, remains with the Client and their site management team. Additional control measures may be required to achieve the objectives set out in the Surface Water Management Plan to be implemented and financed by the Client.

4. Service Constraints where the Report relates to Waste Management:

4.1 In accordance with the definition provided in the Waste Framework Directive (WFD), materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Naturally occurring soils are not considered waste if re-used on the site of origin for the purposes of development. Soils such as made ground that are not of clean and natural origin (irrespective of whether they are contaminated or not) and other materials such as recycled aggregate, do not necessarily become waste until the criteria above are met. Excavation arisings from the development may therefore be classified as waste if surplus to requirements and/or unsuitable for re-use.

4.2 It is the duty of the waste producer, to ensure that all waste is accurately classified prior to waste disposal. Technical Guidance WM3 (EA, 2018) sets out in its Appendix D requirements for waste sampling. It is a legal requirement to correctly assess and classify waste. The level of sampling should be proportionate to the volume of waste and its heterogeneity. Unless otherwise stated, the waste assessment presented in this Report should be considered as preliminary and further testing and assessment of the waste under the provisions of a Waste Sampling Plan may be required to obtain the necessary level of data required for basic characterisation of the waste in support of disposal.

4.3 Unless stated otherwise in the Report, information relating to historical operations at the site was not reviewed as part of the assessment by RSK. In addition, unless otherwise stated in the Services, RSK was not present during the collection of the samples nor had any input on the chemical testing suite. Therefore, the waste assessment and classification detailed in this Report are based solely on any information that were provided to RSK (e.g., laboratory chemical data, exploratory hole records) and were completed without prejudice for our Client.

4.4 RSK's assumes that any ground investigation data, chemical testing results etc., that were provided by the Client to inform the waste assessment and supporting review were carried out in accordance with current best practice and relevant guidance/ standards, where applicable. Thus, the

comments given in this Report and the opinions expressed are based solely on the information provided by the Client. However, it is noted that there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account as part of the RSK assessment.

5. Service Constraints for Construction Environmental Management Plan Reports:

5.1 This Report should be considered in the light of any changes in legislation, statutory requirement or industry practices that may have occurred subsequent to the date of issue.

5.2 The measures and comments outlined in this Report and any opinions expressed are based on the plans provided at the time and discussions with relevant parties. However, there may be conditions pertaining to the site that have not been disclosed by investigations and therefore could not be taken into account.

5.3 This CEMP is a live document and is subject to change throughout the project, as and when necessary, to ensure management of environmental aspects remains relevant, and to ensure continued compliance with legislation and commitments as they may change. RSK understands that this CEMP will be reviewed by the Client every six months and updated as and when necessary.

5.4 It is the full responsibility of the Principal Contractor/ Client to ensure that their works do not contravene legal requirements, and adherence to this CEMP alone cannot be a full defence regarding legal action against the Principal Contractor.

6. Service Constraints where the Report relates to Ground Gas Membrane Verification:

6.1 This Report is limited to the verification of the gas resistant membrane/vapour membrane/ radon barrier after installation and no inspections were undertaken of the substrate (i.e. prepared ground). The Report therefore does not constitute as a full verification of ground gas protection system.

6.2 The comments given in this Report and the opinions expressed, are based on the condition of the ground gas membrane as encountered at the time of inspection by suitably qualified personnel. RSK cannot accept liability for any subsequent change to the status of the gas membrane by follow-on trades or other construction activity.

6.3 Where not designed by RSK, the verification of protection measures is carried out with reference to the gas protection design provided by the Client. RSK assume the scope of gas protection measures as determined by third parties to be correct and to have achieved any required approval from authorities.

6.4 The Ground Gas Design Report/Remediation Strategy and Verification Plan contains details of the procedures to be adopted for inspection and validation of the works. However, it should be noted that responsibility for the correct implementation of the strategy lies with the appointed contractor. RSK cannot be held responsible for any remedial works that are carried out without the agreed procedures involving either direct supervision by RSK, or inspection and validation of the works by a representative from RSK.

7. Service Constraints for Environmental Due Diligence (EDD)Reports:

7.1 The comments given in this Report and the opinions expressed are based on the information obtained and reviewed as part of the desk-based assessment. However, there may be conditions pertaining to the Site that have not been disclosed by the assessment and therefore could not be taken into account. Furthermore, no intrusive investigations, monitoring or sampling have been undertaken to confirm the environmental status of the site, therefore any comments relating to ground conditions and subsurface contamination are based solely on a review of desk-based information.

7.2 This Report describes the results of the EDD exercise. The scope of this EDD Report, where appropriate, covers legal or regulatory compliance with respect to UK or international regulations associated with environmental matters.

7.3 As with any EDD exercise, there is a certain degree of dependence upon information provided by the target company. The EDD does not include a site walkover / visit or liaison with site representatives unless identified in the Services. Therefore, the assessment is based on the available desk study information. Also, there is a certain degree of dependence upon oral information provided by site representatives, which is not readily verifiable through visual inspection, or supported by any available written documentation. RSK shall not be held responsible for conditions or consequences arising from relevant facts that were not fully disclosed by facility or site representatives at the time this EDD exercise was performed.

7.4 This Report, including all supporting data and notes (collectively referred to hereinafter as "information"), was prepared or collected by RSK for the benefit of its Client.

7.5 The comments given in this Report and the opinions expressed are based on the information obtained and reviewed as part of the desk-based assessment and the site inspection visit. However, there may be conditions pertaining to the Site that have not been disclosed by the assessment and therefore could not be taken into account. Furthermore, no intrusive investigations, monitoring or sampling have been undertaken to confirm the environmental status of the Site therefore any comments relating to ground conditions and subsurface contamination are based solely on a review of desk-based information and observations collected during the site inspection visit.

8. Service Constraints for Ground source heat energy Reports:

8.1 It is understood that this is a desktop survey only and that there are no requirements for a site walkover, service utility survey, or provision of service plans. These services can be provided upon request if required.

8.2 At a later stage, it is possible that a thermal response test (TRT) will need to be completed, for which a test borehole will have to be drilled, and these would be costed at the time. RSK can provide all aspects of subsequent site work for a GSHP system if required.

9. Service Constraints for Water Abstraction Borehole Reports:

9.1 The Report aims principally to only identify and assess the suitability of the site for a water abstraction borehole. This Report should be considered in the light of any changes in legislation, statutory requirements, and industry practices, that have occurred subsequent to the date of the Report.

9.2 Unless stated in the Report, the opinions expressed in this Report including all comments and recommendations provided are on the basis of the information obtained from a desk-based assessment.

Appendix B
PROJECT-RELATED SUSTAINABILITY CONSIDERATIONS

Sustainability considerations have been taken into account during the design, planning and implementation stages of the project. We manage and monitor this using the RSK Geosciences Sustainable Management Practices (SMP) tool. More detail is provided on this below.

Sustainable management practices (SMPs)

The UK Sustainable Remediation Forum (SuRF-UK) was established to develop a sustainable remediation framework that allows assessors to identify remediation strategies and techniques that are more explicitly linked to the goals of sustainable development. However, it was recognised that the same sustainability principles discussed in the framework underpin all aspects of land contaminated management and can be applied across the full range of activities. These include aspects such as site characterisation that would not normally have a formal sustainability assessment, but where sustainability-related benefits may be gained.

SuRF-UK defines Sustainable Management Practices (SMPs) as 'relatively simple, common sense actions that can be implemented at any stage in a land contamination management project to improve its environmental, social and/or economic performance. SMPs can be used to improve the benefits (e.g. resource efficiency, community satisfaction) or reduce the negative impacts (e.g. spillages, complaints, cost) of a project, leading to project 'sustainability gains', without requiring a formal sustainability assessment. SMPs may also be used where sustainability gains are sought at a programme of work level using generic criteria or standards that can apply to a range of project types' (CL:AIRE, 2021a).

RSK Geosciences has developed these SMPs further to identify those that are relevant to each phase of geo-environmental and geotechnical site assessment, along with methods of measurement and reporting. Some of the SMPs are mandatory as they an intrinsic requirement of our ISO-certified Safety, Health, Environment and Quality management system (SHEQMS) or of other procedures. In addition, for each project, optional items are selected either to:

- identify opportunities to reduce emissions during project delivery, and/or
- support achievement of more sustainable outcomes for clients.

Further details are available on request.

Sustainability-related considerations relevant to the project

The following sustainability-related considerations have been identified to be relevant to this project. Relevant aspects have been included in the appropriate section of the report.

Effective site investigation

Undertaking effective site investigations in accordance with standards, technical standards and good practice informs a better understanding of below ground issues. Where applicable, RSK recommends the application of geophysical surveys to optimise and supplement data from intrusive investigations. These aspects contribute to the overall sustainability of the development and reductions in associated carbon emissions.

For geo-environmental assessments, effective site investigation informs more site-specific land contamination risk assessment. This means that where remediation is required, it is targeted to have the greatest benefit in mitigating identified risks to human health and the environment, and avoids emissions and other negative environmental impacts associated with unnecessary remediation. Effective site assessment undertaken in accordance with good practice supports the achievement of wider sustainability goals including:

- supporting the beneficial reuse of brownfield and other degraded land, or the development of nature-based solutions
- reducing risks from historical land contamination or on-going releases to groundwater, surface waters and ecological receptors
- supporting decarbonisation of the energy and other sectors through undertaking effective site assessment and providing advice on mitigation of ground-based risks.

For geotechnical assessments, effective site investigation informs lean, optimal design of foundations and structures ensuring efficient use of materials, long-term performance and stability including climate resilience, and a reduction in community disruption during construction. It also allows for early identification of geotechnical hazards to aid in the prevention of environmentally damaging issues during construction, for example, soil erosion and landslips. In earthworks, site investigations aid in confirming the material types and properties allowing for their reuse in construction. Furthermore, early identification of materials enables better planning and management of site resources, reducing waste and promoting retention and reuse of soils and other excavated materials.

Reuse and disposal of excavated materials

Reuse and disposal of excavated materials is a key issue on many development or construction projects. In accordance with the definition provided in the Waste Framework Directive (WFD), materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Naturally occurring soils are not considered waste if reused on the site of origin for the purposes of development.

Excavated materials that are not of 'clean and natural origin' (irrespective of whether they are contaminated or not), such as made ground and other anthropogenic materials, may be considered waste after excavation. This means that they cannot be reused unless 'recovered' through use of waste licensing controls, such as exemptions, or a waste recovery permit. Alternatively, in limited circumstances, the CL:AIRE Definition of Waste Code of Practice (DoWCoP; CL:AIRE, 2011)) can be applied, in specific scenarios, to support suitable reuse on or off-site using materials management plans (MMPs). Otherwise, disposal is required, typically off-site, under an appropriate landfill permit. This has important implications for the assessment, excavation, temporary storage, reuse and disposal of excavated materials.

In accordance with the waste hierarchy (Ref. Defra, 2011) and circular economy principles, there are a range of approaches to reduce the volume of waste materials created from development projects with the following order of preference:

- prevention – designing out the need for excavation and identifying during the development planning phase the potential for surplus soils to be generated during construction
- minimisation – implementing effective segregation, stockpile and materials management during construction

- reuse – assessing potential for reuse without treatment, either on or off-site
- recycling/recovery – processing of materials to allow reuse and support waste recovery
- disposal – the last resort, either on or off-site.

The potential for the generation of waste materials through land redevelopment must therefore be considered as part of any construction activity. Reuse of excavated materials, including topsoil, subsoil, aggregates and rock, generated through the works may also offer opportunities to reduce the amount of waste created, diverting it away from landfill, resulting in a more sustainable development. The materials may have reuse potential on the site of origin or at other development sites. In some instances, generated waste materials have the potential for beneficial reuse, with some non-waste materials needing to be disposed of to landfill.

Early consideration, planning and effective implementation are all needed to maximise the reuse of materials. As well as reducing cost for off-site disposal, sustainability-related benefits include reducing the volumes of materials for transport and disposal, quality and import of virgin materials and associated carbon emissions.

Assessment of the potential for reuse materials is essential, with information on the soil quality being collected and understood as part of the intrusive investigation phases where relevant.

Soil as a resource

Soil forms an important sub-category of excavated material. Soil contains approximately three times as much carbon as the atmosphere. As well as avoiding the generation of waste, minimising the disturbance of soils on site minimises the loss of carbon during soil handling and storage. Retaining as much soil as possible without damage also reduces flooding, dust and silt management risks, nutrient retention, and supports biodiversity net gain. Soil is therefore a valuable resource in its own right, requiring careful planning at an early stage in the project lifetime to ensure that it can be successfully retained or reused. Defra has published a Code of Practice for the sustainable use of soil on construction sites (Defra, 2009). This is intended to be a practical guide to assist anyone involved in the construction industry to protect the soil resources with which they work, with a focus on England.

Site-won topsoil should, where possible, be left in situ or handled carefully to prevent damage to the soil structure. Where topsoil is to be stripped, stockpiled and re-used such activities should be undertaken during dry weather (generally June to September). Once stockpiled, topsoil should be kept dry. Significant working of topsoil whilst wet can damage the soil structure, reducing the soils' ability to drain and resulting in anaerobic rather an aerobic soil conditions.

Anaerobic soil conditions can have a negative impact on plants and their roots, which will impact the ability of plants to take root once the soil has been placed for its proposed end use. Machinery tracking over recently placed topsoil should be avoided. Should prolonged poor storage result in degradation of the soil some treatment is likely to be required. This may include sand amelioration to improve the soil structure or the addition of composts to reduce nutrient deficiency.

Where site-won topsoil cannot be reused on site, it may then be classed as a waste and consideration should be given to the donation of this material to another construction site where a deficit of topsoil material has been calculated. This would need to be carried out under an MMP. Alternatively, to prevent a valuable resource from going to landfill, consideration could be given to donating topsoil to a Soil Treatment Facility (STF) where it can be treated, processed and reused on other sites, assuming the STF has an appropriate Environmental Permit.

Where relevant, the presence of topsoil and subsoil is considered in site investigation interpretative reports, and how it may be valuable to retain this within the development. By assessing the quality of soils at the investigation phase, together with the anticipated volumes generated from the project, the potential for reuse of excavated soils can also be considered. This may include identifying opportunities for the reuse of surplus soils and minimising the generation of materials classified as waste. Where improvements in soil quality are needed or possible, recommendations can be given to assist in the reuse of this valuable resource.

DoWCoP was developed in consultation with the Environment Agency and the development industry to enable the reuse of materials under certain scenarios subject to demonstrating that specific criteria are met. The current re-use scenarios covered by DoWCoP comprise:

- reuse on the site of origin (with or without treatment)
- direct transfer of clean and natural soils between sites
- use in the development of land other than the site of origin following treatment at an authorised Hub site (including a fixed Soil Treatment Facility).

The importation of made ground soils (irrespective of contamination status) or crushed demolition materials is not permitted under the CoP and requires either a standard rules environmental permit or a U1 waste exemption.

In the context of excavated materials used on sites undergoing development, four factors are considered to be of particular relevance in determining if the material is a waste or when it ceases to be waste:

- the aim of the Waste Framework Directive is not undermined, i.e. if the use of the material will create an unacceptable risk of pollution of the environment or harm to human health it is likely to be waste
- the material is certain to be used
- the material is suitable for use both chemically and geotechnically
- only the required quantity of material will be used.

DoWCoP requires the preparation of a MMP that confirms the above factors will be met. This plan needs to be reviewed by a 'Qualified Person' (QP) who will then issue a declaration form to the EA. As the project progresses, data must be collated and on completion a verification report produced that shows the MMP was followed and describes any changes. The MMP establishes whether specific materials are classified as waste and how excavated materials will be treated and/or re-used in line with the CoP. The MMP is likely to form part of the site waste management plan (SWMP), where applicable.

Future climate change considerations

Future global climate change has been numerically modelled by the Intergovernmental Panel on Climate Change (IPCC) to the year 2100 based on potential anthropogenic greenhouse gas emissions scenarios. The modelling output results in projections, which the Met Office has used to determine the potential impacts of climatic change for the UK. 'UKCP18' is the most up to date set of climate projections for the UK and are based on Representative Concentration Pathways (RCP) greenhouse gas emission scenarios. All scenarios project warming with RCP 8.5 being the most extreme scenario with global temperatures increasing by 4.3°C. Typically projections indicate changes will increase in magnitude with time. It is noted that RCPs have been superseded by

Shared Socioeconomic Pathways (SSP) which were published by the IPCC in 2021, although the Met Office has yet to publish updated projections based on SSP data.

The Met Office defines climate change as the large-scale, long-term shift in average weather patterns and average temperatures and is assessed by averaging data over a 30-year period. The most recent reference period is 1991-2020. The UKCP18 data indicate that the UK climate is changing resulting in hotter drier summers and warmer wetter winters, with an increase in the frequency and intensity of extreme weather and significant weather events with a higher likelihood of heat waves, flash floods and droughts. Sea level is also rising.

The key pieces of legislation associated with climate change are the Climate Change Act (2008) and the Climate Change (Scotland) Act 2009. They established the Committee on Climate Change (CCC) and require a UK Climate Change Risk Assessment (CCRA) to be published every five years to assess 'the risks for the UK from the current and predicted impacts of climate change', combined with a National Adaptation Programme. The adaptation programmes place requirements on the planning regime to incorporate the effects of climate change within their decision making. This is implemented through national planning frameworks and planning policy.

The need to incorporate the predicted effects of future climate change and associated extreme weather events (EWE) into qualitative and quantitative land contamination risk assessments is set out within Land Contamination Risk Management (LCRM) LCRM Stage 1 risk assessment (Environment Agency, 2023). BS 21365:2020 'Soil Quality: Conceptual site models for potentially contaminated sites' (BSI, 2020) includes the requirement to identify possible foreseeable events that could affect contaminant impacts or create new exposure pathways including potential for flooding (rivers, sea, groundwater), rising groundwater or seawater levels, extreme weather conditions and change of use. While there is currently no statutory guidance detailing how the effects of future climate change should be considered within land contamination assessments, several industry-led publications have been produced which provide details on how this can be incorporated, including:

- CL:AIRE, March 2007. Climate Change, Pollutant Linkage and Brownfield Regeneration (CL:AIRE, 2007)
- CL:AIRE, October 2021. Good Practice for Risk Assessment for Coal Mine Gas Emissions (CL:AIRE, 2021a)
- SoBRA, August 2022. Guidance on Assessing Risk to Controlled Waters from UK Land Contamination Under Conditions of Future Climate Change" version 1.0, (SoBRA, 2022)
- NHBC, 2023. NF94: Hazardous ground gas – an essential guide for housebuilders (NHBC, 2023).

Climate change-related impacts on the CSM and land contamination risk assessment are considered at each stage of the site assessment as per LCRM.

Climate change and EWE also have substantial implications for future geotechnical ground conditions, influencing the stability and durability of geotechnical structures, such as foundations, retaining walls, slopes and pavements to mention but a few. Therefore climate change will significantly impact the design of land development projects going forward over their lifecycle and beyond. Furthermore, climate change will significantly impact the future performance of existing land development projects that have not been designed taking into account these issues. Relevant standards and guidance are referred to in the relevant sections of the report.

Embodied ground carbon assessment


As part of achieving pathways to net zero for the construction sector, there is an urgent need to significantly reduce carbon emissions without compromising suitable and climate resilient development. Created by Leap Environmental (part of RSK Geosciences) in collaboration with the University of Surrey, CReDiT is a suite of carbon calculator tools designed to assess the embodied carbon in materials and associated transport. The tools provide information on relative embodied carbon for below ground aspects, such as foundations, cover systems, and reuse and disposal of soils and excavated materials. The results are intended to inform discussions with relevant parties about embodied carbon at an early stage in the design process and enable comparison and evaluation of different design options.

Support to biodiversity net gain/rewilding projects

The quality and condition of soils is a key factor in the establishment or enhancement of flora, which then supports goals of achieving biodiversity net gain (BNG) or rewilding projects. For example, low fertility soils promote the establishment of wildflowers that support insect populations, which would otherwise be outcompeted by grasslands. Where applicable, RSK Geosciences undertakes soil sampling, soil fertility testing and assessments to support nature-positive actions.

Appendix C
DEVELOPMENT DRAWINGS

A0



Existing Site Plan
1 : 1000

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NOTES

Planning Application Boundary

REVISIONS

REV.	DATE	AMENDMENT
P01	05/02/26	Planning Boundaries
P02	05/02/26	Planning Boundary Updated

KEYPLAN

CLIENT
Airport City Limited Partnership

PROJECT
MIX Manchester

SCALE@A0	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 1000	05/02/26	JD	CP	PC

DESCRIPTION
Existing Site Plan

STAGE
Stage 3

SR NO.
7092

SHEPPARD ROBSON

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T: +44 (0)20 7504 1700 E: enquiries@sheppardrobson.com

STATUS: **S2** PURPOSE FOR ISSUE: **Planning**

DRAWING NO.: **7092-SRA-ZZ-ZZ-DR-A-02020** REV.: **P02**



Illustrative Masterplan
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NOTES

- Planning Application Boundary
- Outline Development Parcels
- Proposed Building Footprints for Detailed Approval
- Illustrative Building Plots for Approval in Outline (all matters reserved, save for primary access)

REVISIONS

REV.	DATE	AMENDMENT
P01	05/02/26	Planning Boundaries
P02	05/02/26	Planning Boundary Updated

KEYPLAN

CLIENT
Airport City Limited Partnership

PROJECT
MIX Manchester

SCALE@A0	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 1000	05/02/26	JD	CP	PC

DESCRIPTION
Illustrative Masterplan

STAGE
Stage 3

SR NO.
7092

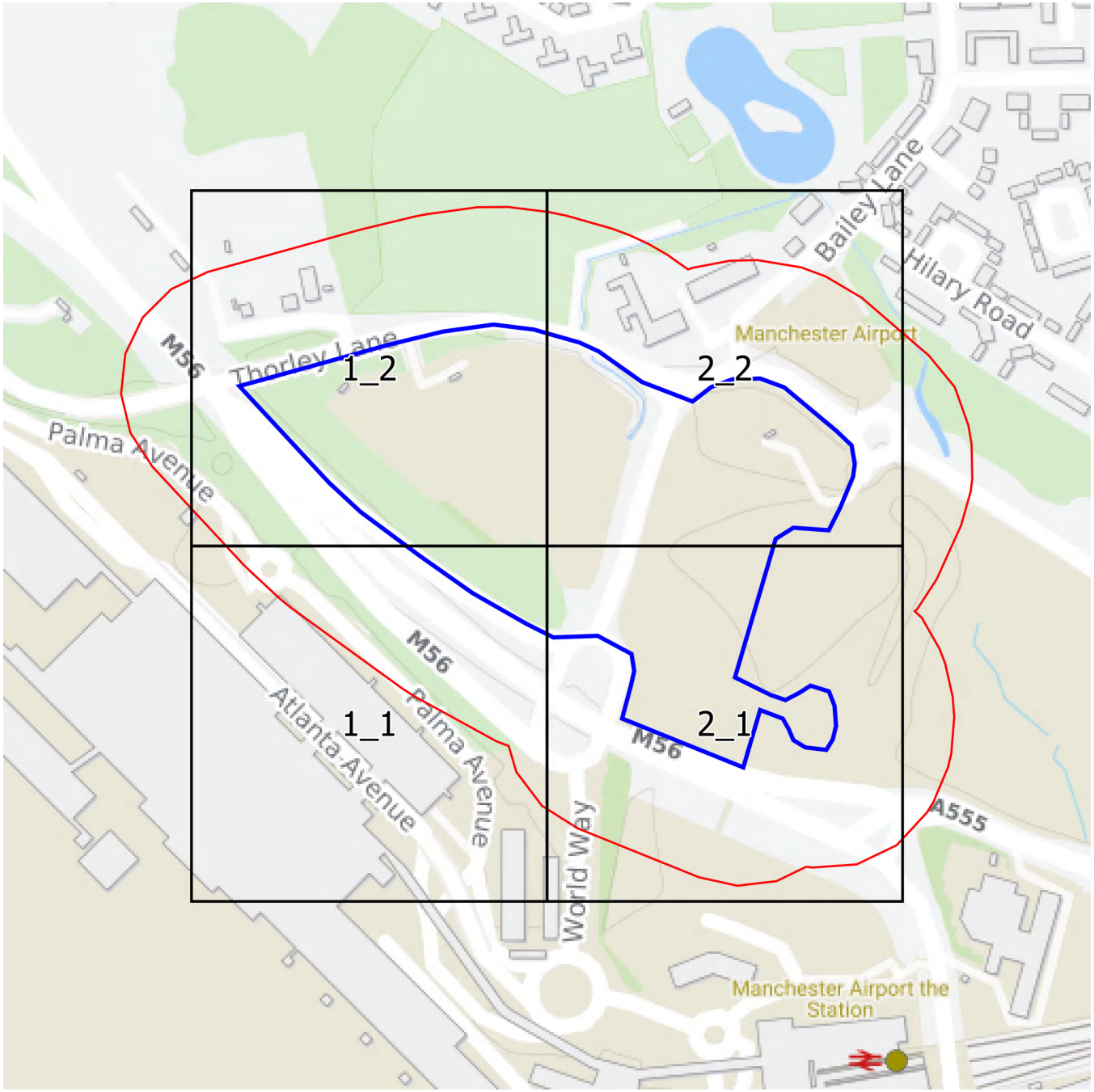
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STATUS PURPOSE FOR ISSUE
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REV.
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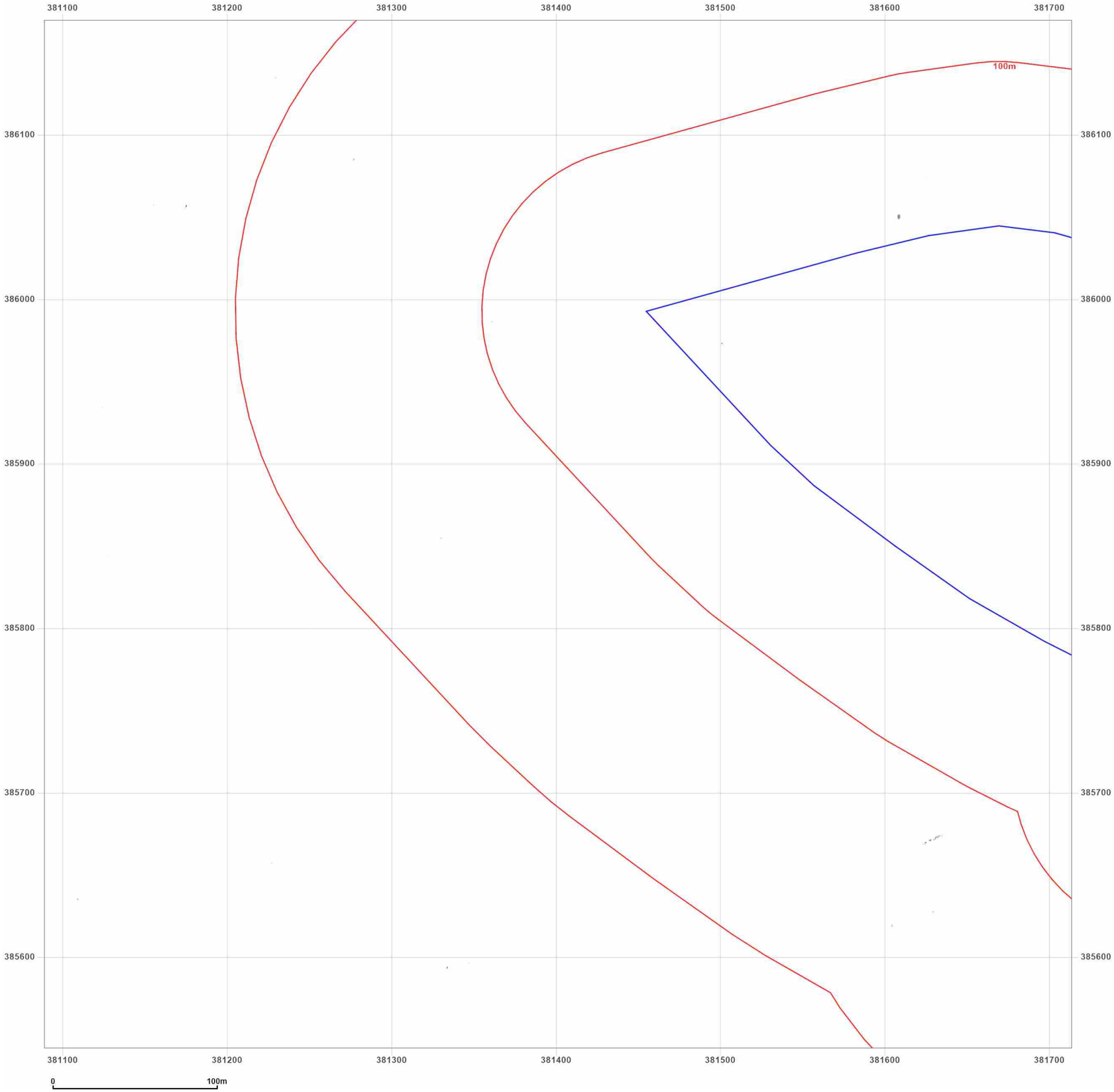
Appendix D
ENVIRONMENTAL DATABASE REPORT



Groundsure INSIGHTS

Landline Scale Grid Index

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Groundsure INSIGHTS

Site Details:

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MANCHESTER, M90 4EG

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Report Ref: GS-LLH-F2J-3NP-S9U_LS_1_1
Grid Ref: 381401, 385857

Map Name: County Series
Map date: **1872**
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Surveyed 1872
Revised 1872
Edition N/A
Copyright N/A
Levelled N/A

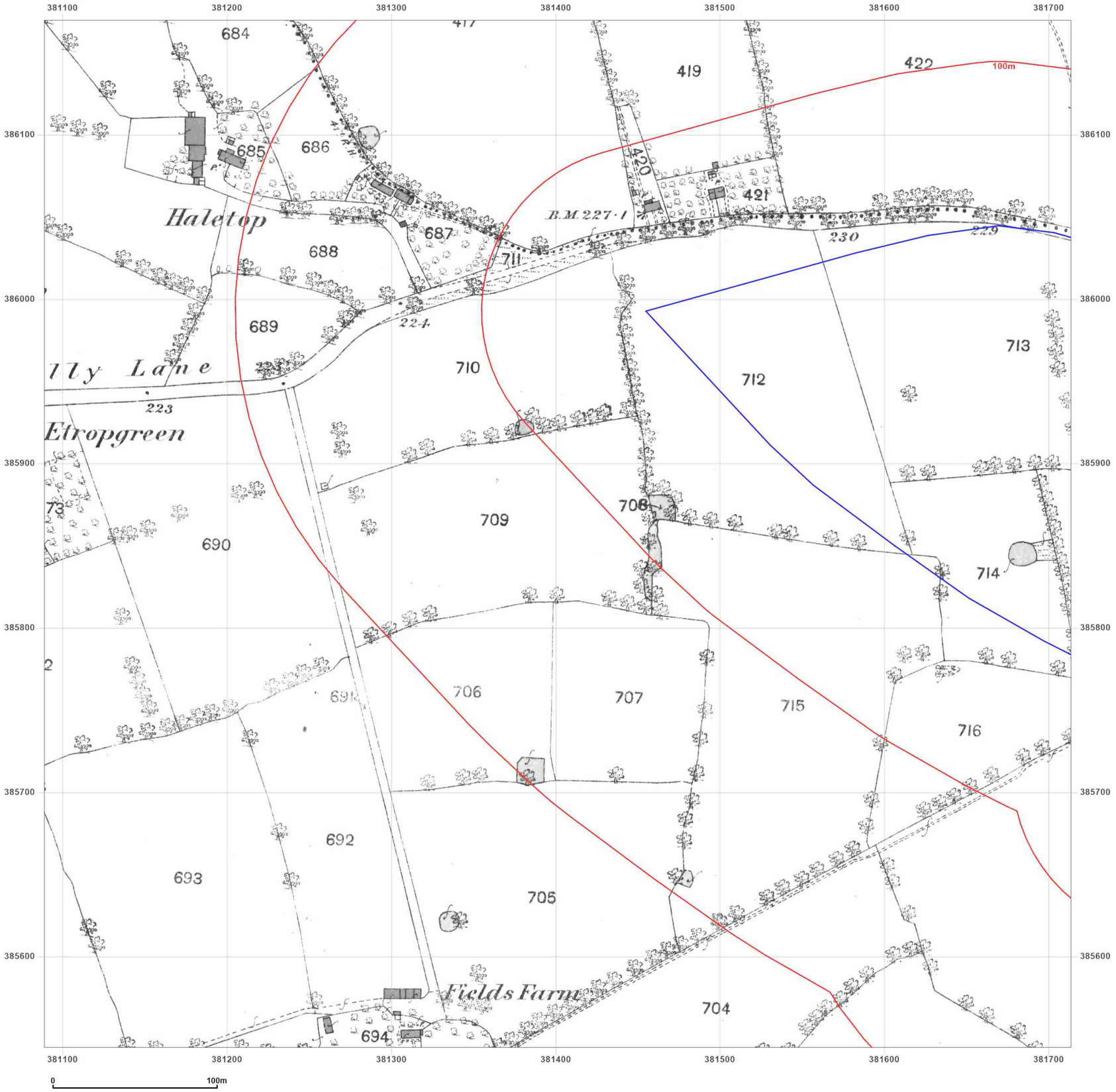
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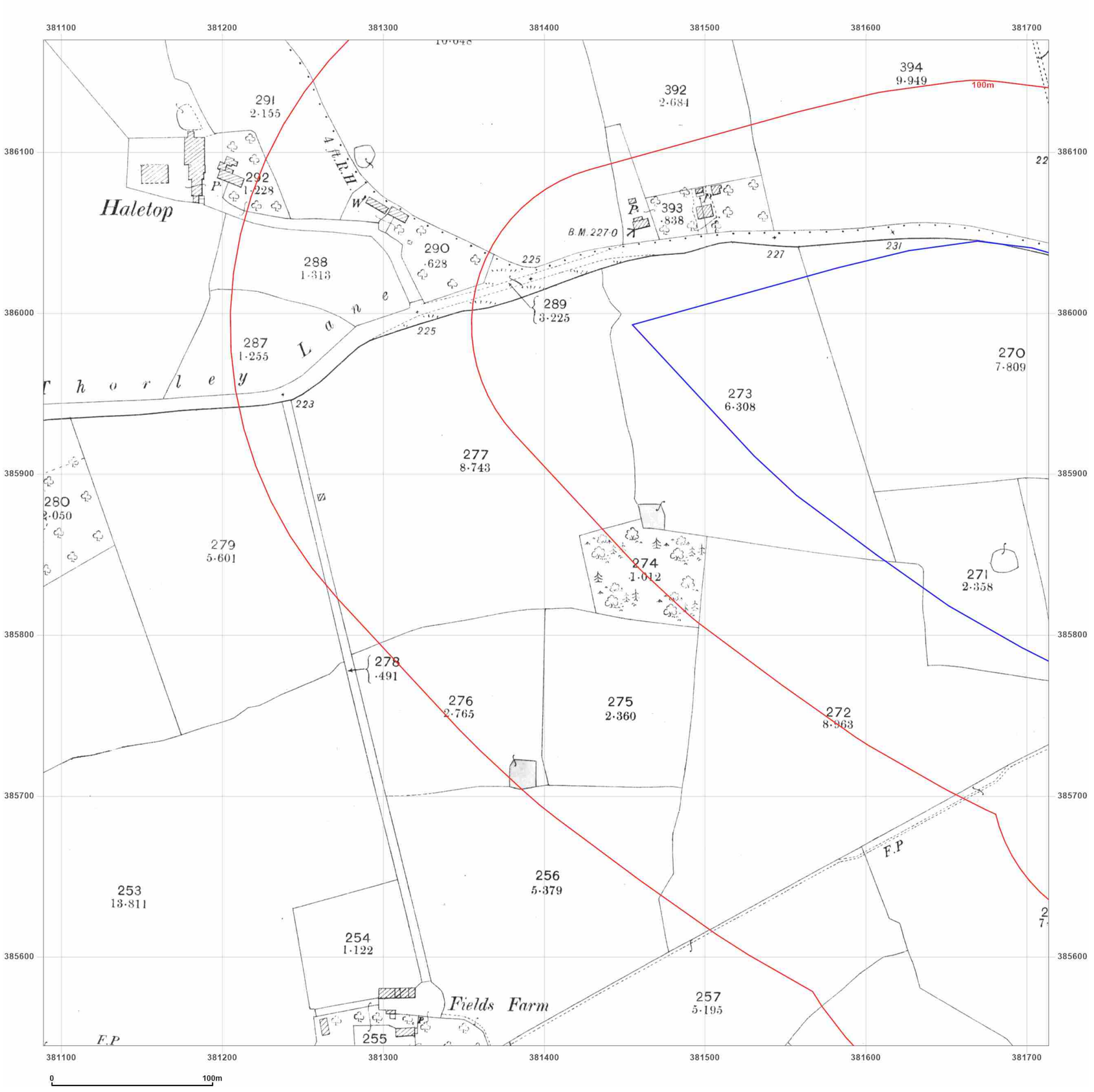
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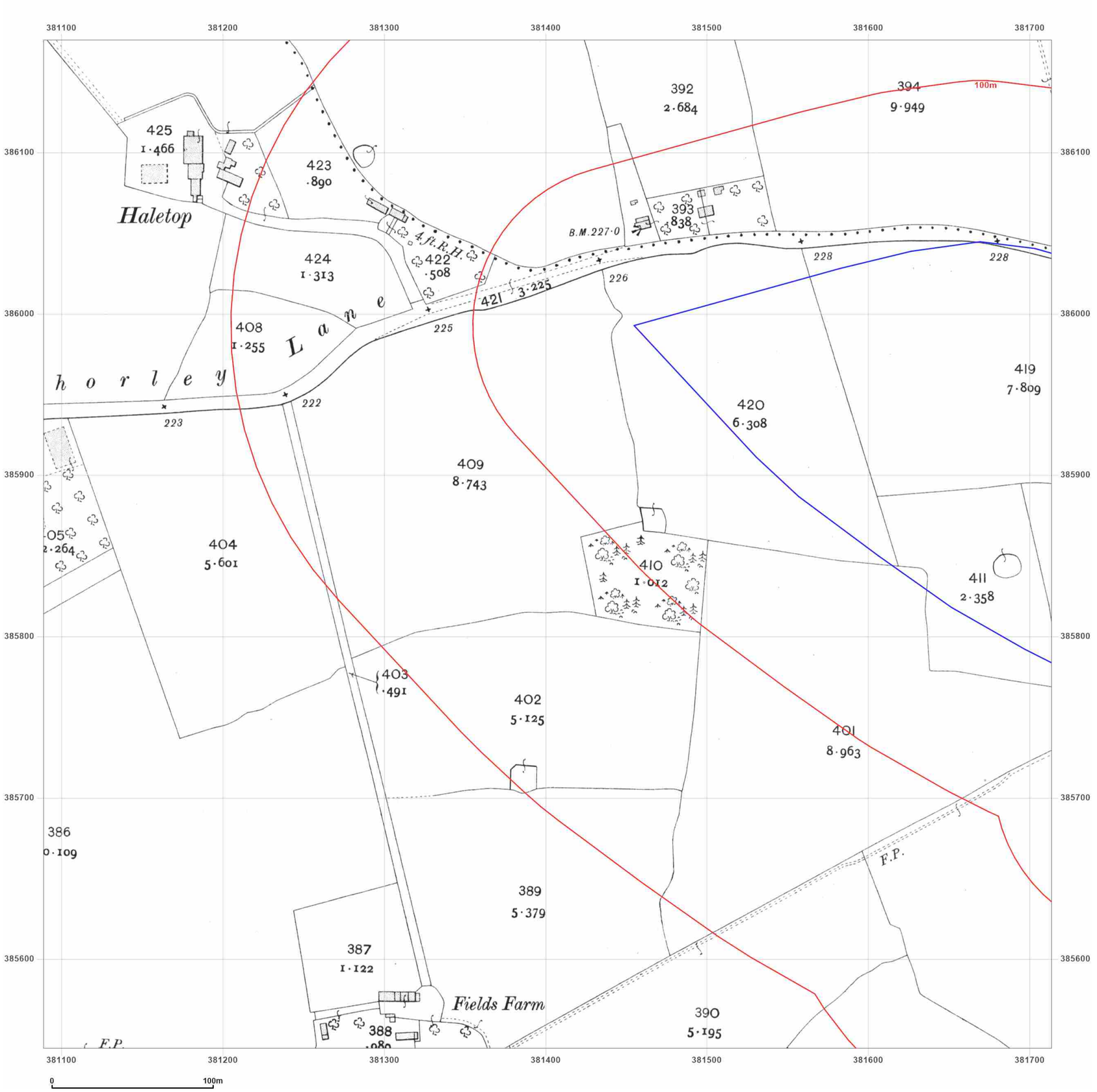
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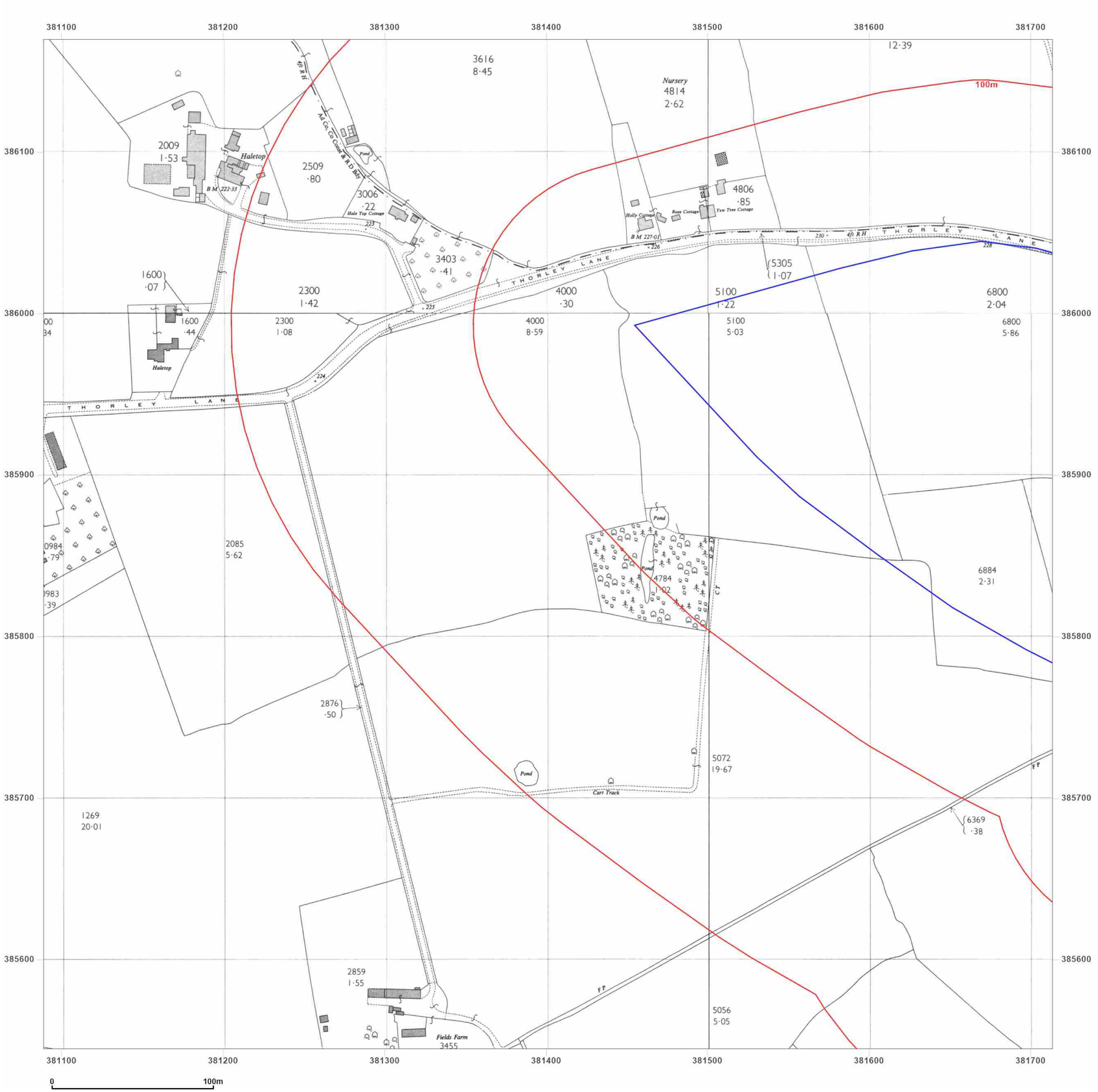
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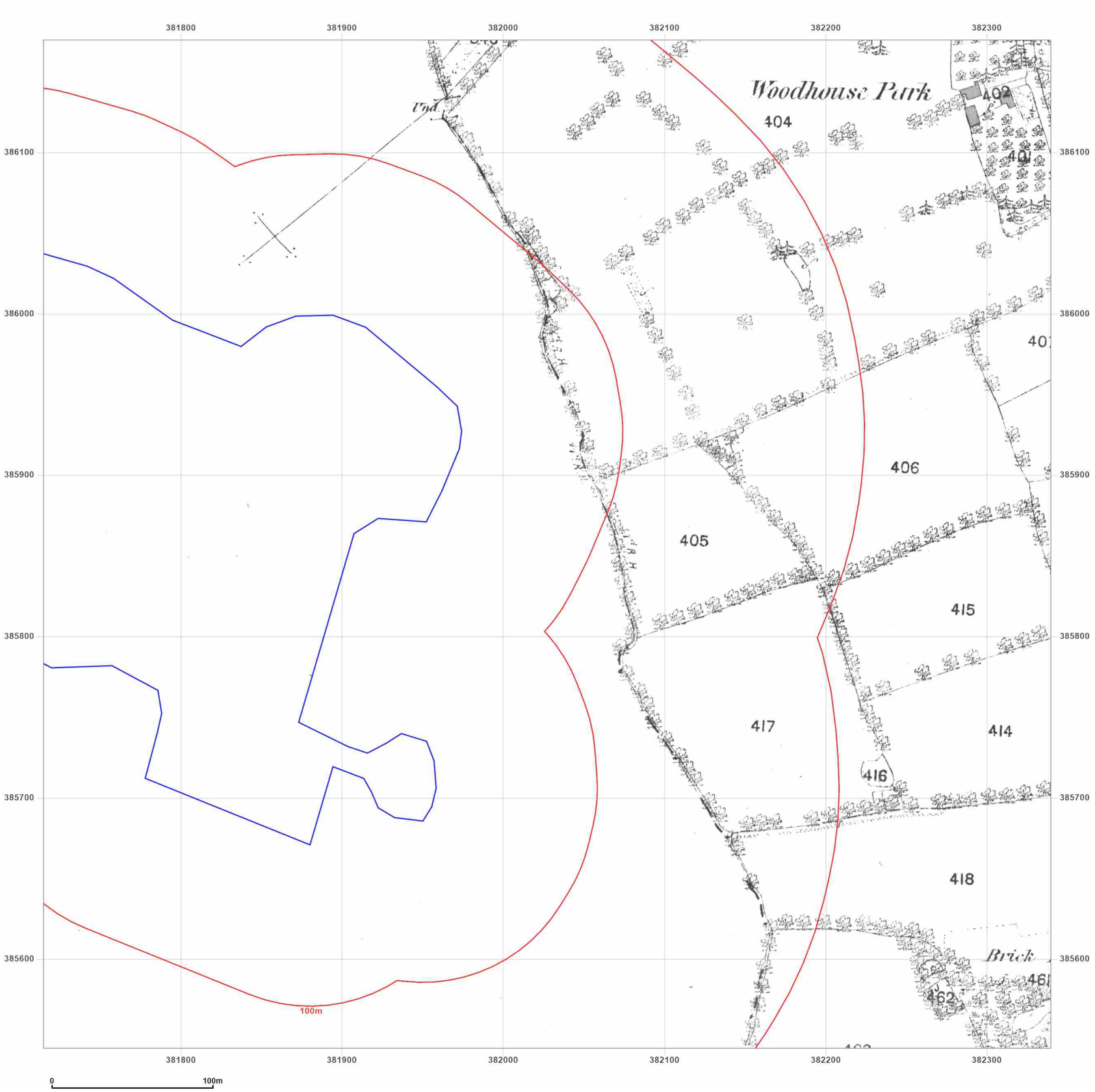
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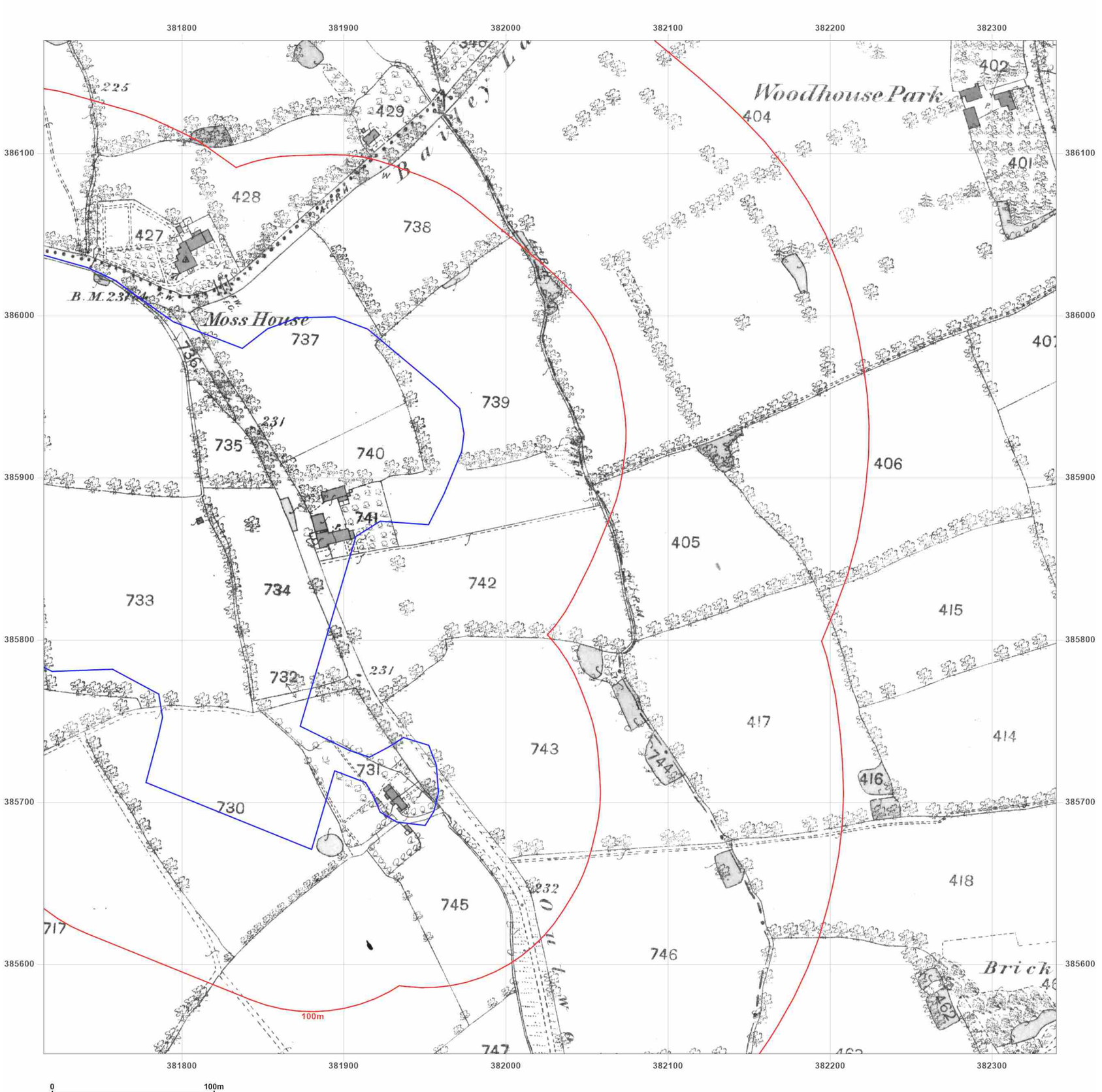
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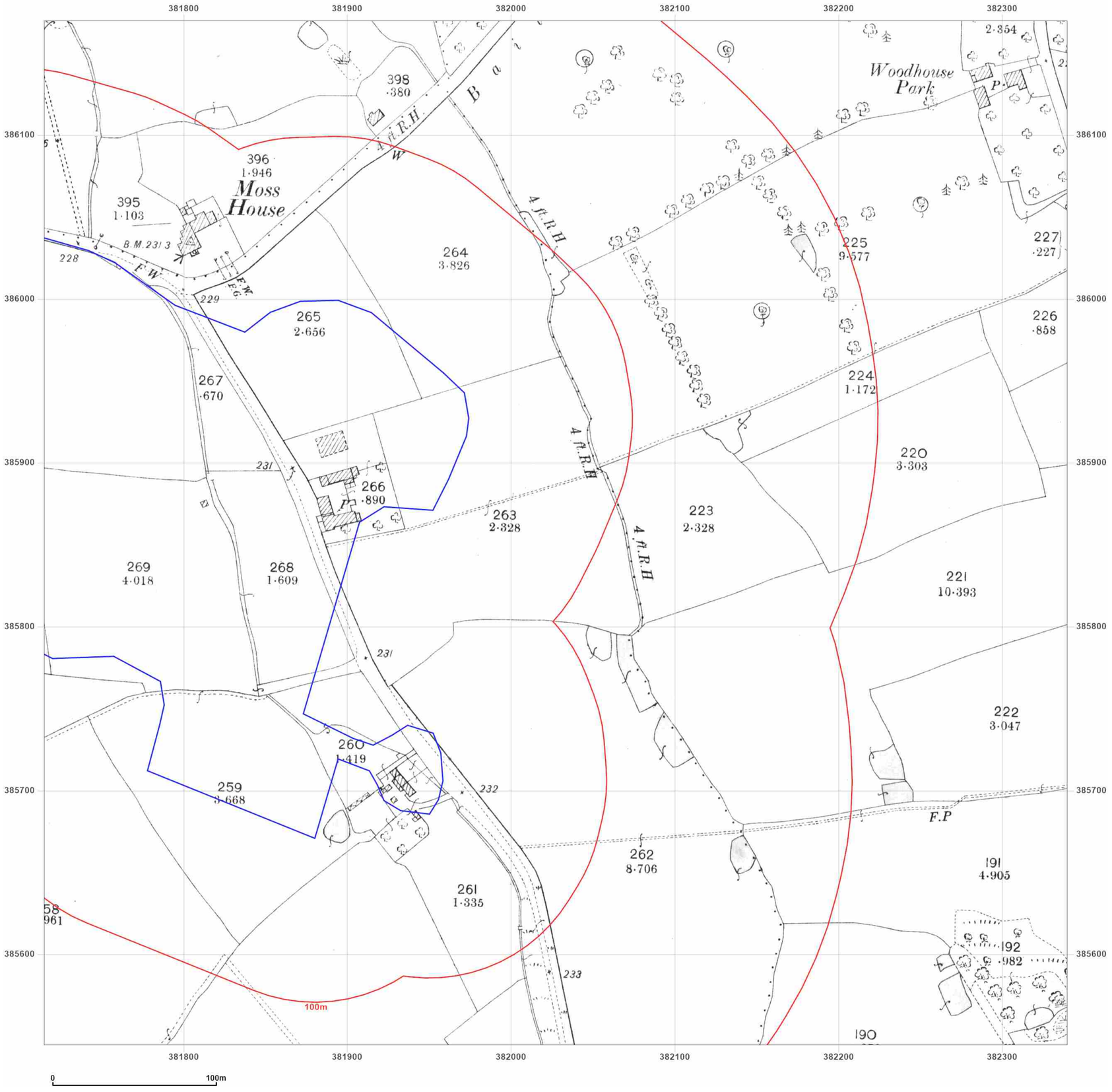
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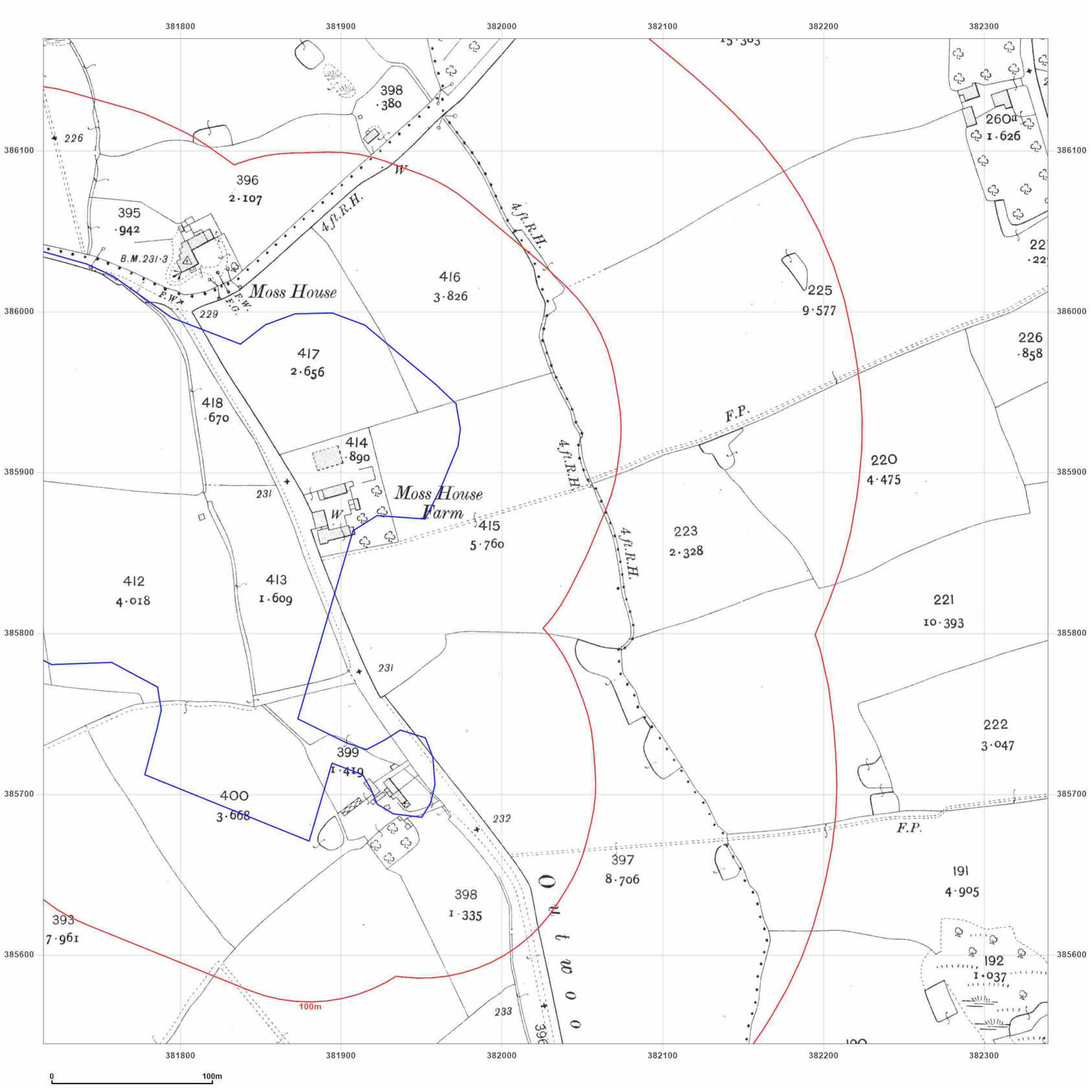
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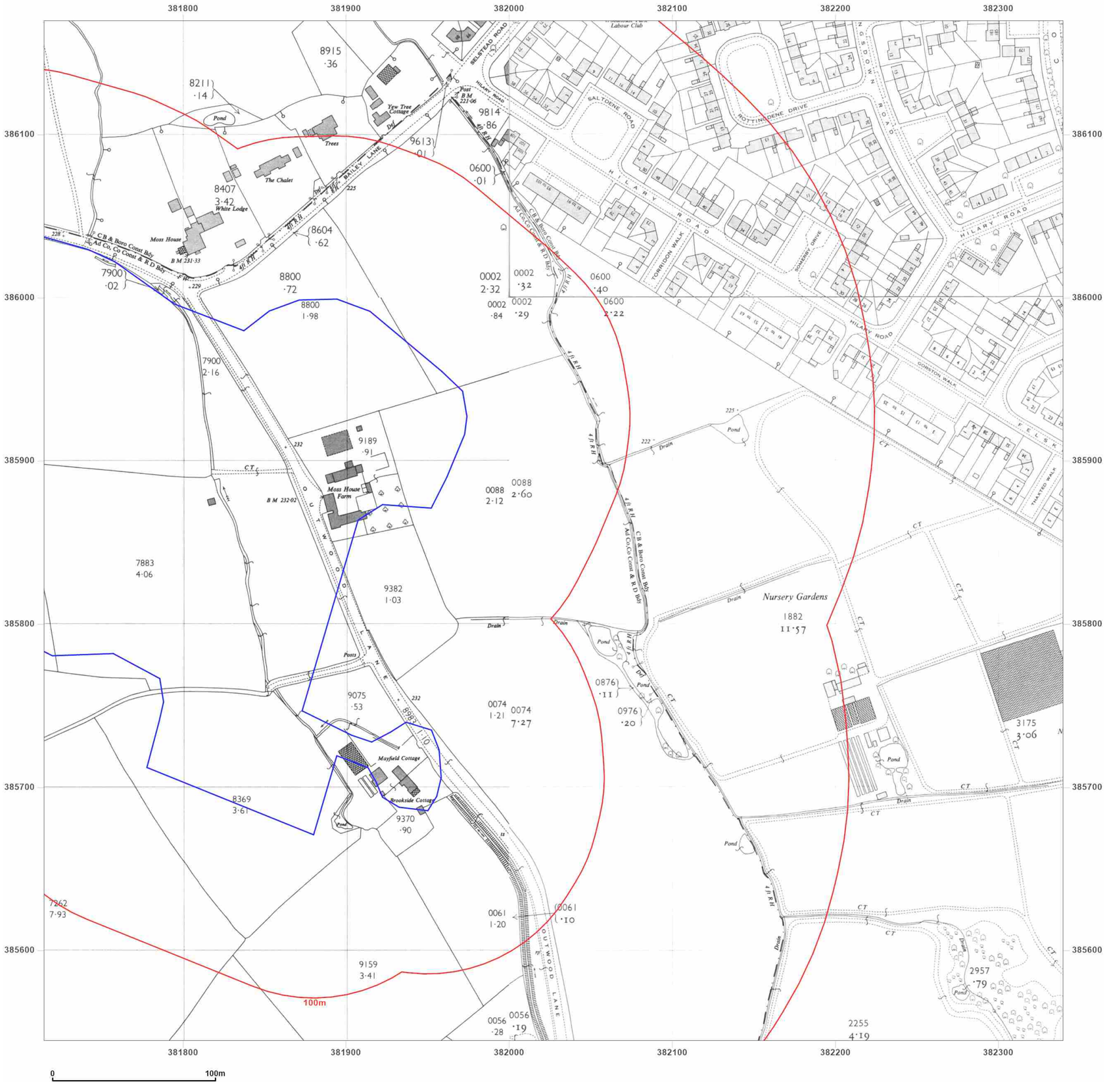
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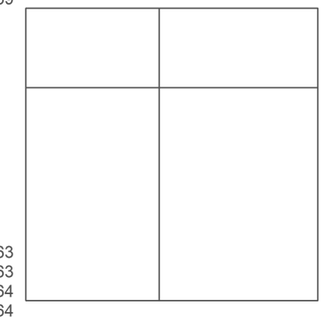
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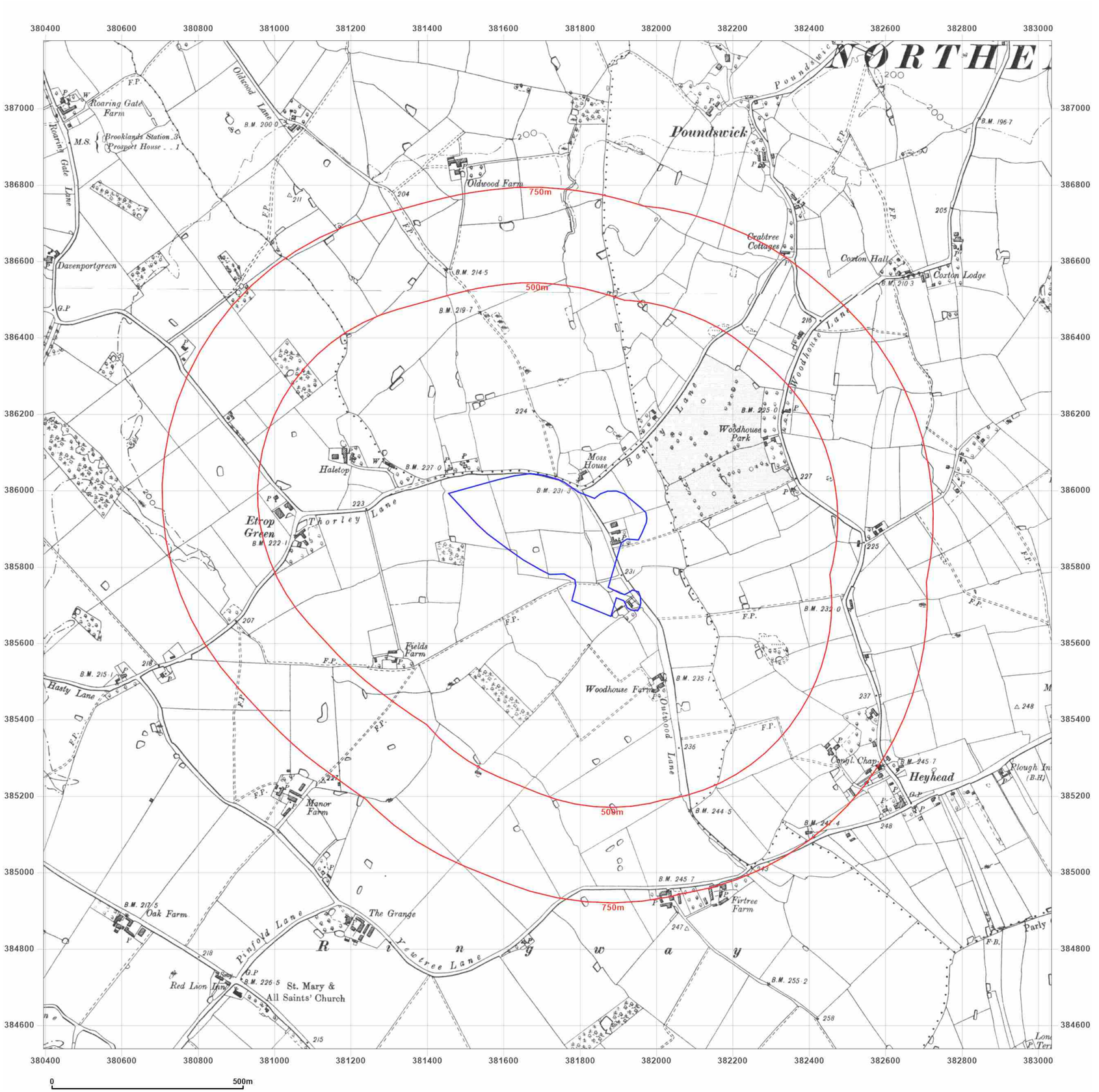
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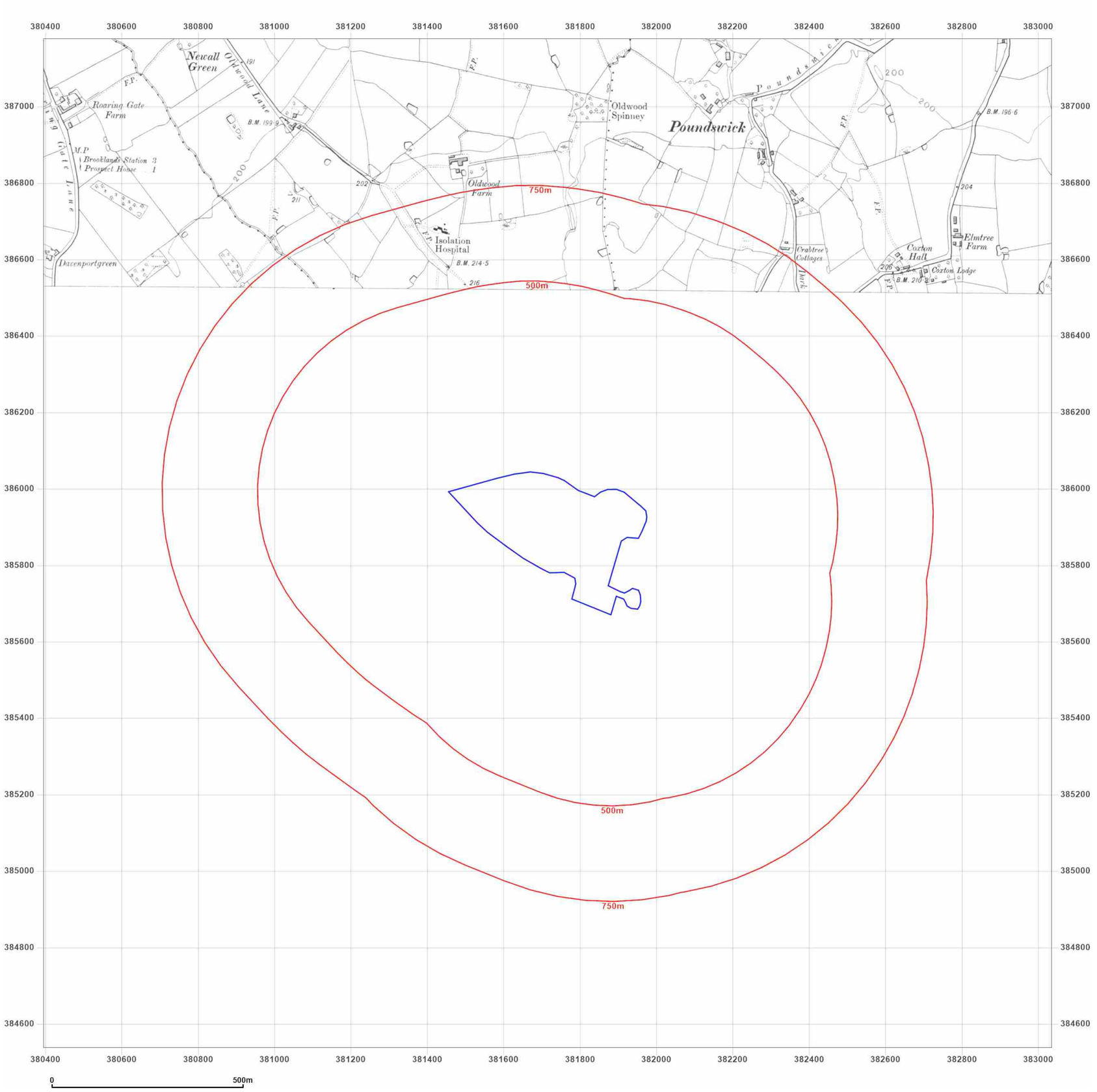
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Grid Ref: 381714, 385857

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Revised 1907
Edition N/A
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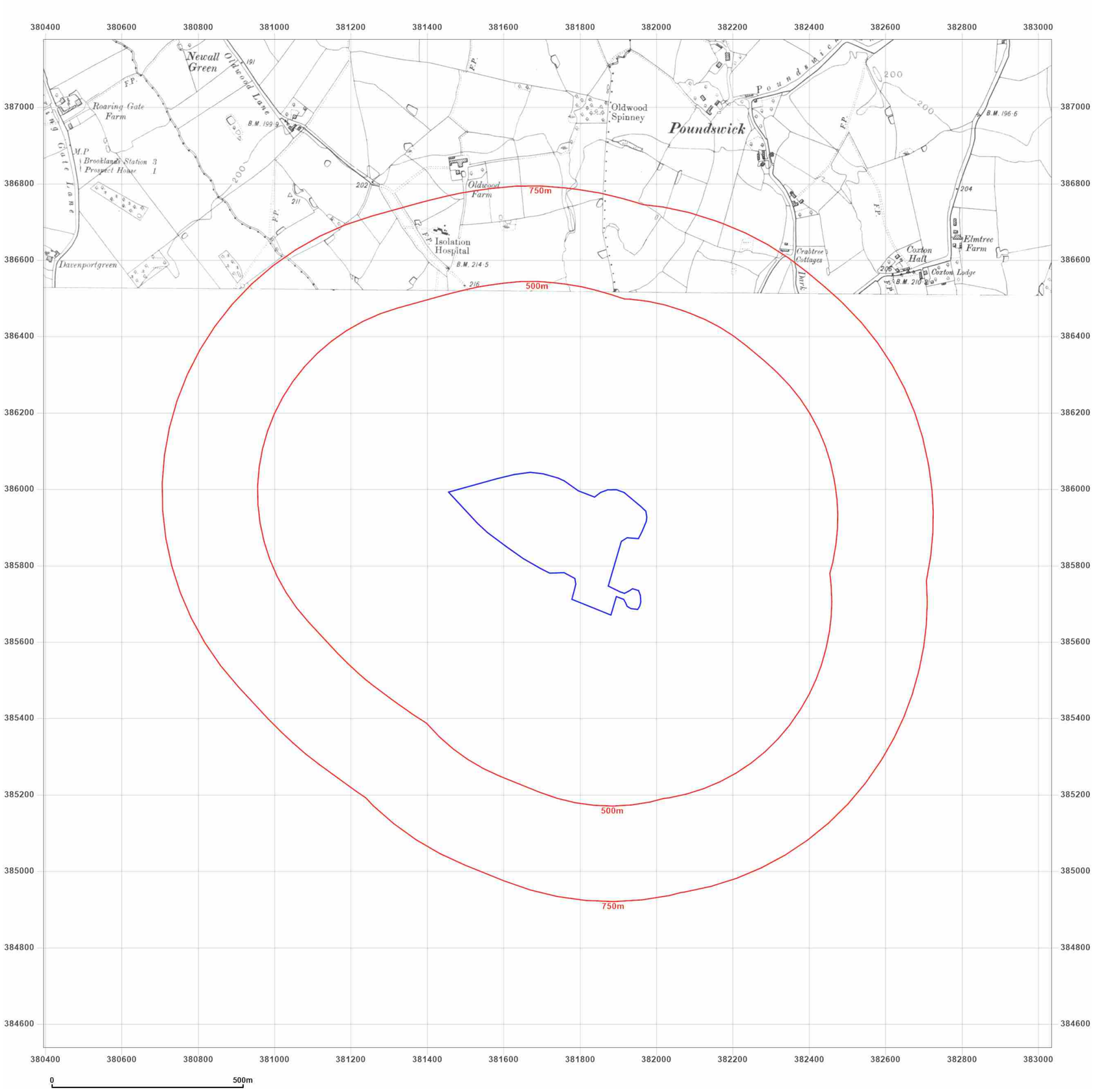
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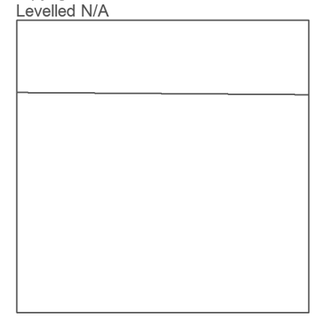
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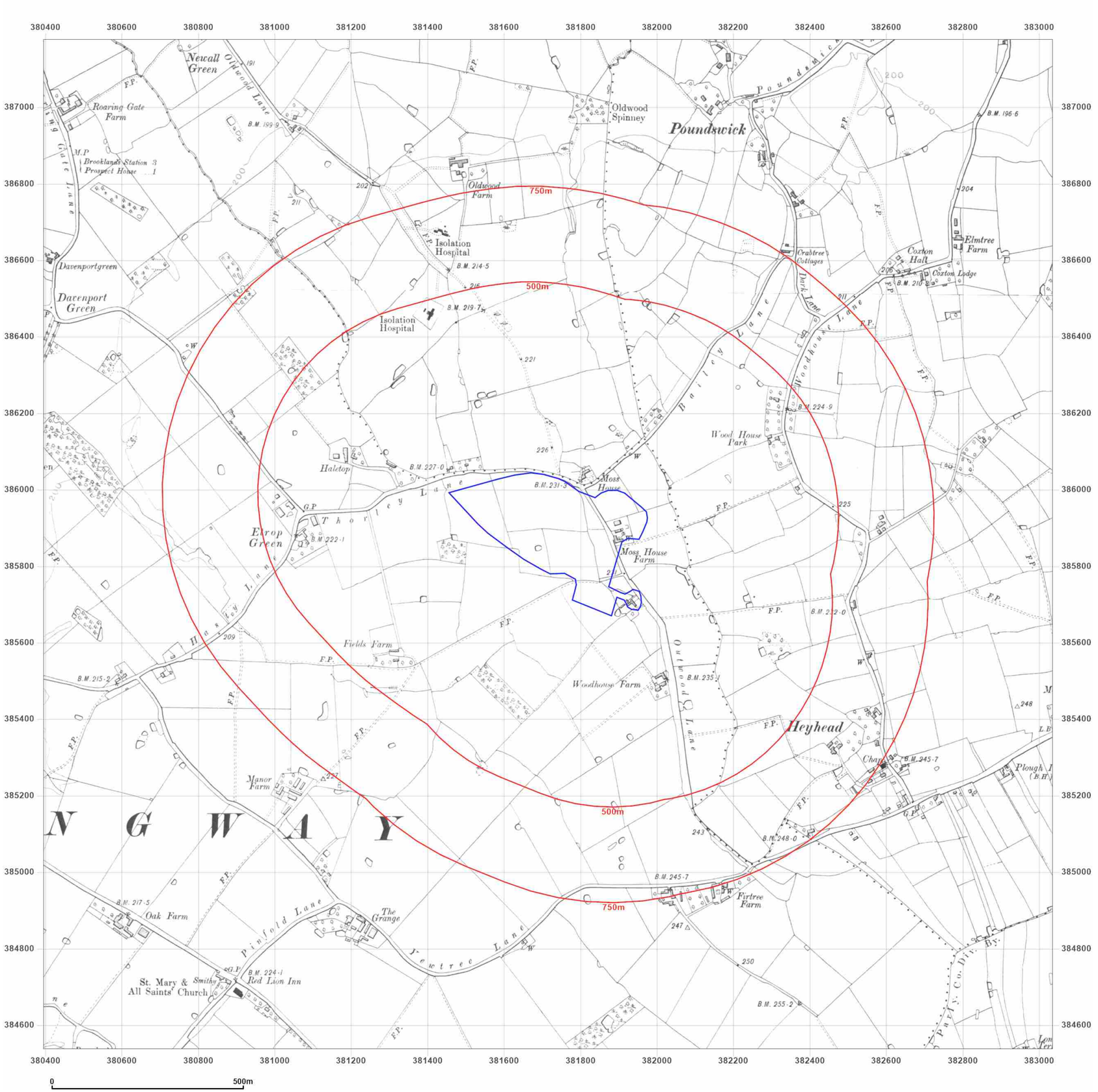
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Map Name: County Series

Map date: **1907-1910**

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1873
Revised 1907
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1874
Revised 1910
Edition 1910
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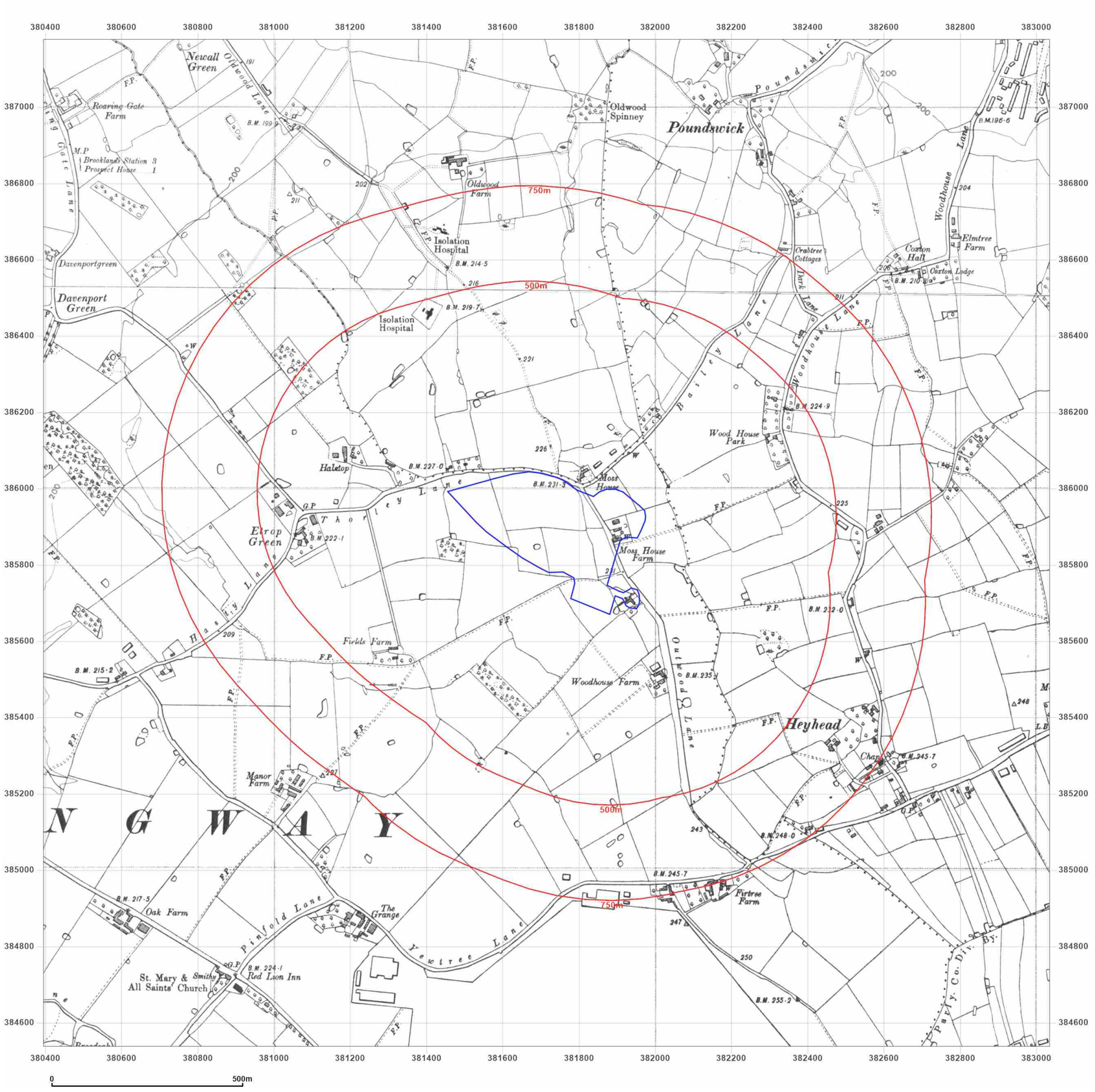


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Site Details:

MANCHESTER AIRPORT,
MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U
Grid Ref: 381714, 385857

Map Name: County Series

Map date: **1938**

Scale: 1:10,560

Printed at: 1:10,560

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Edition 1938
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Surveyed 1874
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Edition N/A
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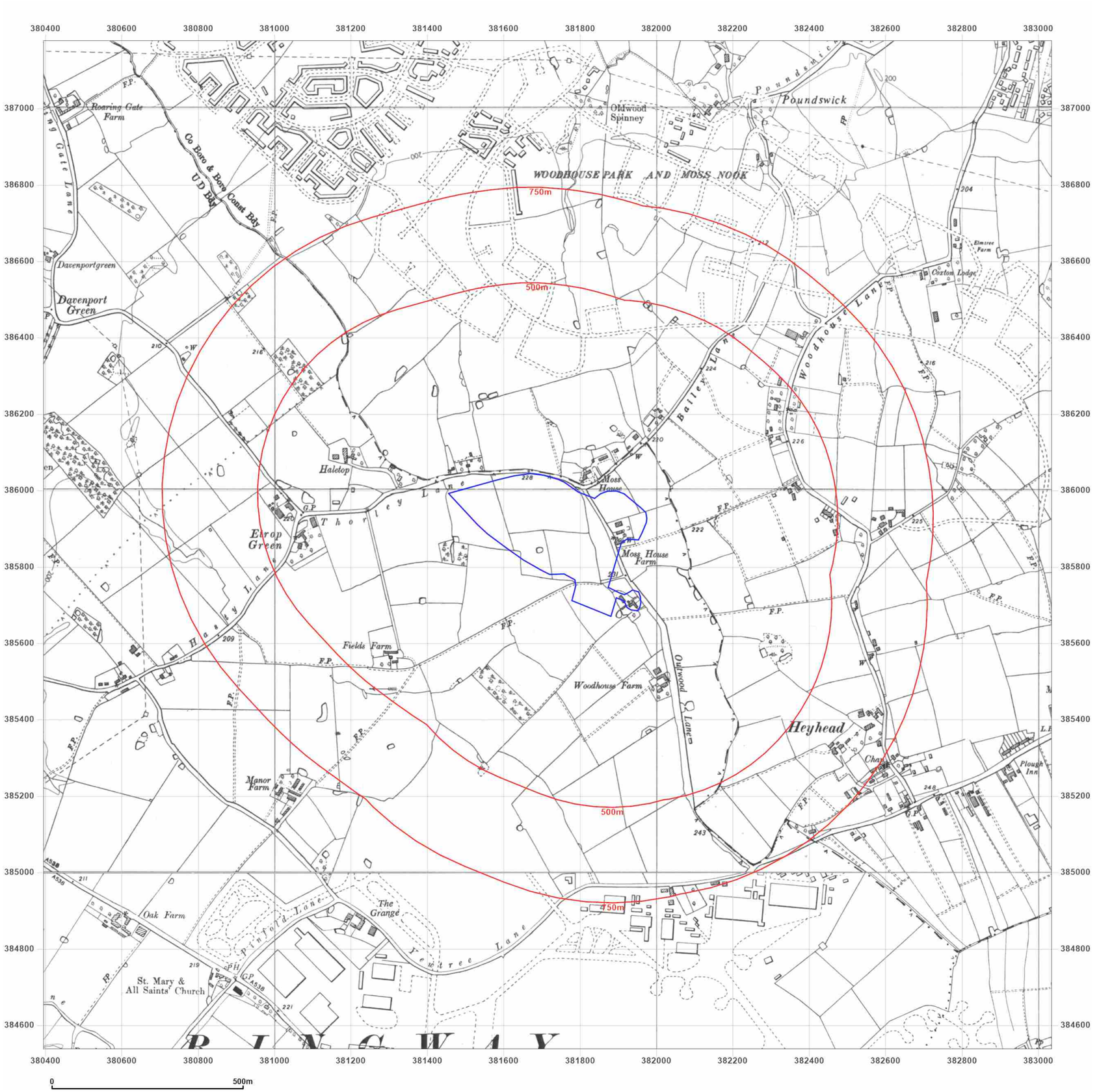
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Site Details:

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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U
Grid Ref: 381714, 385857

Map Name: Provisional

Map date: **1954**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1949
Revised 1954
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised 1953
Edition 1954
Copyright N/A
Levelled N/A

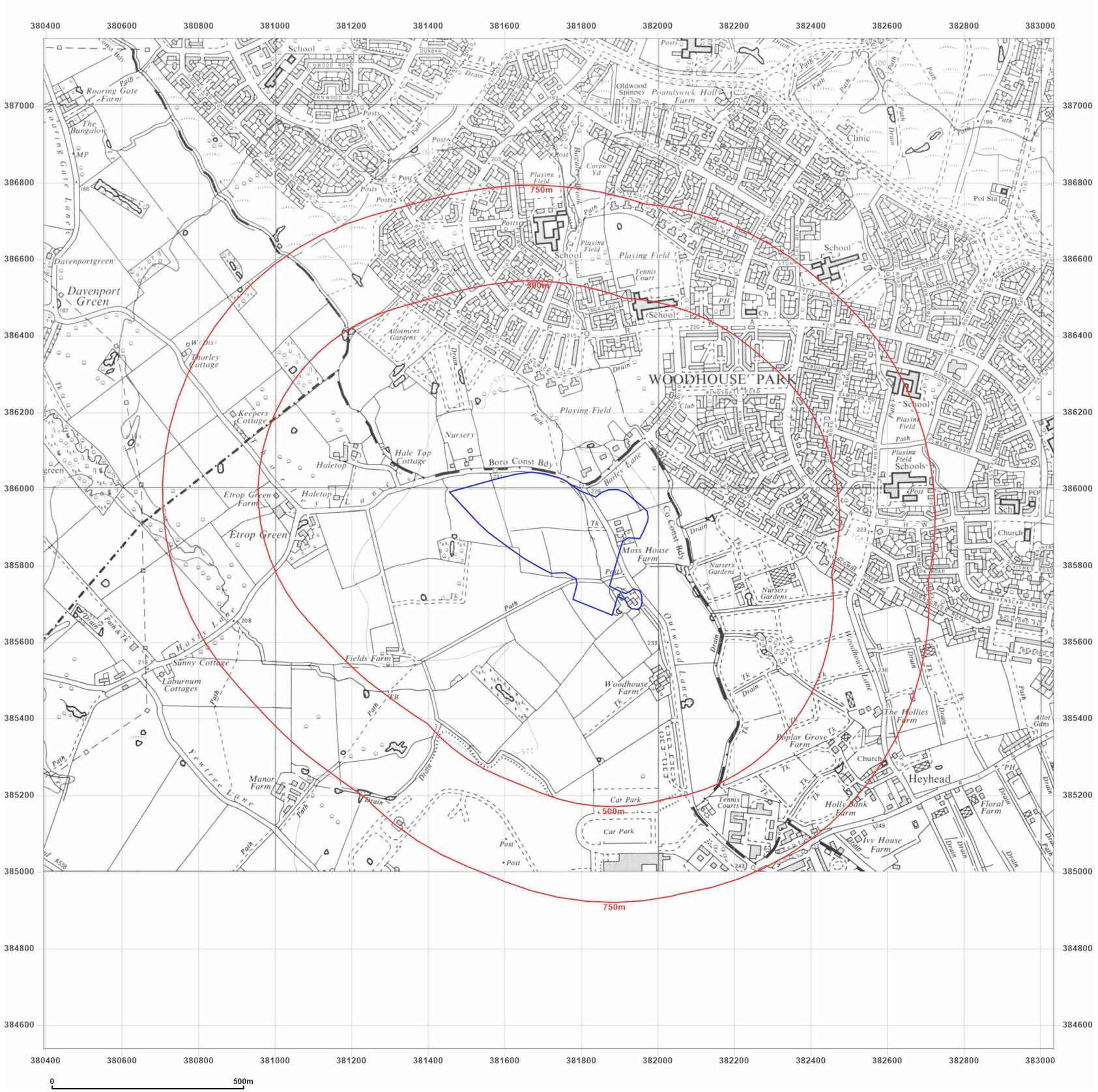
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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U
Grid Ref: 381714, 385857

Map Name: Provisional

Map date: **1967**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1967
Revised 1967
Edition N/A
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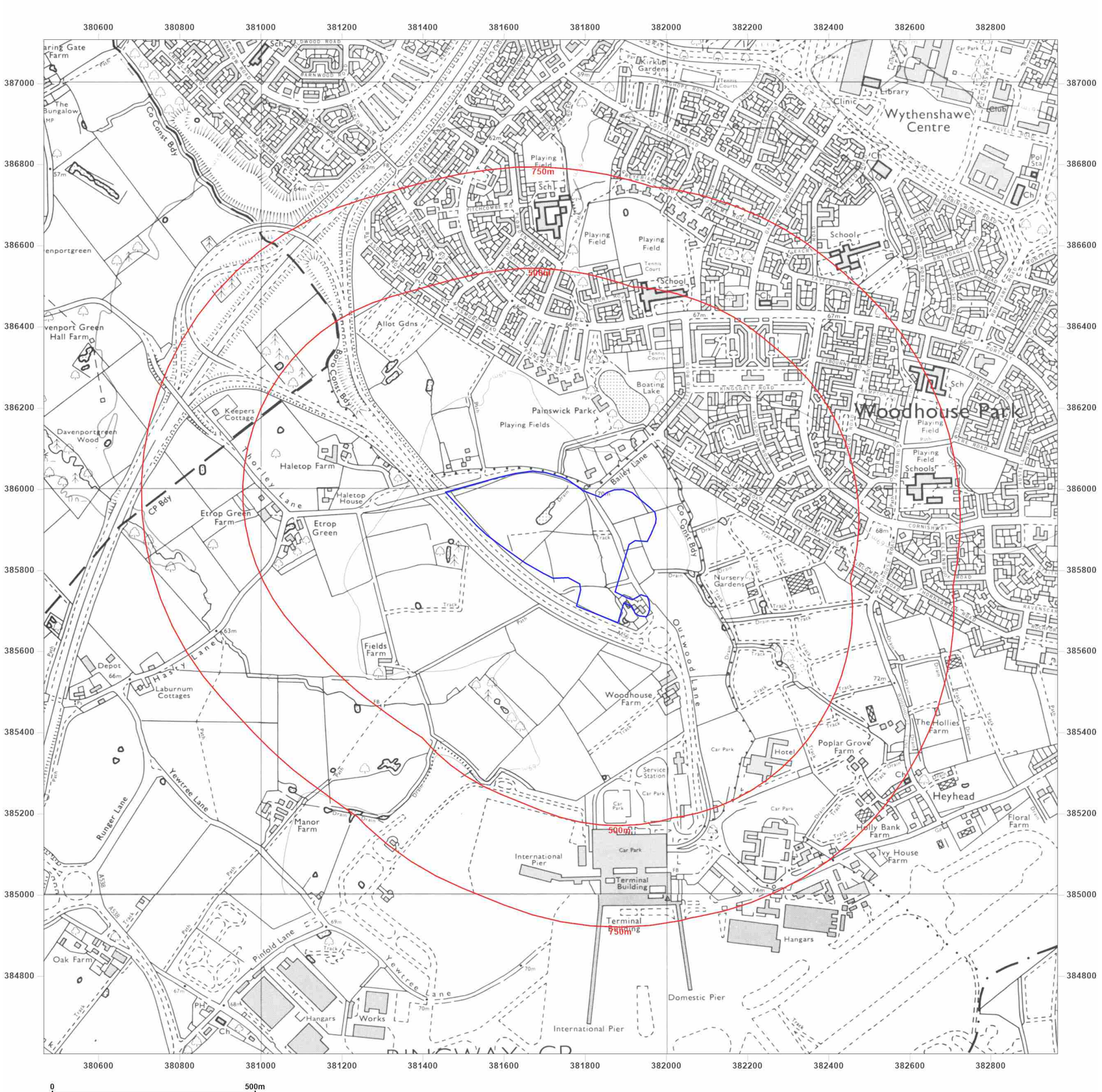
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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U
Grid Ref: 381714, 385857

Map Name: National Grid

Map date: **1976-1977**

Scale: 1:10,000

Printed at: 1:10,000

N
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Surveyed 1975
Revised 1977
Edition N/A
Copyright 1977
Levelled 1964

Surveyed 1973
Revised 1976
Edition N/A
Copyright 1976
Levelled N/A

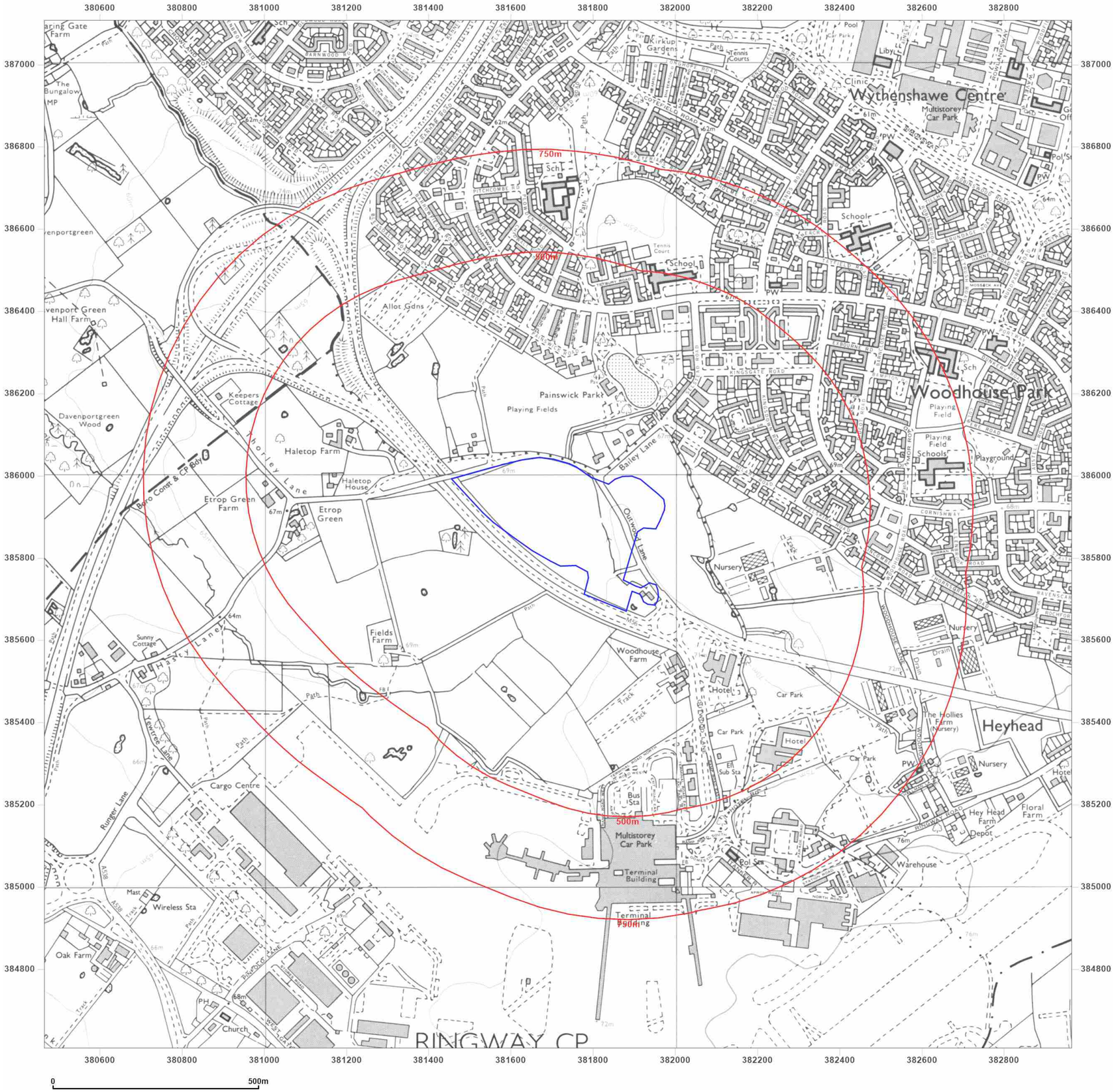
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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U
Grid Ref: 381714, 385857

Map Name: National Grid

Map date: **1989**

Scale: 1:10,000

Printed at: 1:10,000

N
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Surveyed 1984
Revised 1989
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1974
Revised 1989
Edition N/A
Copyright N/A
Levelled N/A

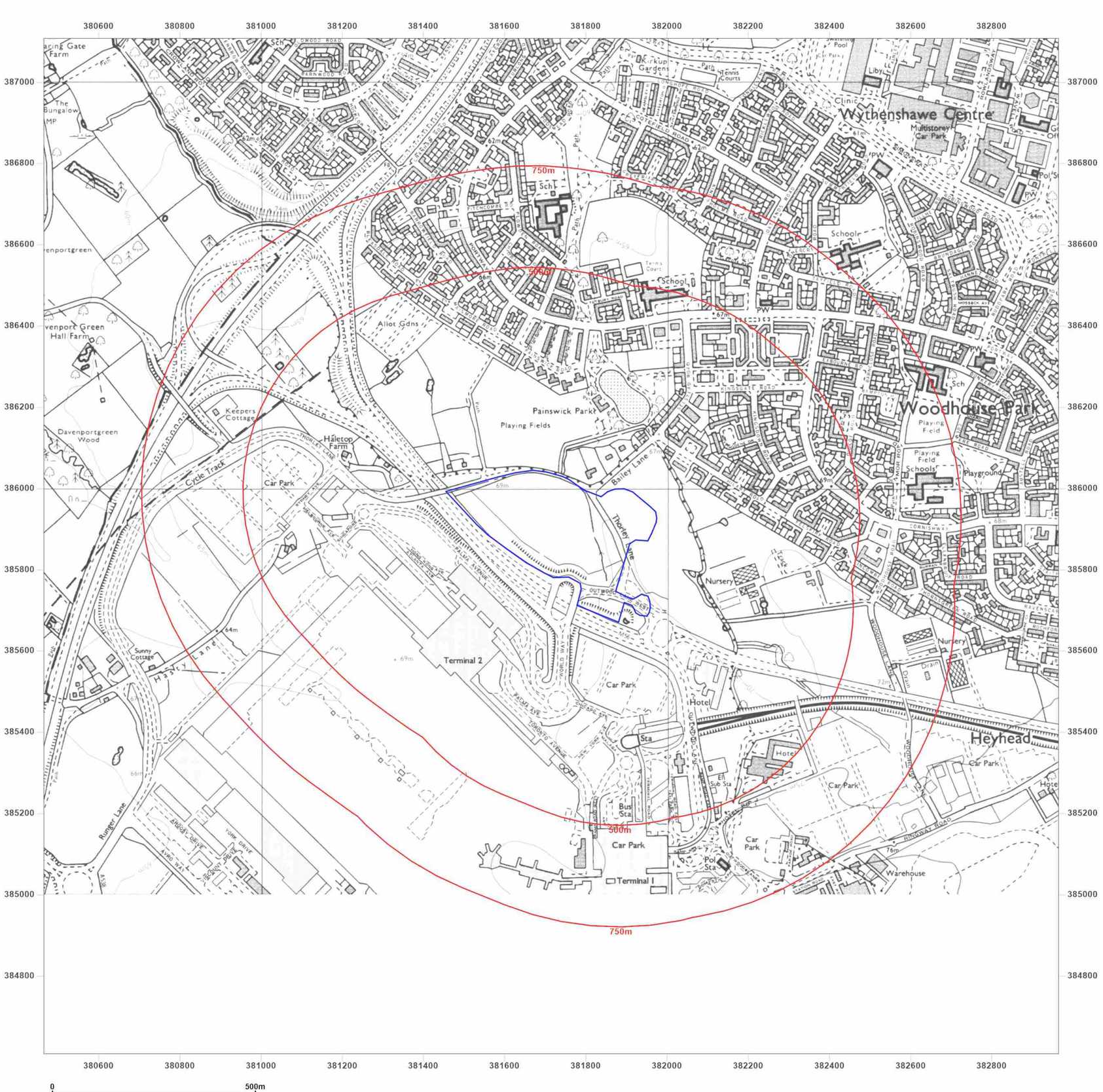
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MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U
Grid Ref: 381714, 385857

Map Name: National Grid

Map date: **1995**

Scale: 1:10,000

Printed at: 1:10,000

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Surveyed 1984
Revised 1995
Edition N/A
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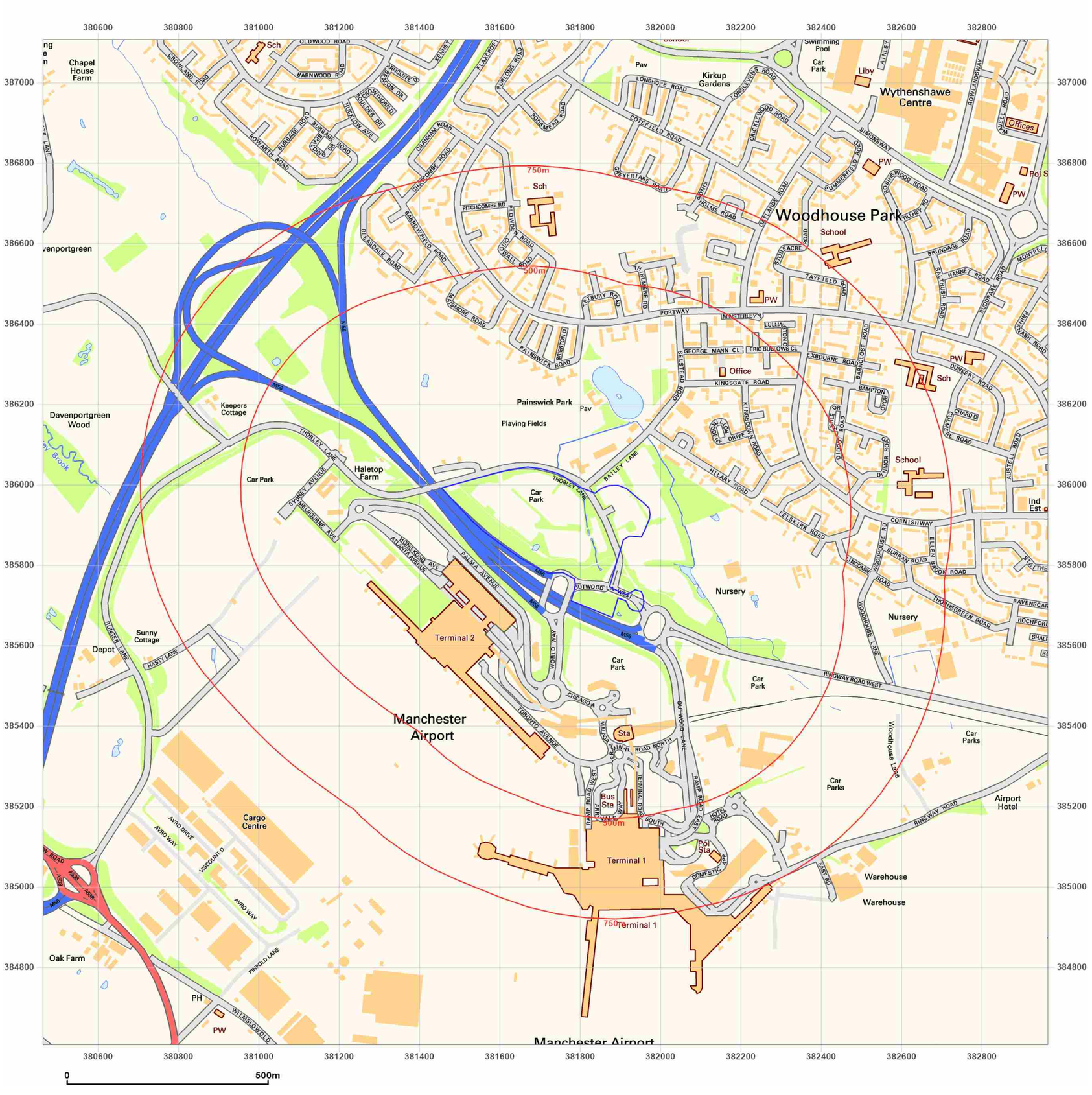
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Site Details:

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MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U
Grid Ref: 381714, 385857

Map Name: National Grid

Map date: **2001**

Scale: 1:10,000

Printed at: 1:10,000

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2001

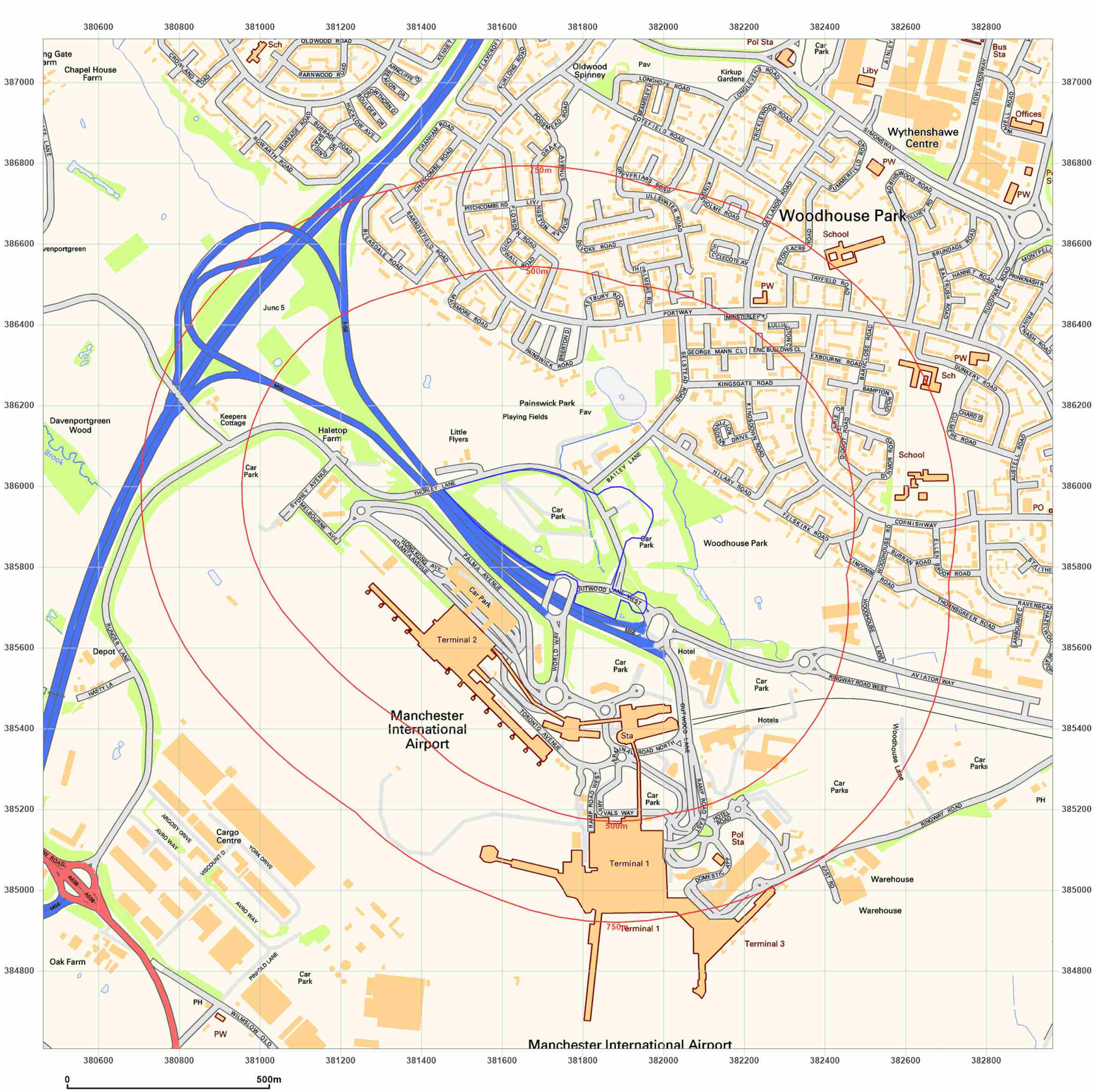
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Site Details:

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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U
Grid Ref: 381714, 385857

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

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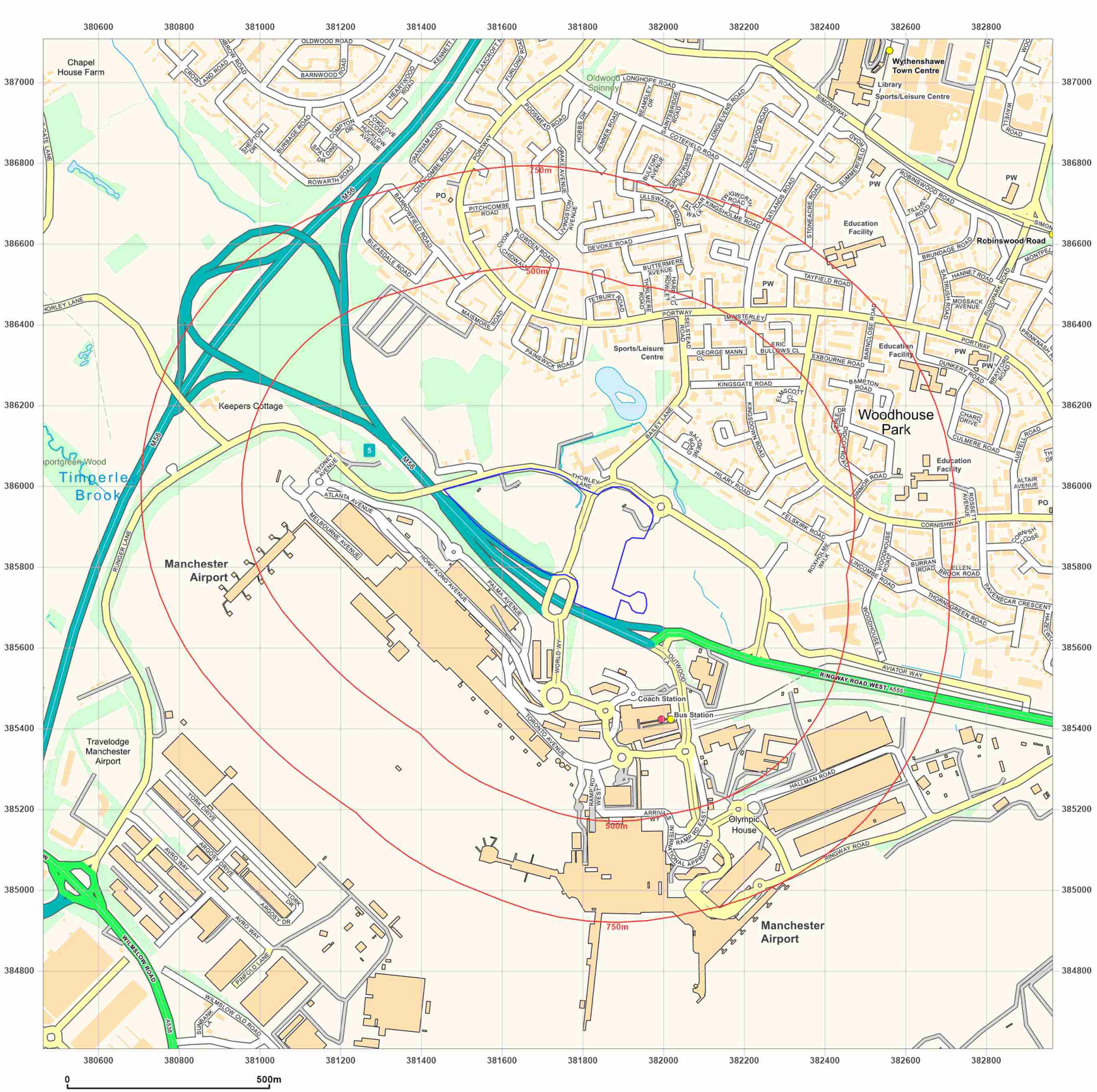
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Report Ref: GS-LLH-F2J-3NP-S9U
Grid Ref: 381714, 385857

Map Name: National Grid

Map date: **2025**

Scale: 1:10,000

Printed at: 1:10,000

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MANCHESTER AIRPORT, MANCHESTER, M90 4EG

Order Details

Date: 10/10/2025

Your ref: PBJ20682

Our Ref: GS-DSN-TX5-ZBT-T3A

Site Details

Location: 381746 385894

Area: 9.9 ha

Authority: Manchester City Council ↗



Summary of findings p. 2 >

Aerial image p. 9 >

OS MasterMap site plan p.14 >

Insight User Guide ↗

Contact us with any questions at:
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Summary of findings

Page	Section	Past land use >	On site	0-50m	50-250m	250-500m	500-2000m
15 >	1.1 >	Historical industrial land uses >	2	2	3	17	-
17 >	1.2 >	Historical tanks >	0	0	0	4	-
17 >	1.3 >	Historical energy features >	0	1	4	18	-
18	1.4	Historical petrol stations	0	0	0	0	-
19 >	1.5 >	Historical garages >	0	0	0	4	-
19	1.6	Historical military land	0	0	0	0	-
Page	Section	Past land use - un-grouped >	On site	0-50m	50-250m	250-500m	500-2000m
20 >	2.1 >	Historical industrial land uses >	2	2	4	22	-
22 >	2.2 >	Historical tanks >	0	0	0	11	-
22 >	2.3 >	Historical energy features >	0	3	15	38	-
25	2.4	Historical petrol stations	0	0	0	0	-
25 >	2.5 >	Historical garages >	0	0	0	6	-
Page	Section	Waste and landfill >	On site	0-50m	50-250m	250-500m	500-2000m
26	3.1	Active or recent landfill	0	0	0	0	-
26	3.2	Historical landfill (BGS records)	0	0	0	0	-
27	3.3	Historical landfill (LA/mapping records)	0	0	0	0	-
27	3.4	Historical landfill (EA/NRW records)	0	0	0	0	-
27	3.5	Historical waste sites	0	0	0	0	-
27	3.6	Licensed waste sites	0	0	0	0	-
27 >	3.7 >	Waste exemptions >	0	0	1	3	-
Page	Section	Current industrial land use >	On site	0-50m	50-250m	250-500m	500-2000m
29 >	4.1 >	Recent industrial land uses >	1	2	9	-	-
30	4.2	National Geographic Database (NGD) - Current or recent tanks	0	0	0	-	-
30 >	4.3 >	Current or recent petrol stations >	0	0	1	1	-
31	4.4	Electricity cables	0	0	0	0	-
31	4.5	Gas pipelines	0	0	0	0	-

31	4.6	Sites determined as Contaminated Land	0	0	0	0	-
31	4.7	Control of Major Accident Hazards (COMAH)	0	0	0	0	-
32	4.8	Regulated explosive sites	0	0	0	0	-
32	4.9	Hazardous substance storage/usage	0	0	0	0	-
32	4.10	Historical licensed industrial activities (IPC)	0	0	0	0	-
32	4.11	Licensed industrial activities (Part A(1))	0	0	0	0	-
32 >	**4.12 >**	**Licensed pollutant release (Part A(2)/B) >**	0	0	2	2	-
33	4.13	Radioactive Substance Authorisations	0	0	0	0	-
33 >	**4.14 >**	**Licensed Discharges to controlled waters >**	0	0	1	2	-
34	4.15	Pollutant release to surface waters (Red List)	0	0	0	0	-
34	4.16	Pollutant release to public sewer	0	0	0	0	-
34	4.17	List 1 Dangerous Substances	0	0	0	0	-
35	4.18	List 2 Dangerous Substances	0	0	0	0	-
35	4.19	Pollution Incidents (EA/NRW)	0	0	0	0	-
35	4.20	Pollution inventory substances	0	0	0	0	-
35	4.21	Pollution inventory waste transfers	0	0	0	0	-
35	4.22	Pollution inventory radioactive waste	0	0	0	0	-

Page	Section	**Hydrogeology >**	On site	0-50m	50-250m	250-500m	500-2000m
36 >	**5.1 >**	**Superficial aquifer >**	Identified (within 500m)				
38 >	**5.2 >**	**Bedrock aquifer >**	Identified (within 500m)				
39 >	**5.3 >**	**Groundwater vulnerability >**	Identified (within 50m)				
40	5.4	Groundwater vulnerability- soluble rock risk	None (within 0m)				
40	5.5	Groundwater vulnerability- local information	None (within 0m)				
41	5.6	Groundwater abstractions	0	0	0	0	0
42 >	**5.7 >**	**Surface water abstractions >**	0	0	0	0	5
43	5.8	Potable abstractions	0	0	0	0	0
43	5.9	Source Protection Zones	0	0	0	0	-
44	5.10	Source Protection Zones (confined aquifer)	0	0	0	0	-

Page	Section	**Hydrology >**	On site	0-50m	50-250m	250-500m	500-2000m

45 >	6.1 >	Water Network (OS MasterMap) >	2	1	13	-	-
47 >	6.2 >	Surface water features >	1	1	5	-	-
47 >	6.3 >	WFD Surface water body catchments >	1	-	-	-	-
48 >	6.4 >	WFD Surface water bodies >	0	0	0	-	-
48 >	6.5 >	WFD Groundwater bodies >	1	-	-	-	-

Page	Section	River and coastal flooding	On site	0-50m	50-250m	250-500m	500-2000m
49	7.1	Risk of flooding from rivers and the sea	None (within 50m)				
49	7.2	Historical Flood Events	0	0	0	-	-
49	7.3	Flood Defences	0	0	0	-	-
50	7.4	Areas Benefiting from Flood Defences	0	0	0	-	-
50	7.5	Flood Storage Areas	0	0	0	-	-
51 >	7.6 >	Flood Zone 2 >	Identified (within 50m)				
52	7.7	Flood Zone 3	None (within 50m)				

Page	Section	Surface water flooding >	
53 >	8.1 >	Surface water flooding >	1 in 30 year, 0.3m - 1.0m (within 50m)

Page	Section	Groundwater flooding >	
55 >	9.1 >	Groundwater flooding >	Low (within 50m)

Page	Section	Environmental designations >	On site	0-50m	50-250m	250-500m	500-2000m
56 >	10.1 >	Sites of Special Scientific Interest (SSSI) >	0	0	0	0	2
57	10.2	Conserved wetland sites (Ramsar sites)	0	0	0	0	0
57	10.3	Special Areas of Conservation (SAC)	0	0	0	0	0
57	10.4	Special Protection Areas (SPA)	0	0	0	0	0
57	10.5	National Nature Reserves (NNR)	0	0	0	0	0
58	10.6	Local Nature Reserves (LNR)	0	0	0	0	0
58 >	10.7 >	Designated Ancient Woodland >	0	0	0	0	4
58	10.8	Biosphere Reserves	0	0	0	0	0
59	10.9	Forest Parks	0	0	0	0	0
59	10.10	Marine Conservation Zones	0	0	0	0	0
59 >	10.11 >	Green Belt >	0	0	0	0	4

59	10.12	Proposed Ramsar sites	0	0	0	0	0
60	10.13	Possible Special Areas of Conservation (pSAC)	0	0	0	0	0
60	10.14	Potential Special Protection Areas (pSPA)	0	0	0	0	0
60	10.15	Nitrate Sensitive Areas	0	0	0	0	0
60	10.16	Nitrate Vulnerable Zones	0	0	0	0	0
61	10.17	SSSI Impact Risk Zones	0	-	-	-	-
62 >	**10.18 >**	**SSSI Units >**	0	0	0	0	2
Page	Section	**Visual and cultural designations >**	On site	0-50m	50-250m	250-500m	500-2000m
63	11.1	World Heritage Sites	0	0	0	-	-
64	11.2	Area of Outstanding Natural Beauty	0	0	0	-	-
64	11.3	National Parks	0	0	0	-	-
64 >	**11.4 >**	**Listed Buildings >**	0	1	0	-	-
65	11.5	Conservation Areas	0	0	0	-	-
65	11.6	Scheduled Ancient Monuments	0	0	0	-	-
65	11.7	Registered Parks and Gardens	0	0	0	-	-
Page	Section	**Agricultural designations >**	On site	0-50m	50-250m	250-500m	500-2000m
66 >	**12.1 >**	**Agricultural Land Classification >**	Urban (within 250m)				
67	12.2	Open Access Land	0	0	0	-	-
67 >	**12.3 >**	**Tree Felling Licences >**	1	3	9	-	-
68	12.4	Environmental Stewardship Schemes	0	0	0	-	-
68	12.5	Countryside Stewardship Schemes	0	0	0	-	-
Page	Section	**Habitat designations >**	On site	0-50m	50-250m	250-500m	500-2000m
69 >	**13.1 >**	**Priority Habitat Inventory >**	6	6	12	-	-
70	13.2	Habitat Networks	0	0	0	-	-
71	13.3	Open Mosaic Habitat	0	0	0	-	-
71	13.4	Limestone Pavement Orders	0	0	0	-	-
Page	Section	**Geology 1:10,000 scale >**	On site	0-50m	50-250m	250-500m	500-2000m
72 >	**14.1 >**	**10k Availability >**	Identified (within 500m)				
73	14.2	Artificial and made ground (10k)	0	0	0	0	-

74 >	14.3 >	Superficial geology (10k) >	1	0	0	1	-
75	14.4	Landslip (10k)	0	0	0	0	-
76 >	14.5 >	Bedrock geology (10k) >	1	0	0	0	-
77	14.6	Bedrock faults and other linear features (10k)	0	0	0	0	-
Page	Section	Geology 1:50,000 scale >	On site	0-50m	50-250m	250-500m	500-2000m
78 >	15.1 >	50k Availability >	Identified (within 500m)				
79	15.2	Artificial and made ground (50k)	0	0	0	0	-
79	15.3	Artificial ground permeability (50k)	0	0	-	-	-
80 >	15.4 >	Superficial geology (50k) >	1	0	0	1	-
81 >	15.5 >	Superficial permeability (50k) >	Identified (within 50m)				
81	15.6	Landslip (50k)	0	0	0	0	-
81	15.7	Landslip permeability (50k)	None (within 50m)				
82 >	15.8 >	Bedrock geology (50k) >	1	0	0	0	-
83 >	15.9 >	Bedrock permeability (50k) >	Identified (within 50m)				
83	15.10	Bedrock faults and other linear features (50k)	0	0	0	0	-
Page	Section	Boreholes >	On site	0-50m	50-250m	250-500m	500-2000m
84 >	16.1 >	BGS Boreholes >	7	5	79	-	-
Page	Section	Natural ground subsidence >					
89 >	17.1 >	Shrink swell clays >	Very low (within 50m)				
90 >	17.2 >	Running sands >	Very low (within 50m)				
91 >	17.3 >	Compressible deposits >	Negligible (within 50m)				
92 >	17.4 >	Collapsible deposits >	Very low (within 50m)				
93 >	17.5 >	Landslides >	Very low (within 50m)				
94 >	17.6 >	Ground dissolution of soluble rocks >	Negligible (within 50m)				
Page	Section	Mining and ground workings >	On site	0-50m	50-250m	250-500m	500-2000m
96 >	18.1 >	BritPits >	0	0	0	1	-
97 >	18.2 >	Surface ground workings >	1	2	25	-	-
98	18.3	Underground workings	0	0	0	0	0
98	18.4	Underground mining extents	0	0	0	0	-

99	18.5	Historical Mineral Planning Areas	0	0	0	0	-
99	18.6	Non-coal mining	0	0	0	0	0
99	18.7	JPB mining areas	None (within 0m)				
99	18.8	The Coal Authority non-coal mining	0	0	0	0	-
100	18.9	Researched mining	0	0	0	0	-
100	18.10	Mining record office plans	0	0	0	0	-
100	18.11	BGS mine plans	0	0	0	0	-
100	18.12	Coal mining	None (within 0m)				
100 >	**18.13 >**	**Brine areas >**	Identified (within 0m)				
101	18.14	Gypsum areas	None (within 0m)				
101	18.15	Tin mining	None (within 0m)				
101	18.16	Clay mining	None (within 0m)				
Page	Section	Ground cavities and sinkholes	On site	0-50m	50-250m	250-500m	500-2000m
102	19.1	Natural cavities	0	0	0	0	-
102	19.2	Mining cavities	0	0	0	0	0
102	19.3	Reported recent incidents	0	0	0	0	-
102	19.4	Historical incidents	0	0	0	0	-
Page	Section	**Radon >**					
104 >	**20.1 >**	**Radon >**	Less than 1% (within 0m)				
Page	Section	**Soil chemistry >**	On site	0-50m	50-250m	250-500m	500-2000m
106 >	**21.1 >**	**BGS Estimated Background Soil Chemistry >**	4	1	-	-	-
106	21.2	BGS Estimated Urban Soil Chemistry	0	0	-	-	-
107	21.3	BGS Measured Urban Soil Chemistry	0	0	-	-	-
Page	Section	Railway infrastructure and projects	On site	0-50m	50-250m	250-500m	500-2000m
108	22.1	Underground railways (London)	0	0	0	-	-
108	22.2	Underground railways (Non-London)	0	0	0	-	-
108	22.3	Railway tunnels	0	0	0	-	-
108	22.4	Historical railway and tunnel features	0	0	0	-	-
108	22.5	Royal Mail tunnels	0	0	0	-	-

109	22.6	Historical railways	0	0	0	-	-
109	22.7	Railways	0	0	0	-	-
109	22.8	Crossrail 2	0	0	0	0	-
109	22.9	HS2	0	0	0	0	-

Recent aerial photograph



Capture Date: 07/04/2023

Site Area: 9.9ha

Recent site history - 2022 aerial photograph



Capture Date: 28/09/2022

Site Area: 9.9ha

Recent site history - 2016 aerial photograph



Capture Date: 21/04/2016

Site Area: 9.9ha

Recent site history - 2009 aerial photograph



Capture Date: 02/06/2009

Site Area: 9.9ha

Recent site history - 2000 aerial photograph

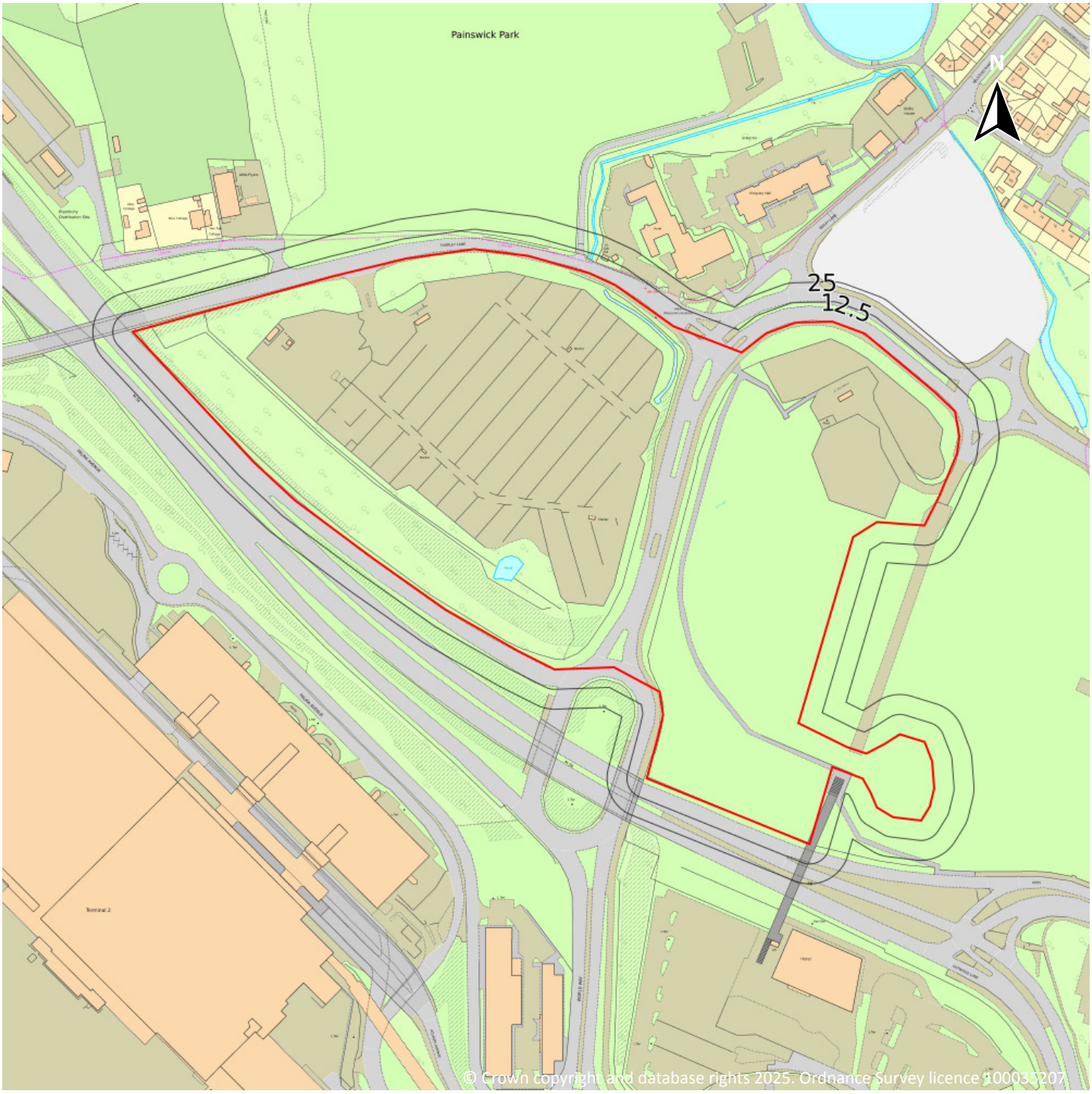


Aerial photography supplied by Getmapping PLC. © Copyright Getmapping PLC 2025. All Rights Reserved.

Capture Date: 27/06/2000

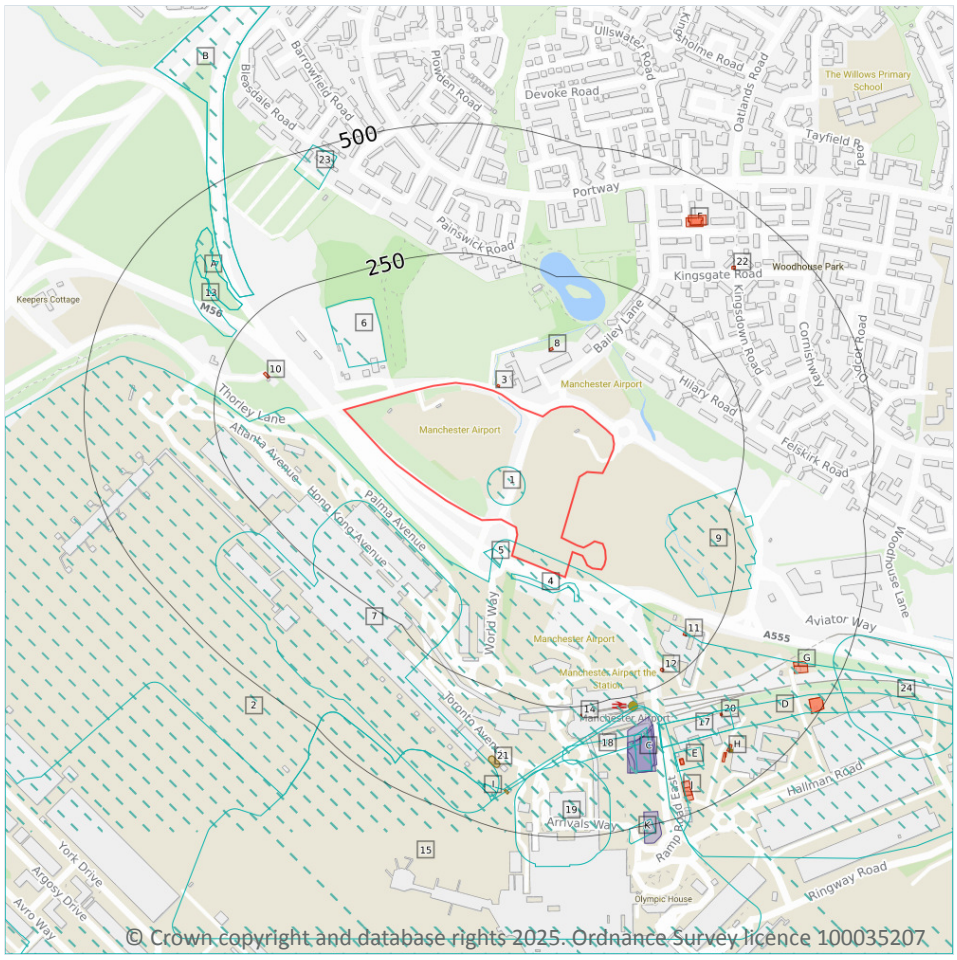
Site Area: 9.9ha

OS MasterMap site plan



Site Area: 9.9ha

1 Past land use



1.1 Historical industrial land uses

Records within 500m	24

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 1:10,560 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 15 >**

ID	Location	Land use	Dates present	Group ID
1	**On site**	**Terminal**	**1995**	**812353**

ID	Location	Land use	Dates present	Group ID
2	**On site**	**Airport**	**1995**	**914304**
4	12m S	Unspecified Ground Workings	1995	815673
5	18m W	Unspecified Pit	1995	830562
6	69m N	Nursery	1967	831745
7	91m SW	Terminal	1995	812354
9	116m E	Nursery	1989 - 1995	893421
13	256m NW	Unspecified Heap	1995	993190
15	271m S	Airport	1976 - 1989	903224
16	276m S	Airport	1967	859512
A	281m NW	Unspecified Heap	1989	871739
A	281m NW	Unspecified Heap	1977	875190
B	281m NW	Cuttings	1989 - 1995	929695
B	281m NW	Cuttings	1977	994332
C	316m S	Service Station	1977	816995
17	319m S	Railway Sidings	1995	857825
D	319m S	Cuttings	1907 - 1995	923607
18	322m S	Unspecified Station	1995	821547
19	352m S	Bus Station	1989 - 1995	869550
E	380m S	Electric Substation	1989 - 1995	863423
23	421m N	Isolation Hospital	1910 - 1938	957529
I	426m S	Unspecified Tanks	1995	819651
24	474m E	Nursery	1989	831747
K	489m S	Unspecified Heap	1967	843671

This data is sourced from Ordnance Survey / Groundsure.

1.2 Historical tanks

Records within 500m	4

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 15 >**

ID	Location	Land use	Dates present	Group ID
21	371m S	Tanks	1993 - 1998	153023
I	424m S	Unspecified Tank	1995 - 1998	146940
H	424m SE	Unspecified Tank	1987 - 1990	127605
H	426m SE	Unspecified Tank	1993 - 1998	145906

This data is sourced from Ordnance Survey / Groundsure.

1.3 Historical energy features

Records within 500m	23

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 15 >**

ID	Location	Land use	Dates present	Group ID
3	11m NE	Electricity Substation	1992 - 1996	79350
8	109m N	Electricity Substation	1992 - 1996	71414
10	157m NW	Electricity Substation	1993 - 1995	88032
11	199m SE	Electricity Substation	1987 - 1996	92538
12	222m SE	Electricity Substation	1987 - 1998	90664
14	265m S	Electricity Substation	1998	67148
20	359m SE	Electricity Substation	1996 - 1998	92362

ID	Location	Land use	Dates present	Group ID
22	392m NE	Electricity Substation	1986 - 1995	69093
E	394m S	Electricity Substation	1987	91778
E	396m S	Electricity Substation	1993 - 1998	82106
F	405m NE	Electricity Substation	1986	83515
G	409m SE	Electricity Substation	1995 - 1996	74174
F	411m NE	Electricity Substation	1999	85521
F	412m NE	Electricity Substation	1994 - 1995	92246
G	413m SE	Electricity Substation	1993 - 1998	87437
H	417m SE	Electricity Substation	1987 - 1998	88687
H	421m SE	Electricity Substation	1976	67151
H	424m SE	Electricity Substation	1998	89867
H	425m SE	Electricity Substation	1996	82656
J	437m S	Electricity Substation	1996	79237
J	449m S	Electricity Substation	1995 - 1998	74412
D	471m SE	Electricity Substation	1995 - 1998	75355
D	471m SE	Electricity Substation	1996	75233

This data is sourced from Ordnance Survey / Groundsure.

1.4 Historical petrol stations

Records within 500m	0

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

This data is sourced from Ordnance Survey / Groundsure.

1.5 Historical garages

Records within 500m	4

Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 15 >**

ID	Location	Land use	Dates present	Group ID
C	297m S	Service Station	1976	22126
C	313m S	Garage	1993	27119
C	321m S	Garage	1987 - 1990	27424
K	474m S	Garage	1967 - 1976	24893

This data is sourced from Ordnance Survey / Groundsure.

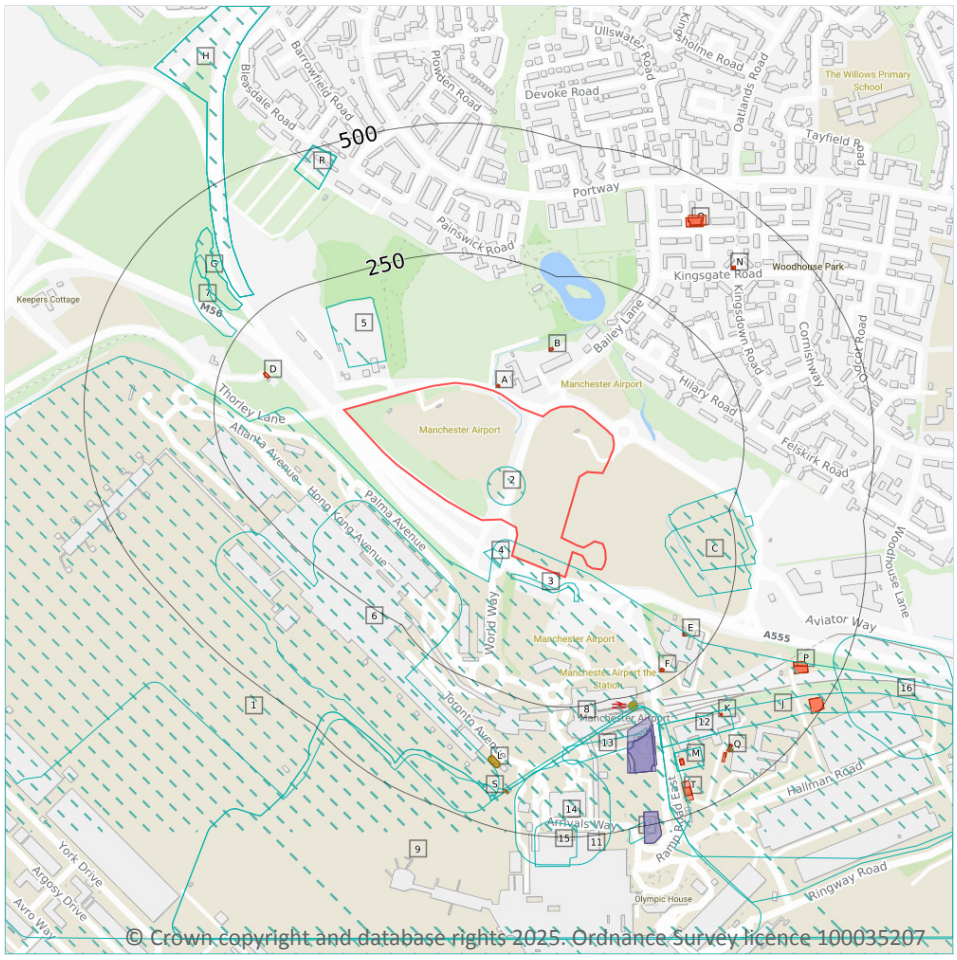
1.6 Historical military land

Records within 500m	0

Areas of military land digitised from multiple sources including the National Archives, local records, MOD records and verified other sources, intelligently grouped into contiguous features.

This data is sourced from Ordnance Survey / Groundsure / other sources.

2 Past land use - un-grouped



2.1 Historical industrial land uses

Records within 500m	30

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 10,560 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 20 >**

ID	Location	Land Use	Date	Group ID
1	**On site**	**Airport**	**1995**	**914304**
2	**On site**	**Terminal**	**1995**	**812353**
3	12m S	Unspecified Ground Workings	1995	815673

ID	Location	Land Use	Date	Group ID
4	18m W	Unspecified Pit	1995	830562
5	69m N	Nursery	1967	831745
6	91m SW	Terminal	1995	812354
C	116m E	Nursery	1995	893421
C	137m E	Nursery	1989	893421
7	256m NW	Unspecified Heap	1995	993190
9	271m S	Airport	1989	903224
10	276m S	Airport	1967	859512
11	276m S	Airport	1977	903224
G	281m NW	Unspecified Heap	1977	875190
G	281m NW	Unspecified Heap	1989	871739
H	281m NW	Cuttings	1995	929695
H	281m NW	Cuttings	1977	994332
H	281m NW	Cuttings	1989	929695
I	316m S	Service Station	1977	816995
12	319m S	Railway Sidings	1995	857825
J	319m S	Cuttings	1995	923607
13	322m S	Unspecified Station	1995	821547
14	352m S	Bus Station	1989	869550
M	380m S	Electric Substation	1995	863423
M	380m S	Electric Substation	1989	863423
R	421m N	Isolation Hospital	1938	957529
R	422m N	Isolation Hospital	1910	957529
S	426m S	Unspecified Tanks	1995	819651
15	471m S	Bus Station	1995	869550
16	474m E	Nursery	1989	831747
U	489m S	Unspecified Heap	1967	843671

This data is sourced from Ordnance Survey / Groundsure.

2.2 Historical tanks

Records within 500m	11

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 20 >**

ID	Location	Land Use	Date	Group ID
L	371m S	Tanks	1995	153023
L	371m S	Tanks	1993	153023
L	371m S	Tanks	1998	153023
S	424m S	Unspecified Tank	1995	146940
Q	424m SE	Unspecified Tank	1990	127605
Q	424m SE	Unspecified Tank	1987	127605
S	425m S	Unspecified Tank	1998	146940
Q	426m SE	Unspecified Tank	1995	145906
Q	426m SE	Unspecified Tank	1998	145906
Q	426m SE	Unspecified Tank	1993	145906
Q	426m SE	Unspecified Tank	1996	145906

This data is sourced from Ordnance Survey / Groundsure.

2.3 Historical energy features

Records within 500m	56

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 20 >**

ID	Location	Land Use	Date	Group ID
A	11m NE	Electricity Substation	1992	79350
A	11m NE	Electricity Substation	1996	79350
A	11m NE	Electricity Substation	1992	79350

ID	Location	Land Use	Date	Group ID
B	109m N	Electricity Substation	1992	71414
B	109m N	Electricity Substation	1996	71414
B	109m N	Electricity Substation	1992	71414
D	157m NW	Electricity Substation	1995	88032
D	157m NW	Electricity Substation	1993	88032
E	199m SE	Electricity Substation	1987	92538
E	200m SE	Electricity Substation	1989	92538
E	200m SE	Electricity Substation	1995	92538
E	200m SE	Electricity Substation	1996	92538
F	222m SE	Electricity Substation	1990	90664
F	222m SE	Electricity Substation	1987	90664
F	223m SE	Electricity Substation	1995	90664
F	223m SE	Electricity Substation	1998	90664
F	223m SE	Electricity Substation	1993	90664
F	223m SE	Electricity Substation	1996	90664
8	265m S	Electricity Substation	1998	67148
K	359m SE	Electricity Substation	1996	92362
K	360m SE	Electricity Substation	1998	92362
N	392m NE	Electricity Substation	1986	69093
N	392m NE	Electricity Substation	1986	69093
N	393m NE	Electricity Substation	1995	69093
N	393m NE	Electricity Substation	1994	69093
M	394m S	Electricity Substation	1987	91778
M	396m S	Electricity Substation	1995	82106
M	396m S	Electricity Substation	1998	82106
M	396m S	Electricity Substation	1993	82106
M	396m S	Electricity Substation	1996	82106
O	405m NE	Electricity Substation	1986	83515

ID	Location	Land Use	Date	Group ID
O	405m NE	Electricity Substation	1986	83515
P	409m SE	Electricity Substation	1995	74174
P	409m SE	Electricity Substation	1996	74174
O	411m NE	Electricity Substation	1999	85521
O	412m NE	Electricity Substation	1995	92246
O	412m NE	Electricity Substation	1994	92246
P	413m SE	Electricity Substation	1995	87437
P	413m SE	Electricity Substation	1998	87437
P	413m SE	Electricity Substation	1993	87437
P	413m SE	Electricity Substation	1996	87437
Q	417m SE	Electricity Substation	1990	88687
Q	417m SE	Electricity Substation	1987	88687
Q	418m SE	Electricity Substation	1995	88687
Q	418m SE	Electricity Substation	1998	88687
Q	418m SE	Electricity Substation	1993	88687
Q	418m SE	Electricity Substation	1996	88687
Q	421m SE	Electricity Substation	1976	67151
Q	424m SE	Electricity Substation	1998	89867
Q	425m SE	Electricity Substation	1996	82656
T	437m S	Electricity Substation	1996	79237
T	449m S	Electricity Substation	1995	74412
T	449m S	Electricity Substation	1998	74412
J	471m SE	Electricity Substation	1995	75355
J	471m SE	Electricity Substation	1998	75355
J	471m SE	Electricity Substation	1996	75233

This data is sourced from Ordnance Survey / Groundsure.

2.4 Historical petrol stations

Records within 500m	0

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

This data is sourced from Ordnance Survey / Groundsure.

2.5 Historical garages

Records within 500m	6

Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 20 >**

ID	Location	Land Use	Date	Group ID
I	297m S	Service Station	1976	22126
I	313m S	Garage	1993	27119
I	321m S	Garage	1990	27424
I	321m S	Garage	1987	27424
U	474m S	Garage	1967	24893
U	474m S	Garage	1976	24893

This data is sourced from Ordnance Survey / Groundsure.

3 Waste and landfill



3.1 Active or recent landfill

Records within 500m	0

Active or recently closed landfill sites under Environment Agency/Natural Resources Wales regulation.

This data is sourced from the Environment Agency and Natural Resources Wales.

3.2 Historical landfill (BGS records)

Records within 500m	0

Landfill sites identified on a survey carried out on behalf of the DoE in 1973. These sites may have been closed or operational at this time.

This data is sourced from the British Geological Survey.

3.3 Historical landfill (LA/mapping records)

Records within 500m	0

Landfill sites identified from Local Authority records and high detail historical mapping.

This data is sourced from the Ordnance Survey/Groundsure and Local Authority records.

3.4 Historical landfill (EA/NRW records)

Records within 500m	0

Known historical (closed) landfill sites (e.g. sites where there is no PPC permit or waste management licence currently in force). This includes sites that existed before the waste licensing regime and sites that have been licensed in the past but where a licence has been revoked, ceased to exist or surrendered and a certificate of completion has been issued.

This data is sourced from the Environment Agency and Natural Resources Wales.

3.5 Historical waste sites

Records within 500m	0

Waste site records derived from Local Authority planning records and high detail historical mapping.

This data is sourced from Ordnance Survey/Groundsure and Local Authority records.

3.6 Licensed waste sites

Records within 500m	0

Active or recently closed waste sites under Environment Agency/Natural Resources Wales regulation.

This data is sourced from the Environment Agency and Natural Resources Wales.

3.7 Waste exemptions

Records within 500m	4

Activities involving the storage, treatment, use or disposal of waste that are exempt from needing a permit. Exemptions have specific limits and conditions that must be adhered to.

Features are displayed on the Waste and landfill map on **page 26 >**

ID	Location	Site	Reference	Category	Sub-Category	Description
1	243m SW	Laing O'rourke Site Office, Hale Top, Melbourne Avenue, Manchester Airport, M90 4af	WEX104525	Treating waste exemption	Not on a farm	Treatment of waste aerosol cans
2	303m SW	-	WEX374338	Using waste exemption	Not on a farm	Use of waste in construction
3	452m SW	-	WEX374339	Using waste exemption	Not on a farm	Use of waste in construction
4	469m E	-	WEX393643	Treating waste exemption	Not on a farm	Sorting and de-naturing of controlled drugs for disposal

This data is sourced from the Environment Agency and Natural Resources Wales.

4 Current industrial land use



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4.1 Recent industrial land uses

Records within 250m **12**

Current potentially contaminative industrial sites.

Features are displayed on the Current industrial land use map on **page 29 >**

ID	Location	Company	Address	Activity	Category
1	**On site**	**Mast**	**Greater Manchester, M90**	**Telecommunications Features**	**Infrastructure and Facilities**
2	10m NE	Mast (Telecommunication)	Greater Manchester, M22	Telecommunications Features	Infrastructure and Facilities

ID	Location	Company	Address	Activity	Category
3	19m NE	Electricity Sub Station	Greater Manchester, M90	Electrical Features	Infrastructure and Facilities
4	120m N	Electricity Sub Station	Greater Manchester, M90	Electrical Features	Infrastructure and Facilities
5	134m NW	Gantry	Greater Manchester, WA15	Travelling Cranes and Gantries	Industrial Features
6	164m S	Swissport Manchester (Man)	Floor 6 6 Voyager House, Level Chicago Avenue, Manchester Airport, Manchester, Greater Manchester, M90 3DQ	Airlines and Airline Services	Transport, Storage and Delivery
7	204m SE	Electricity Sub Station	Greater Manchester, M90	Electrical Features	Infrastructure and Facilities
8	214m S	Electricity Sub Station	Greater Manchester, M90	Electrical Features	Infrastructure and Facilities
9	222m NW	Gantry	Greater Manchester, WA15	Travelling Cranes and Gantries	Industrial Features
B	226m SE	Electricity Sub Station	Greater Manchester, M90	Electrical Features	Infrastructure and Facilities
10	226m S	Electricity Sub Station	Greater Manchester, M90	Electrical Features	Infrastructure and Facilities
11	246m S	I C T S UK Ltd	4m Building, Malaga Avenue, Manchester, Greater Manchester, M90 3RR	Airlines and Airline Services	Transport, Storage and Delivery

This data is sourced from Ordnance Survey.

4.2 National Geographic Database (NGD) - Current or recent tanks

Records within 250m	0

Current or recent tanks identified from the Ordnance Survey NGD.

This data is sourced from Ordnance Survey.

4.3 Current or recent petrol stations

Records within 500m	2

Open, closed, under development and obsolete petrol stations.

Features are displayed on the Current industrial land use map on **page 29 >**

ID	Location	Company	Address	LPG	Status
A	138m SW	UNBRANDED	Palma Avenue, Manchester Airport, Manchester, Greater Manchester, M90 4ZY	Not Applicable	Obsolete
C	395m S	UNBRANDED	30, Outwood Lane, Terminal Road East, Manchester Airport, Manchester, Greater Manchester, M90 3WR	Not Applicable	Obsolete

This data is sourced from Experian.

4.4 Electricity cables

Records within 500m	0

High voltage underground electricity transmission cables.

This data is sourced from National Grid.

4.5 Gas pipelines

Records within 500m	0

High pressure underground gas transmission pipelines.

This data is sourced from National Grid.

4.6 Sites determined as Contaminated Land

Records within 500m	0

Contaminated Land Register of sites designated under Part 2a of the Environmental Protection Act 1990.

This data is sourced from Local Authority records.

4.7 Control of Major Accident Hazards (COMAH)

Records within 500m	0

Control of Major Accident Hazards (COMAH) sites. This data includes upper and lower tier sites, and includes a historical archive of COMAH sites and Notification of Installations Handling Hazardous Substances (NIHHS) records.

This data is sourced from the Health and Safety Executive.

4.8 Regulated explosive sites

Records within 500m	0

Sites registered and licensed by the Health and Safety Executive under the Manufacture and Storage of Explosives Regulations 2005 (MSER). The last update to this data was in April 2011.

This data is sourced from the Health and Safety Executive.

4.9 Hazardous substance storage/usage

Records within 500m	0

Consents granted for a site to hold certain quantities of hazardous substances at or above defined limits in accordance with the Planning (Hazardous Substances) Regulations 2015.

This data is sourced from Local Authority records.

4.10 Historical licensed industrial activities (IPC)

Records within 500m	0

Integrated Pollution Control (IPC) records of substance releases to air, land and water. This data represents a historical archive as the IPC regime has been superseded.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.11 Licensed industrial activities (Part A(1))

Records within 500m	0

Records of Part A(1) installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.12 Licensed pollutant release (Part A(2)/B)

Records within 500m	4

Records of Part A(2) and Part B installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

Features are displayed on the Current industrial land use map on **page 29 >**

ID	Location	Address	Details	
A	134m SW	Airport Terminal 2 Petrol Service Station, Terminal 2 Petrol Stop, Palma Avenue, Manchester International Airport, M90 4ZY	Process: Unloading of Petrol into Storage at Service Stations Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcement Notified Comment: No Enforcement Notified
A	153m SW	Terminal 2 Petrolstop, Palma Avenue, Manchester Airport, M90 4ZY	Process: Unloading of Petrol into Storage at Service Stations Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcement Notified Comment: No Enforcement Notified
C	389m S	Airport Terminal 1 Petrol Service Station, Terminal 1 Petrol Stop, 30 Outwood Lane, Manchester Airport, M90 3WR	Process: Unloading of Petrol into Storage at Service Stations Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcement Notified Comment: No Enforcement Notified
C	394m S	Terminal 1 Petrolstop, 30 Outwood Lane, Manchester Airport, M90 3WR	Process: Unloading of Petrol into Storage at Service Stations Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcement Notified Comment: No Enforcement Notified

This data is sourced from Local Authority records.

4.13 Radioactive Substance Authorisations

Records within 500m	**0**

Records of the storage, use, accumulation and disposal of radioactive substances regulated under the Radioactive Substances Act 1993.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.14 Licensed Discharges to controlled waters

Records within 500m	**3**

Discharges of treated or untreated effluent to controlled waters under the Water Resources Act 1991.

Features are displayed on the Current industrial land use map on **page 29 >**

ID	Location	Address	Details	
B	239m SE	LADBROKE HOTELS DEVELOPMENT STP, EAST OF OUTWOOD LANE, NORTH OF MANCHESTER AIRPORT, GREATER MANCHESTER	Effluent Type: MISCELLANEOUS DISCHARGES - SURFACE WATER Permit Number: 016990612 Permit Version: 1 Receiving Water: PAINSWICK POOL	Status: REVOKED - UNSPECIFIED Issue date: - Effective Date: 16/05/1985 Revocation Date: 01/07/1991
D	486m SE	MANCHESTER AIRPORT: SITE DRAINAGE, AND CONTAINMENT SYSTEM, OLYMPIC HOUSE, OFF THE DOMESTIC APPROACH ROAD, MANCHESTER, M90 1QX	Effluent Type: TRADE DISCHARGES - SITE DRAINAGE Permit Number: EPRCB3299EN Permit Version: 1 Receiving Water: RIVER BOLLIN & NEARBY TRIBS	Status: NEW ISSUED UNDER EPR 2010 Issue date: 30/10/2015 Effective Date: 16/11/2015 Revocation Date: 14/02/2019
D	486m SE	MANCHESTER AIRPORT: SITE DRAINAGE, AND CONTAINMENT SYSTEM, OLYMPIC HOUSE, OFF THE DOMESTIC APPROACH ROAD, MANCHESTER, M90 1QX	Effluent Type: TRADE DISCHARGES - SITE DRAINAGE Permit Number: EPRCB3299EN Permit Version: 2 Receiving Water: RIVER BOLLIN & NEARBY TRIBS	Status: VARIED UNDER EPR 2010 Issue date: 15/02/2019 Effective Date: 15/02/2019 Revocation Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

4.15 Pollutant release to surface waters (Red List)

Records within 500m	0

Discharges of specified substances under the Environmental Protection (Prescribed Processes and Substances) Regulations 1991.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.16 Pollutant release to public sewer

Records within 500m	0

Discharges of Special Category Effluents to the public sewer.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.17 List 1 Dangerous Substances

Records within 500m	0

Discharges of substances identified on List I of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.18 List 2 Dangerous Substances

Records within 500m	0

Discharges of substances identified on List II of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.19 Pollution Incidents (EA/NRW)

Records within 500m	0

Records of substantiated pollution incidents. Since 2006 this data has only included category 1 (major) and 2 (significant) pollution incidents.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.20 Pollution inventory substances

Records within 500m	0

The pollution inventory (substances) includes reporting on annual emissions of certain regulated substances to air, controlled waters and land. A reporting threshold for each substance is also included. Where emissions fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

4.21 Pollution inventory waste transfers

Records within 500m	0

The pollution inventory (waste transfers) includes reporting on annual transfers and recovery/disposal of controlled wastes from a site. A reporting threshold for each waste type is also included. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

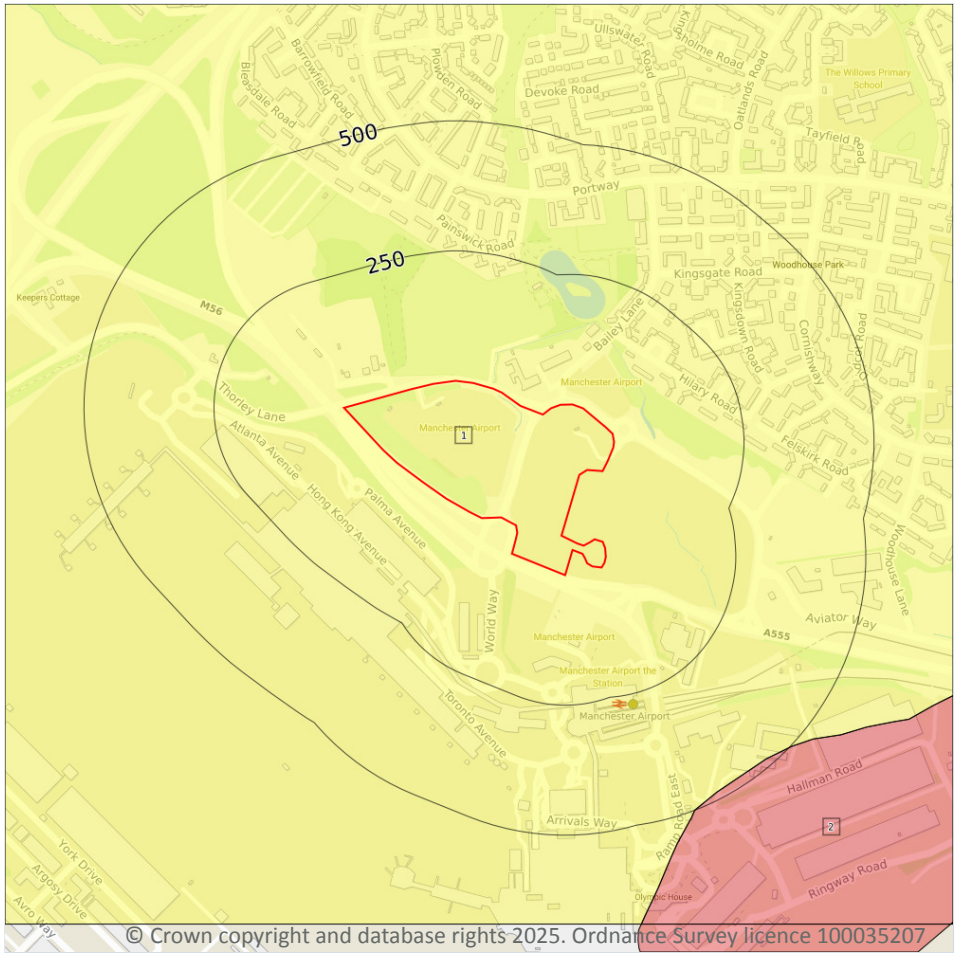
4.22 Pollution inventory radioactive waste

Records within 500m	0

The pollution inventory (radioactive wastes) includes reporting on annual releases of radioactive substances from a site, including the means of release. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

5 Hydrogeology - Superficial aquifer



5.1 Superficial aquifer

Records within 500m	2

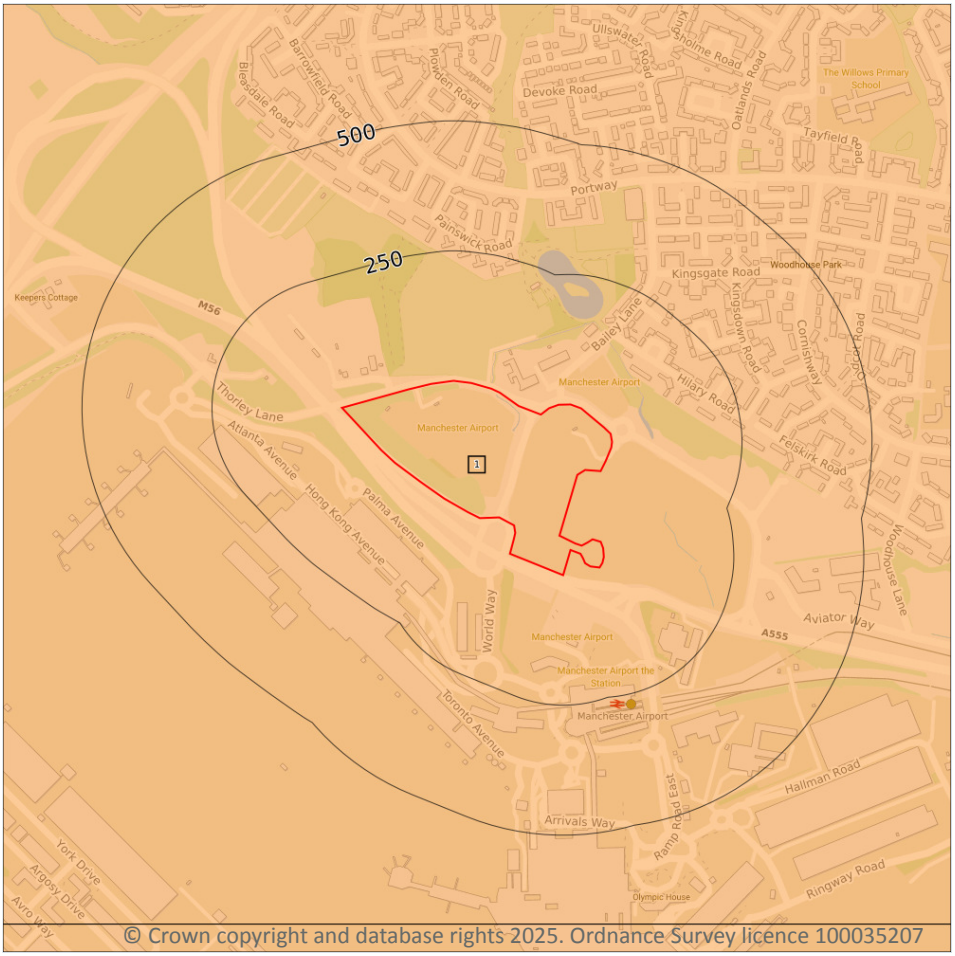
Aquifer status of groundwater held within superficial geology.

Features are displayed on the Hydrogeology map on **page 36 >**

ID	Location	Designation	Description
1	**On site**	**Secondary Undifferentiated**	**Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type**
2	482m SE	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

Bedrock aquifer



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5.2 Bedrock aquifer

Records within 500m	1

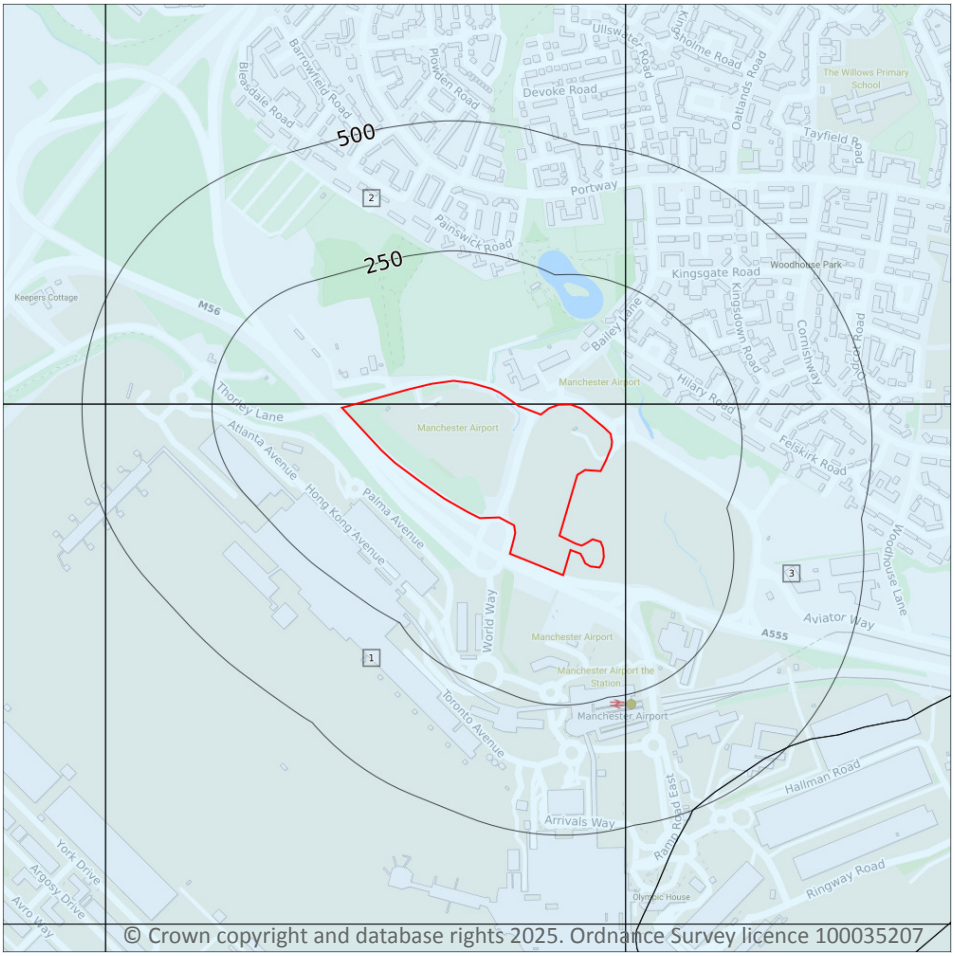
Aquifer status of groundwater held within bedrock geology.

Features are displayed on the Bedrock aquifer map on **page 38 >**

ID	Location	Designation	Description
1	**On site**	**Secondary B**	**Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeablehorizons and weathering. These are generally the water-bearing parts of the former non-aquifers**

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

Groundwater vulnerability



Site Outline

Search buffers in metres (m)

Superficial vulnerability

- Principal superficial aquifer, high vulnerability
- Secondary superficial aquifer, high vulnerability
- Principal superficial aquifer, medium vulnerability
- Secondary superficial aquifer, medium vulnerability
- Principal superficial aquifer, low vulnerability
- Secondary superficial aquifer, low vulnerability

Bedrock vulnerability

- Principal bedrock aquifer, high vulnerability
- Secondary bedrock aquifer, high vulnerability
- Principal bedrock aquifer, medium vulnerability
- Secondary bedrock aquifer, medium vulnerability
- Principal bedrock aquifer, low vulnerability
- Secondary bedrock aquifer, low vulnerability

Other information

- Unproductive aquifer
- Soluble rock risk
- Local information

5.3 Groundwater vulnerability

Records within 50m	3

An assessment of the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a one kilometre square grid. Groundwater vulnerability is described as High, Medium or Low as follows:

- High - Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
- Medium - Intermediate between high and low vulnerability.
- Low - Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

Features are displayed on the Groundwater vulnerability map on **page 39 >**

ID	Location	Summary	Soil / surface	Superficial geology	Bedrock geology
1	**On site**	**Summary Classification: Secondary superficial aquifer - Low Vulnerability Combined classification: Productive Bedrock Aquifer, Productive Superficial Aquifer**	**Leaching class: Low Infiltration value: <40% Dilution value: 300-550mm/year**	**Vulnerability: Low Aquifer type: Secondary Thickness: 3-10m Patchiness value: >90% Recharge potential: Low**	**Vulnerability: Low Aquifer type: Secondary Flow mechanism: Well connected fractures**
2	**On site**	**Summary Classification: Secondary superficial aquifer - Low Vulnerability Combined classification: Productive Bedrock Aquifer, Productive Superficial Aquifer**	**Leaching class: Low Infiltration value: <40% Dilution value: 300-550mm/year**	**Vulnerability: Low Aquifer type: Secondary Thickness: 3-10m Patchiness value: >90% Recharge potential: Low**	**Vulnerability: Low Aquifer type: Secondary Flow mechanism: Well connected fractures**
3	26m E	Summary Classification: Secondary superficial aquifer - Low Vulnerability Combined classification: Productive Bedrock Aquifer, Productive Superficial Aquifer	Leaching class: Low Infiltration value: <40% Dilution value: 300-550mm/year	Vulnerability: Low Aquifer type: Secondary Thickness: 3-10m Patchiness value: >90% Recharge potential: Low	Vulnerability: Low Aquifer type: Secondary Flow mechanism: Well connected fractures

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

5.4 Groundwater vulnerability- soluble rock risk

Records on site	0

This dataset identifies areas where solution features that enable rapid movement of a pollutant may be present within a 1km grid square.

This data is sourced from the British Geological Survey and the Environment Agency.

5.5 Groundwater vulnerability- local information

Records on site	0

This dataset identifies areas where additional local information affecting vulnerability is held by the Environment Agency. Further information can be obtained by contacting the Environment Agency local Area groundwater team through the Environment Agency National Customer Call Centre on 03798 506 506 or by email on enquiries@environment-agency.gov.uk ↗.

This data is sourced from the British Geological Survey and the Environment Agency.

Abstractions and Source Protection Zones



Site Outline

Search buffers in metres (m)

- Source Protection Zone 1 — Inner catchment
- Source Protection Zone 2 — Outer catchment
- Source Protection Zone 3 — Total catchment
- Source Protection Zone 4 — Zone of Special Interest
- Source Protection Zone 1c — Inner catchment - confined aquifer
- Source Protection Zone 2c — Outer catchment - confined aquifer
- Source Protection Zone 3c — Total catchment - confined aquifer
- Drinking water abstraction licences
- Drinking water abstraction licences — Polygon features
- Drinking water abstraction licences — Linear features
- Groundwater abstraction licence (point)
- Groundwater abstraction licence (area)
- Groundwater abstraction licence (linear)
- Surface Water Abstractions (point)
- Surface Water Abstractions (area)
- Surface Water Abstractions (linear)

5.6 Groundwater abstractions

Records within 2000m	0

Licensed groundwater abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, between two points (line data) or a larger area.

This data is sourced from the Environment Agency and Natural Resources Wales.

5.7 Surface water abstractions

Records within 2000m	5

Licensed surface water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on **page 41 >**

ID	Location	Details	
-	1923m W	Status: Historical Licence No: 2569017036/R1 Details: Spray Irrigation - Direct Direct Source: Surface, Non-Tidal - North West Region Point: UNDERGROUND STORAGE TANK FED BY LOCAL SURFACE DRAINAGE Data Type: Point Name: RINGWAY GOLF CLUB LIMITED Easting: 379536 Northing: 386114	Annual Volume (m^3): 5000 Max Daily Volume (m^3): 71.5 Original Application No: - Original Start Date: 28/04/2004 Expiry Date: 31/03/2018 Issue No: 1 Version Start Date: 28/04/2004 Version End Date: -
-	1923m W	Status: Historical Licence No: 2569017036/R02 Details: Spray Irrigation - Direct Direct Source: Surface, Non-Tidal - North West Region Point: UNDERGROUND STORAGE TANK FED BY LOCAL SURFACE DRAINAGE Data Type: Point Name: RINGWAY GOLF CLUB LIMITED Easting: 379536 Northing: 386114	Annual Volume (m^3): 5000 Max Daily Volume (m^3): 60 Original Application No: NPS/WR/020466 Original Start Date: 01/04/2018 Expiry Date: 31/03/2030 Issue No: 1 Version Start Date: 01/04/2018 Version End Date: -
-	1958m W	Status: Historical Licence No: 2569017036 Details: Spray Irrigation - Direct Direct Source: Surface, Non-Tidal - North West Region Point: UNDERGROUND STORAGE TANK FED BY LOCAL SURFACE DRAINAGE Data Type: Point Name: THE SECRETARY Easting: 379500 Northing: 386100	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 13/07/1999 Expiry Date: 12/07/2004 Issue No: 1 Version Start Date: 13/07/1999 Version End Date: -

ID	Location	Details	
-	1958m W	Status: Historical Licence No: 2569017036/R1 Details: Spray Irrigation - Direct Direct Source: Surface, Non-Tidal - North West Region Point: UNDERGROUND STORAGE TANK FED BY LOCAL SURFACE DRAINAGE Data Type: Point Name: RINGWAY GOLF CLUB LIMITED Easting: 379500 Northing: 386100	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 28/04/2004 Expiry Date: 31/03/2018 Issue No: 1 Version Start Date: 28/04/2004 Version End Date: -
-	1958m W	Status: Historical Licence No: 2569017036/R1 Details: Spray Irrigation - Direct Direct Source: Surface, Non-Tidal - North West Region Point: UNDERGROUND STORAGE TANK FED BY LOCAL SURFACE DRAINAGE Data Type: Point Name: RINGWAY GOLF CLUB LIMITED Easting: 379500 Northing: 386100	Annual Volume (m^3): 5000 Max Daily Volume (m^3): 71.5 Original Application No: - Original Start Date: 28/04/2004 Expiry Date: 31/03/2018 Issue No: 1 Version Start Date: 28/04/2004 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

5.8 Potable abstractions

Records within 2000m	**0**

Licensed potable water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

This data is sourced from the Environment Agency and Natural Resources Wales.

5.9 Source Protection Zones

Records within 500m	**0**

Source Protection Zones define the sensitivity of an area around a potable abstraction site to contamination.

This data is sourced from the Environment Agency and Natural Resources Wales.

5.10 Source Protection Zones (confined aquifer)

Records within 500m	0

Source Protection Zones in the confined aquifer define the sensitivity around a deep groundwater abstraction to contamination. A confined aquifer would normally be protected from contamination by overlying geology and is only considered a sensitive resource if deep excavation/drilling is taking place.

This data is sourced from the Environment Agency and Natural Resources Wales.

6 Hydrology



Site Outline

Search buffers in metres (m)

Water Network (OS MasterMap)

Surface water features (wider than 5m)

Surface water features (narrower than 5m)

WFD River, canal and surface water transfer water bodies

WFD Lake water bodies

WFD Transitional and coastal water bodies

WFD Surface water body catchments boundaries

WFD Groundwater body boundaries

6.1 Water Network (OS MasterMap)

Records within 250m	**16**

Detailed water network of Great Britain showing the flow and precise central course of every river, stream, lake and canal.

Features are displayed on the Hydrology map on **page 45 >**

ID	Location	Type of water feature	Ground level	Permanence	Name
1	**On site**	**Inland river not influenced by normal tidal action.**	**Underground**	**Watercourse contains water year round (in normal circumstances)**	**-**

ID	Location	Type of water feature	Ground level	Permanence	Name
A	**On site**	**Inland river not influenced by normal tidal action.**	**On ground surface**	**Watercourse contains water year round (in normal circumstances)**	**-**
B	9m N	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-
C	68m NE	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	Baguley Brook
5	79m E	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	Baguley Brook
6	97m W	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	Fairywell Brook
7	98m E	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	Baguley Brook
D	128m E	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	Baguley Brook
E	138m NE	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	Baguley Brook
E	147m N	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	Baguley Brook
F	158m N	Lake, loch or reservoir.	On ground surface	Watercourse contains water year round (in normal circumstances)	Baguley Brook
G	179m E	Inland river not influenced by normal tidal action.	Underground	Watercourse contains water year round (in normal circumstances)	Baguley Brook
G	186m E	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	Baguley Brook
G	224m E	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-

ID	Location	Type of water feature	Ground level	Permanence	Name
G	224m E	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	Baguley Brook
8	226m E	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-

This data is sourced from the Ordnance Survey.

6.2 Surface water features

Records within 250m	**7**

Covering rivers, streams and lakes (some overlap with OS MasterMap Water Network data in previous section) but additionally covers smaller features such as ponds. Rivers and streams narrower than 5m are represented as a single line. Lakes, ponds and rivers or streams wider than 5m are represented as polygons.

Features are displayed on the Hydrology map on **page 45 >**

This data is sourced from the Ordnance Survey.

6.3 WFD Surface water body catchments

Records on site	**1**

The Water Framework Directive is an EU-led framework for the protection of inland surface waters, estuaries, coastal waters and groundwater through river basin-level management planning. In terms of surface water, these basins are broken down into smaller units known as management, operational and water body catchments.

Features are displayed on the Hydrology map on **page 45 >**

ID	Location	Type	Water body catchment	Water body ID	Operational catchment	Management catchment
2	**On site**	**River**	**Sinderland Brook (Fairywell Bk and Baguley Bk)**	**GB112069061270**	**Bollin Dean Mersey Upper**	**Mersey Upper**

This data is sourced from the Environment Agency and Natural Resources Wales.

6.4 WFD Surface water bodies

Records identified	1

Surface water bodies under the Directive may be rivers, lakes, estuary or coastal. To achieve the purpose of the Directive, environmental objectives have been set and are reported on for each water body. The progress towards delivery of the objectives is then reported on by the relevant competent authorities at the end of each six-year cycle. The river water body directly associated with the catchment listed in the previous section is detailed below, along with any lake, canal, coastal or artificial water body within 250m of the site. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each water body listed.

Features are displayed on the Hydrology map on **page 45 >**

ID	Location	Type	Name	Water body ID	Overall rating	Chemical rating	Ecological rating	Year
10	286m NE	River	Sinderland Brook (Fairywell Bk and Baguley Bk)	GB112069061270 ↗	Moderate	Fail	Moderate	2019

This data is sourced from the Environment Agency and Natural Resources Wales.

6.5 WFD Groundwater bodies

Records on site	1

Groundwater bodies are also covered by the Directive and the same regime of objectives and reporting detailed in the previous section is in place. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each groundwater body listed.

Features are displayed on the Hydrology map on **page 45 >**

ID	Location	Name	Water body ID	Overall rating	Chemical rating	Quantitative	Year
3	**On site**	**Weaver and Dane Quaternary Sand and Gravel Aquifers**	**GB41202G991700 ↗**	**Poor**	**Poor**	**Good**	**2019**

This data is sourced from the Environment Agency and Natural Resources Wales.

7 River and coastal flooding

7.1 Risk of flooding from rivers and the sea

Records within 50m	0

The chance of flooding from rivers and/or the sea in any given year, based on cells of 50m within the Risk of Flooding from Rivers and Sea (RoFRaS)/Flood Risk Assessment Wales (FRAW) models. Each cell is allocated one of four flood risk categories, taking into account flood defences and their condition. The risk categories for RoFRaS for rivers and the sea and FRAW for rivers are; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 100 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 100 chance) or High (greater than or equal to 1 in 30 chance). The risk categories for FRAW for the sea are; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 200 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 200 chance) or High (greater than or equal to 1 in 30 chance).

This data is sourced from the Environment Agency and Natural Resources Wales.

7.2 Historical Flood Events

Records within 250m	0

Records of historic flooding from rivers, the sea, groundwater and surface water. Records began in 1946 when predecessor bodies started collecting detailed information about flooding incidents, although limited details may be included on flooding incidents prior to this date. Takes into account the presence of defences, structures, and other infrastructure where they existed at the time of flooding, and includes flood extents that may have been affected by overtopping, breaches or blockages.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.3 Flood Defences

Records within 250m	0

Records of flood defences owned, managed or inspected by the Environment Agency and Natural Resources Wales. Flood defences can be structures, buildings or parts of buildings. Typically these are earth banks, stone and concrete walls, or sheet-piling that is used to prevent or control the extent of flooding.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.4 Areas Benefiting from Flood Defences

Records within 250m	0

Areas that would benefit from the presence of flood defences in a 1 in 100 (1%) chance of flooding each year from rivers or 1 in 200 (0.5%) chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.5 Flood Storage Areas

Records within 250m	0

Areas that act as a balancing reservoir, storage basin or balancing pond to attenuate an incoming flood peak to a flow level that can be accepted by the downstream channel or to delay the timing of a flood peak so that its volume is discharged over a longer period.

This data is sourced from the Environment Agency and Natural Resources Wales.

River and coastal flooding - Flood Zones



Site Outline

Search buffers in metres (m)

Flood zone 2

Flood zone 3

7.6 Flood Zone 2

Records within 50m	1

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land between Flood Zone 3 (see next section) and the extent of the flooding from rivers or the sea with a 1 in 1000 (0.1%) chance of flooding each year.

Features are displayed on the River and coastal flooding map on **page 49 >**

Location	Type
31m W	Zone 2 - (Fluvial /Tidal Models)

This data is sourced from the Environment Agency and Natural Resources Wales.

7.7 Flood Zone 3

Records within 50m	0

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land with a 1 in 100 (1%) or greater chance of flooding each year from rivers or a 1 in 200 (0.5%) or greater chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.

8 Surface water flooding



Site Outline

Search buffers in metres (m)

1 in 1000 return period
- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 250 return period
- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 100 return period
- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 30 return period
- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

8.1 Surface water flooding

Highest risk on site	**1 in 30 year, 0.3m - 1.0m**
Highest risk within 50m	**1 in 30 year, 0.3m - 1.0m**

Ambiental Risk Analytics surface water (pluvial) FloodMap identifies areas likely to flood as a result of extreme rainfall events, i.e. land naturally vulnerable to surface water ponding or flooding. This data set was produced by simulating 1 in 30 year, 1 in 100 year, 1 in 250 year and 1 in 1,000 year rainfall events. Modern urban drainage systems are typically built to cope with rainfall events between 1 in 20 and 1 in 30 years, though some older ones may flood in a 1 in 5 year rainfall event.

Features are displayed on the Surface water flooding map on **page 53 >**

The data shown on the map and in the table above shows the highest likelihood of flood events happening at the site. Lower likelihood events may have greater flood depths and hence a greater potential impact on a site.

The table below shows the maximum flood depths for a range of return periods for the site.

Return period	Maximum modelled depth
1 in 1000 year	Greater than 1.0m
1 in 250 year	Greater than 1.0m
1 in 100 year	Greater than 1.0m
1 in 30 year	Between 0.3m and 1.0m

This data is sourced from Ambiental Risk Analytics.

9 Groundwater flooding



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9.1 Groundwater flooding

Highest risk on site	**Low**
Highest risk within 50m	**Low**

Groundwater flooding is caused by unusually high groundwater levels. It occurs when the water table rises above the ground surface or within underground structures such as basements or cellars. Groundwater flooding tends to exhibit a longer duration than surface water flooding, possibly lasting for weeks or months, and as a result it can cause significant damage to property. This risk assessment is based on a 1 in 100 year return period and a 5m Digital Terrain Model (DTM).

Features are displayed on the Groundwater flooding map on **page 55 >**

This data is sourced from Ambiental Risk Analytics.

10 Environmental designations



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Site Outline

Search buffers in metres (m)

Sites of Special Scientific Interest (SSSI)

Designated Ancient Woodland

Green Belt

10.1 Sites of Special Scientific Interest (SSSI)

Records within 2000m	2

Sites providing statutory protection for the best examples of UK flora, fauna, or geological or physiographical features. Originally notified under the National Parks and Access to the Countryside Act 1949, SSSIs were re-notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs were introduced by the Countryside and Rights of Way Act 2000 (in England and Wales) and (in Scotland) by the Nature Conservation (Scotland) Act 2004 and the Wildlife and Natural Environment (Scotland) Act 2010.

Features are displayed on the Environmental designations map on **page 56 >**

ID	Location	Name	Data source
A	1575m SW	Cotteril Clough SSSI	Natural England

ID	Location	Name	Data source
-	1996m SW	Cotteril Clough SSSI	Natural England

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.2 Conserved wetland sites (Ramsar sites)

Records within 2000m	0

Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. They cover all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities. These sites cover a broad definition of wetland; marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, and even some marine areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.3 Special Areas of Conservation (SAC)

Records within 2000m	0

Areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.4 Special Protection Areas (SPA)

Records within 2000m	0

Sites classified by the UK Government under the EC Birds Directive, SPAs are areas of the most important habitat for rare (listed on Annex I to the Directive) and migratory birds within the European Union.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.5 National Nature Reserves (NNR)

Records within 2000m	0

Sites containing examples of some of the most important natural and semi-natural terrestrial and coastal ecosystems in Great Britain. They are managed to conserve their habitats, provide special opportunities for scientific study or to provide public recreation compatible with natural heritage interests.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.6 Local Nature Reserves (LNR)

Records within 2000m	0

Sites managed for nature conservation, and to provide opportunities for research and education, or simply enjoying and having contact with nature. They are declared by local authorities under the National Parks and Access to the Countryside Act 1949 after consultation with the relevant statutory nature conservation agency.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.7 Designated Ancient Woodland

Records within 2000m	4

Ancient woodlands are classified as areas which have been wooded continuously since at least 1600 AD. This includes semi-natural woodland and plantations on ancient woodland sites. 'Wooded continuously' does not mean there is or has previously been continuous tree cover across the whole site, and not all trees within the woodland have to be old.

Features are displayed on the Environmental designations map on **page 56 >**

ID	Location	Name	Woodland Type
2	860m W	Davenport Green Wood	Ancient & Semi-Natural Woodland
A	1372m SW	Cotterill Clough	Ancient & Semi-Natural Woodland
5	1824m SW	Sunbank Wood	Ancient & Semi-Natural Woodland
-	1996m SW	Cotterill Clough	Ancient & Semi-Natural Woodland

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.8 Biosphere Reserves

Records within 2000m	0

Biosphere Reserves are internationally recognised by UNESCO as sites of excellence to balance conservation and socioeconomic development between nature and people. They are recognised under the Man and the Biosphere (MAB) Programme with the aim of promoting sustainable development founded on the work of the local community.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.9 Forest Parks

Records within 2000m	0

These are areas managed by the Forestry Commission designated on the basis of recreational, conservation or scenic interest.

This data is sourced from the Forestry Commission.

10.10 Marine Conservation Zones

Records within 2000m	0

A type of marine nature reserve in UK waters established under the Marine and Coastal Access Act (2009). They are designated with the aim to protect nationally important, rare or threatened habitats and species.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.11 Green Belt

Records within 2000m	4

Areas designated to prevent urban sprawl by keeping land permanently open.

Features are displayed on the Environmental designations map on **page 56 >**

ID	Location	Name	Local Authority name
1	776m W	Merseyside and Greater Manchester Green Belt	Trafford
3	949m SE	Merseyside and Greater Manchester Green Belt	Manchester
4	1300m SE	Merseyside and Greater Manchester Green Belt	Cheshire East
-	1831m E	Merseyside and Greater Manchester Green Belt	Manchester

This data is sourced from the Ministry of Housing, Communities and Local Government.

10.12 Proposed Ramsar sites

Records within 2000m	0

Ramsar sites are areas listed as a Wetland of International Importance under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention) 1971. The sites here supplied have a status of 'Proposed' having been identified for potential adoption under the framework.

This data is sourced from Natural England.

10.13 Possible Special Areas of Conservation (pSAC)

Records within 2000m	0

Special Areas of Conservation are areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive. Those sites supplied here are those with a status of 'Possible' having been identified for potential adoption under the framework.

This data is sourced from Natural England and Natural Resources Wales.

10.14 Potential Special Protection Areas (pSPA)

Records within 2000m	0

Special Protection Areas (SPAs) are areas designated (or 'classified') under the European Union Wild Birds Directive for the protection of nationally and internationally important populations of wild birds. Those sites supplied here are those with a status of 'Potential' having been identified for potential adoption under the framework.

This data is sourced from Natural England.

10.15 Nitrate Sensitive Areas

Records within 2000m	0

Areas where nitrate concentrations in drinking water sources exceeded or was at risk of exceeding the limit of 50 mg/l set by the 1980 EC Drinking Water Directive. Voluntary agricultural measures as a means of reducing the levels of nitrate were introduced by DEFRA as MAFF, with payments being made to farmers who complied. The scheme was started as a pilot in 1990 in ten areas, later implemented within 32 areas. The scheme was closed to further new entrants in 1998, although existing agreements continued for their full term. All Nitrate Sensitive Areas fell within the areas designated as Nitrate Vulnerable Zones (NVZs) in 1996 under the EC Nitrate Directive (91/676/EEC).

This data is sourced from Natural England.

10.16 Nitrate Vulnerable Zones

Records within 2000m	0

Areas at risk from agricultural nitrate pollution designated under the EC Nitrate Directive (91/676/EEC). These are areas of land that drain into waters polluted by nitrates. Farmers operating within these areas have to follow mandatory rules to tackle nitrate loss from agriculture.

This data is sourced from Natural England and Natural Resources Wales.

SSSI Impact Zones and Units



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Site Outline

Search buffers in metres (m)

SSSI Impact Risk Zones

SSSI Units

- Not recorded
- Favourable
- Unfavourable - Recovering
- Unfavourable - No change
- Unfavourable - Declining
- Partially destroyed
- Destroyed

10.17 SSSI Impact Risk Zones

Records on site	0

Developed to allow rapid initial assessment of the potential risks to SSSIs posed by development proposals. They define zones around each SSSI which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts.

This data is sourced from Natural England.

10.18 SSSI Units

Records within 2000m	2

Divisions of SSSIs used to record management and condition details. Units are the smallest areas for which Natural England gives a condition assessment, however, the size of units varies greatly depending on the types of management and the conservation interest.

Features are displayed on the SSSI Impact Zones and Units map on **page 61 >**

ID: 1
Location: 1575m SW
SSSI name: Cotteril Clough
Unit name: Eastern Woodland
Broad habitat: Broadleaved, Mixed And Yew Woodland - Lowland
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Lowland mixed deciduous woodland	Favourable	13/06/2013
Wet woodland	Favourable	13/06/2013

ID: -
Location: 1996m SW
SSSI name: Cotteril Clough
Unit name: Western Woodland
Broad habitat: Broadleaved, Mixed And Yew Woodland - Lowland
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Lowland mixed deciduous woodland	Favourable	30/05/2014
Wet woodland	Favourable	30/05/2014

This data is sourced from Natural England and Natural Resources Wales.

11 Visual and cultural designations



Site Outline

Search buffers in metres (m)

- Listed buildings
- Conservation areas
- Conservation areas - no data
- National Parks
- Areas of Outstanding Natural Beauty
- Registered parks and gardens
- Scheduled Monuments
- World Heritage Sites

11.1 World Heritage Sites

Records within 250m	0

Sites designated for their globally important cultural or natural interest requiring appropriate management and protection measures. World Heritage Sites are designated to meet the UK's commitments under the World Heritage Convention.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.2 Area of Outstanding Natural Beauty

Records within 250m	0

Areas of Outstanding Natural Beauty (AONB) are conservation areas, chosen because they represent 18% of the finest countryside. Each AONB has been designated for special attention because of the quality of their flora, fauna, historical and cultural associations, and/or scenic views. The National Parks and Access to the Countryside Act of 1949 created AONBs and the Countryside and Rights of Way Act, 2000 added further regulation and protection. There are likely to be restrictions to some developments within these areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

11.3 National Parks

Records within 250m	0

In England and Wales, the purpose of National Parks is to conserve and enhance landscapes within the countryside whilst promoting public enjoyment of them and having regard for the social and economic well-being of those living within them. In Scotland National Parks have the additional purpose of promoting the sustainable use of the natural resources of the area and the sustainable social and economic development of its communities. The National Parks and Access to the Countryside Act 1949 established the National Park designation in England and Wales, and The National Parks (Scotland) Act 2000 in Scotland.

This data is sourced from Natural England, Natural Resources Wales and the Scottish Government.

11.4 Listed Buildings

Records within 250m	1

Buildings listed for their special architectural or historical interest. Building control in the form of 'listed building consent' is required in order to make any changes to that building which might affect its special interest. Listed buildings are graded to indicate their relative importance, however building controls apply to all buildings equally, irrespective of their grade, and apply to the interior and exterior of the building in its entirety, together with any curtilage structures.

Features are displayed on the Visual and cultural designations map on **page 63 >**

ID	Location	Name	Grade	Reference Number	Listed date
1	34m NE	Etrop Grange	II	1197799	18/12/1963

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.5 Conservation Areas

Records within 250m	0

Local planning authorities are obliged to designate as conservation areas any parts of their own area that are of special architectural or historic interest, the character and appearance of which it is desirable to preserve or enhance. Designation of a conservation area gives broader protection than the listing of individual buildings. All the features within the area, listed or otherwise, are recognised as part of its character. Conservation area designation is the means of recognising the importance of all factors and of ensuring that planning decisions address the quality of the landscape in its broadest sense.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.6 Scheduled Ancient Monuments

Records within 250m	0

A scheduled monument is an historic building or site that is included in the Schedule of Monuments kept by the Secretary of State for Digital, Culture, Media and Sport. The regime is set out in the Ancient Monuments and Archaeological Areas Act 1979. The Schedule of Monuments has c.20,000 entries and includes sites such as Roman remains, burial mounds, castles, bridges, earthworks, the remains of deserted villages and industrial sites. Monuments are not graded, but all are, by definition, considered to be of national importance.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

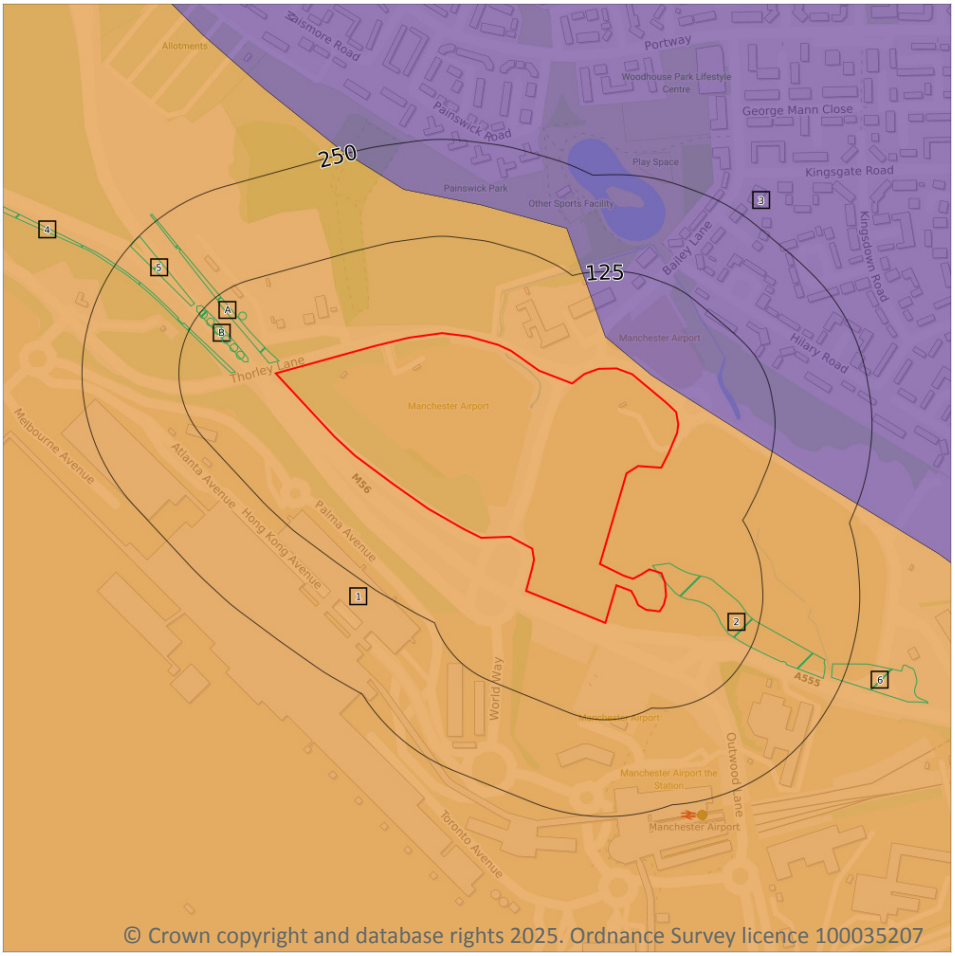
11.7 Registered Parks and Gardens

Records within 250m	0

Parks and gardens assessed to be of particular interest and of special historic interest. The emphasis being on 'designed' landscapes, rather than on planting or botanical importance. Registration is a 'material consideration' in the planning process, meaning that planning authorities must consider the impact of any proposed development on the special character of the landscape.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

12 Agricultural designations



Site Outline

Search buffers in metres (m)

- Grade 1 - excellent quality
- Grade 2 - very good quality
- Grade 3 - good to moderate quality
- Grade 3a - good quality
- Grade 3b - moderate quality
- Grade 4 - poor quality
- Grade 5 - very poor quality
- Non-agricultural land
- Urban land
- Exclusion land
- Tree felling licences
- Open Access land

12.1 Agricultural Land Classification

Records within 250m	2

Classification of the quality of agricultural land taking into consideration multiple factors including climate, physical geography and soil properties. It should be noted that the categories for the grading of agricultural land are not consistent across England, Wales and Scotland.

Features are displayed on the Agricultural designations map on **page 66 >**

ID	Location	Classification	Description
1	**On site**	**Grade 3**	**Good to moderate quality agricultural land. Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.**
3	15m NE	Urban	Non-agricultural/no quality assigned

This data is sourced from Natural England.

12.2 Open Access Land

Records within 250m	0

The Countryside and Rights of Way Act 2000 (CROW Act) gives a public right of access to land without having to use paths. Access land includes mountains, moors, heaths and downs that are privately owned. It also includes common land registered with the local council and some land around the England Coast Path. Generally permitted activities on access land are walking, running, watching wildlife and climbing.

This data is sourced from Natural England and Natural Resources Wales.

12.3 Tree Felling Licences

Records within 250m	13

Felling Licence Application (FLA) areas approved by Forestry Commission England. Anyone wishing to fell trees must ensure that a licence or permission under a grant scheme has been issued by the Forestry Commission before any felling is carried out or that one of the exceptions apply.

Features are displayed on the Agricultural designations map on **page 66 >**

ID	Location	Description	Reference	Application date
2	**On site**	**Selective Fell/Thin (Unconditional)**	**010/223/10-11**	**17/02/2011**
A	14m N	Selective Fell/Thin (Unconditional)	018/366/15-16	-
B	39m W	Selective Fell/Thin (Unconditional)	018/366/15-16	-
B	47m NW	Single Tree	018/366/15-16	-
4	52m W	Selective Fell/Thin (Unconditional)	018/366/15-16	-
B	58m NW	Single Tree	018/366/15-16	-
B	73m NW	Single Tree	018/366/15-16	-
A	81m NW	Single Tree	018/366/15-16	-
B	88m NW	Single Tree	018/366/15-16	-
B	102m NW	Single Tree	018/366/15-16	-
B	115m NW	Single Tree	018/366/15-16	-
5	138m NW	Selective Fell/Thin (Unconditional)	018/366/15-16	-
6	231m E	Selective Fell/Thin (Unconditional)	010/223/10-11	17/02/2011

This data is sourced from the Forestry Commission.

12.4 Environmental Stewardship Schemes

Records within 250m	0

Environmental Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment. The schemes identified may be historical schemes that have now expired, or may still be active.

This data is sourced from Natural England.

12.5 Countryside Stewardship Schemes

Records within 250m	0

Countryside Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment. Main objectives are to improve the farmed environment for wildlife and to reduce diffuse water pollution.

This data is sourced from Natural England.

13 Habitat designations



Site Outline

Search buffers in metres (m)

Priority Habitat Inventory
Open Mosaic Habitat
Limestone Pavement Orders

Habitat Networks

Primary Habitat
Restorable Habitat
Associated Habitats
Habitat Restoration-Creation
Network Enhancement Zone 1
Network Enhancement Zone 2

13.1 Priority Habitat Inventory

Records within 250m	24

Habitats of principal importance as named under Natural Environment and Rural Communities Act (2006) Section 41.

Features are displayed on the Habitat designations map on **page 69 >**

ID	Location	Main Habitat	Other habitats
1	On site	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
2	On site	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
3	On site	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
4	On site	Deciduous woodland	Main habitat: DWOOD (INV > 50%)

ID	Location	Main Habitat	Other habitats
A	**On site**	**Deciduous woodland**	**Main habitat: DWOOD (INV > 50%)**
A	**On site**	**Deciduous woodland**	**Main habitat: DWOOD (INV > 50%)**
5	8m N	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
6	9m E	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
7	17m NE	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
8	21m NW	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
B	27m W	No main habitat but additional habitats present	Additional: DWOOD (INV 50%)
9	37m E	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
10	66m NE	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
11	86m NE	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
12	90m E	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
13	116m N	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
14	127m NE	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
B	131m NW	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
15	139m N	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
16	149m E	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
17	186m E	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
18	187m E	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
19	191m NW	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
20	193m W	Deciduous woodland	Main habitat: DWOOD (INV > 50%)

This data is sourced from Natural England.

13.2 Habitat Networks

Records within 250m	**0**

Habitat networks for 18 priority habitat networks (based primarily, but not exclusively, on the priority habitat inventory) and areas suitable for the expansion of networks through restoration and habitat creation.

This data is sourced from Natural England.

13.3 Open Mosaic Habitat

Records within 250m	0

Sites verified as Open Mosaic Habitat. Mosaic habitats are brownfield sites that are identified under the UK Biodiversity Action Plan as a priority habitat due to the habitat variation within a single site, supporting an array of invertebrates.

This data is sourced from Natural England.

13.4 Limestone Pavement Orders

Records within 250m	0

Limestone pavements are outcrops of limestone where the surface has been worn away by natural means over millennia. These rocks have the appearance of paving blocks, hence their name. Not only do they have geological interest, they also provide valuable habitats for wildlife. These habitats are threatened due to their removal for use in gardens and water features. Many limestone pavements have been designated as SSSIs which affords them some protection. In addition, Section 34 of the Wildlife and Countryside Act 1981 gave them additional protection via the creation of Limestone Pavement Orders, which made it a criminal offence to remove any part of the outcrop. The associated Limestone Pavement Priority Habitat is part of the UK Biodiversity Action Plan priority habitat in England.

This data is sourced from Natural England.

14 Geology 1:10,000 scale - Availability



Site Outline

Search buffers in metres (m)

- Full coverage
- Partial coverage
- No coverage

14.1 10k Availability

Records within 500m	1

An indication on the coverage of 1:10,000 scale geology data for the site, the most detailed dataset provided by the British Geological Survey. Either 'Full', 'Partial' or 'No coverage' for each geological theme.

Features are displayed on the Geology 1:10,000 scale - Availability map on **page 72 >**

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	**On site**	**No coverage**	**Full**	**Full**	**No coverage**	**SJ88NW**

This data is sourced from the British Geological Survey.

Geology 1:10,000 scale - Artificial and made ground

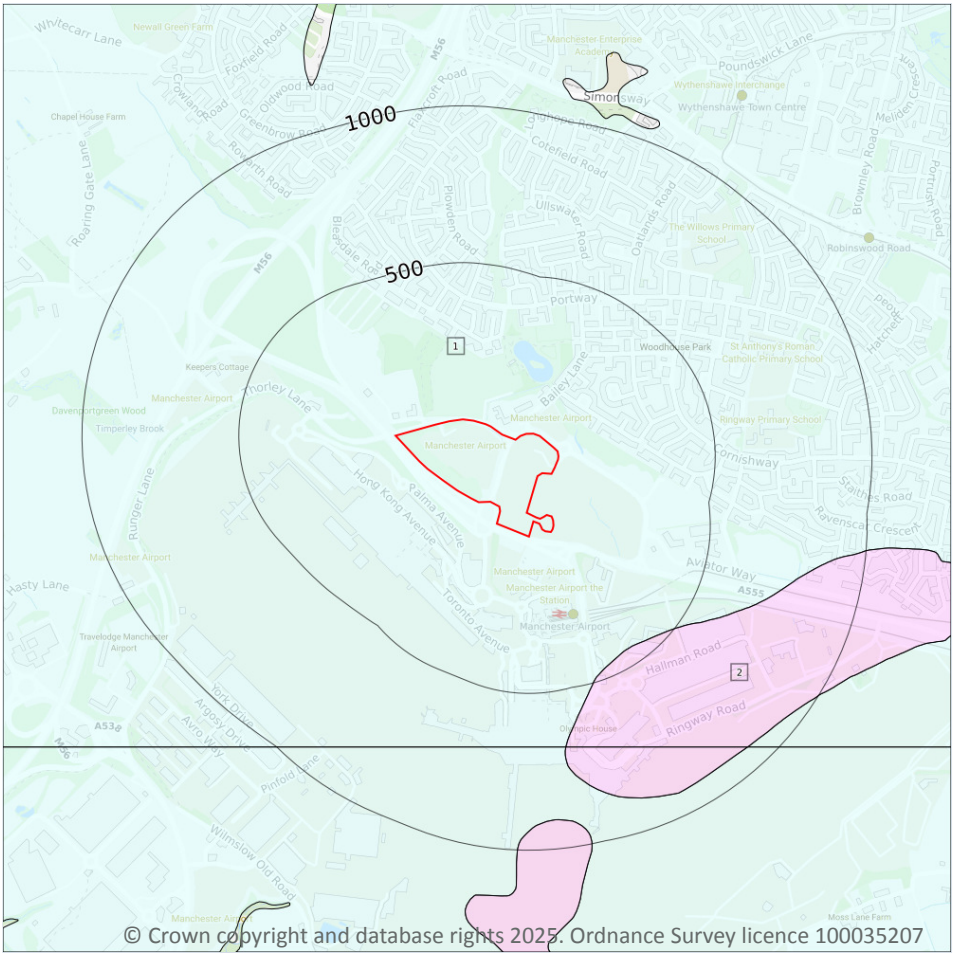
14.2 Artificial and made ground (10k)

Records within 500m	0

Details of made, worked, infilled, disturbed and landscaped ground at 1:10,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

This data is sourced from the British Geological Survey.

Geology 1:10,000 scale - Superficial



Site Outline

Search buffers in metres (m)

Landslip (10k)

Superficial geology (10k)
Please see table for more details.

14.3 Superficial geology (10k)

Records within 500m **2**

Superficial geological deposits at 1:10,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

Features are displayed on the Geology 1:10,000 scale - Superficial map on **page 74 >**

ID	Location	LEX Code	Description	Rock description
1	**On site**	**TILLD-DMTN**	**Till, Devensian - Diamicton**	**Diamicton**
2	446m SE	GFDUD-XSV	Glaciofluvial Deposits, Devensian - Sand And Gravel	Sand And Gravel

This data is sourced from the British Geological Survey.

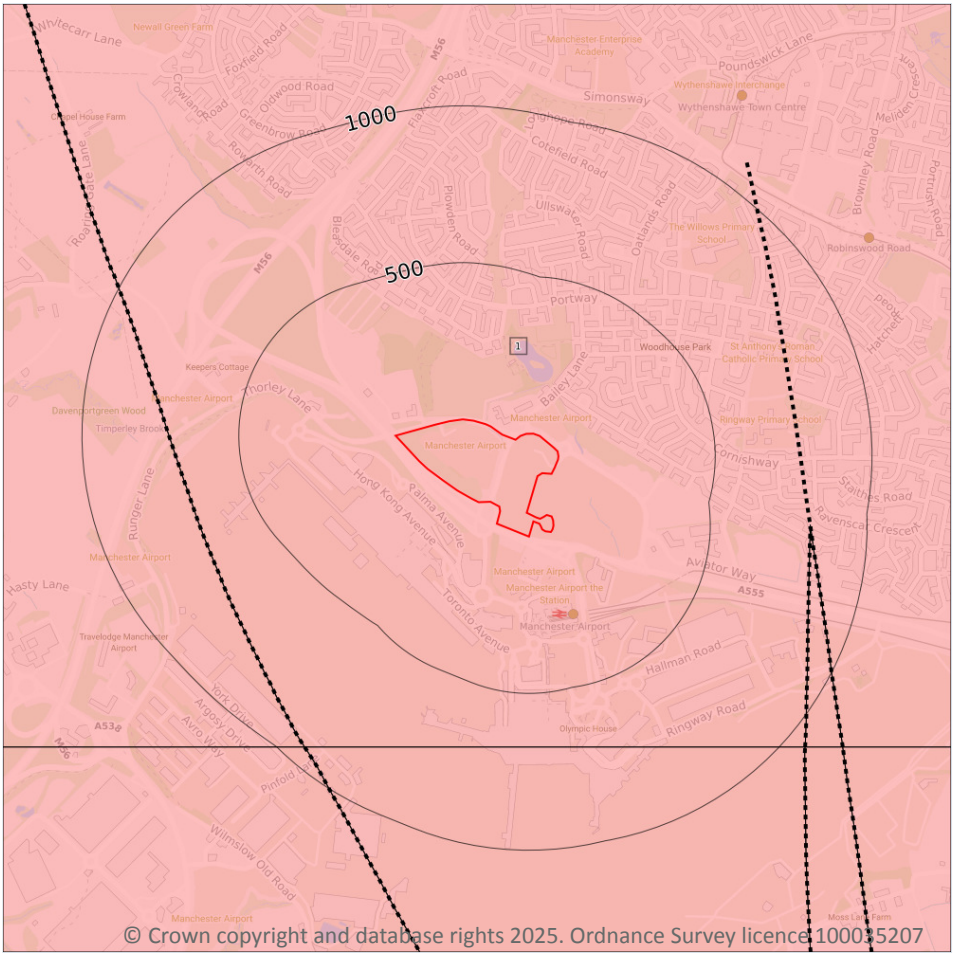
14.4 Landslip (10k)

Records within 500m	0

Mass movement deposits on BGS geological maps at 1:10,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.

Geology 1:10,000 scale - Bedrock



Site Outline

Search buffers in metres (m)

Bedrock faults and other linear features (10k)

Bedrock geology (10k)
Please see table for more details.

14.5 Bedrock geology (10k)

Records within 500m	1

Bedrock geology at 1:10,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:10,000 scale - Bedrock map on **page 76 >**

ID	Location	LEX Code	Description	Rock age
1	**On site**	**BOM-MDST**	**Bollin Mudstone Member - Mudstone**	**Anisian Age**

This data is sourced from the British Geological Survey.

14.6 Bedrock faults and other linear features (10k)

Records within 500m	0

Linear features at the ground or bedrock surface at 1:10,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

This data is sourced from the British Geological Survey.

15 Geology 1:50,000 scale - Availability



Site Outline

Search buffers in metres (m)

Geological map tile

15.1 50k Availability

Records within 500m	1

An indication on the coverage of 1:50,000 scale geology data for the site. Either 'Full' or 'No coverage' for each geological theme.

Features are displayed on the Geology 1:50,000 scale - Availability map on page 78 >

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	On site	No coverage	Full	Full	Full	EW098_stockport_v4

This data is sourced from the British Geological Survey.

Geology 1:50,000 scale - Artificial and made ground

15.2 Artificial and made ground (50k)

Records within 500m	0

Details of made, worked, infilled, disturbed and landscaped ground at 1:50,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

This data is sourced from the British Geological Survey.

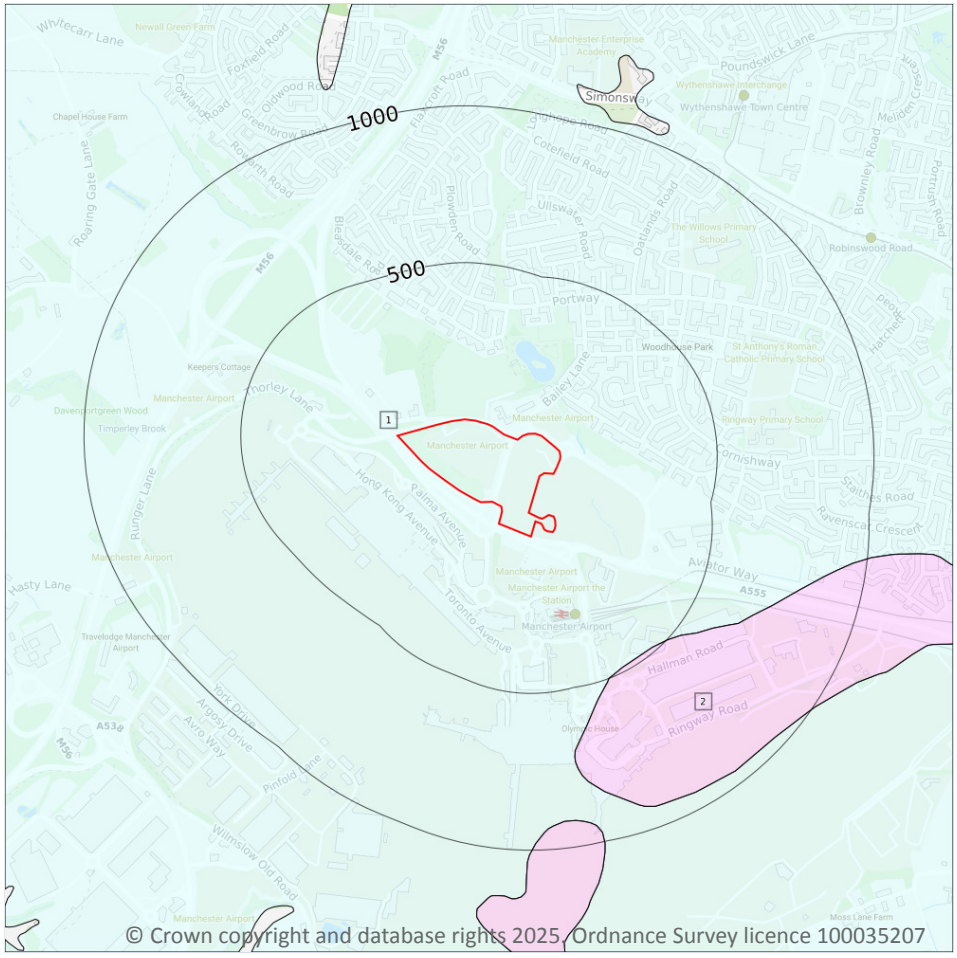
15.3 Artificial ground permeability (50k)

Records within 50m	0

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any artificial deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.

Geology 1:50,000 scale - Superficial



Site Outline

Search buffers in metres (m)

Landslip (50k)

Superficial geology (50k)
Please see table for more details.

15.4 Superficial geology (50k)

Records within 500m	2

Superficial geological deposits at 1:50,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

Features are displayed on the Geology 1:50,000 scale - Superficial map on **page 80 >**

ID	Location	LEX Code	Description	Rock description
1	**On site**	**TILLD-DMTN**	**TILL, DEVENSIAN**	**DIAMICTON**
2	482m SE	GFDUD-XSV	GLACIOFLUVIAL DEPOSITS, DEVENSIAN	SAND AND GRAVEL

This data is sourced from the British Geological Survey.

15.5 Superficial permeability (50k)

Records within 50m	1

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any superficial deposits (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	**Mixed**	**High**	**Low**

This data is sourced from the British Geological Survey.

15.6 Landslip (50k)

Records within 500m	0

Mass movement deposits on BGS geological maps at 1:50,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.

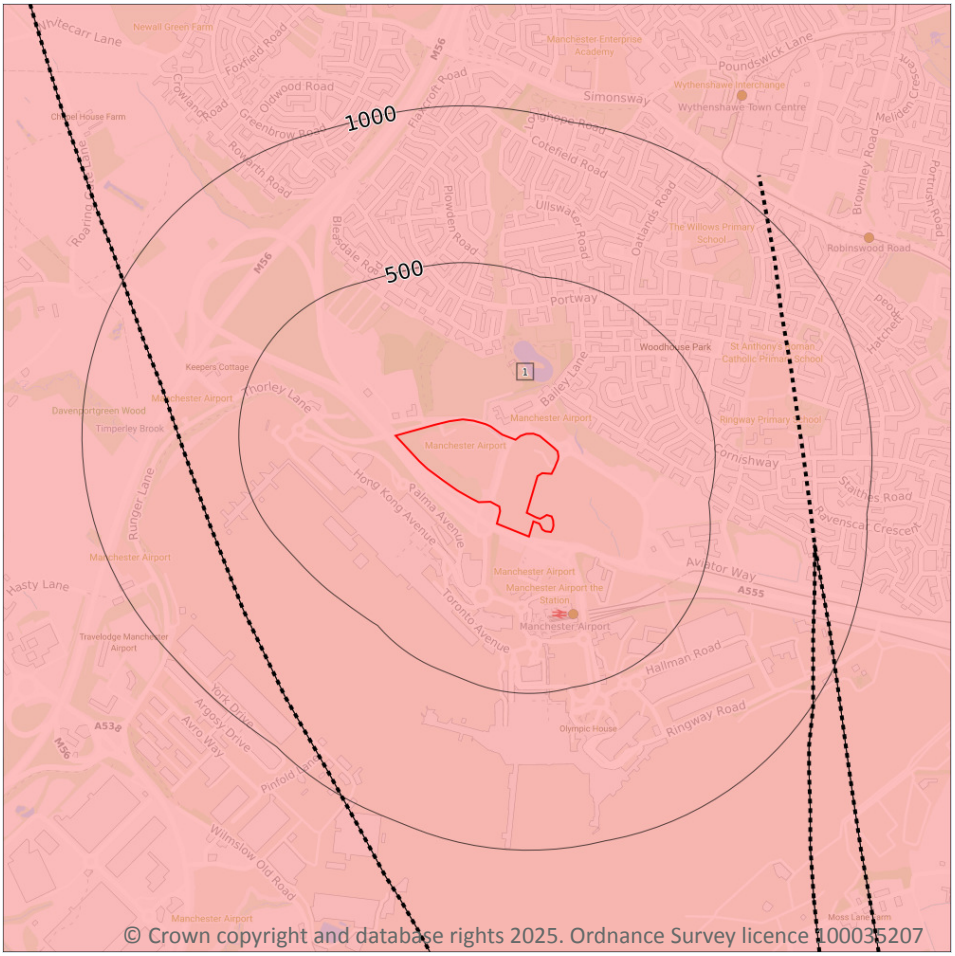
15.7 Landslip permeability (50k)

Records within 50m	0

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any landslip deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.

Geology 1:50,000 scale - Bedrock



Site Outline

Search buffers in metres (m)

Bedrock faults and other linear features (50k)

Bedrock geology (50k)
Please see table for more details.

15.8 Bedrock geology (50k)

Records within 500m	1

Bedrock geology at 1:50,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:50,000 scale - Bedrock map on **page 82 >**

ID	Location	LEX Code	Description	Rock age
1	**On site**	**BOM-MDST**	**BOLLIN MUDSTONE MEMBER - MUDSTONE**	**ANISIAN**

This data is sourced from the British Geological Survey.

15.9 Bedrock permeability (50k)

Records within 50m	1

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of bedrock (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	**Fracture**	**Low**	**Low**

This data is sourced from the British Geological Survey.

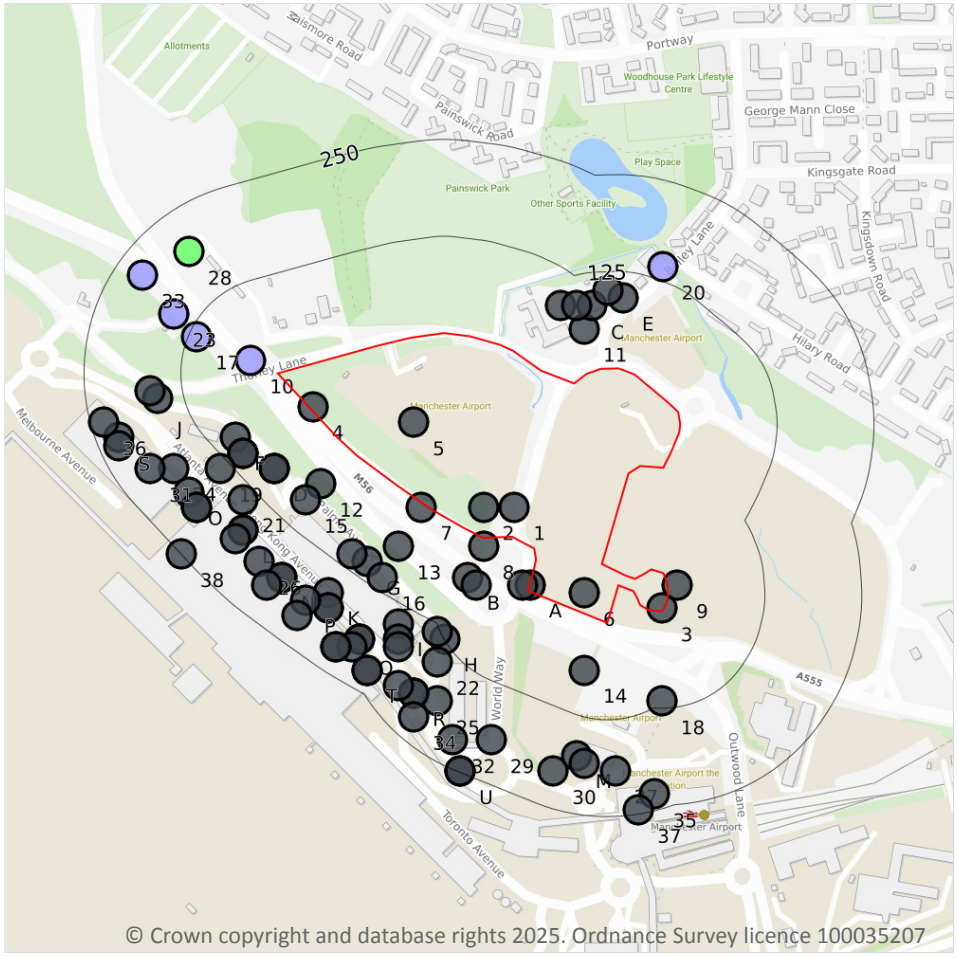
15.10 Bedrock faults and other linear features (50k)

Records within 500m	0

Linear features at the ground or bedrock surface at 1:50,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

This data is sourced from the British Geological Survey.

16 Boreholes



16.1 BGS Boreholes

Records within 250m	91

The Single Onshore Boreholes Index (SOBI); an index of over one million records of boreholes, shafts and wells from all forms of drilling and site investigation work held by the British Geological Survey. Covering onshore and nearshore boreholes dating back to at least 1790 and ranging from one to several thousand metres deep.

Features are displayed on the Boreholes map on **page 84 >**

ID	Location	Grid reference	Name	Length	Confidential	Web link
1	On site	381760 385820	AIRPORT ACCESS - STAGE 2 M3	-	Y	N/A
2	On site	381720 385820	SECOND TERMINAL, MANCHESTER AIRPORT 21	-	Y	N/A
3	On site	381950 385690	SECOND TERMINAL, MANCHESTER AIRPORT 25	-	Y	N/A

ID	Location	Grid reference	Name	Length	Confidential	Web link
4	**On site**	**381500 385950**	**SECOND PASSENGER TERMINAL, MANCHESTER AIRPORT TP3**	**-**	**Y**	**N/A**
5	**On site**	**381630 385930**	**SECOND PASSENGER TERMINAL MANCHESTER AIRPORT TP7**	**-**	**Y**	**N/A**
6	**On site**	**381850 385710**	**SECOND PASSENGER TERMINAL MANCHESTER AIRPORT TP10**	**-**	**Y**	**N/A**
A	**On site**	**381780 385720**	**SECOND TERMINAL, MANCHESTER AIRPORT R9**	**-**	**Y**	**N/A**
7	5m SW	381640 385820	AIRPORT ACCESS - STAGE 2 M4	-	Y	N/A
A	9m W	381770 385720	SECOND TERMINAL, MANCHESTER AIRPORT 24	-	Y	N/A
8	11m S	381720 385770	AIRPORT ACCESS - STAGE 2 M1	-	Y	N/A
9	13m E	381970 385720	SECOND PASSENGER TERMINAL MANCHESTER AIRPORT TP11	-	Y	N/A
10	39m NW	381420 386010	M56 WIDENING JUNCTIONS 4 - 6 CH22	10.0	N	915590 ↗
B	54m S	381700 385730	AIRPORT ACCESS - STAGE 2 M7	-	Y	N/A
11	56m N	381850 386050	ETROP GREEN 5	-	Y	N/A
12	59m SW	381510 385850	AIRPORT ACCESS - STAGE 2 M6	-	Y	N/A
B	61m S	381710 385720	AIRPORT ACCESS - STAGE 2 M2	-	Y	N/A
13	63m SW	381610 385770	AIRPORT ACCESS - STAGE 2 M5	-	Y	N/A
14	68m S	381850 385610	SECOND TERMINAL, MANCHESTER AIRPORT 26	-	Y	N/A
C	82m N	381860 386080	ETROP GREEN 3	-	Y	N/A
C	83m NE	381820 386080	ETROP GREEN 1	-	Y	N/A
15	87m SW	381490 385830	MHR AIRPORT TERMINAL2 TP2/53T	-	Y	N/A
D	87m SW	381450 385870	MANCHESTER AIRPORT - TERMINAL 2 2/53	-	Y	N/A
D	87m SW	381450 385870	MANCHESTER AIRPORT - TERMINAL 2 2/54	-	Y	N/A
C	87m N	381840 386080	ETROP GREEN 2	-	Y	N/A
E	91m N	381900 386090	ETROP GREEN 6	-	Y	N/A
F	96m SW	381400 385910	MHR AIRPORT TERMINAL2 TP2/52T	-	Y	N/A
E	101m N	381880 386100	ETROP GREEN 4	-	Y	N/A
G	103m SW	381570 385750	MANCHESTER AIRPORT - TERMINAL 2 2/55	-	Y	N/A
F	103m SW	381410 385890	MHR AIRPORT TERMINAL2 BH2/53	-	Y	N/A

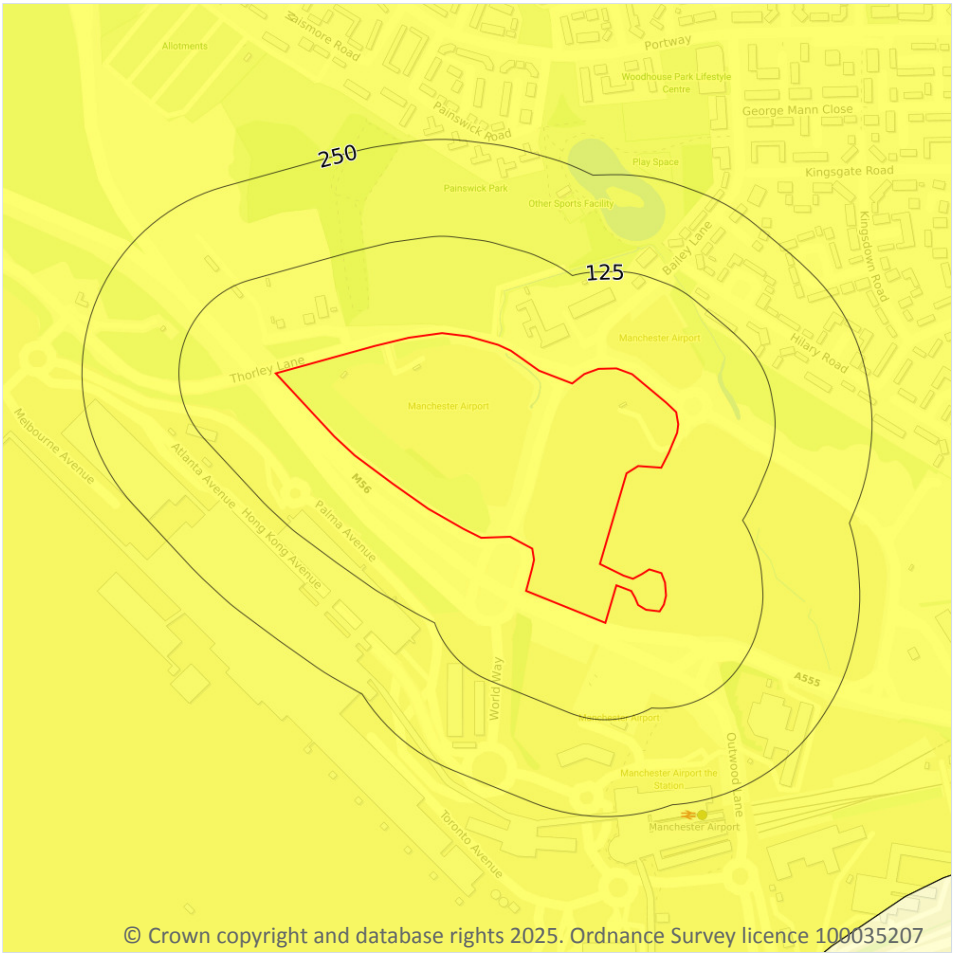
ID	Location	Grid reference	Name	Length	Confidential	Web link
F	103m SW	381410 385890	MHR AIRPORT TERMINAL2 BH2/54	-	Y	N/A
G	106m SW	381550 385760	MHR AIRPORT TERMINAL2 BH2/55	-	Y	N/A
16	107m SW	381590 385730	MHR AIRPORT TERMINAL2 TP2/54T	-	Y	N/A
17	115m NW	381350 386040	M56 WIDENING JUNCTIONS 4 - 6 CH4	9.63	N	915571 ↗
18	116m S	381950 385570	SECOND PASSENGER TERMINAL MANCHESTER AIRPORT TP15	-	Y	N/A
H	124m SW	381670 385650	MANCHESTER AIRPORT - TERMINAL 2 2/56	-	Y	N/A
H	129m SW	381660 385660	MHR AIRPORT TERMINAL2 BH2/56	-	Y	N/A
19	138m SW	381380 385870	SECOND TERMINAL, MANCHESTER AIRPORT 2	-	Y	N/A
20	143m N	381951 386131	NEAR MOSS HOUSE 11	7.92	N	914666 ↗
21	144m SW	381410 385830	SECOND TERMINAL, MANCHESTER AIRPORT R2	-	Y	N/A
I	149m SW	381610 385670	SECOND PASSENGER TERMINAL MANCHESTER AIRPORT TP9	-	Y	N/A
22	150m SW	381660 385620	MHR AIRPORT TERMINAL2 TP2/55T	-	Y	N/A
23	155m NW	381320 386070	M56 WIDENING JUNCTIONS 4 - 6 CH23	10.0	N	915591 ↗
J	158m W	381300 385960	MHR AIRPORT TERMINAL2 TP2/51T	-	Y	N/A
K	164m SW	381520 385710	SECOND TERMINAL, MANCHESTER AIRPORT R4	-	Y	N/A
J	166m W	381290 385970	MANCHESTER AIRPORT SECOND PASSENGER TERMINAL TP 1/14	-	Y	N/A
I	167m SW	381610 385650	SECOND TERMINAL, MANCHESTER AIRPORT 33	-	Y	N/A
L	171m SW	381410 385790	MHR AIRPORT TERMINAL2 BH2/67	-	Y	N/A
L	171m SW	381410 385790	MHR AIRPORT TERMINAL2 BH2/68	-	Y	N/A
I	175m SW	381610 385640	SECOND TERMINAL, MANCHESTER AIRPORT 8	-	Y	N/A
M	176m S	381840 385500	AIRLINE OFFICE DEVELOPMENT MANCHESTER AIRPORT 2	-	Y	N/A
K	180m SW	381520 385690	MHR AIRPORT TERMINAL2 BH2/71	-	Y	N/A
K	180m SW	381520 385690	MHR AIRPORT TERMINAL2 BH2/72	-	Y	N/A
24	182m SW	381320 385870	MHR AIRPORT TERMINAL2 TP2/57T	-	Y	N/A
M	183m S	381850 385490	AIRLINE OFFICE DEVELOPMENT MANCHESTER AIRPORT 3	-	Y	N/A
N	184m SW	381460 385730	MHR AIRPORT TERMINAL2 BH2/70	-	Y	N/A

ID	Location	Grid reference	Name	Length	Confidential	Web link
N	184m SW	381460 385730	MHR AIRPORT TERMINAL2 BH2/69	-	Y	N/A
25	185m SW	381660 385570	SECOND TERMINAL, MANCHESTER AIRPORT R5	-	Y	N/A
L	185m SW	381400 385780	MHR AIRPORT TERMINAL2 TP2/58T	-	Y	N/A
26	187m SW	381430 385750	SECOND TERMINAL, MANCHESTER AIRPORT 5	-	Y	N/A
O	188m SW	381340 385840	MHR AIRPORT TERMINAL2 BH2/62	-	Y	N/A
P	190m SW	381490 385700	MHR AIRPORT TERMINAL2 TP2/59T	-	Y	N/A
27	191m S	381890 385480	AIRLINE OFFICE DEVELOPMENT MANCHESTER AIRPORT 4	-	Y	N/A
Q	191m SW	381560 385650	MHR AIRPORT TERMINAL2 BH2/73	-	Y	N/A
Q	191m SW	381560 385650	MHR AIRPORT TERMINAL2 BH2/74	-	Y	N/A
O	194m SW	381350 385820	MHR AIRPORT TERMINAL2 BH2/65	-	Y	N/A
O	194m SW	381350 385820	MHR AIRPORT TERMINAL2 BH2/66	-	Y	N/A
28	195m NW	381340 386150	M56 WIDENING JUNCTIONS 4 - 6 CH5	12.0	N	915572 ↗
29	196m S	381730 385520	SECOND TERMINAL, MANCHESTER AIRPORT 13	-	Y	N/A
R	198m SW	381630 385580	MHR AIRPORT TERMINAL2 BH2/77	-	Y	N/A
R	198m SW	381630 385580	MHR AIRPORT TERMINAL2 BH2/78	-	Y	N/A
30	203m S	381810 385480	AIRLINE OFFICE DEVELOPMENT MANCHESTER AIRPORT 1	-	Y	N/A
N	204m SW	381440 385720	MANCHESTER AIRPORT SECOND PASSENGER TERMINAL 1/47	-	Y	N/A
Q	205m SW	381550 385640	MHR AIRPORT TERMINAL2 TP2/60T	-	Y	N/A
31	205m SW	381290 385870	MHR AIRPORT TERMINAL2 BH2/61	-	Y	N/A
R	208m SW	381610 385590	MHR AIRPORT TERMINAL2 TP2/61T	-	Y	N/A
P	212m SW	381480 385680	MANCHESTER AIRPORT SECOND PASSENGER TERMINAL 1/41	-	Y	N/A
Q	216m SW	381530 385640	MANCHESTER AIRPORT SECOND PASSENGER TERMINAL 1/35	-	Y	N/A
Q	216m SW	381530 385640	MANCHESTER AIRPORT SECOND PASSENGER TERMINAL 1/36R	-	Y	N/A
32	216m SW	381680 385520	MHR AIRPORT TERMINAL2 BH2/64	-	Y	N/A
33	216m NW	381280 386120	M56 WIDENING JUNCTIONS 4 - 6 CH3	9.63	N	915570 ↗

ID	Location	Grid reference	Name	Length	Confidential	Web link
34	219m SW	381630 385550	MHR AIRPORT TERMINAL2 BH2/63	-	Y	N/A
S	221m W	381250 385910	SECOND TERMINAL, MANCHESTER AIRPORT 20	-	Y	N/A
T	221m SW	381570 385610	MHR AIRPORT TERMINAL2 BH2/76	-	Y	N/A
T	221m SW	381570 385610	MHR AIRPORT TERMINAL2 BH2/75	-	Y	N/A
S	225m SW	381250 385900	SECOND PASSENGER TERMINAL, MANCHESTER AIRPORT TP4	-	Y	N/A
35	229m S	381940 385450	SECOND TERMINAL, MANCHESTER AIRPORT 32	-	Y	N/A
36	233m W	381230 385930	MHR AIRPORT TERMINAL2 TP2/56T	-	Y	N/A
37	244m S	381920 385430	SECOND TERMINAL, MANCHESTER AIRPORT R10	-	Y	N/A
U	248m S	381690 385480	MANCHESTER AIRPORT - TERMINAL 2 2/57	-	Y	N/A
U	248m S	381690 385480	MANCHESTER AIRPORT - TERMINAL 2 2/58	-	Y	N/A
38	250m SW	381330 385760	SECOND TERMINAL, MANCHESTER AIRPORT 4	-	Y	N/A

This data is sourced from the British Geological Survey.

17 Natural ground subsidence - Shrink swell clays



17.1 Shrink swell clays

Records within 50m	1

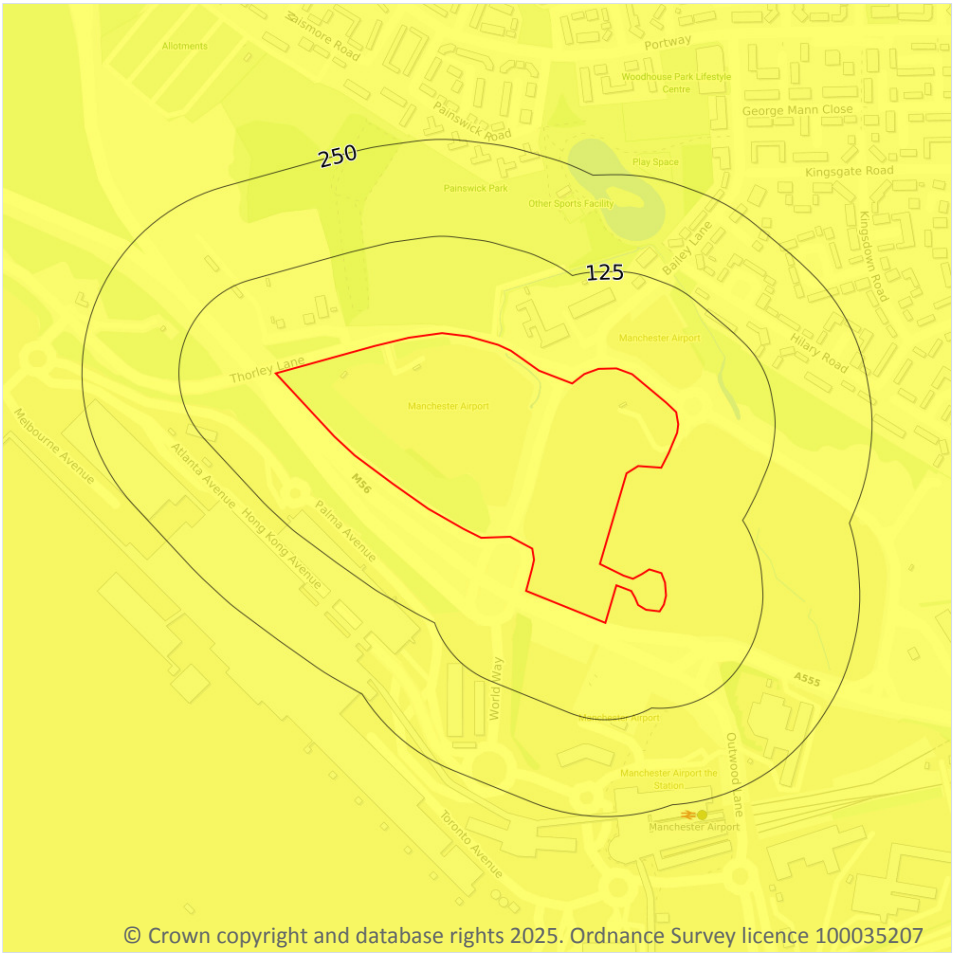
The potential hazard presented by soils that absorb water when wet (making them swell), and lose water as they dry (making them shrink). This shrink-swell behaviour is controlled by the type and amount of clay in the soil, and by seasonal changes in the soil moisture content (related to rainfall and local drainage).

Features are displayed on the Natural ground subsidence - Shrink swell clays map on **page 89 >**

Location	Hazard rating	Details
On site	**Very low**	**Ground conditions predominantly low plasticity.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Running sands



17.2 Running sands

Records within 50m	1

The potential hazard presented by rocks that can contain loosely-packed sandy layers that can become fluidised by water flowing through them. Such sands can 'run', removing support from overlying buildings and causing potential damage.

Features are displayed on the Natural ground subsidence - Running sands map on **page 90 >**

Location	Hazard rating	Details
On site	**Very low**	**Running sand conditions are unlikely. No identified constraints on land use due to running conditions unless water table rises rapidly.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Compressible deposits



Site Outline

Search buffers in metres (m)

- No data
- Negligible
- Very low
- Low
- Moderate
- High

17.3 Compressible deposits

Records within 50m	1

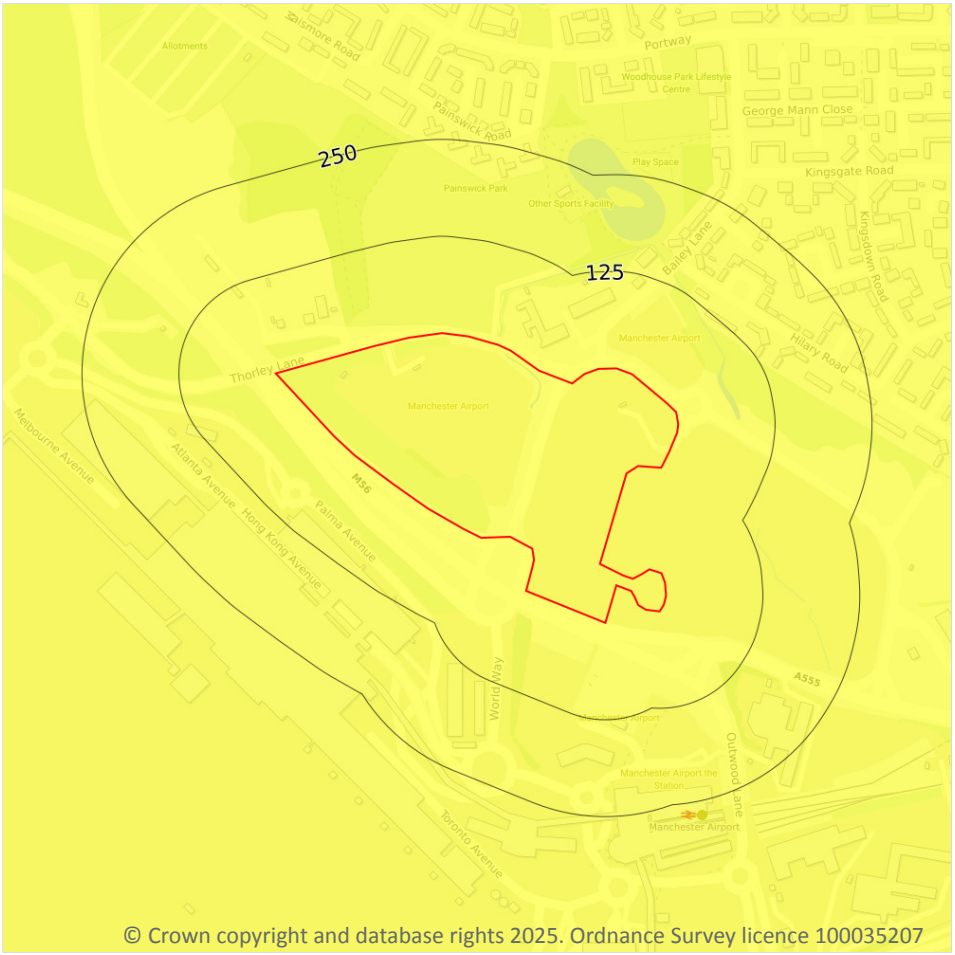
The potential hazard presented by types of ground that may contain layers of very soft materials like clay or peat and may compress if loaded by overlying structures, or if the groundwater level changes, potentially resulting in depression of the ground and disturbance of foundations.

Features are displayed on the Natural ground subsidence - Compressible deposits map on **page 91 >**

Location	Hazard rating	Details
On site	**Negligible**	**Compressible strata are not thought to occur.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Collapsible deposits



17.4 Collapsible deposits

Records within 50m	1

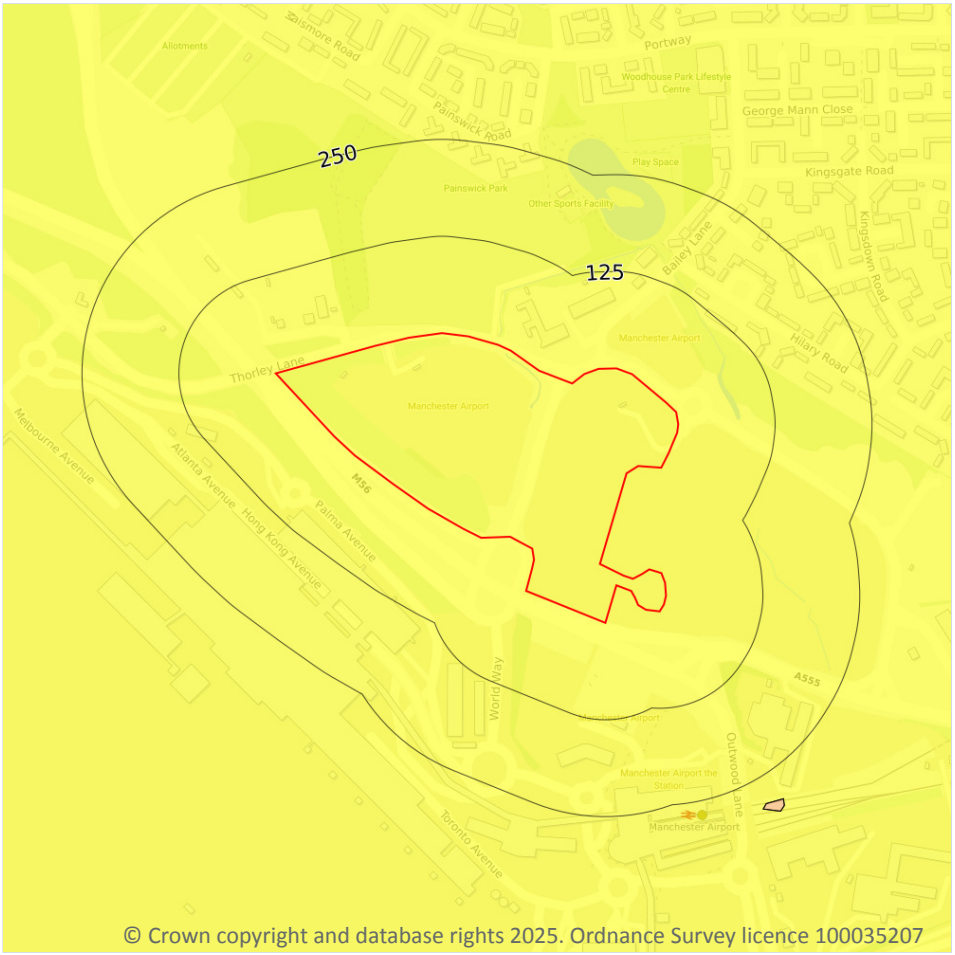
The potential hazard presented by natural deposits that could collapse when a load (such as a building) is placed on them or they become saturated with water.

Features are displayed on the Natural ground subsidence - Collapsible deposits map on **page 92 >**

Location	Hazard rating	Details
On site	**Very low**	**Deposits with potential to collapse when loaded and saturated are unlikely to be present.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Landslides



17.5 Landslides

Records within 50m	1

The potential for landsliding (slope instability) to be a hazard assessed using 1:50,000 scale digital maps of superficial and bedrock deposits, combined with information from the BGS National Landslide Database and scientific and engineering reports.

Features are displayed on the Natural ground subsidence - Landslides map on **page 93 >**

Location	Hazard rating	Details
On site	**Very low**	**Slope instability problems are not likely to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Ground dissolution of soluble rocks



17.6 Ground dissolution of soluble rocks

Records within 50m	1

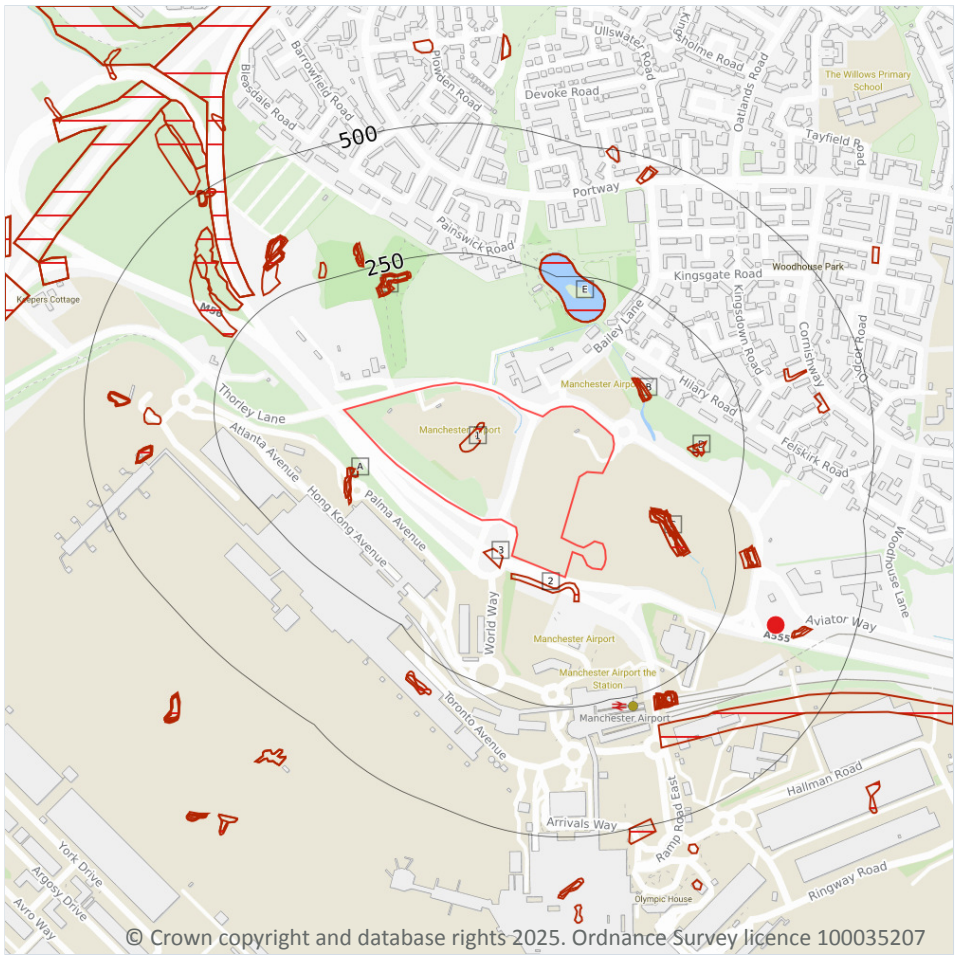
The potential hazard presented by ground dissolution, which occurs when water passing through soluble rocks produces underground cavities and cave systems. These cavities reduce support to the ground above and can cause localised collapse of the overlying rocks and deposits.

Features are displayed on the Natural ground subsidence - Ground dissolution of soluble rocks map on **page 94 >**

Location	Hazard rating	Details
On site	**Negligible**	**Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present.**

This data is sourced from the British Geological Survey.

18 Mining and ground workings



Site Outline

Search buffers in metres (m)

- BritPits
- Surface ground workings
- Underground workings
- Underground mining extents
- Historical mineral planning areas
- TCA non-coal mining

Non Coal Mining

- Sporadic underground mining of restricted extent possible
- Localised small scale underground mining possible
- Small scale mining possible
- Underground mining known or likely within or in close proximity
- Underground mining known within or in very close proximity

18.1 BritPits

Records within 500m	1

BritPits (an abbreviation of British Pits) is a database maintained by the British Geological Survey of currently active and closed surface and underground mineral workings. Details of major mineral handling sites, such as wharfs and rail depots are also held in the database.

Features are displayed on the Mining and ground workings map on **page 96 >**

ID	Location	Details	Description
N	348m E	Name: Woodhouse Farm Brick Field Address: Woodhouse Park, MANCHESTER, Cheshire Commodity: Clay & Shale Status: Ceased	Type: A surface mineral working. It may be termed Quarry, Delf, Delph, Gravel Pit, Sand Pit, Sand and Gravel Pit, Clay Pit, Pit, Opencast Coal Site or Surface Mine. It may be mapped as Worked Ground or Worked and Made Ground on BGS mapping. Status description: Site which has ceased to extract minerals. May be considered as 'Closed' by operator. May be considered to have 'Active', 'Dormant' or 'Expired' planning permissions by the Mineral Planning Authority.

This data is sourced from the British Geological Survey.

18.2 Surface ground workings

Records within 250m **28**

Historical land uses identified from Ordnance Survey mapping that involved ground excavation at the surface. These features may or may not have been subsequently backfilled.

Features are displayed on the Mining and ground workings map on **page 96 >**

ID	Location	Land Use	Year of mapping	Mapping scale
1	**On site**	**Pond**	**1977**	**1:10000**
2	12m S	Unspecified Ground Workings	1995	1:10000
3	18m W	Unspecified Pit	1995	1:10000
A	60m SW	Ponds	1954	1:10560
A	64m SW	Ponds	1977	1:10000
A	64m SW	Ponds	1989	1:10000
A	64m SW	Ponds	1967	1:10560
B	88m NE	Ponds	1910	1:10560
B	90m NE	Pond	1938	1:10560
B	93m NE	Pond	1954	1:10560
C	103m NE	Ponds	1899	1:10560
C	104m NE	Ponds	1899	1:10560
C	111m NE	Ponds	1977	1:10000
C	111m NE	Ponds	1967	1:10560

ID	Location	Land Use	Year of mapping	Mapping scale
C	112m NE	Ponds	1910	1:10560
C	113m NE	Pond	1938	1:10560
C	114m NE	Ponds	1954	1:10560
C	119m NE	Ponds	1989	1:10000
C	135m E	Pond	1938	1:10560
D	142m E	Pond	1899	1:10560
D	153m E	Pond	1910	1:10560
E	164m N	Boating Lake	1977	1:10000
E	164m N	Pond	1989	1:10000
E	164m N	Pond	1995	1:10000
F	190m N	Ponds	1938	1:10560
F	191m N	Ponds	1899	1:10560
F	191m N	Ponds	1954	1:10560
F	193m N	Ponds	1910	1:10560

This is data is sourced from Ordnance Survey/Groundsure.

18.3 Underground workings

Records within 1000m	0

Historical land uses identified from Ordnance Survey mapping that indicate the presence of underground workings e.g. mine shafts.

This is data is sourced from Ordnance Survey/Groundsure.

18.4 Underground mining extents

Records within 500m	0

This data identifies underground mine workings that could present a potential risk, including adits and seam workings. These features have been identified from BGS Geological mapping and mine plans sourced from the BGS and various collections and sources.

This data is sourced from Groundsure.

18.5 Historical Mineral Planning Areas

Records within 500m	0

Boundaries of mineral planning permissions for England and Wales. This data was collated between the 1940s (and retrospectively to the 1930s) and the mid 1980s. The data includes permitted, withdrawn and refused permissions.

This data is sourced from the British Geological Survey.

18.6 Non-coal mining

Records within 1000m	0

The potential for historical non-coal mining to have affected an area. The assessment is drawn from expert knowledge and literature in addition to the digital geological map of Britain. Mineral commodities may be divided into seven general categories - vein minerals, chalk, oil shale, building stone, bedded ores, evaporites and 'other' commodities (including ball clay, jet, black marble, graphite and chert).

This data is sourced from the British Geological Survey.

18.7 JPB mining areas

Records on site	0

Areas which could be affected by former coal and other mining. This data includes some mine plans unavailable to the Coal Authority.

This data is sourced from Johnson Poole and Bloomer.

18.8 The Coal Authority non-coal mining

Records within 500m	0

This data provides an indication of the potential zone of influence of recorded underground non-coal mining workings. Any and all analysis and interpretation of Coal Authority Data in this report is made by Groundsure, and is in no way supported, endorsed or authorised by the Coal Authority. The use of the data is restricted to the terms and provisions contained in this report. Data reproduced in this report may be the copyright of the Coal Authority and permission should be sought from Groundsure prior to any re-use.

This data is sourced from The Coal Authority.

18.9 Researched mining

Records within 500m	0

This data indicates areas of potential mining identified from alternative or archival sources, including; BGS Geological paper maps, Lidar data, aerial photographs (from World War II onwards), archaeological data services, websites, Tithe maps, and various text/plans from collected books and reports. Some of this data is approximate and Groundsure have interpreted the resultant risk area and, where possible, specific areas of risk have been captured.

This data is sourced from Groundsure.

18.10 Mining record office plans

Records within 500m	0

This dataset is representative of Mining Record Office and/or plan extents held by Groundsure and should be considered approximate. Where possible, plans have been located and any specific areas of risk they depict have been captured.

This data is sourced from Groundsure.

18.11 BGS mine plans

Records within 500m	0

This dataset is representative of BGS mine plans held by Groundsure and should be considered approximate. Where possible, plans have been located and any specific areas of risk they depict have been captured.

This data is sourced from Groundsure.

18.12 Coal mining

Records on site	0

Areas which could be affected by past, current or future coal mining.

This data is sourced from the Coal Authority.

18.13 Brine areas

Records on site	1

The Cheshire Brine Compensation District indicates areas that may be affected by salt and brine extraction in Cheshire and where compensation would be available where damage from this mining has occurred. Damage from salt and brine mining can still occur outside this district, but no compensation will be available.

Location	Details
On site	**The site is located within the Cheshire Brine Compensation District. The extraction of brine over many years has caused some properties within the Cheshire area to be at risk of subsidence. This subsidence can occur a considerable distance from the location of the extraction and further assessment is recommended. A Cheshire Salt search can be obtained direct from Groundsure or your preferrred search provider.**

This data is sourced from the Cheshire Brine Subsidence Compensation Board.

18.14 Gypsum areas

Records on site	**0**

Generalised areas that may be affected by gypsum extraction.

This data is sourced from British Gypsum.

18.15 Tin mining

Records on site	**0**

Generalised areas that may be affected by historical tin mining.

This data is sourced from Groundsure.

18.16 Clay mining

Records on site	**0**

Generalised areas that may be affected by kaolin and ball clay extraction.

This data is sourced from the Kaolin and Ball Clay Association (UK).

19 Ground cavities and sinkholes

19.1 Natural cavities

Records within 500m	0

Industry recognised national database of natural cavities. Sinkholes and caves are formed by the dissolution of soluble rock, such as chalk and limestone, gulls and fissures by cambering. Ground instability can result from movement of loose material contained within these cavities, often triggered by water.

This data is sourced from Stantec UK Ltd.

19.2 Mining cavities

Records within 1000m	0

Industry recognised national database of mining cavities. Degraded mines may result in hazardous subsidence (crown holes). Climatic conditions and water escape can also trigger subsidence over mine entrances and workings.

This data is sourced from Stantec UK Ltd.

19.3 Reported recent incidents

Records within 500m	0

This data identifies sinkhole information gathered from media reports and Groundsure's own records. This data goes back to 2014 and includes relative accuracy ratings for each event and links to the original data sources. The data is updated on a regular basis and should not be considered a comprehensive catalogue of all sinkhole events. The absence of data in this database does not mean a sinkhole definitely has not occurred during this time.

This data is sourced from Groundsure.

19.4 Historical incidents

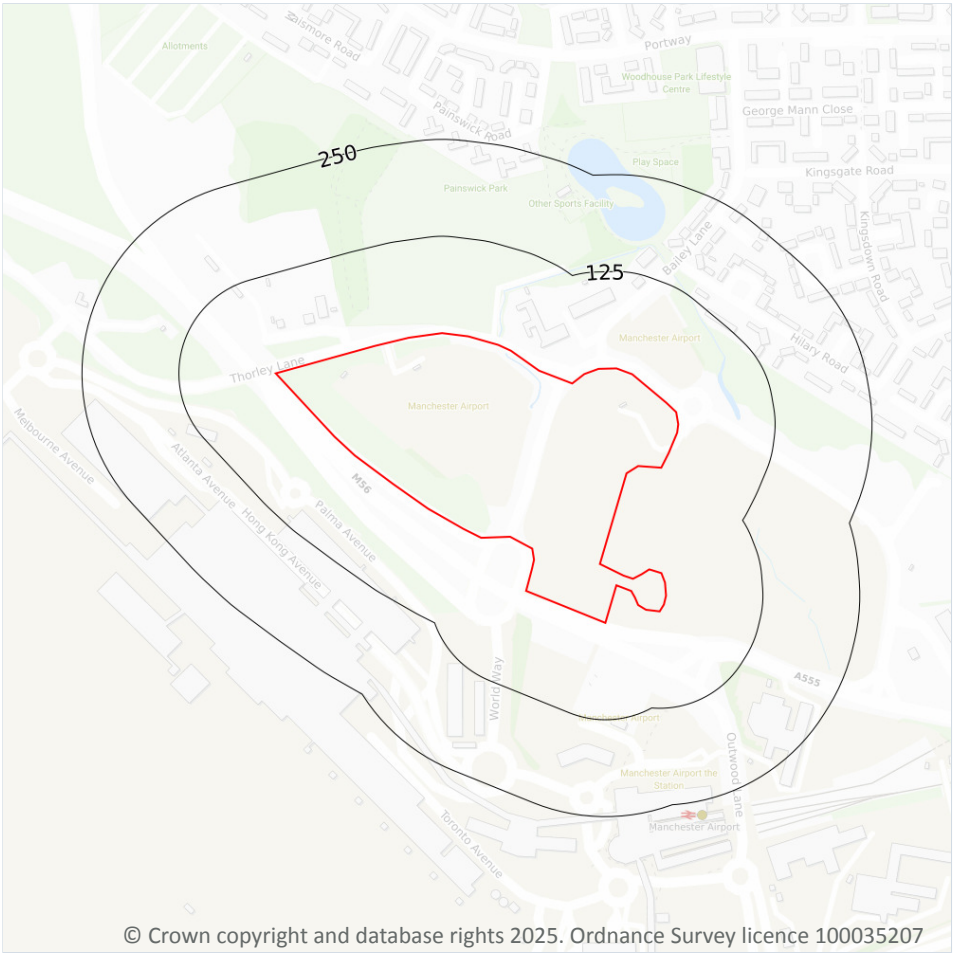
Records within 500m	0

This dataset comprises an extract of 1:10,560, 1:10,000, 1:2,500 and 1:1,250 scale historical Ordnance Survey maps held by Groundsure, dating back to the 1840s. It shows shakeholes, deneholes and other 'holes' as noted on these maps. Dene holes are medieval chalk extraction pits, usually comprising a narrow shaft with a number of chambers at the base of the shaft. Shakeholes are an alternative name for suffusion sinkholes, most commonly found in the limestone landscapes of North Yorkshire but also extensively noted around the Brecon Beacons National Park.

Not all 'holes' noted on Ordnance Survey mapping will necessarily be present within this dataset.

This data is sourced from Groundsure.

20 Radon



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20.1 Radon

Records on site	1

The Radon Potential data classifies areas based on their likelihood of a property having a radon level at or above the Action Level in Great Britain. The dataset is intended for use at 1:50,000 scale and was derived from both geological assessments and indoor radon measurements (more than 560,000 records). A minimum 50m buffer should be considered when searching the maps, as the smallest detectable feature at this scale is 50m. The findings of this section should supersede any estimations derived from the Indicative Atlas of Radon in Great Britain (1:100,000 scale).

Features are displayed on the Radon map on **page 104 >**

Location	Estimated properties affected	Radon Protection Measures required
On site	**Less than 1%**	**None**

This data is sourced from the British Geological Survey and UK Health Security Agency.

21 Soil chemistry

21.1 BGS Estimated Background Soil Chemistry

Records within 50m	5

The estimated values provide the likely background concentration of the potentially harmful elements Arsenic, Cadmium, Chromium, Lead and Nickel in topsoil. The values are estimated primarily from rural topsoil data collected at a sample density of approximately 1 per 2 km^2. In areas where rural soil samples are not available, estimation is based on stream sediment data collected from small streams at a sampling density of 1 per 2.5 km^2; this is the case for most of Scotland, Wales and southern England. The stream sediment data are converted to soil-equivalent concentrations prior to the estimation.

Location	Arsenic	Bioaccessible Arsenic	Lead	Bioaccessible Lead	Cadmium	Chromium	Nickel
On site	**15 mg/kg**	**No data**	**100 mg/kg**	**60 mg/kg**	**1.8 mg/kg**	**60 - 90 mg/kg**	**15 mg/kg**
On site	**15 mg/kg**	**No data**	**100 mg/kg**	**60 mg/kg**	**1.8 mg/kg**	**60 - 90 mg/kg**	**15 mg/kg**
On site	**15 mg/kg**	**No data**	**100 mg/kg**	**60 mg/kg**	**1.8 mg/kg**	**60 - 90 mg/kg**	**15 mg/kg**
On site	**15 mg/kg**	**No data**	**100 mg/kg**	**60 mg/kg**	**1.8 mg/kg**	**60 - 90 mg/kg**	**15 mg/kg**
26m E	15 mg/kg	No data	100 - 200 mg/kg	60 - 120 mg/kg	1.8 mg/kg	60 - 90 mg/kg	15 mg/kg

This data is sourced from the British Geological Survey.

21.2 BGS Estimated Urban Soil Chemistry

Records within 50m	0

Estimated topsoil chemistry of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc and bioaccessible Arsenic and Lead in 23 urban centres across Great Britain. These estimates are derived from interpolation of the measured urban topsoil data referred to above and provide information across each city between the measured sample locations (4 per km^2).

This data is sourced from the British Geological Survey.

21.3 BGS Measured Urban Soil Chemistry

Records within 50m	0

The locations and measured total concentrations (mg/kg) of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc in urban topsoil samples from 23 urban centres across Great Britain. These are collected at a sample density of 4 per km^2.

This data is sourced from the British Geological Survey.

22 Railway infrastructure and projects

22.1 Underground railways (London)

Records within 250m	0

Details of all active London Underground lines, including approximate tunnel roof depth and operational hours.

This data is sourced from publicly available information by Groundsure.

22.2 Underground railways (Non-London)

Records within 250m	0

Details of the Merseyrail system, the Tyne and Wear Metro and the Glasgow Subway. Not all parts of all systems are located underground. The data contains location information only and does not include a depth assessment.

This data is sourced from publicly available information by Groundsure.

22.3 Railway tunnels

Records within 250m	0

Railway tunnels taken from contemporary Ordnance Survey mapping.

This data is sourced from the Ordnance Survey.

22.4 Historical railway and tunnel features

Records within 250m	0

Railways and tunnels digitised from historical Ordnance Survey mapping as scales of 1:1,250, 1:2,500, 1:10,000 and 1:10,560.

This data is sourced from Ordnance Survey/Groundsure.

22.5 Royal Mail tunnels

Records within 250m	0

The Post Office Railway, otherwise known as the Mail Rail, is an underground railway running through Central London from Paddington Head District Sorting Office to Whitechapel Eastern Head Sorting Office. The line is 10.5km long. The data includes details of the full extent of the tunnels, the depth of the tunnel, and the depth to track level.

This data is sourced from Groundsure/the Postal Museum.

22.6 Historical railways

Records within 250m	0

Former railway lines, including dismantled lines, abandoned lines, disused lines, historic railways and razed lines.

This data is sourced from OpenStreetMap.

22.7 Railways

Records within 250m	0

Currently existing railway lines, including standard railways, narrow gauge, funicular, trams and light railways.

This data is sourced from Ordnance Survey and OpenStreetMap.

22.8 Crossrail 2

Records within 500m	0

Crossrail 2 is a proposed railway linking the national rail networks in Surrey and Hertfordshire via an underground tunnel through London.

This data is sourced from publicly available information by Groundsure.

22.9 HS2

Records within 500m	0

HS2 is a proposed high speed rail network running from London to Manchester and Leeds via Birmingham. Main civils construction on Phase 1 (London to Birmingham) of the project began in 2019, and it is currently anticipated that this phase will be fully operational by 2026. Construction on Phase 2a (Birmingham to Crewe) is anticipated to commence in 2021, with the service fully operational by 2027. Construction on Phase 2b (Crewe to Manchester and Birmingham to Leeds) is scheduled to begin in 2023 and be operational by 2033.

This data is sourced from HS2 ltd.

Data providers

Groundsure works with respected data providers to bring you the most relevant and accurate information. To find out who they are and their areas of expertise see https://www.groundsure.com/sources-reference ↗.

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Site Details:

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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_1_1
Grid Ref: 381464, 385607

Map Name: National Grid
Map date: **1963**
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1962
Revised 1962
Edition N/A
Copyright 1963
Levelled 1959

Surveyed 1962
Revised 1962
Edition N/A
Copyright 1963
Levelled 1959

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Revised 1963
Edition N/A
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Revised 1963
Edition N/A
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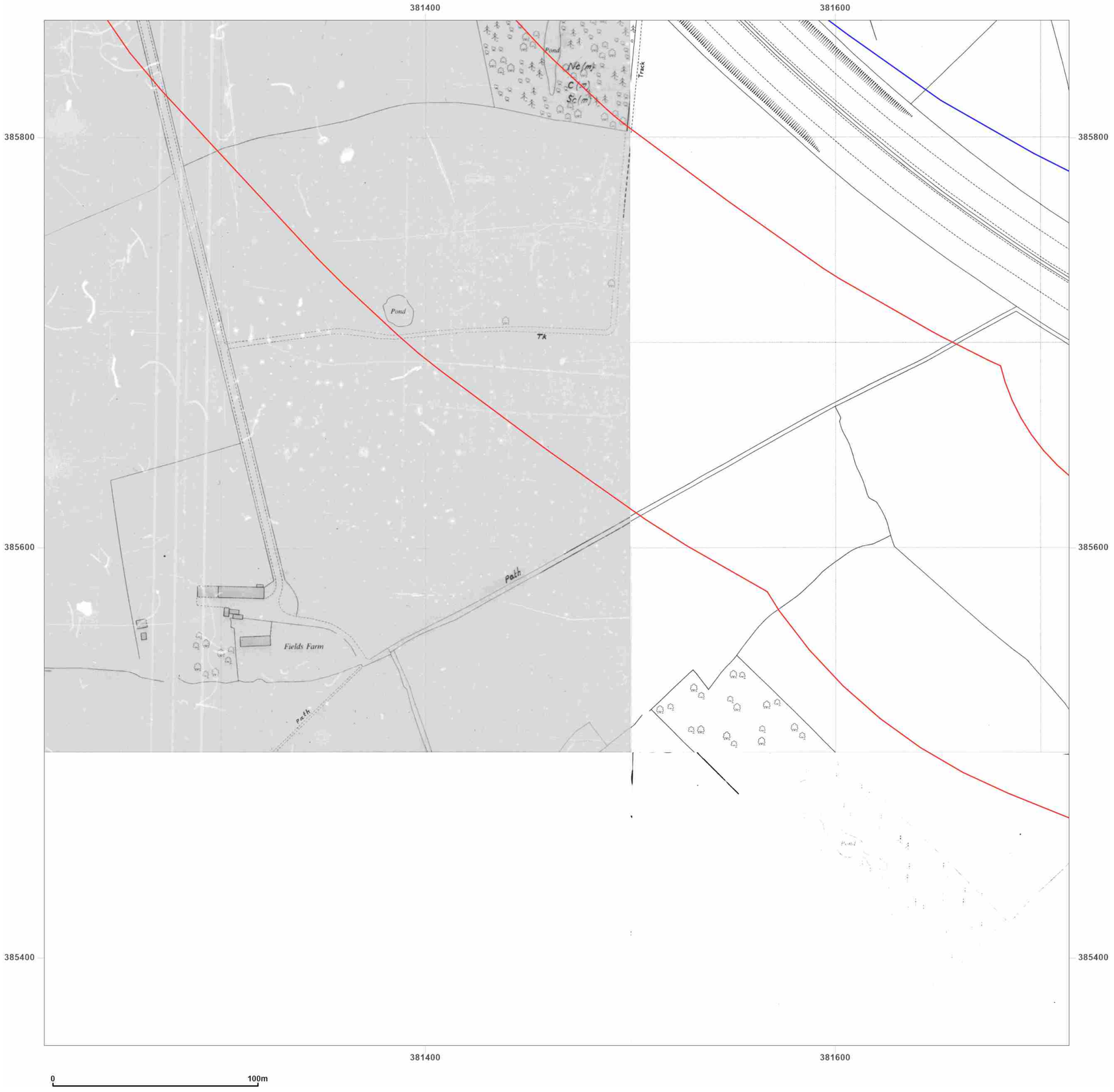
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Grid Ref: 381464, 385607

Map Name: National Grid
Map date: **1974**
Scale: 1:1,250
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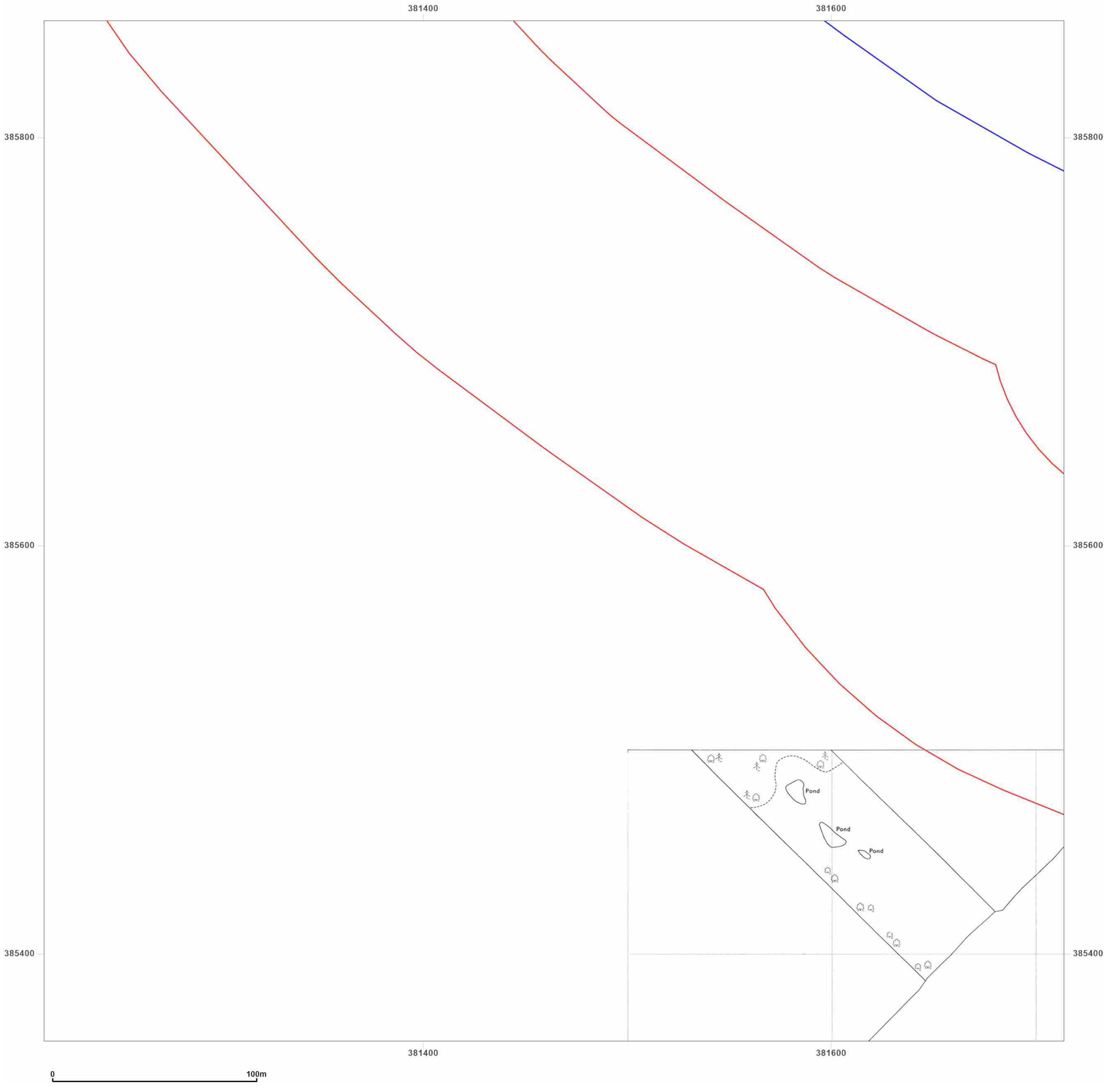
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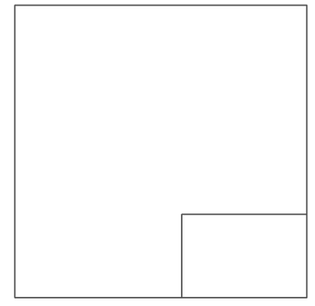
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MANCHESTER, M90 4EG

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Report Ref: GS-LLH-F2J-3NP-S9U_1250_1_1
Grid Ref: 381464, 385607

Map Name: National Grid
Map date: **1976**
Scale: 1:1,250
Printed at: 1:2,000

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Revised 1975
Edition N/A
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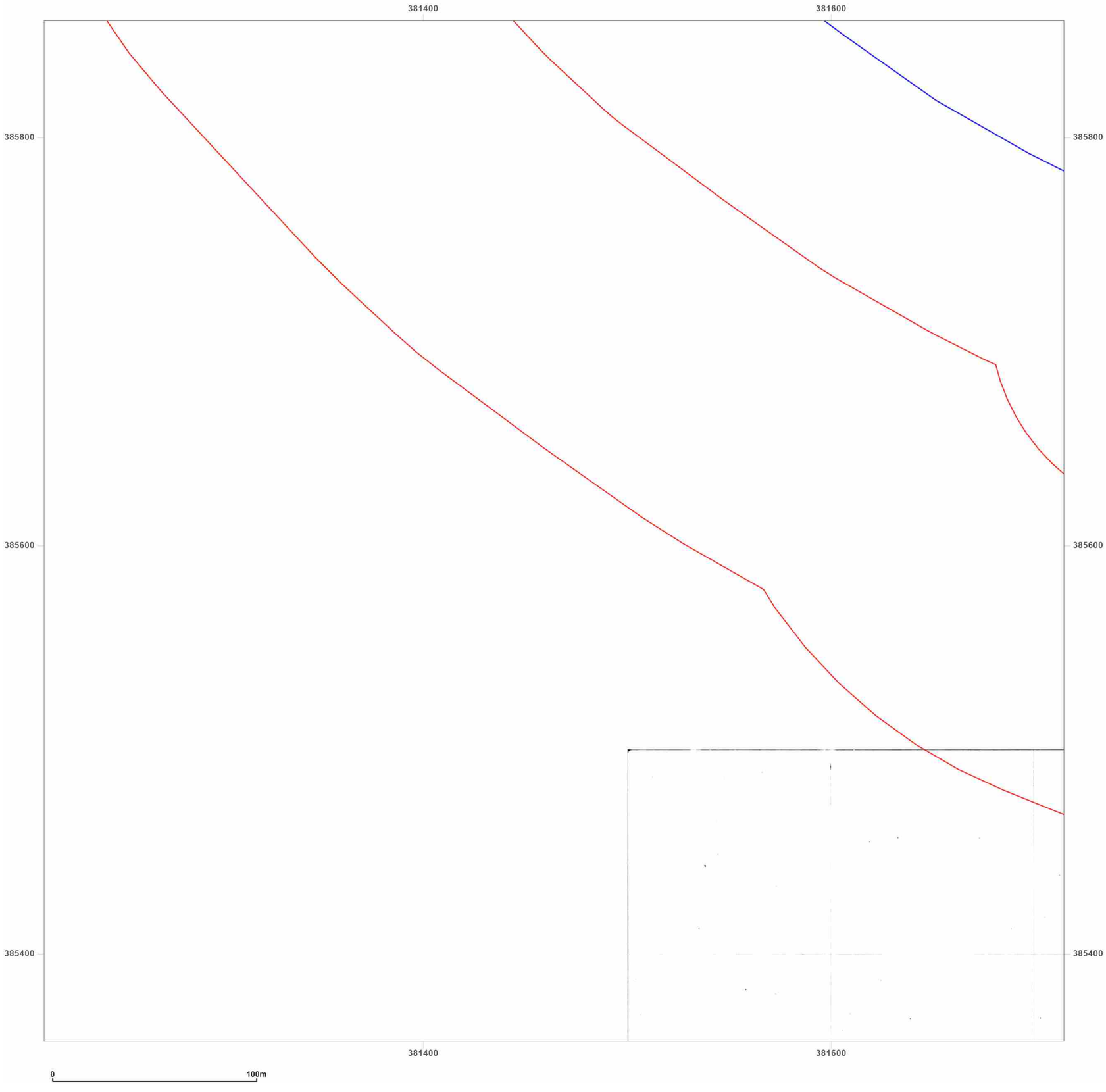
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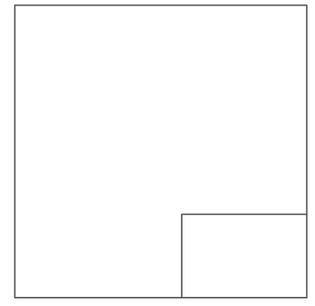
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Map Name: National Grid
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Scale: 1:1,250
Printed at: 1:2,000

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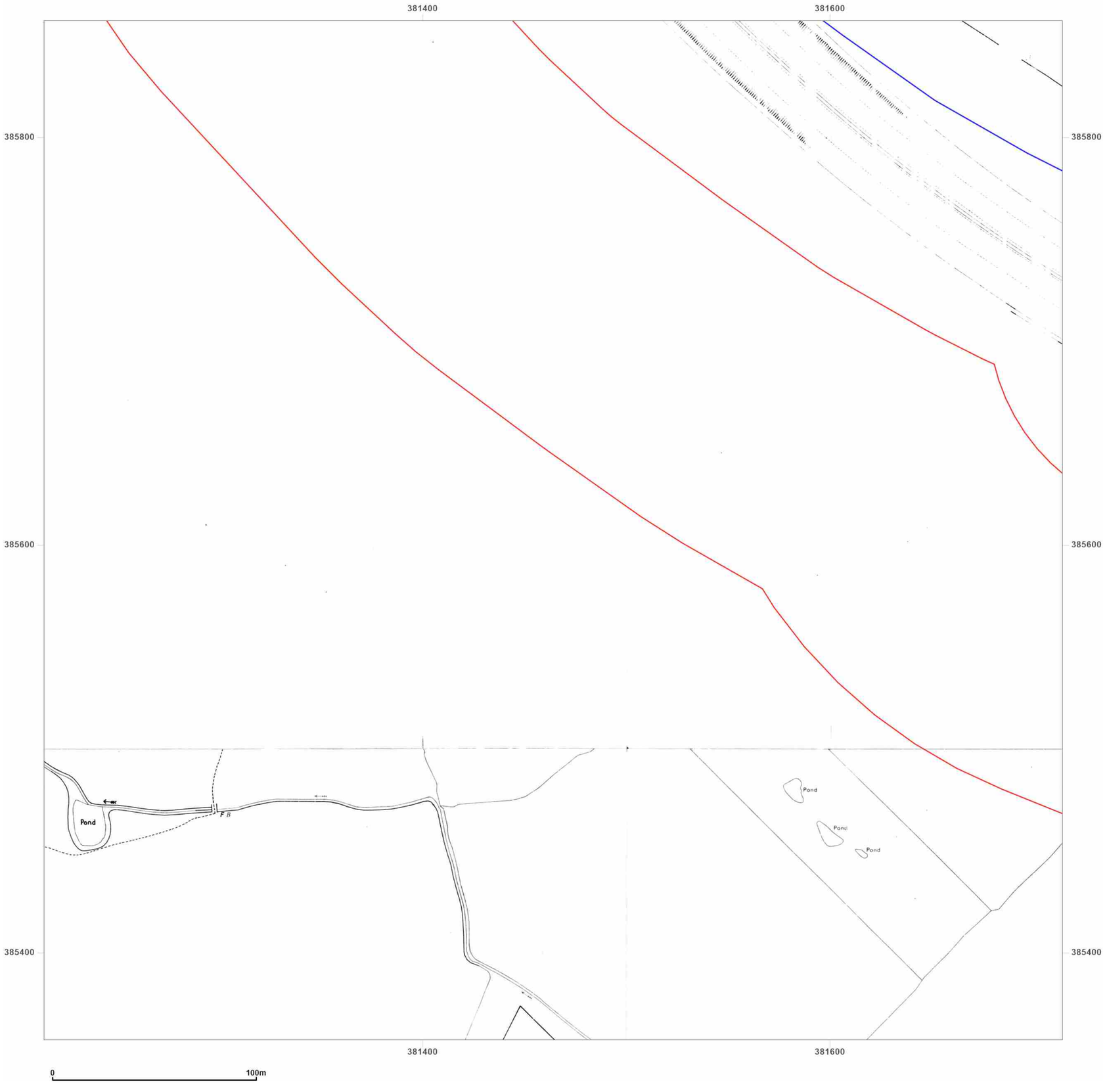
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Grid Ref: 381464, 385607

Map Name: National Grid
Map date: **1987-1990**
Scale: 1:1,250
Printed at: 1:2,000

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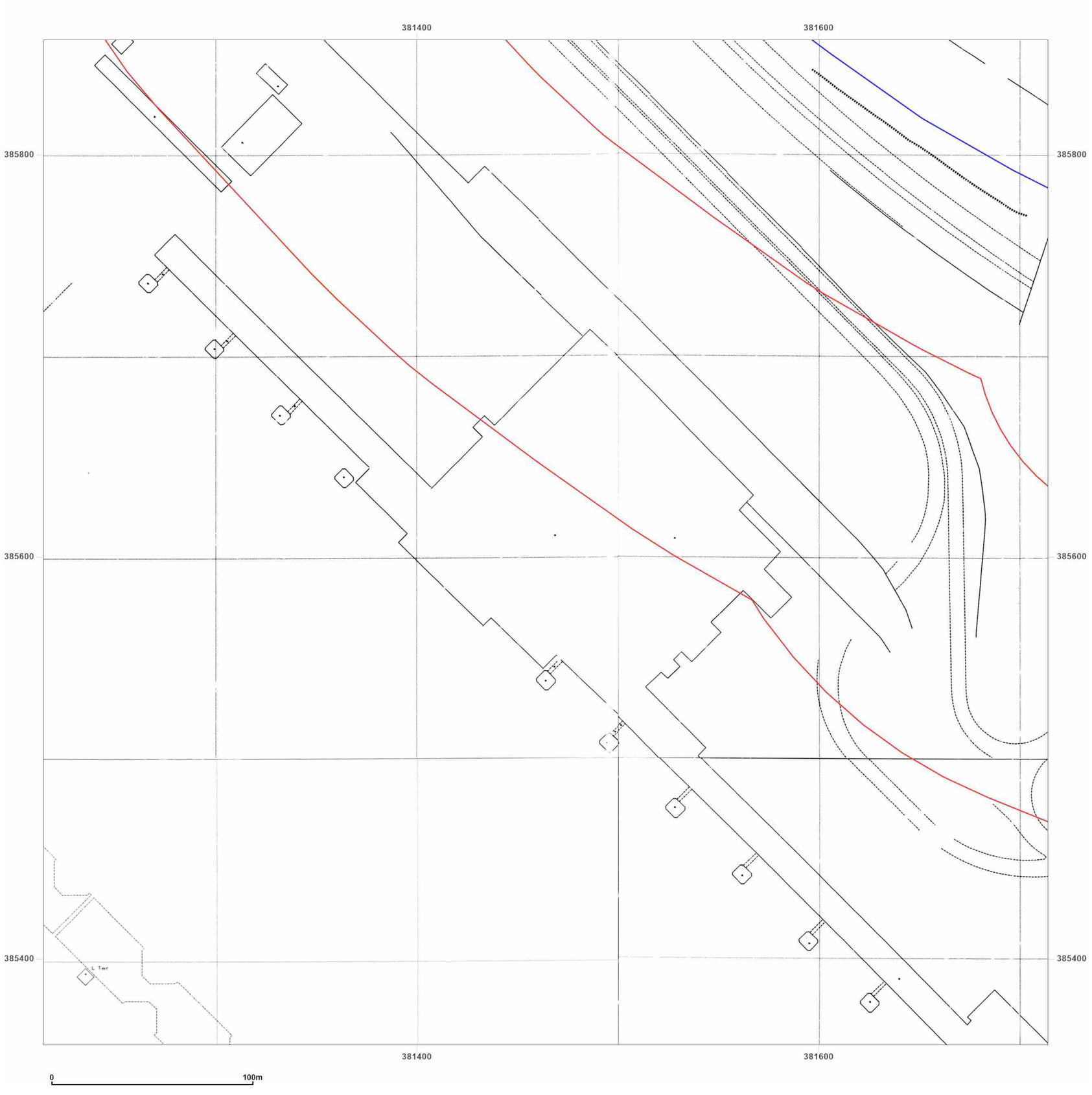
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Grid Ref: 381464, 385607

Map Name: National Grid
Map date: **1992**
Scale: 1:1,250
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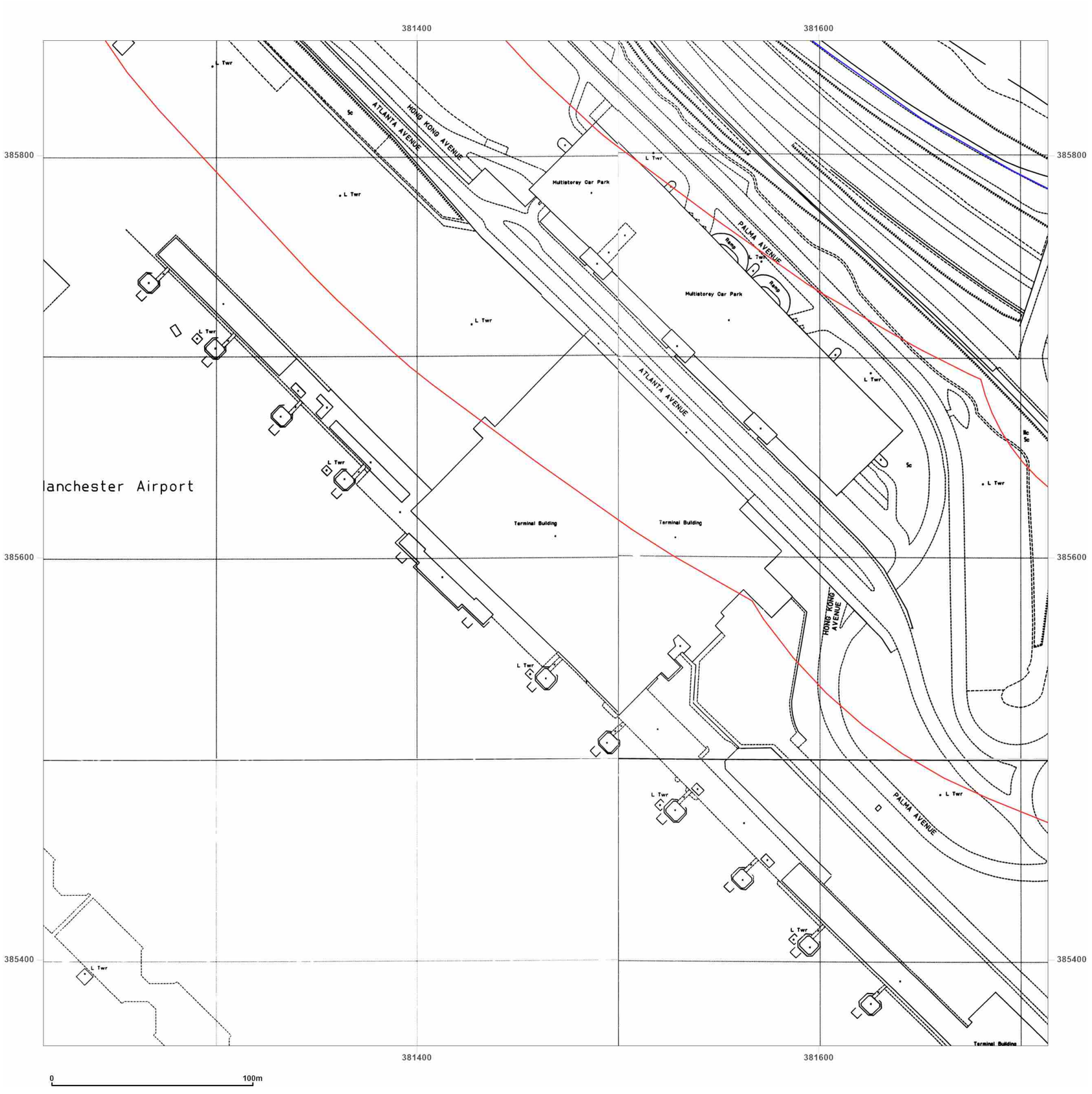
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Grid Ref: 381464, 385607

Map Name: National Grid
Map date: **1992-1993**
Scale: 1:1,250
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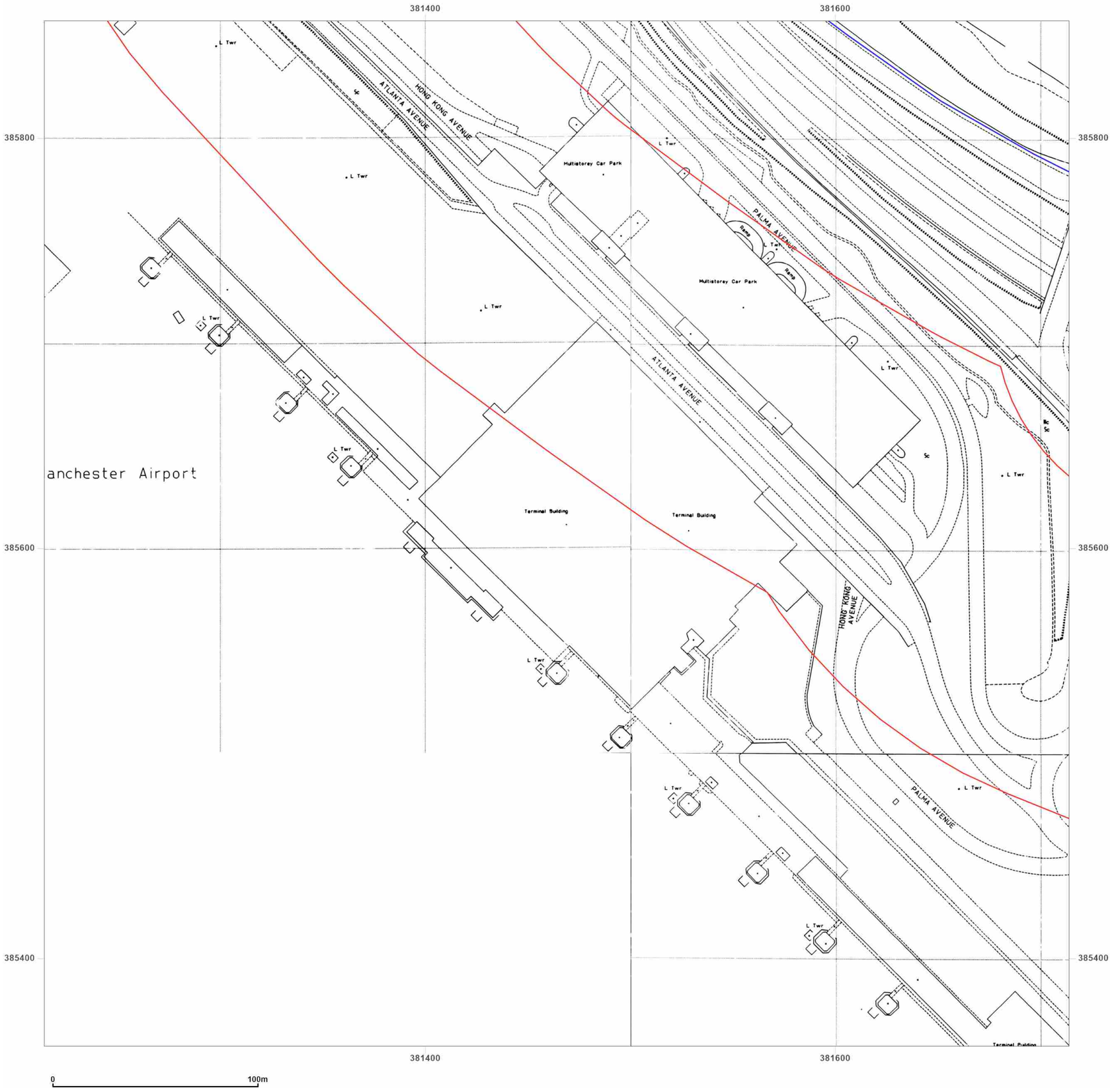
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Report Ref: GS-LLH-F2J-3NP-S9U_1250_1_1
Grid Ref: 381464, 385607

Map Name: National Grid
Map date: **1993**
Scale: 1:1,250
Printed at: 1:2,000

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Grid Ref: 381464, 385607

Map Name: National Grid
Map date: **1995**
Scale: 1:1,250
Printed at: 1:2,000

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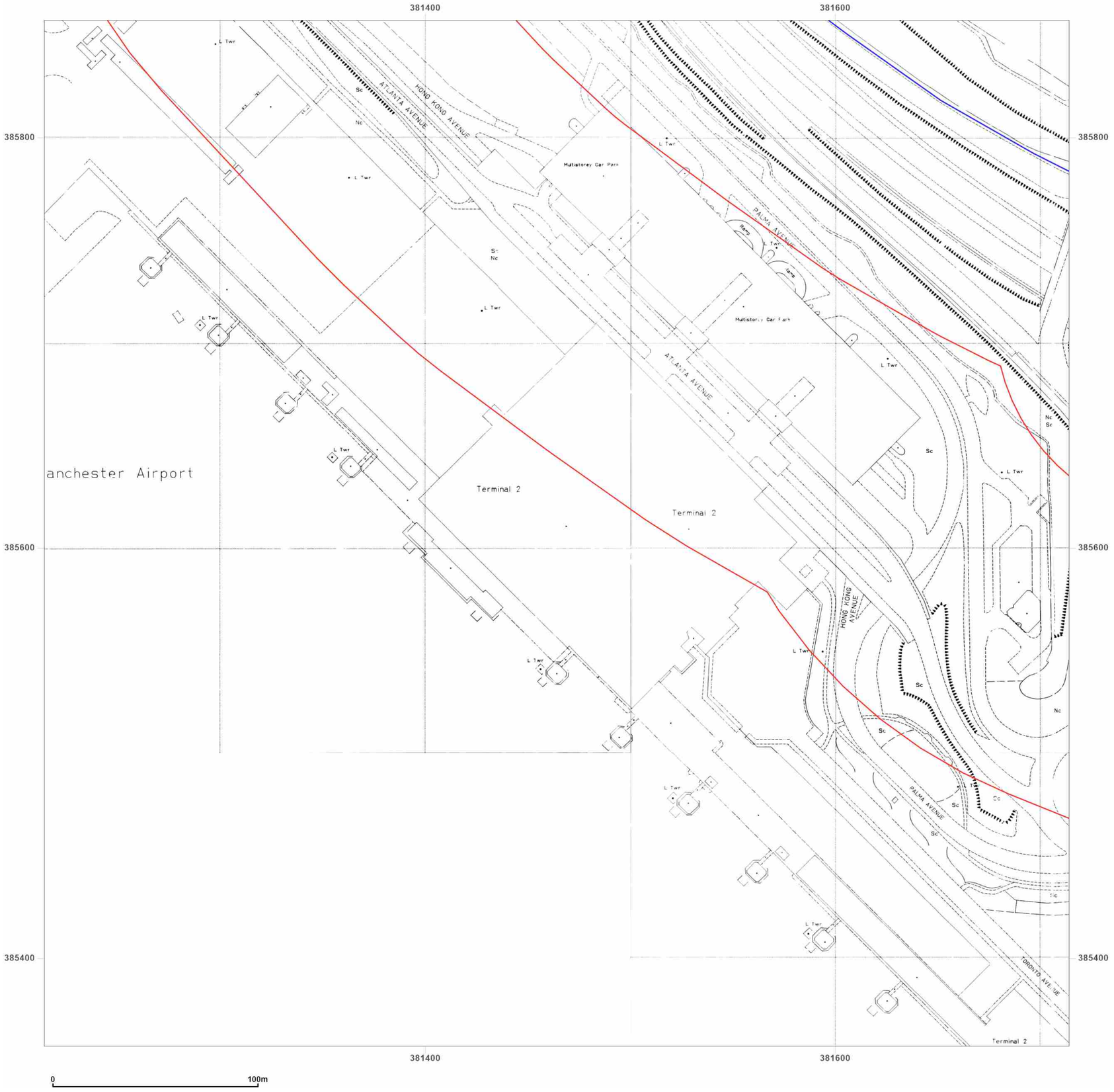
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Report Ref: GS-LLH-F2J-3NP-S9U_1250_1_1
Grid Ref: 381464, 385607

Map Name: National Grid
Map date: **1995**
Scale: 1:1,250
Printed at: 1:2,000

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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_1_2
Grid Ref: 381464, 386107

Map Name: National Grid

Map date: **1960-1963**

Scale: 1:1,250

Printed at: 1:2,000

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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_1_2
Grid Ref: 381464, 386107

Map Name: National Grid
Map date: **1974**
Scale: 1:1,250
Printed at: 1:2,000

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Report Ref: GS-LLH-F2J-3NP-S9U_1250_1_2
Grid Ref: 381464, 386107

Map Name: National Grid

Map date: **1974**

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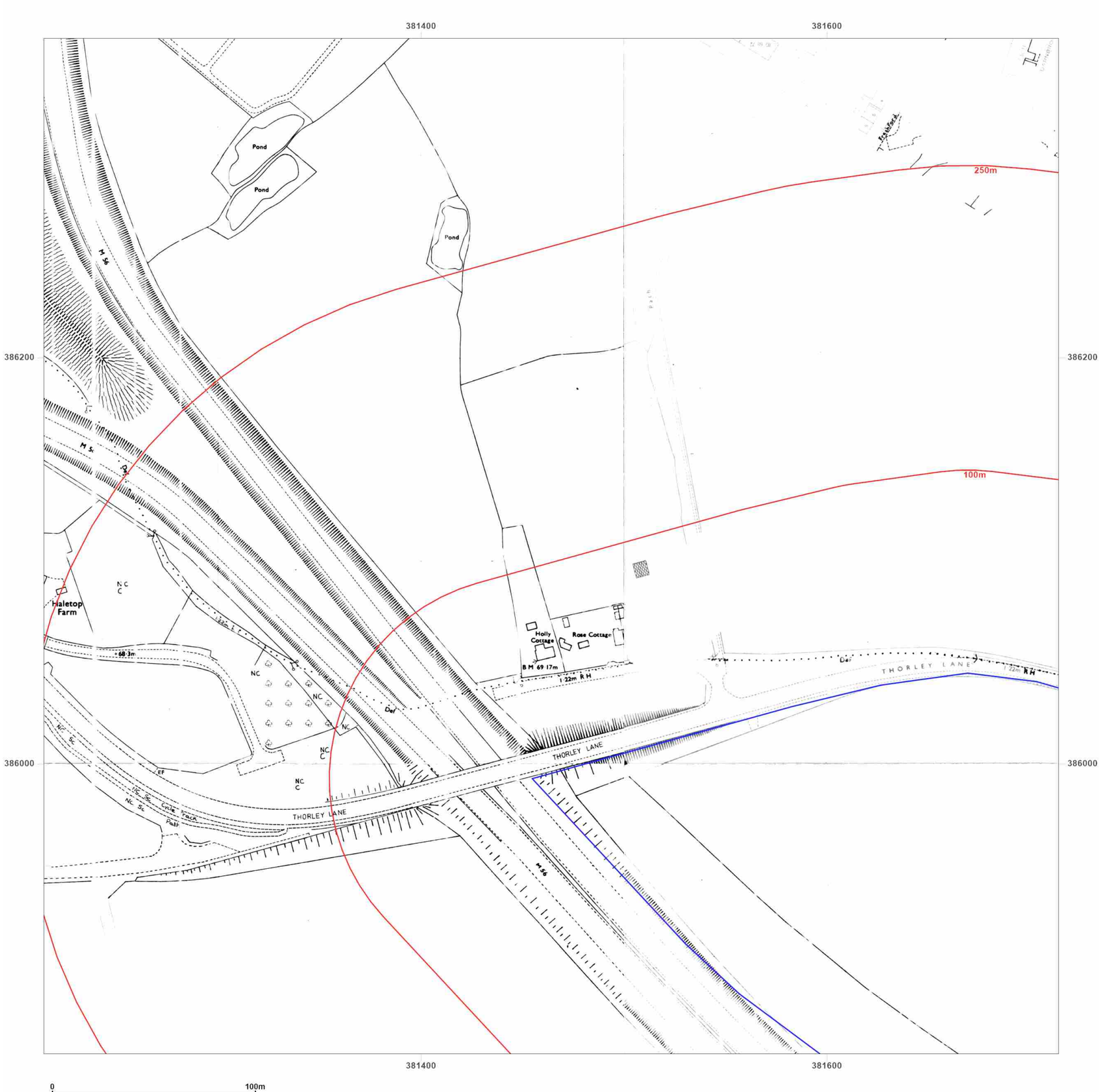
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Report Ref: GS-LLH-F2J-3NP-S9U_1250_1_2
Grid Ref: 381464, 386107

Map Name: National Grid
Map date: **1990**
Scale: 1:1,250
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Report Ref: GS-LLH-F2J-3NP-S9U_1250_1_2
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Map Name: National Grid
Map date: **1992-1993**
Scale: 1:1,250
Printed at: 1:2,000

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Map Name: National Grid
Map date: **1992-1995**
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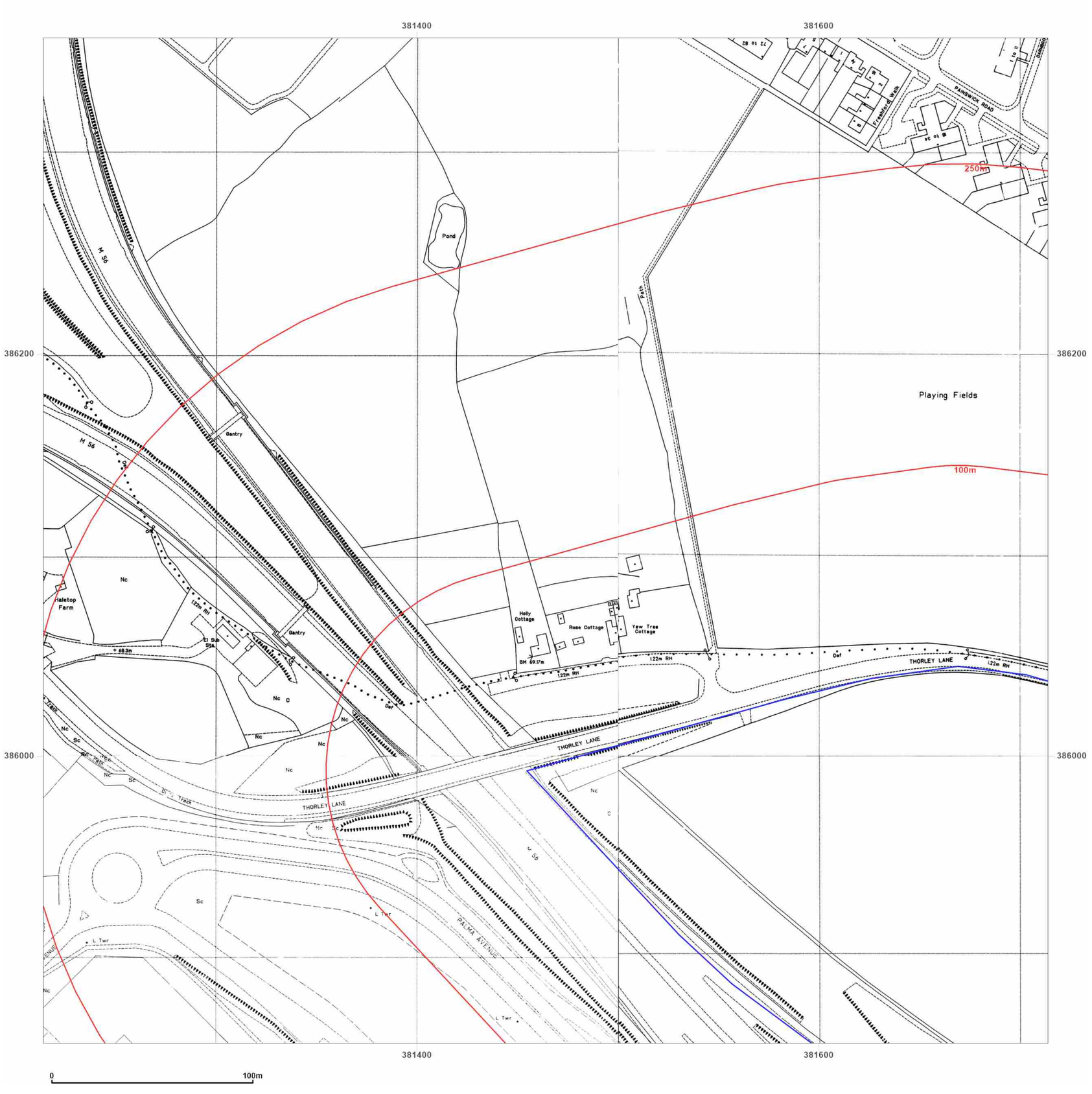
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Map Name: National Grid

Map date: **1992-1995**

Scale: 1:1,250

Printed at: 1:2,000

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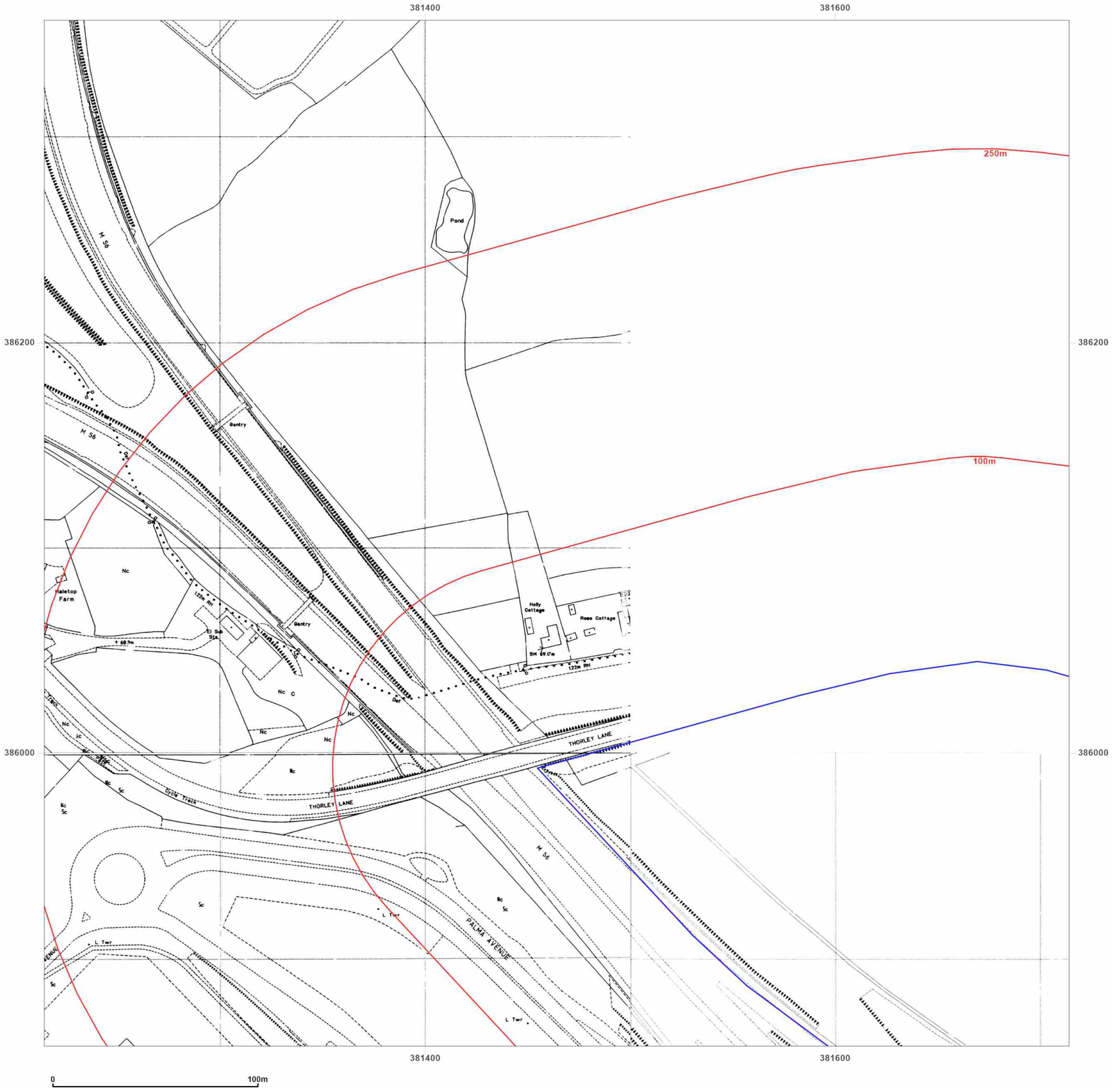
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Site Details:

MANCHESTER AIRPORT,
MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid

Map date: **1960-1963**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1963 Revised 1963 Edition N/A Copyright 1963 Levelled 1959	Surveyed 1959 Revised 1959 Edition N/A Copyright 1960 Levelled 1949

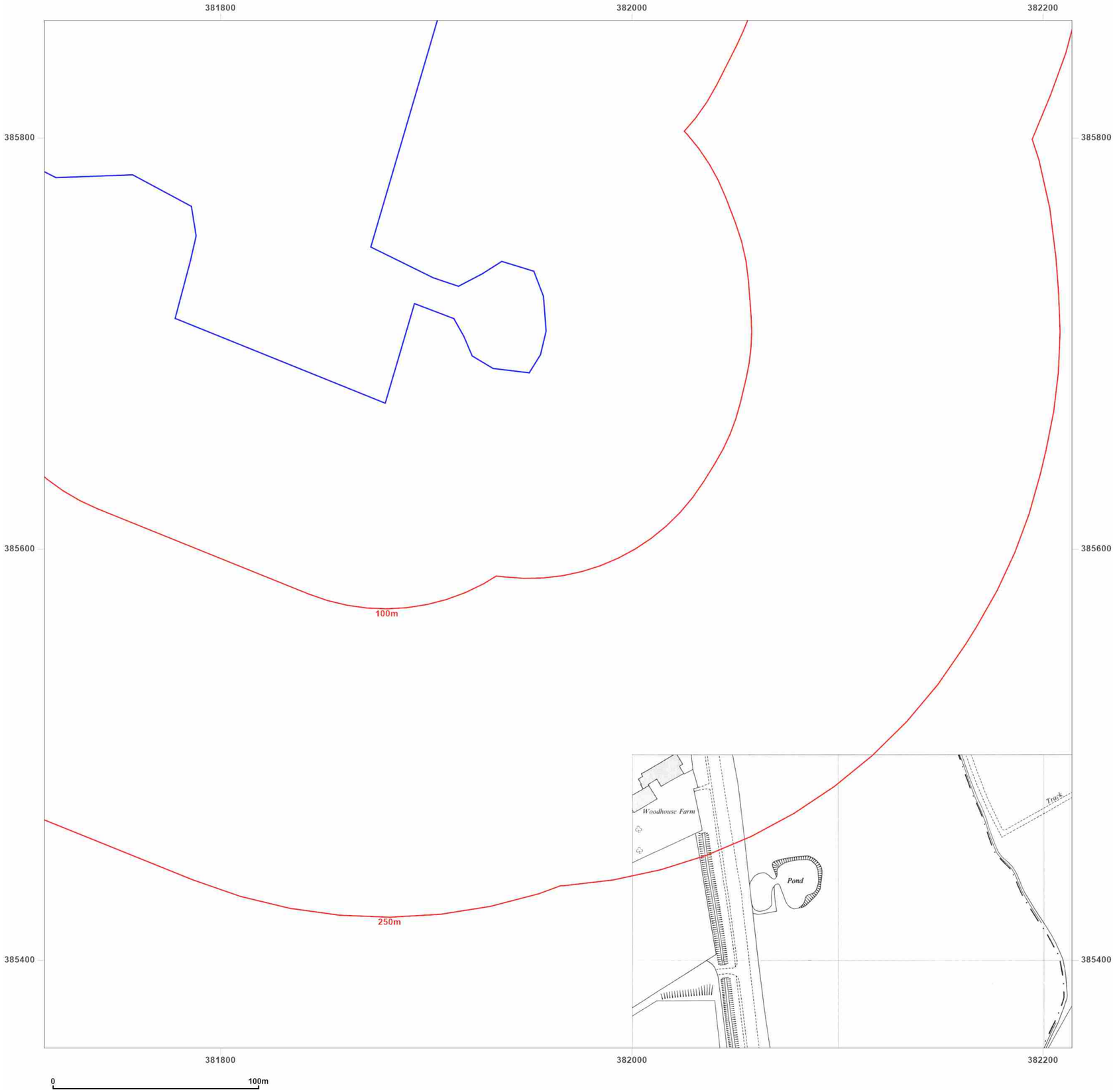
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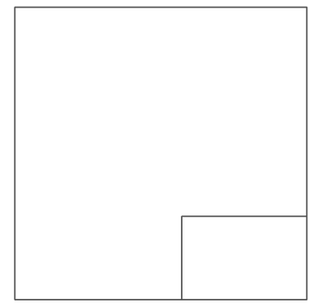
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MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid
Map date: **1967**
Scale: 1:1,250
Printed at: 1:2,000

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Surveyed 1959
Revised 1966
Edition N/A
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Levelled 1959

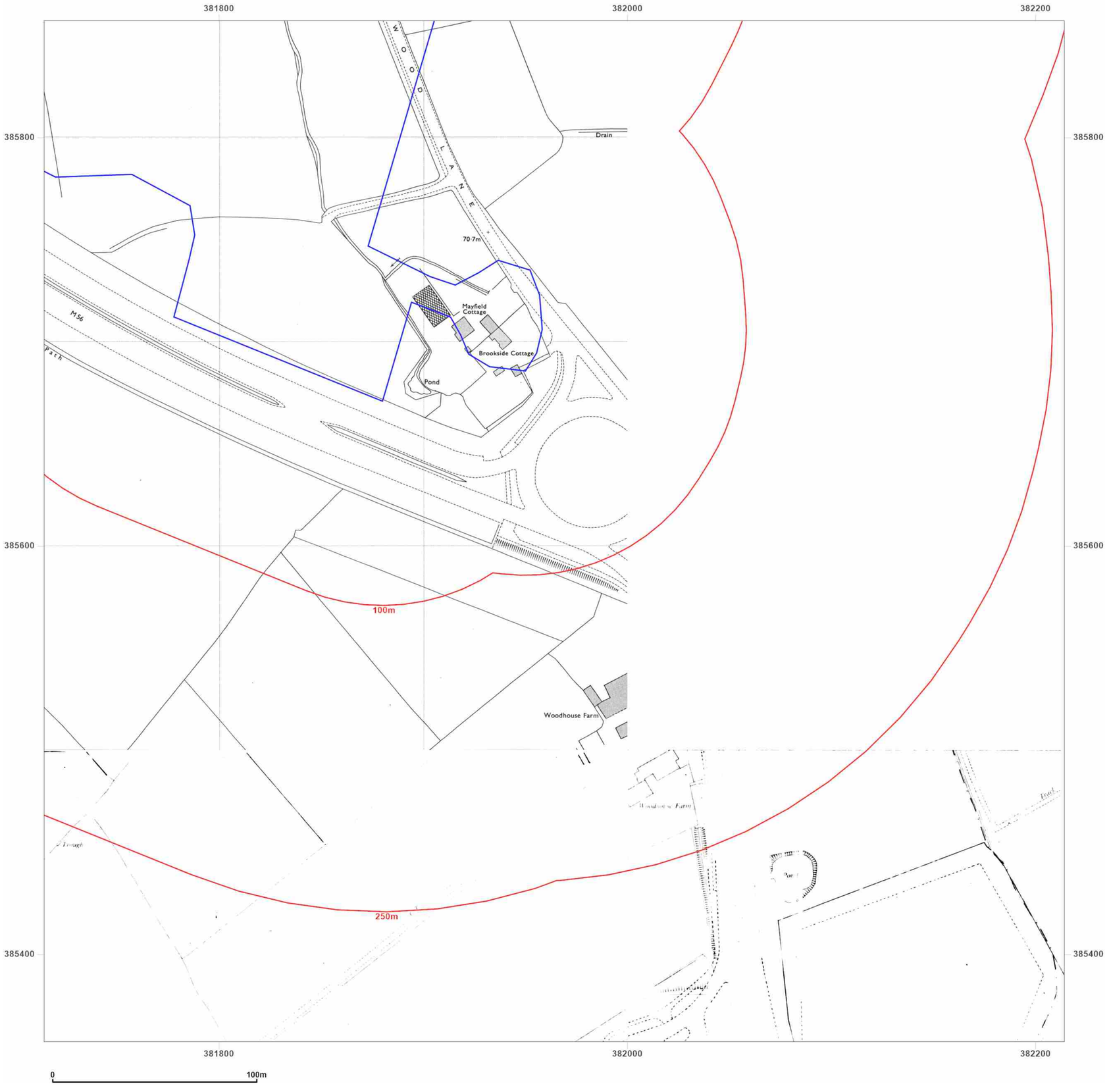
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MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid
Map date: **1974**
Scale: 1:1,250
Printed at: 1:2,000

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Revised 1973
Edition N/A
Copyright 1974
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Surveyed N/A
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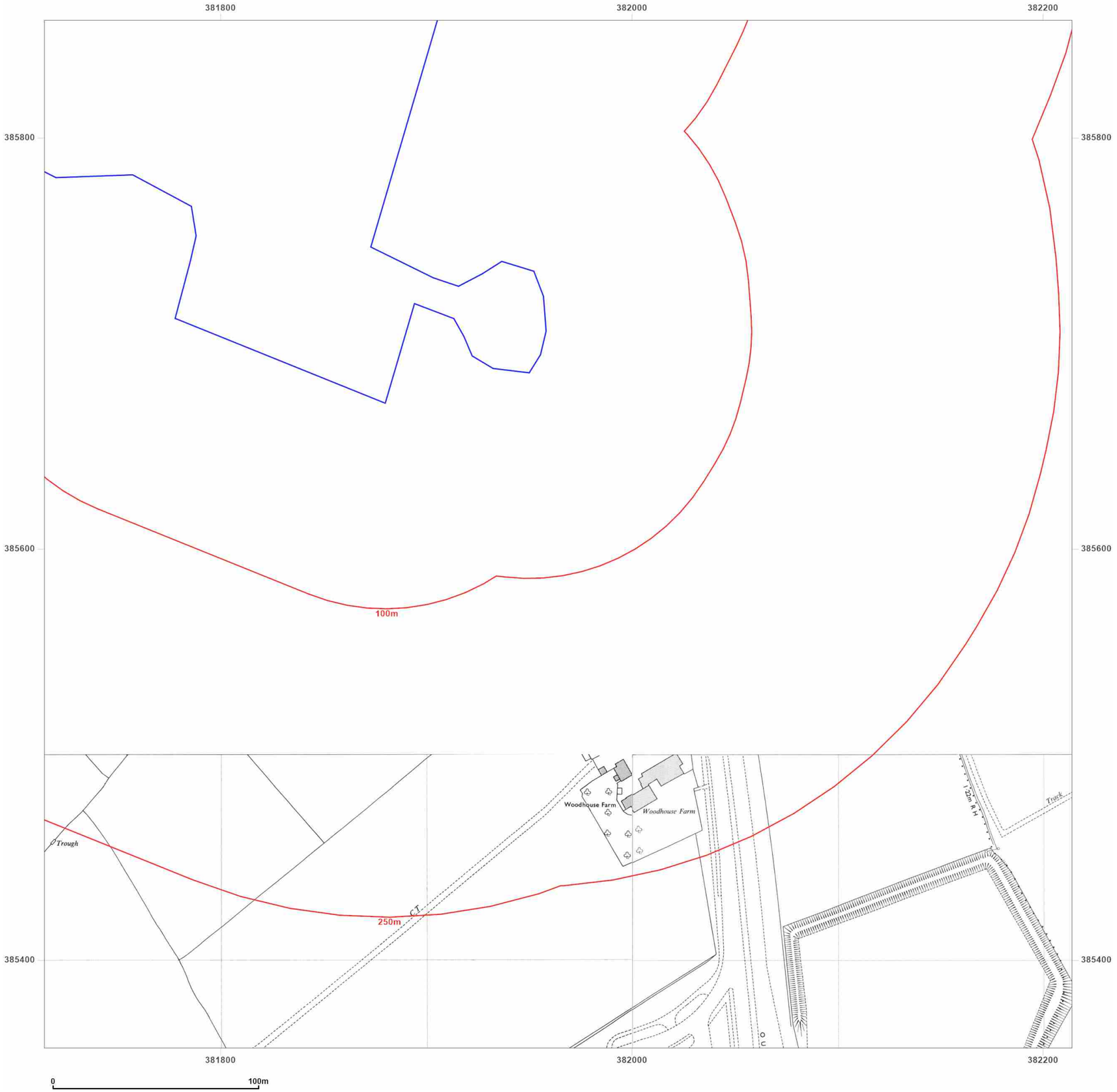
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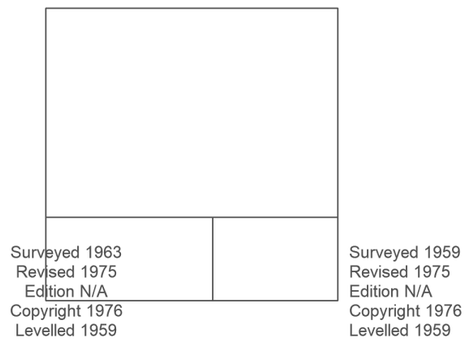
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MANCHESTER AIRPORT,
MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid
Map date: **1976**
Scale: 1:1,250
Printed at: 1:2,000

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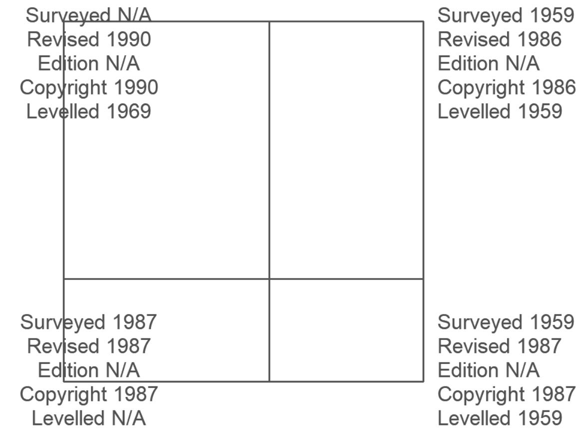
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Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid

Map date: **1986-1990**

Scale: 1:1,250

Printed at: 1:2,000

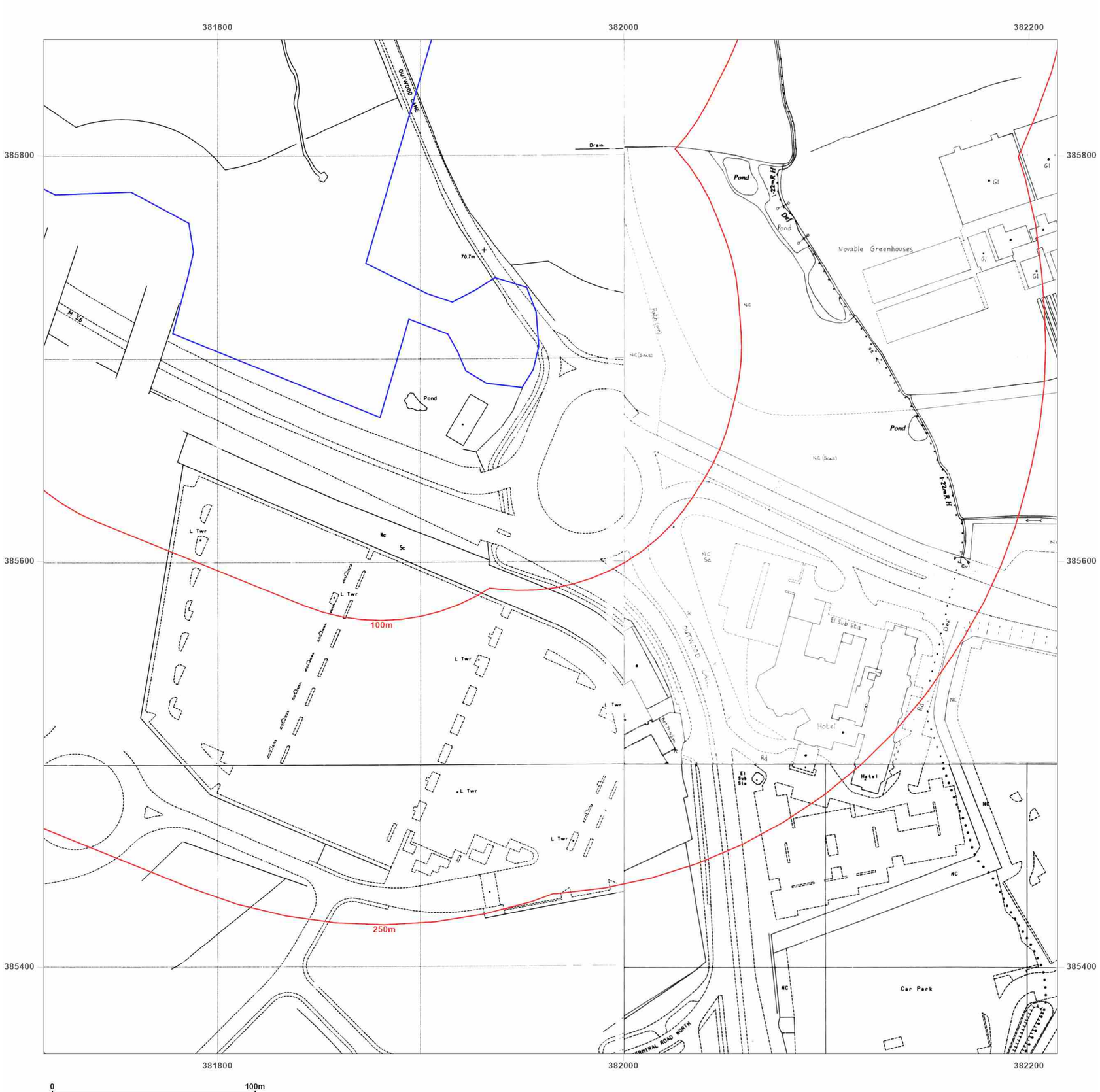


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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid
Map date: **1987-1992**
Scale: 1:1,250
Printed at: 1:2,000

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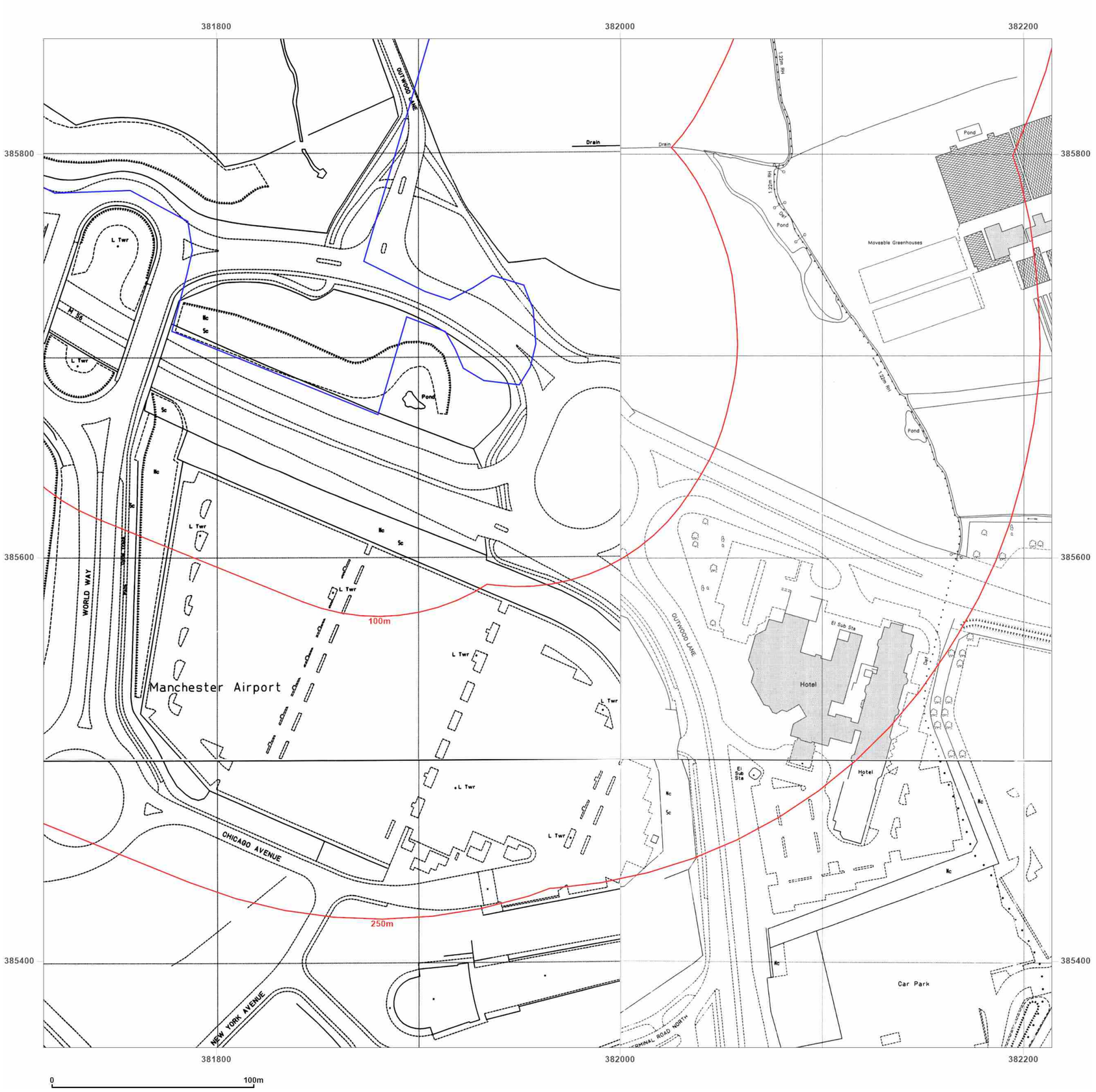
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Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid
Map date: **1989-1993**
Scale: 1:1,250
Printed at: 1:2,000

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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid
Map date: **1992-1993**
Scale: 1:1,250
Printed at: 1:2,000

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MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid
Map date: **1995**
Scale: 1:1,250
Printed at: 1:2,000

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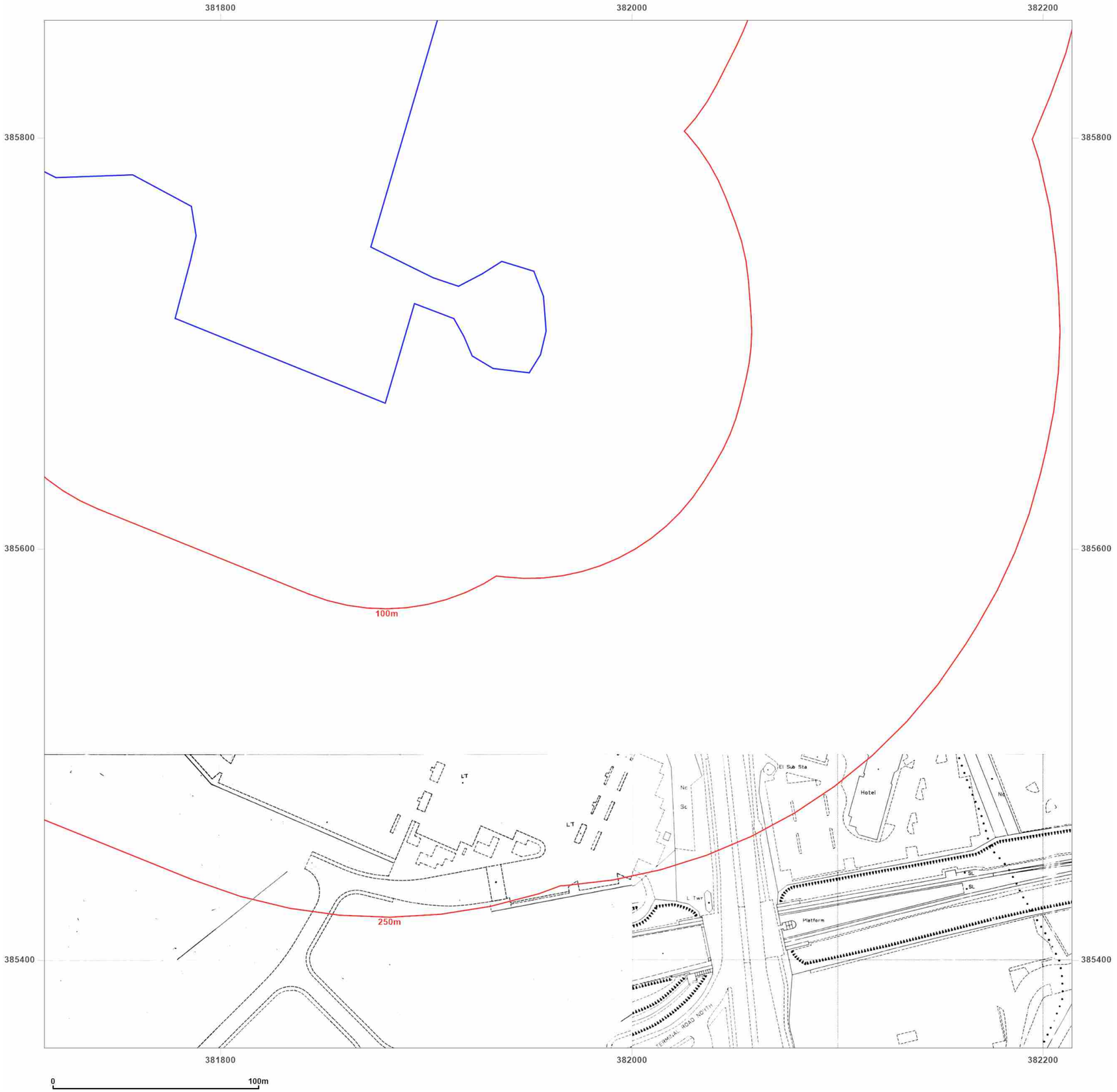
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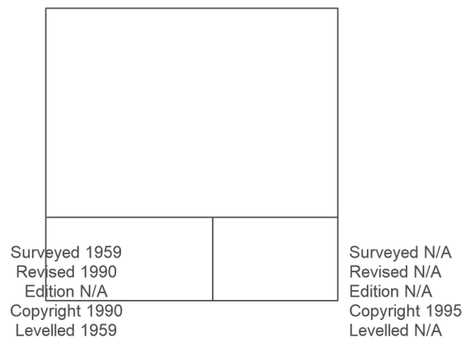
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MANCHESTER AIRPORT,
MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid
Map date: **1990-1995**
Scale: 1:1,250
Printed at: 1:2,000

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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_1
Grid Ref: 381964, 385607

Map Name: National Grid

Map date: **1993-1995**

Scale: 1:1,250

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Surveyed 1995 Revised 1995 Edition N/A Copyright 1995 Levelled N/A	Surveyed N/A Revised N/A Edition N/A Copyright 1993 Levelled N/A

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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_2
Grid Ref: 381964, 386107

Map Name: National Grid

Map date: **1960-1963**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1962 Revised 1962 Edition N/A Copyright 1963 Levelled 1959	Surveyed 1959 Revised 1959 Edition N/A Copyright 1960 Levelled 1949

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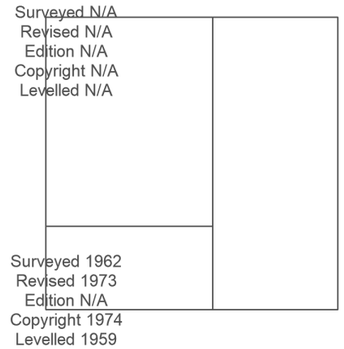
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MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_2
Grid Ref: 381964, 386107

Map Name: National Grid
Map date: **1974**
Scale: 1:1,250
Printed at: 1:2,000

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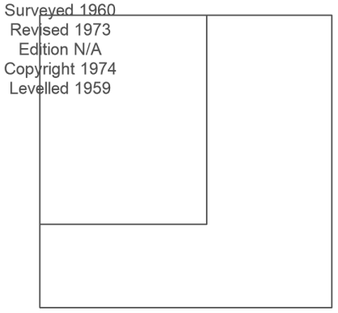
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Grid Ref: 381964, 386107

Map Name: National Grid
Map date: **1974**
Scale: 1:1,250
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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_2
Grid Ref: 381964, 386107

Map Name: National Grid
Map date: **1986-1990**
Scale: 1:1,250
Printed at: 1:2,000

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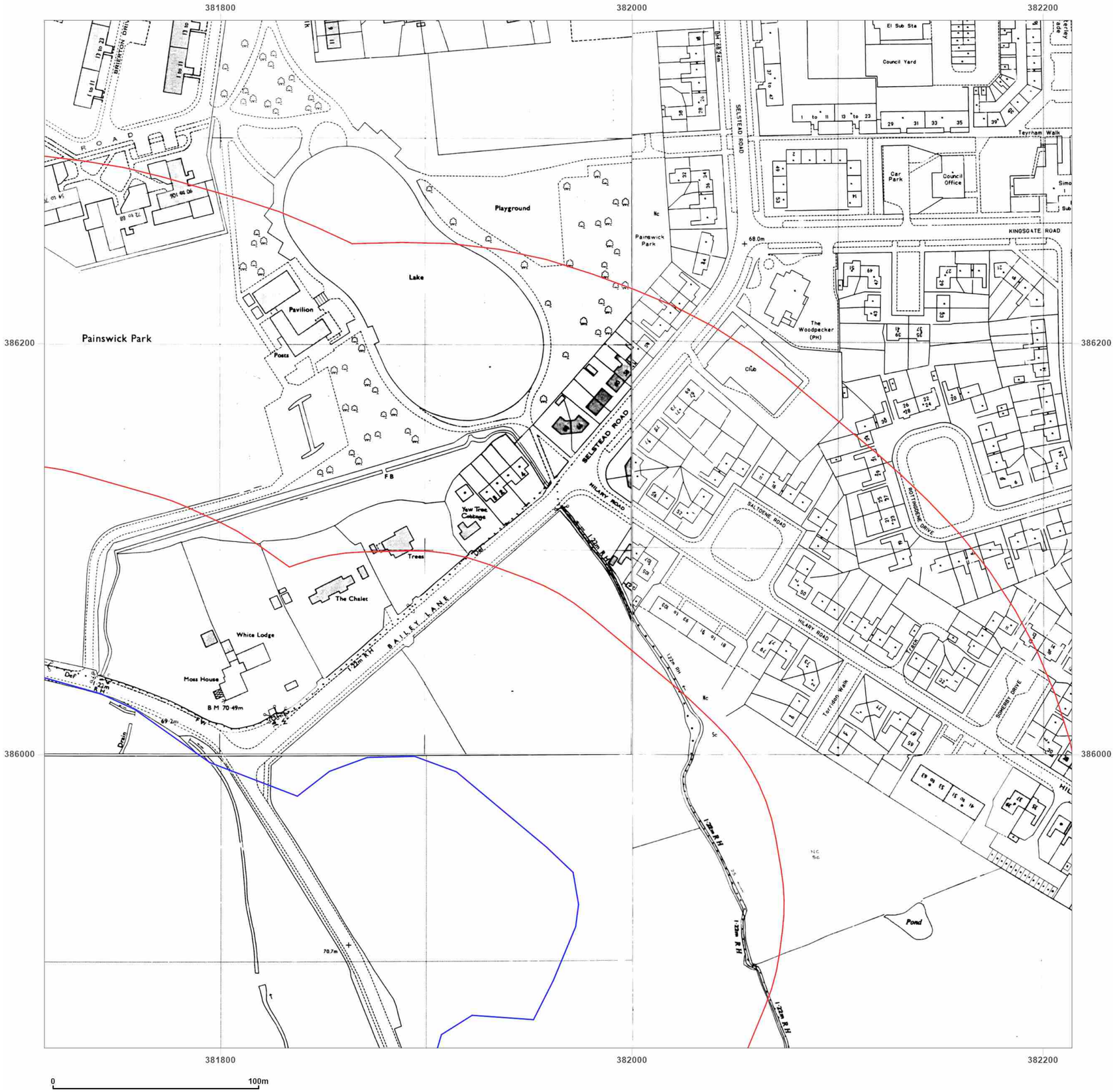
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Site Details:

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MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_2
Grid Ref: 381964, 386107

Map Name: National Grid

Map date: **1987-1992**

Scale: 1:1,250

Printed at: 1:2,000

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Site Details:

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MANCHESTER, M90 4EG

Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_2
Grid Ref: 381964, 386107

Map Name: National Grid

Map date: **1989-1994**

Scale: 1:1,250

Printed at: 1:2,000

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Client Ref: PBJ20682
Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_2
Grid Ref: 381964, 386107

Map Name: National Grid

Map date: **1992-1994**

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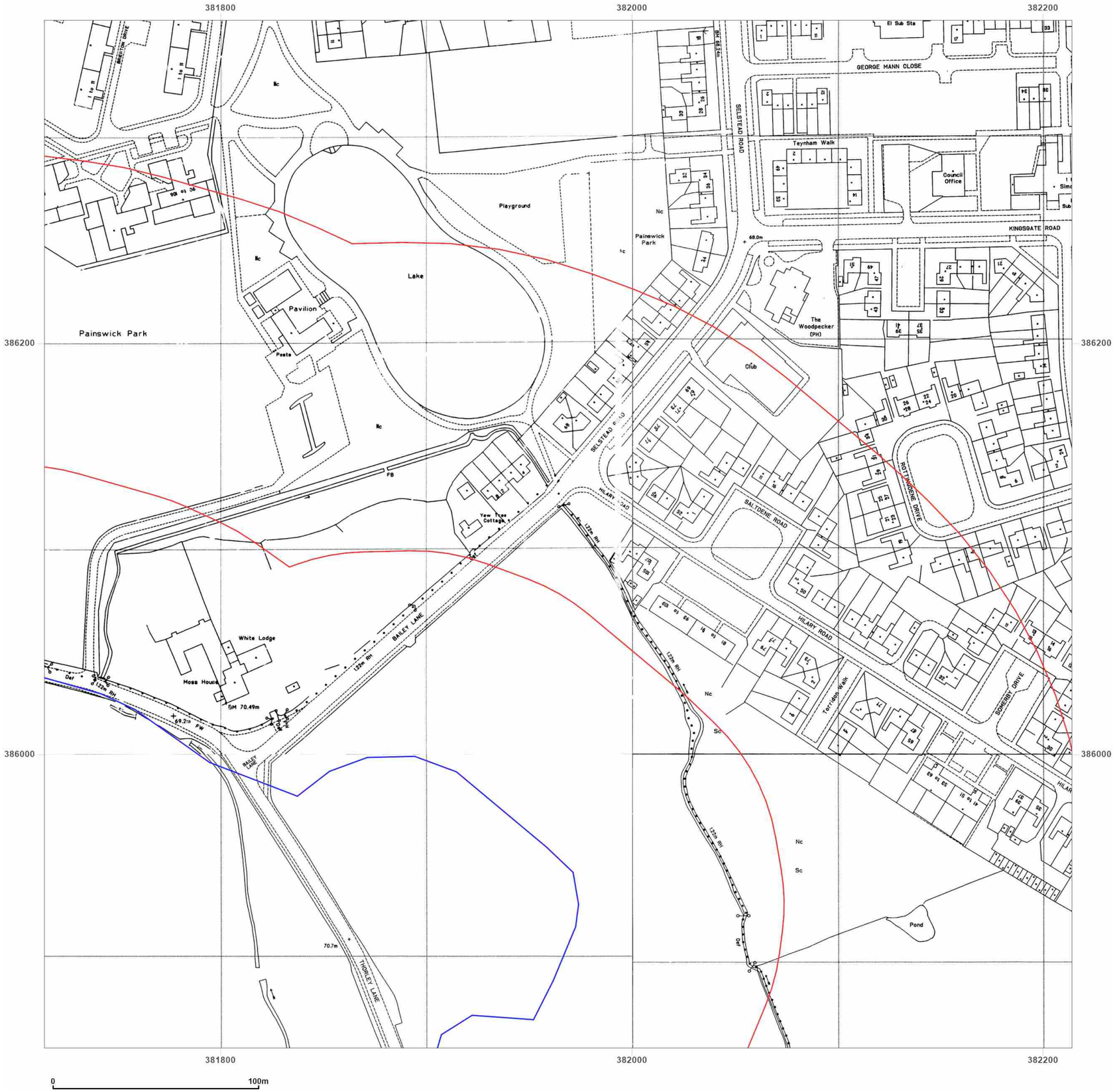
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Grid Ref: 381964, 386107

Map Name: National Grid
Map date: **1992-1995**
Scale: 1:1,250
Printed at: 1:2,000

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Report Ref: GS-LLH-F2J-3NP-S9U_1250_2_2
Grid Ref: 381964, 386107

Map Name: National Grid
Map date: **1995**
Scale: 1:1,250
Printed at: 1:2,000

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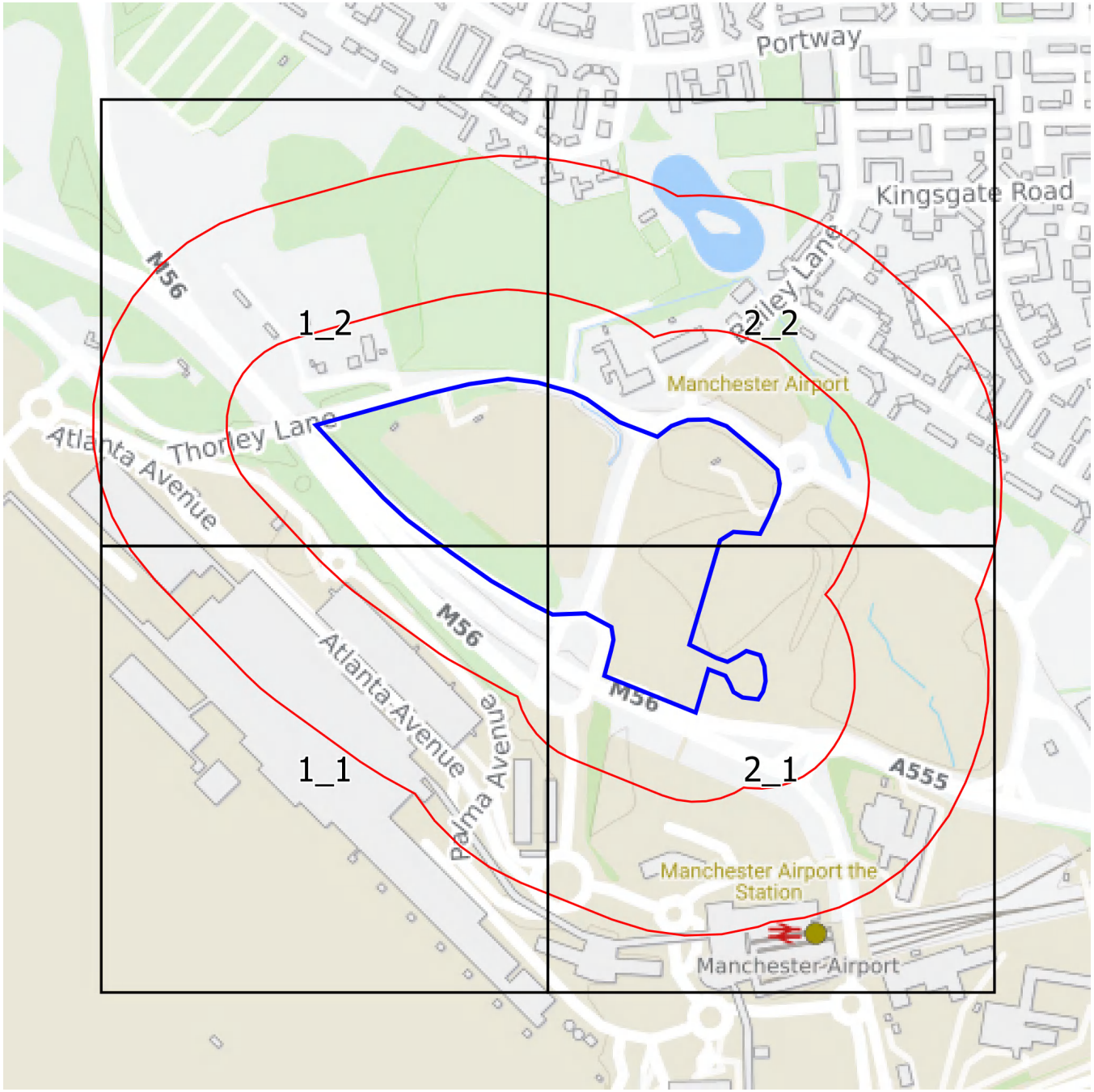
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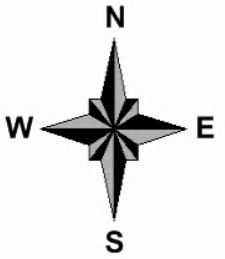
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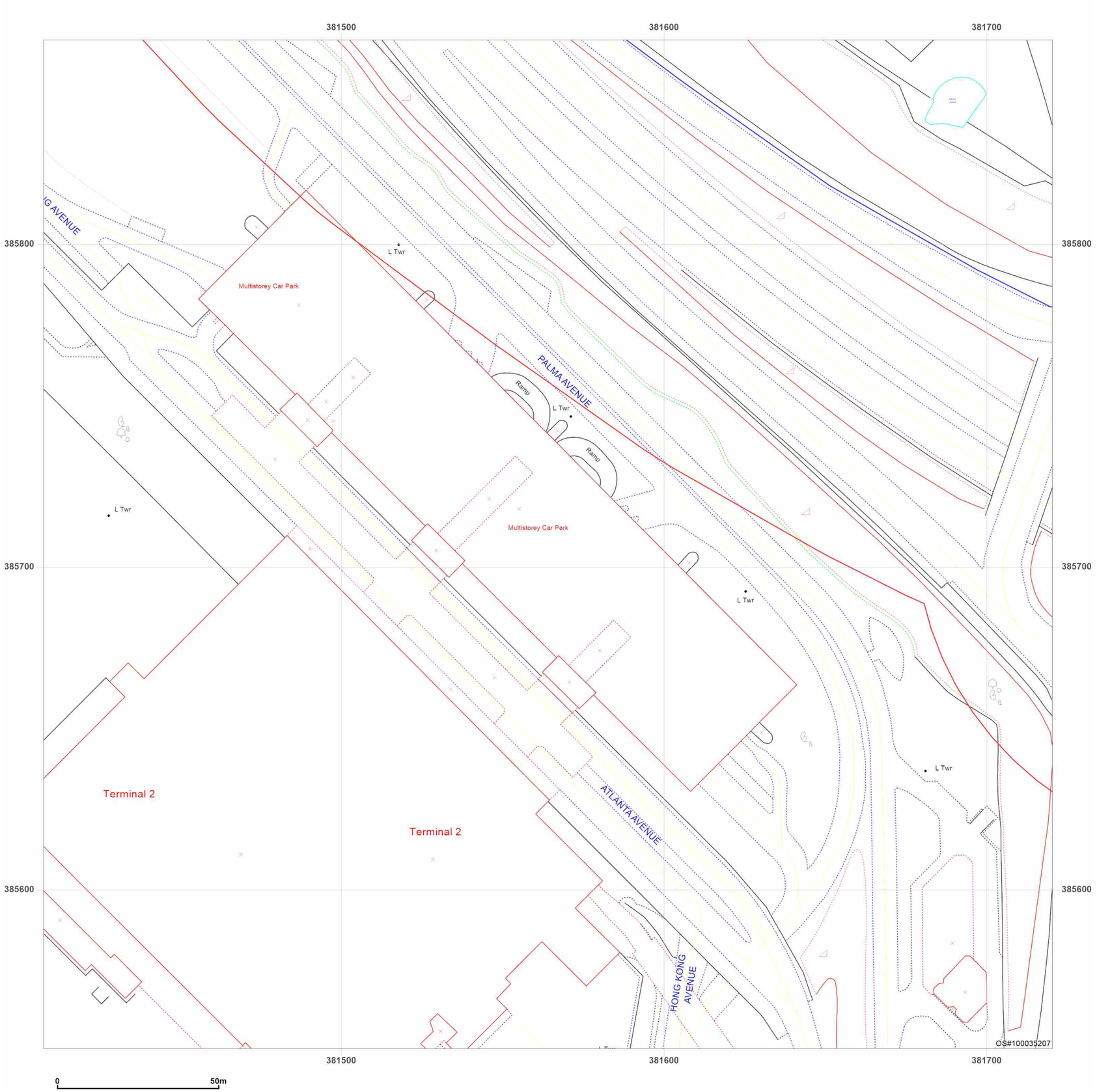
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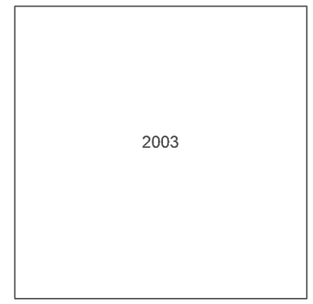
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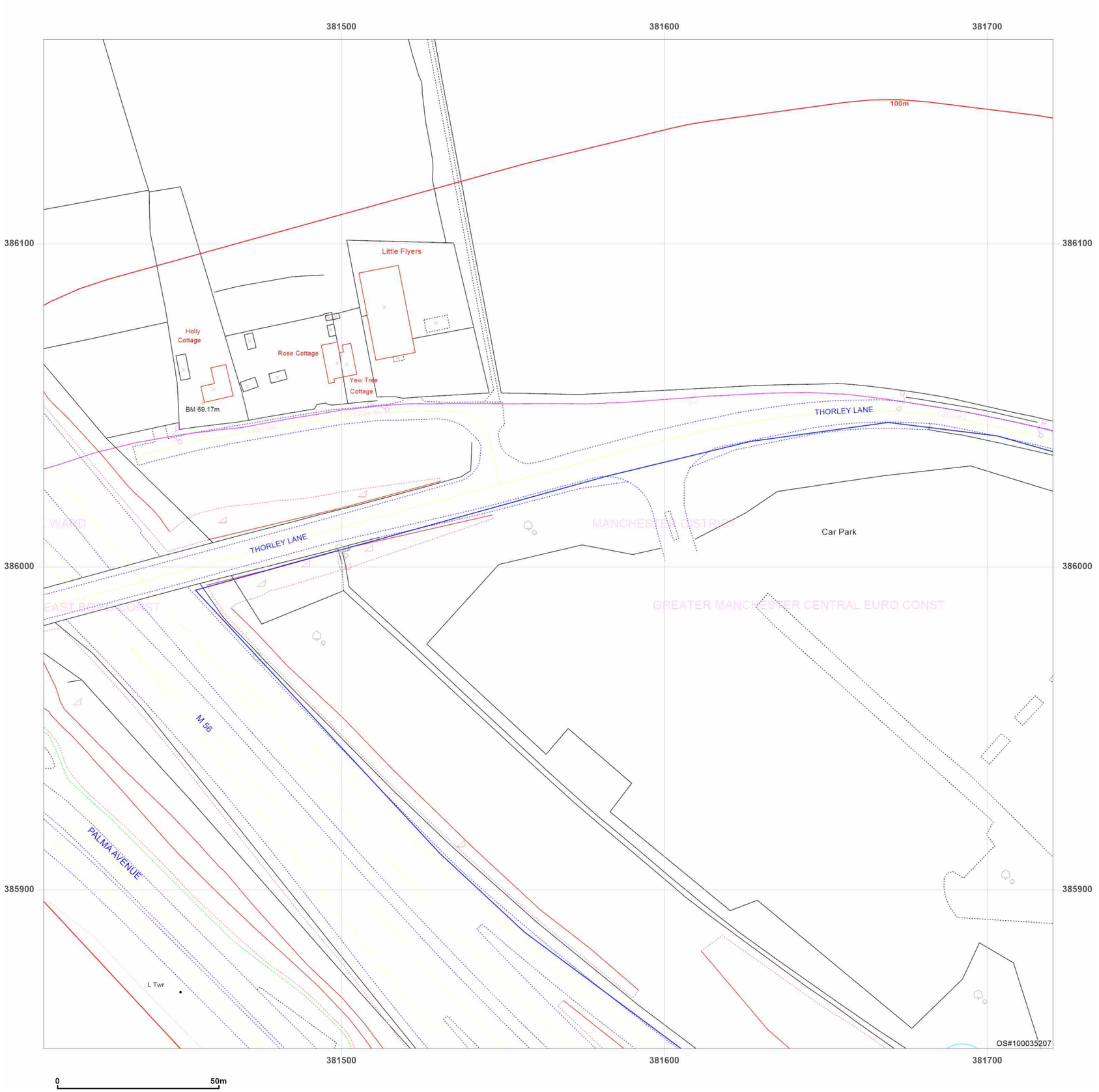
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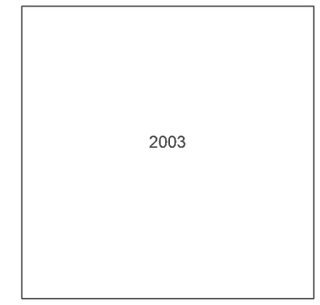
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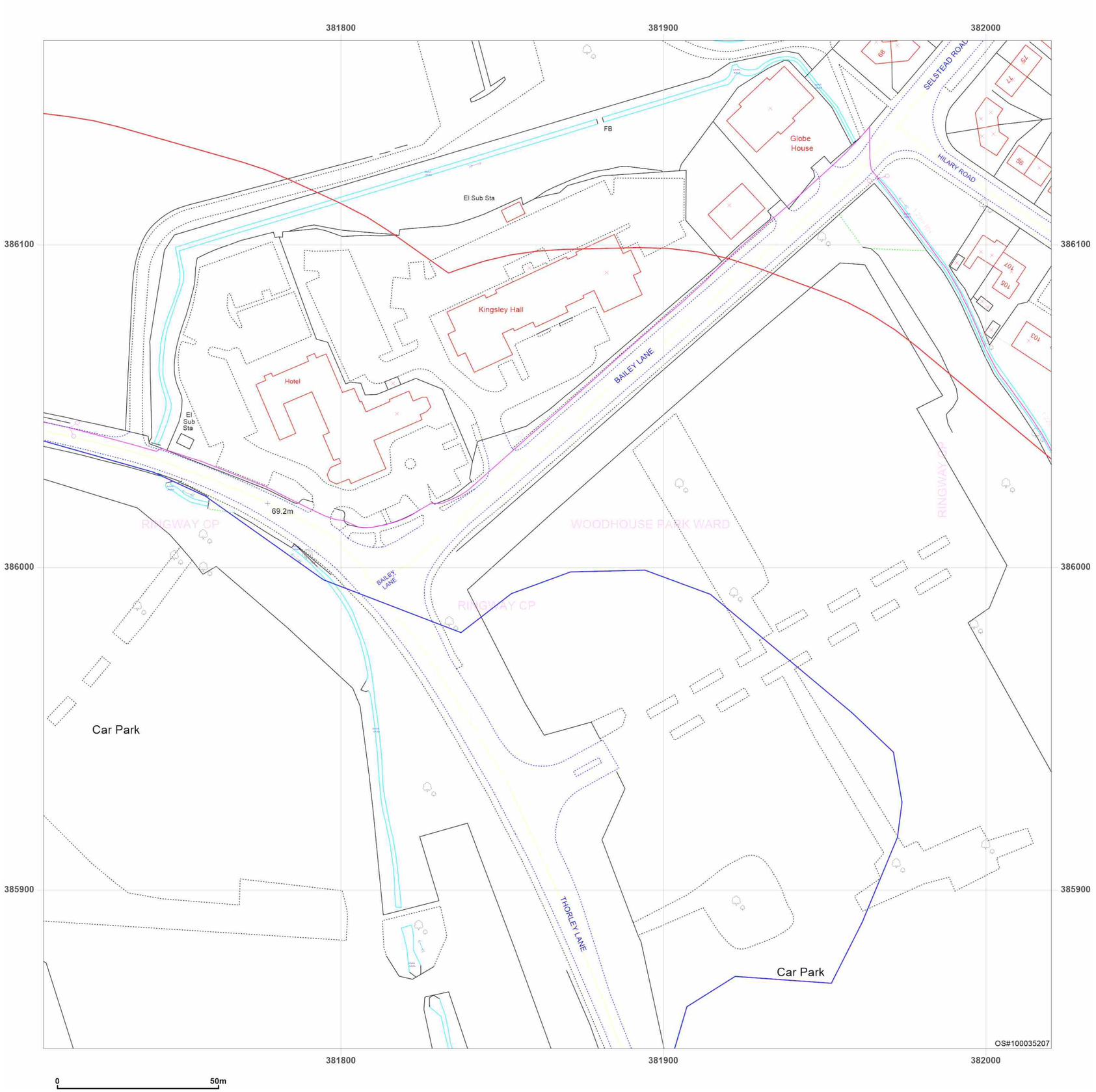
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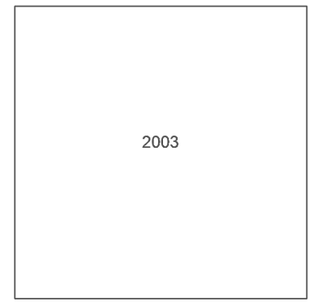
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Appendix E
THIRD PARTY DATA

RoC CONSULTING

EXCELLENCE IN ENGINEERING
CONSULTANT OF CHOICE
ADDING VALUE



Phase 2 Site Investigation

On

Airport City North

For

Airport City Partnerships

May 2016

EXCELLENCE IN ENGINEERING
CONSULTANT OF CHOICE
ADDING VALUE

PHASE 2 SITE INVESTIGATION

ON

AIRPORT CITY NORTH

ISSUED	DESCRIPTION	DATE	Collated By	Reviewed By
1	Phase 2 Site Investigation Report	16/05/2016	Jason Bradley	Alex Smiles
REVISION	**DESCRIPTION**	**DATE**	**AUTHOR**	



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1.0 INTRODUCTION

1.0.1 RºC Consulting have been appointed by Airport City Partnerships to conduct a Phase 2 Site Investigation across Airport City North (the site). It is understood that the site is to be redeveloped for a range of Commercial end uses divided between 16 individual development plots. In addition the redevelopment will include the construction of an access road (the "Jug Handle" road) through the sites centre as well as associated car parking and public realm space.

1.0.2 An indicative development masterplan has been produced by 5 Plus Architects which is provided within Appendix A.

1.0.3 The following investigation has been completed to support design and master planning requirements for the sites redevelopment and was tailored to provide an initial indication of ground conditions across the entire Airport City North development site.

1.0.4 The report follows on from a number of site investigations relating to the development site; namely:

1. Phase 1 Desktop Study completed by URS in October 2012 relating to the Airport City North site.
2. Phase 2 Factual Ground Investigation for the Airport City Link Road by completed by Costain Environmental Services in June 2012.

1.0.5 It is recommended reference be made to the abovementioned report (s) when reviewing the current assessment.

1.0.6 The scope of the report and its assessment has been based around the sites redevelopment proposals as outlined in the aforementioned 5 Plus Architects plans. It should be noted that any subsequent revision of the proposed redevelopment or site boundary away from the above mentioned drawing may result in the full or partial re-interpretation of this report and assessment.

1.1 Terms of Reference

1.1.1 The Phase 2 Site Investigation was carried out following receipt of an instruction from Mr Andy Potter of Faithful & Gould, acting on behalf of Airport City Partnerships Ltd.



1.2 Objectives

1.2.1 The scope of works has been tailored to meet both planning and design requirements to assist with the sites redevelopment. These considerations include:

1. Review existing site investigation information for the site to identify data gaps and areas that warrant further consideration.

2. Design a program of site investigation works to establish ground conditions and quality beneath the site including shallow soil composition, depth to rockhead, bedrock strength, geochemical properties and ground gas conditions.

3. Completion of site investigation field works comprising the formation of x8 Rotary Core boreholes, x17 Trial pits, x21 TRL CBR tests and x35 Cone Penetration test holes.

4. Completion of x6 ground gas and groundwater monitoring visits utilising wells installed during ground investigation fieldworks.

5. Completion of geo-environmental and geotechnical laboratory analysis of soil / rock samples to determine physical and chemical characteristics.

6. Completion of a preliminary geotechnical assessment of site conditions to inform new building foundation and road design.

7. Completion of a geo-environmental assessment utilising results provided from soil chemical testing and monitoring works to evaluate risks posed by site soils, as well as ground gas ingress.

1.2.2 A detailed explanation of the site investigation design rational and fieldworks is provided in Sections 4.0 and 5.0 respectively.



2.0 LIMITATIONS OF STUDY ASSESSMENT

2.0.1 The report has been produced by RºC Consulting for the client solely for the purposes of a review of information for the above mentioned site. It may not be used by any person for any other purpose other than that specified without the express written permission of RºC Consulting. Any liability arising out of its use by a third party for purposes not wholly connected with the above shall be the responsibility of that party who shall indemnify RºC Consulting against all claims costs damages and losses arising out of such use.

2.0.2 This report is written in the context of an agreed scope of work and should not be used in a different context. The report should be read in its entirety. Furthermore new information, improved practices and changes in legislation may require re-interpretation of this report in whole or in part after its original issue. RºC Consulting reserve the right to alter their conclusions and recommendations in the light of further information that may become available.

2.0.3 Ground conditions can change rapidly, especially in areas of made ground, however, it is assumed that the ground conditions observed are typical and representative of the site as a whole. The ground conditions have been determined from a limited number of exploratory holes formed across the property, therefore, only a small percentage of the total area of the property has been investigated. Interpolation between exploratory holes has enabled a general picture of the subsurface conditions to be produced. Conclusions drawn from the ground investigation should be read in this context.

2.0.4 RºC Consulting cannot accept responsibility for any situations resulting from locally unforeseen ground conditions occurring between exploratory holes.



3.0 BACKGROUND INFORMATION

3.0.1 A previous Phase 1 Desktop study has been undertaken for the site by URS (2012) which included a Preliminary Risk Assessment as to the risks posed by soil or groundwater contamination. In addition a limited program of site investigations were completed by Costain Environmental Services along the proposed line of the Airport City Link Road comprising the formation of boreholes and machine excavated trial pits, along with associated chemical and geotechnical testing.

3.0.2 The following appraise has been collated with reference to the abovementioned reports as supporting information to the current assessment.

3.1 Site Description

3.1.1 The site is located to the north of the main airport complex and is bounded to the north by the Woodhouse Park residential estate; the M56 and main terminal buildings to the south; Aviator Way and commercial office development to the east; and open ground and the M56 to the west. Topography of the site is largely flat although embankments are noted along southern extent with the M56.

3.1.2 Land use across the site is split into two main areas; the central and western extent comprises gravel two car park areas (Jet Parks 1 and 2) that are used by the airport for both long and short term parking. Topography of Both car parks is relatively flat, and are covered by hard standing split between tarmac and gravel material which is in good condition.

3.1.3 The area to the east (Goodman's Land) is predominantly open grass and scrub land with mixed woodland toward the sites boundaries. Topography is uneven, slightly undulating toward the north west of Goodman's Land. There is an area of standing water and drainage ditch to the south of the site and two tributaries of Baguley Brook flowing parallel to each other north-west across the site was noted, bounding the Jet Parks 2 boundary.



3.2 Desktop Study

3.2.1 A previous Phase 1 desk study has been undertaken for the site by URS (2012) which provided a preliminary risk assessment of contamination which may be present in soil or water resources at the site and potential implications for the proposed development.

3.2.2 The site is underlain by superficial glacial Till, which is subsequently underlain by solid geology of Bolin Mudstone. The Till is classified as unproductive strata and the mudstone as a Secondary B Aquifer, overlain by soils of negligible leaching potential. There are two tributaries of Baguley Brook that flow parallel to each other, south-east to northwest across the site. A number of areas of standing water were also noted across the site.

3.2.3 Historical maps indicate the site has been used as agricultural land, as a nursery and as car parking, with an area of infilled land in the south-east (a former opencast clay pit). Land adjacent to the site was formerly agricultural and woodland and more recently a housing estate to the north and the airport to the south.

3.2.4 Primary on-site sources of contamination have been identified as the former agricultural land use, nursery, car parking and possible infilled land features. Potential off-site sources of contamination have been identified as infilled land, the airport, motorway infrastructure, agricultural land and nurseries. Potential primary receptors have been identified as construction workers and future operational site users, controlled waters and buildings and infrastructure.



3.3 Geological Characteristics

3.3.1 Review of publically available BGS geological map records indicate the site is underlain by the following:

Drift Geology: Glacial Till - Boulder clay with thickly bedded sand bands

Solid Geology: Bollin Mudstone

3.3.2 The URS Phase 1 report (Appendix C) indicates that the site is not located in an area which may be affected by historic Coal Mining or Brine extraction and a Coal Authority report is not required. In addition the site does lie within an area that may be affected by subsidence from the historic pumping of Brine.

3.3.3 Records provided as part of the 2012 Costain ground investigation indicate conditions along the proposed Link Road alignment predominantly comprise variable depths of granular made ground deposits overlying extremely weak, becoming weak with depth, Mudstone and Siltstones. The bedrock was reported at 7 of the 13 boreholes and trial pits attempted the level to which varied between 63.94 and 67.42mAOD.

3.3.4 Made ground was also reported although the depths indicated are distorted at some locations (e.g. BH01) due to the construction of the existing M56 embankment. Generally speaking made ground varies in thickness between 0.4 and 1.2m and comprises largely inert Sandstone and Mudstone gravel associated with the existing car park construction.

3.3.5 Subsequent monitoring works completed during the Costain investigation failed to indicate significant levels of ground gasses such as Methane and Carbon Dioxide beneath the site with peak CO2 levels not exceeding 1.8% and gas flow rates around zero.



3.3.6 Geotechnical testing of soil and bedrock samples obtained during the Costain investigation; results from shallow clay testing indicated a Plasticity Index range between 11 and 27% with a mean of 17% indicating the shallow glacial clays are of a low to medium plasticity. Undrained shear strength testing of the clay varied between 41 and 48kPa indicating a soft to firm range, although it is also noted only two samples of clay were tested.

3.3.7 Laboratory derived CBR values were found to range between 1.0 and 7.9% with a mean of 3.68% with samples obtained from the undeveloped Goodman's portion of the road were found to exhibit the lower CBR values. Point load testing was undertaken on rock core samples from BH01 to 04 corrected results from which indicate Is50 (Mpa) values ranging between 0.018 and 2.98 with an average strength of 1.09mPA. These results confirm the rocks extremely weak, becoming weak strength range.

3.3.8 Soil and groundwater chemical conducted as part of the Costain investigation failed to indicate any sources of contamination with site soils; in addition to occurrences of Asbestos containing materials were reported within samples tested.



3.4 PRELIMINARY CONCEPTUAL SITE MODEL

3.4.1 The information obtained during the desk study has been reviewed to establish the Preliminary Conceptual Model for the site. This model is based around the Source / Pathway / Receptor methodology as outlined in Fig 3.0.

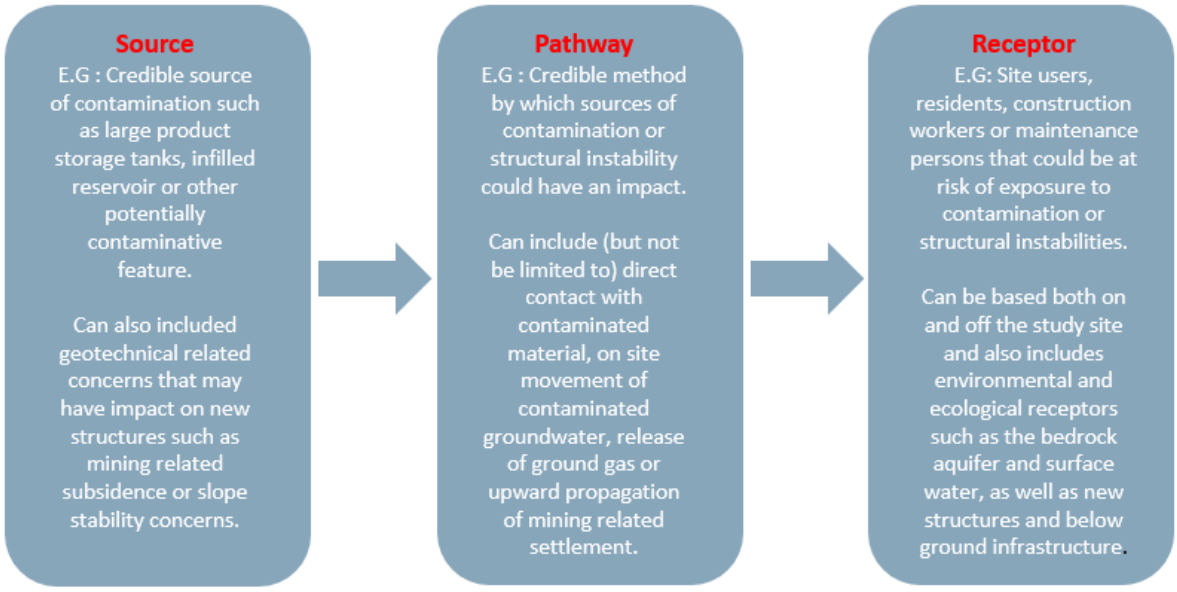


Figure 3.0 Source Pathway Receptor Diagram

3.4.2 Risk assessment is the process of collating known information on a hazard or set hazards in order to establish actual or potential risks to receptors. The receptor may be human health, controlled waters, a sensitive local ecosystem or even construction materials. Receptors can be connected with the hazard under consideration via one or several exposure pathways (e.g. the pathway of direct skin contact and oral exposure).

3.4.3 Risks are generally managed by isolating or removing the hazard, isolating the receptor, or by intercepting the exposure pathway. Without the three essential components of a source (hazard), pathway and receptor, there is deemed to be no risk. In other words, the mere presence of a hazard at a site does not mean that there will necessarily be risks.



3.4.4 CLEA CLR 8 provides a selection of contaminants that may be relevant for the assessment of contaminated land, based on site usage, because they are likely to be found on a large number of industrial sites in the UK and have the potential to affect human health and the environment. The CLEA CLR 8 documentation, along with other relevant guidance, forms the basis against which the site has been assessed.

Potential Sources

3.4.5 Based on the current / historical uses of the site, and the surrounding area, the following potential sources of contamination / abnormal items have been identified:

- **On site**

  Car Park - fuel/oil spillages and chemical relating to vehicular operations such as Total Petroleum Hydrocarbons.

  Nursery and former agricultural land – Horticultural and agricultural chemical including organo-pesticides and fertilisers.

  Infilled Land – Unknown contaminants and ground gas relating to material used to infill features.

  Moss House Farm building – Demolition of former buildings on site which may comprise asbestos containing material.

- **Off Site**

  Infilled land – Migration of unknown contaminants and ground gas from infilled land

  Nurseries and agricultural land - Horticultural and agricultural chemical including organo-pesticides and fertilisers.

  Motorways and Airport Operations – Hydrocarbons relating to vehicle movement and the airport to the south including airport related chemicals such as de-icing compounds.



Potential Pathways and Receptors

3.5.6 The following potential pathways and receptors have been identified for the above potential sources of contamination:

- End users of the site (employees) could be at risk of exposure to contaminated soils / materials at the site via ingestion, direct contact and inhalation of contaminated dust / vapours / hazardous gas.
- Construction persons could also be at risk of exposure to contaminated soils via ingestion, direct contact and inhalation of contaminated dust / vapours / hazardous gas.
- On site migration of contaminants and ground gas toward the site from adjacent infilled features such as ponds.
- Controlled waters (Groundwater and surface water).

Assessment of Risk –Linkages

3.0.8 Risk is normally defined by the consequences of the risk (i.e. severity) and the probability of the risk occurring. For each pollutant linkage both the probability and severity is assessed to determine whether there may be an unacceptable risk. Risk is classified as follows:

- Low - no action required
- Medium - some mitigation measures may be required
- High - mitigation measures definitely required

3.0.9 Table 3.1 (provided overleaf) assess and summarise the pollutant linkages that may exist at the site; the assessment has assumed that the site is to be redeveloped for Commercial end uses.



TABLE 3.1: PRELIMINARY CONCEPTUAL SITE MODEL		
Potential Sources		
Contamination Source	**Risks Posed**	**Comment**
Current land use	Low	The central and western part of the site are currently occupied by car parking facilities which are partially covered by hard standing tarmac and the remainder gravel. There is a theoretical risk posed to site soils by fuel/oil spillage comprising total petroleum hydrocarbons and heavy metals. However, hard standing and limestone gravel material is likely to have acted as a barrier between the source and underlying soils. The eastern part of the site encompasses Goodman's Land, an area of vegetated (shrubs/brambles) land which is currently disused and its current configuration does not pose a risk to site soils.
Historical land use	Low	**On Site** Historically the site has been used for agricultural farming comprising open grass land with an associated farmhouse building. There is potential for residual contamination to be present on site associated with organic fertiliser chemicals used in historical farming operations.
	Low	**Off Site** Areas of infilled land such as ponds may provide a source of migrating unknown contaminants and ground gas. Agricultural land adjacent the site could have impacted site soils by introducing chemical compounds such as organo-pesticides and fertilisers. Motorway link roads and the airport development may provide a source of hydrocarbons relating to vehicle movement and the airport to the south including airport related chemicals such as de-icing compounds.
Proposed land use	Low	The site is to be redeveloped for commercial end uses and proposed site operations are not envisaged to pose a risk to site soils.
Ground Gas	Low	A number of potential sources of ground gases have been identified including infilled land in the south-east of the site and within 250 m of the site. However, the impermeable superficial clay will reduce the potential for ground gas migration onto and across the site.
Potential Receptors		
Human Health– Construction Personnel		Construction persons are considered to be at the greatest risk of exposure to contaminants during the sites redevelopment. A better understanding of site conditions, and specifically the quality of underlying soils, will be required to assist with the identification of any contamination hot spots and associated mitigation measures. The use of full PPE and welfare facilities will be essential during the redevelopment process
Human Health –site users		Post-development the site will be covered by hard standing and buildings reducing the potential for water to infiltrate into the underlying soil and the potential for mobile contaminant migration. In addition, drainage systems will be designed to consider ground conditions and any potential elevated chemical concentrations within site soils.
Off-site properties – Residential Housing		Dust prevention and fuel spillage measures will be required during the construction phase to reduce the risk to off site receptors.
Controlled waters - Surface waters and Aquifers		Two watercourses were recorded flowing south-east to north-west across the site, in addition to the site underlain by a Secondary B aquifer with impermeable cohesive soils. No visual or olfactory evidence of contamination is noted in controlled waters and the current land use (on site) and historical land uses both on and off site pose a low risk to controlled waters.
Cont'd overleaf		



TABLE 3.1: PRELIMINARY CONCEPTUAL SITE MODEL (Cont'd)		
Potential Pathways		
Pathway route	**Likelihood of linkage**	**Reason**
Direct dermal contact, ingestion and inhalation of contaminated soil / dust	Low to Medium	**Construction Workers:** The presence of as yet un reported sources of contamination cannot be precluded. It is considered the risks posed to construction personnel be sources of contamination can be adequately mitigated against via the use of full PPE and the adoption of good hygiene and site practises. As required any suspected sources of contamination discovered during the sites development should be brought to the immediate attention of RoC Consulting to enable the implications to be established and appropriate remedial recommendations made. In the event of such a discovery the scope and findings of the current assessment will require re-assessment and revision.
	Low	**Future site users:** Historical and current site uses present limited risk to future operational site users, specifically considering the site is to be covered by buildings and hard standing coverage thus breaking the potential pathway for contamination.
Leaching of contaminated soil and impact to Aquifer beneath site	Low	There is not considered to be a significant thickness of made ground deposits covering the site, reducing the potential for a leachate source. In addition the site is underlain by cohesive impermeable soils and is likely to act as a barrier between any leachate and water bearing strata.
Migration of contaminated groundwater into surface water features	Low to Medium	A number of surface water courses have been identified across the site that have the potential to be impacted by current operations (e..g fuel spillage and overland flow into water courses) and during the construction process (by the release of fuel and liquid products during building works and the potential flow into water courses). Appropriate mitigation measures will be required during the construction process to mitigate against risks posed.
Ground Gas	Low to Medium	An infilled clay pit is noted adjacent the sites eastern boundary that constitutes a source of ground gas ingress and has the potential to impact on development plots across this portion of the site.
Below ground structures and pipe works	Low	Chemical testing results from the previous Costain investigation have failed to identify sources of contamination or elevated levels of Sulphate within site soils that could present a risk to below ground structures.



4.0 SITE INVESTIGATION DESIGN

General

4.0.1 The RºC intrusive investigation was designed and completed to further investigate geo-environmental issues identified during previous site investigations as well as provide preliminary geotechnical information to facilitate new building foundation and road design.

4.0.2 Site Investigation works subdivided into three portions to reflect current land use and access arrangements as outlined below;

- Zone 1 Fieldworks, Jet Parks 1 car park (borehole and probehole series BH10x / PB10x).
- Zone 2 Fieldworks, Jet Parks 2 car park (borehole and probehole series BH20x / PB20x).
- Zone 3 Fieldworks, Goodman's open / rough vegetated ground (borehole and probehole series BH30x / PB30x).

4.0.3 The boundaries for each of site investigation Zone are indicated on RoC Consulting drawing ES01 provided within Appendix A.

4.0.4 It had been intended to investigate ground conditions across the entire Airport City North development site as part of the current program of works; however it was noted (following on from a site inspection) that access to portions of the site would not be possible owing to the presence of dense vegetation and existing adopted highways (namely Outwood Lane and Thronley Lane). The presence of surface water courses running across the site also presented an access limitation for site investigation works. Access was most restricted across the north and western portions of Goodman's land and along the sites southern boundary with the M56.

4.0.5 A program of vegetation clearance was instigated by contractors BCEGI across portions of the Goodman land centred along the alignment of proposed "Jug Handle" access road; in addition trackways were cut to allow access for ground investigation works. However, it was not possible to clear vegetation across all portions of the site due to cost and ecological constraints leaving areas un-investigated (the locations of which are shown on drawing ES01 within Appendix A).



4.0.6 At the time of writing specific details regarding the proposed development layout, building size etc. were still to be decided, although it is noted the overall Airport City North development will comprise commercial end uses including office space, hotels and multiple storey car parking.

4.0.7 In addition public realm space and the "Jug Handle" access roads are proposed as well as possible connecting bridges linking the site over the M56 motorway to the main Airport terminal buildings. The development will require either the diversion or culverting of several surface water courses including the eastern and western tributaries of the Bagley Brook.

4.0.8 Generally speaking exploratory hole placement was designed to;

- Establish shallow soil conditions and the depth to rockhead across the site.
- Determine underlying bedrock competency and geotechnical properties.
- Assess soil quality across the site including areas of previous developed land such as the former farmstead.
- Determine CBR values along the proposed Link Road alignment.
- Install monitoring wells to assess any risk posed by groundwater and gas ingress.

4.0.9 In addition exploratory hole locations were decided with reference to the latest development plot layout provided by 5Plus Architects (and reproduced on RoC Consulting drawing ES02 within Appendix A) with a view to provide an initial indication of ground conditions.

4.0.10 Site investigation fieldworks comprised a combination of rotary cored boreholes and machine excavated trial pits where access permitted completion (e.g. Goodman's land and lesser used portions of the Jet Parks car park).

4.0.11 Cone Penetration and TRL DCP testing was employed in areas of limited access (including the majority of Jet Parks 1 and 2) as it allowed the sampling and testing of soils with minimal disruption to site operations.



5.0 SITE INVESTIGATION FIELDWORKS

5.0.1 Site Investigation works were undertaken between the 11th and 22nd March 2016 comprising the following :

- x8 rotary cored boreholes to depths ranging between 15.30 and 21.0mbgl.
- x17 trial pits to depths ranging between 0.35 and 4.65mbgl.
- x35 Cone penetration test holes to depths ranging between 1.96 and 6.29mbgl.
- x19 TRL DCP test holes to determine CBR values within the upper 1m of site soils.

5.0.2 Rotary cored boreholes were formed using a Unimog Boring Rig by Danbar Drilling Services Ltd with Cone penetration tests undertaken using a tracked / truck rig operated by Lankelma Ltd. Machine excavated trial pits were limited to the Zone 3 Goodman's land portion of the site and were initially formed using a JCB 3CX. However, the stiffness of underlying clays was such that a larger 13t Volvo tracked excavator was employed to complete the remaining trial holes and confirm the depth to weathered bedrock across this portion of the site. TRL CBR tests were completed by engineers from RoC Consulting utilising a suitably calibrated hand held Cone Penetration device.

5.0.3 The intrusive ground investigation, for shallow soils, in Jet Parks 1 and Jet Parks 2 was carried out using static cone penetration testing (CPT). As previously noted the works were completed by Lankelma Ltd using their UK3 CPTu piezocone methodology. A complete copy of the fieldworks report (including interpretive log sheets) has been provided by Lankelma and is included within Appendix B.

5.0.4 Information with respect to buried services was provided by AECOM Ltd prior to commencement of the investigation works. However, as a precautionary measure all exploratory hole locations were scanned with a Cable Avoidance Tool prior to the commencement of works. In addition, hand dug service pits were completed to a depth of 1.2mbgl at all borehole locations deemed to fall in close proximity to the suspected location of possible buried service runs / infrastructure.



5.0.5 To ensure no new sources of contamination were introduced to underlying soils / bedrock during the formation of each borehole, steel casing was used throughout as well as vegetable oil as a lubrication medium for all drilling apparatus. Sampling equipment was also cleaned between sampling to reduce cross contamination risks. Soil and rock core samples were collected for subsequent chemical and geotechnical laboratory analysis. Samples collected for chemical testing were collected in 300g glass jars and 500g plastic sample tubs. Samples were obtained from both made ground and natural strata to assess the overall quality of underlying soils.

5.0.6 The shallow soils encountered during construction of the boreholes were described and logged by a suitably qualified engineer in accordance with BS 5930: Code of Practice for Site Investigations (the log sheets for which have been provided within Appendix B.

5.0.7 A total of 7 ground gas and ground water monitoring wells were installed within Rotary cored boreholes. Installation details are provided within Table 5.0 below, copies of ground water and gas monitoring records are provided within Appendix E.

Table 5.0: Monitoring Well Installations.

BH ID	Monitoring well depth	Response zone	Response zone strata
BH101	4.50mbgl	0.5 – 4.50mbgl	Made Ground / Glacial Clay
BH201	3.50mbgl	0.5 – 3.50mbgl	Clay / Weathered Mudstone
BH202	6.0mbgl	0.5 – 6.0mbgl	Weathered Mudstone
BH301	4.20mbgl	0.5 – 4.20mbgl	Clay
BH302	8.0mbgl	0.5 – 8.0mbgl	Weathered Mudstone
BH303	6.0mbgl	0.5 – 6.0mbgl	Clay / Weathered Mudstone
BH304	6.0mbgl	0.5 – 6.0mbgl	Clay / Weathered Mudstone



6.0 ENCOUNTERED GROUND CONDITIONS

6.0.1 The following ground conditions are summarised from the exploratory holes formed during the R²C Consulting site investigation. The following represents an overview of encountered ground conditions and it is recommended reference be made to the borehole and trial pit log sheets provided within Appendix B for a detailed strata description; all depths shown are given in meters below ground level (mbgl) unless otherwise stated.

6.0.2 Generally speaking site investigation works have revealed the following ground conditions:

- Made Ground in the two Jet Parks area, granular fill for the parking surface (predominantly inert natural gravel). In addition made ground is likely in the area of the former Moss Lane farmstead across the southern and eastern portion of Goodman's site (Fieldworks Zone 3)

- Drift soils of weaker surface deposits e.g. loose sand mixtures and soft and soft-firm clay mixes. These near surface deposits overlie competent Cohesive Glacial Till stiff and very stiff. As discussed above the anticipated geology for the area is Made Ground and weaker agricultural soils. It is likely that the original ground surface was undulating with old ponds and infilled hollow.

- Bedrock weathered Bollin Mudstone – Triassic Area. a dominantly laminated reddish-brown and greenish-grey mudstone with siltstones. The lower part is a structure less and laminated, dominantly reddish-brown mudstone.

6.0.3 A detailed breakdown of site investigation findings is provided within the following sections, strata description has been divided by shallow drift and bedrock deposits for each fieldwork zone.



6.1 Shallow Ground Conditions

Jet Parks 1

6.1.1 This the most westerly of the developments plots and is bounded to the north by Thorley Lane and to the south by the M56 Airport Spur. The area is gravel surfaced for the parking areas. The surfacing thickness is variable and shown in the inspection pits to be up to 2.0m AT BH101, The pits also identify clay fill and sand fill to a depth of 1.0m. The CPT results shows the surfacing layer that is assessed as extending to circa 0.3-0.5m.

6.1.2 Below the surfacing the CPTu results generally indicate a stiff and very stiff Cohesive Glacial Till with discrete bands of soft and soft-firm clay mixes. There are areas where there is a low strength sand mixtures with SPTN in the range 4-10.

6.1.3 As discussed above the anticipated geology for the area is Made Ground (car park surfacing) and weaker agricultural soils. It is likely that the original ground surface was undulating with old ponds and infilled hollow. From a depth of 2.0m the soils encountered are indicated to be predominantly high strength Cohesive Glacial Till, locally with thin weak bands of sand/clay mixes.

6.1.4 Table 6.0 and 6.1 (provided overleaf) indicates the interpretation of the near surface soils, below any surfacing based on CPTu results for Jet Parks 1.



Table 6.0: Interpretation of CPTu testing results for shallow ground conditions in Jet Parks 1

CPT Probe ID	interpreted Ground Conditions	Strength Testing Result*	Depth to Weathered Bedrock	Prop development plots
PB101	Medium dense sand mixes to 1.4m over stiff clay mixes to 1.9m. Below 1.9m the data suggests soft clay mixes to 2.25m.	1.5-2.3m Undrained Cohesion >110kPa	2.8mbgl 67.68mAOD	J
PB102	Medium dense sand mixes over firm-stiff clay mix. Below 1.5m is a band of firm clay mix, to 2.5m.	1.5-2.5m Undrained Cohesion of 45kPa	3.2mbgl 67.58mAOD	K
PB103	Loose sand mixes to 1.0m over firm-stiff clay.	2.4m Undrained Cohesion of 25-50kPa	3.0mbgl 67.23mAOD	K
PB104	Medium dense sand mixes to 1.0m overlying very stiff clay mixes.	1.3-1.7m Undrained Cohesion of 80kPa	2.6mbgl 67.74mAOD	K
PB105	Stiff clay mixes to 0.8m over medium dense sand to 1.1m. A deeper firm clay layer is noted underlying granular soils to 1.75m.	1.75m Undrained Cohesion of 100-270kPa	3.2mbgl 67.09mAOD	K
PB106	Loose sand mixes N60 to 1.0m over stiff clay mixes.	1.4m Undrained Cohesion of 100-80kPa	2.8mbgl 67.69mAOD	I
PB107	Medium dense sand mixtures to 1.2m overlying loose sand to 1.9m.	2.0m Undrained Cohesion of 150-350kPa	3.5mbgl 66.88mAOD	F
PB108	Loose sand mixes to 0.9 over firm clay mixes to 1.5m.	1.5m Undrained Cohesion of 150kPa	2.4mbgl 67.93mAOD	F
PB109	Stiff clay to 1.24m.	1.0m Undrained Cohesion of 65-200kPa	2.7mbgl 67.43mAOD	K & F
PB110	Stiff and very stiff clay over loose sand mixtures to 1.55m then soft and soft-firm clay mixes.	1.0m Undrained Cohesion of 65-150kPa	2.5mbgl 68.13mAOD	K
PB111	Loose sand mixtures to 1.0m then loose sand mixtures.	2.0m Undrained Cohesion of 180kPa	3.0mbgl 67.50mAOD	I
PB112	Loose sand mixtures to 1.0m then loose-medium dense sand mixtures to 1.5m	1.5-2.5m Loose Sand noted (SPT N values 6 to 10)	2.5mbgl 67.89mAOD	I
PB113	Very loose sand mixtures to 1.0m then soft and soft-firm clay mixture to 1.9m	1.4-3.0m Undrained Cohesion of 123-190kPa	3.0mbgl 67.38mAOD	K

- Undrained Cohesion estimated from CPT testing results.



Jet Parks 2

6.1.5 This the central of the developments plots and is bounded to the west by Thorley Lane, Ringway Road and the M56 Airport Spur. To the north and east is the residential area. The eastern boundary is formed by the stream course that bounds Goodman's land.

6.1.6 The area is gravel surfaced for the parking areas. The surfacing thickness is variable and shown in the inspection pits to be up to 0.5m thick. The CPT results shows the surfacing layer that is assessed as extending to circa 0.3-0.8m.

6.1.7 Below the surfacing the CPTu results generally indicate a stiff and very stiff Cohesive Glacial Till with discrete bands of soft and soft-firm clay mixes. Tables 6.1 and 6.2 (provided overleaf) gives an overview to encountered ground conditions across Jet Parks 2 as revealed by interpretation of CPT testing results.



Table 6.1: Interpretation of CPTu testing results for shallow ground conditions in Jet Parks 2

CPT Probe ID	interpreted Ground Conditions	Strength Testing Result*	Depth to Weathered Bedrock	Prop development plots
PB201	Soft clay mixtures to circa 0.9m over stiff and very stiff clay mixtures.	1.2m Undrained Cohesion 130-175kPa	2.8mbgl 65.67mAOD	L
PB202	Soft clay mixtures to circa 1.1m over stiff and very stiff clay with a discrete band of soft clay mixtures.	1.1m Undrained Cohesion of 110-140kPa	4.4mbgl 63.91mAOD	L
PB203	Stiff clay mixtures from a shallow depth.	1.0m Undrained Cohesion of 110-145kPa	3.8mbgl 64.45mAOD	L
PB204	Stiff clay mixtures from a shallow depth.	1.0m Undrained Cohesion of 120kPa	1.8mbgl 66.66mAOD	L
PB205	Firm-stiff clay to circa 1.5m then a thin band of soft clay (250mm thick). A deeper band of soft clay is also noted circa 4.5m below ground.	1.5m Undrained Cohesion of 20-35kPa 3.1m Undrained Cohesion of 180kPa	4.9mbgl 63.25mAOD	L
PB206	Stiff clay mixtures from a shallow depth.	1.0m Undrained Cohesion of 85-90kPa	2.5mbgl 66.50mAOD	A & L
PB207	Stiff clay mixtures from a shallow depth.	1.0m Undrained Cohesion of 125-185kPa	1.8mbgl 67.62mAOD	A
PB208	Stiff clay mixtures from a shallow depth.	1.0m Undrained Cohesion of 135 -175kPa	1.8mbgl 67.43mAOD	A
PB209	Medium dense sand/clay mix over stiff and very stiff clay mixtures from shallow depth.	1.0m Undrained Cohesion of 155-160kPa	1.8mbgl 66.94mAOD	A
PB210	Medium dense sand/clay mix over stiff and very stiff clay mixtures from shallow depth.	1.0m Undrained Cohesion of 75kPa	2.6mbgl 67.23mAOD	A
PB211	Stiff clay mixtures from a shallow depth.	1.0m Undrained Cohesion of 125-200kPa	2.2mbgl 66.94mAOD	Z
PB212	Stiff clay mixtures from a shallow depth, becoming locally variable in strength below 3.0m.	1.0m Undrained Cohesion of 65-70kPa 3.2m Undrained Cohesion of 30kPa	3.7mbgl 64.60mAOD	Z
PB213	Stiff and very stiff clay mixtures from a shallow depth.	1.0m Undrained Cohesion of 130kPa	1.5mbgl 68.37mAOD	AA & B



Table 6.1: Interpretation of CPTu testing results for shallow ground conditions in Jet Parks 2 (cont'd)

CPT Probe ID	interpreted Ground Conditions	Strength Testing Result*	Depth to Weathered Bedrock	Prop development plots
PB214	Stiff clay mixtures from shallow depth, with a thin band of soft clay mixtures 1.3-1.8m.	1.3m Undrained Cohesion of 35-45kPa 2.2m Undrained Cohesion of 120-200kPa	5.0mbgl 63.59mAOD	AA, C & Z
PB215	Stiff clay mixtures and very stiff clay from shallow depth.	1.4m Undrained Cohesion of 180kPa	5.0mbgl 64.17mAOD	AA
PB216	Initially firm, become stiff below 1.3m, clay mixtures.	1.0m Undrained Cohesion of 65kPa	3.46mbgl 66.12mAOD	C
PB217	Medium dense sand/clay mix over (to 2.9m) stiff and very stiff clay mixtures from shallow depth.	3.0m Undrained Cohesion of 140-280kPa	4.15mbgl 65.65mAOD	C
PB218	Stiff clay mixtures from a shallow depth.	1.0m Undrained Cohesion of 80-125kPa	4.45mbgl 63.85mAOD	L
PB219	Medium dense sand/clay mix over stiff and very stiff clay mixtures from shallow depth.	1.0m Undrained Cohesion of 70-75kPa	5.08mbgl 63.20mAOD	M & Z
PB220	Stiff clay mixtures from shallow depth, with a thin band of soft clay mixtures 1.7-1.8m.	1.0m Undrained Cohesion of 60-90kPa	3.35mbgl 66.25mAOD	B & Z
PB221	Initially stiff, locally weakened to firm, clay mixtures.	1.0m Undrained Cohesion of 200-250kPa 1.2m Undrained Cohesion of 60kPa	4.8mbgl 63.99mAOD	AA & Z
PB222	Initially stiff, locally weakened to firm, clay mixtures.	1.9m Undrained Cohesion of 110kPa	2.3mbgl 67.74mAOD	B



Goodman's Land

6.1.8 Goodman's Land is located at the eastern end of the development area, bounded to the south by Aviator Way \ Ringway Road, to the east by the Airport Business Park and the residential area to the north. The area is undeveloped and is grassed and covered by semi-mature trees and shrubs. The western boundary s formed by the stream course that separates the site from Jet Parks 2.

6.1.9 In this area the shallow investigation was completed by machine excavated trial pits. The results show Topsoil (brown very clayey) with a depth to base in the range 0.3-0.55m. Although a number of trial pits were located within close proximity to the surface water course that crosses the site no evidence of poor quality Alluvial soils was noted; although it should also be noted that access to the entire length of the brook was impeded at the time of investigation works by dense vegetation, particularly toward the southern extent.

6.1.10 The trial pits then show stiff and very stiff Cohesive Glacial Till (dark reddish brown sandy clay with rare fine-medium gravel of sandstone and mudstone. The trial pits show discrete bands of lower strength clayey sand / sandy clay. In TP312 a band of compact yellowish orange slightly silty fine-medium grained slightly gravelly Sand, from 2.5-3.20m. Of the pits completed to depth, all excavations were terminated in weathered mudstone (dark reddish brown thinly bedded).

6.1.12 Hand Shear Vane tests were completed within trial pits the results from which indicate a shear strength range between 35 and 88kPa with a mean value of 64.8kPa. These tests also indicate an increase of strength with depth within the clay formation. In addition to the above an unrecorded below ground service run (suspected electricity cable) was reported in the area of TP305A at a depth of 0.3m below ground level.

6.1.13 Table 6.2 (provided overleaf) summarises the depth bedrock encountered and penetration before excavation was terminated.



Table 6.2: Bedrock Observations & Depth across Goodman's Land.

TP301	TP302	TP303	TP304	TP305(B)	TP306	TP307	TP308
Encountered at 3.0mbgl (64.41mAOD) penetrated to 3.10mbgl (64.51mAOD)	Not encountered pit terminated in hard clay at 1.50m	Not encountered pit terminated in hard clay at 2.10m	Not encountered pit terminated in hard clay at 2.60m	Not encountered pit terminated in hard clay at 2.25m	Not encountered pit terminated in hard clay at 3.30m	Not encountered pit terminated in hard clay at 2.40m	Not encountered pit terminated in hard clay at 2.40m
TP309	**TP310**	**TP311**	**TP312**	**TP313**	**TP314**	**TP315**	
Encountered at 3.10mbgl (64.49mAOD) penetrated to 4.00mbgl (63.59mAOD)	Encountered at 2.50m (66.28mAOD) penetrated to 4.35mbgl (64.43mAOD)	Encountered at 3.35mbgl (64.91mAOD) penetrated to 4.00mbgl (64.26mAOD)	Encountered at 3.20mbgl (66.26mAOD) penetrated to 4.10mbgl (66.06mAOD)	Encountered at 2.90mbgl (66.65mAOD) penetrated to 4.00mbgl (65.55mAOD)	Encountered at 3.00mbgl (67.36mAOD) and penetrated to 3.95mbgl (66.41mAOD)	Encountered at 3.00mbgl (65.89mAOD) penetrated to 4.65mbgl (64.24mAOD)	



6.2 Bedrock Conditions.

6.2.1 The published geological map for the site location shows that the bedrock comprises Triassic Bollin Mudstone Member that is described as "The upper part is predominantly laminated greenish-brown and greenish grey mudstone with siltstones. The lower part is structure less and laminated ·dominantly reddish-brown mudstone. The boreholes confirm the bedrock encountered is the Bollin Mudstone representing a weathering profile from interface with the overlying Cohesive Glacial Till to a less weathered mudstone at depth.

Depth to Bedrock & Spatial Variability

6.2.2 The depth at which Mudstone varies across the site and Table 6.3 gives an indication of the depth to its weathered fraction; in addition a bedrock contour drawing (ES03) has been collated showing the spatial variability of rockhead (a copy of which is provided within Appendix A).

Table 6.3: Depth to Mudstone Bedrock

Jet Parks 1	Jets Parks 2	Goodman's Land
Estimated depth to rockhead (Cone Penetration Tests) 3.1-4.9m 67.4mAOD – 65.5mAOD	Estimated depth to rockhead (Cone Penetration Tests) 2.0-6.29m 67.9mAOD – 62.0mAOD	Estimated from trial pits 2.5-3.35m 66.6mAOD – 64.9mAOD
Estimated from· rotary boreholes 3.5-4.0m 66.9mAOD	Estimated from· rotary boreholes 0.3-0.8m 69.9mAOD – 68.4mAOD	Estimated from rotary boreholes 4.0-5.2m
Proved to a depth of 15.3-21.0m 55.1mAOD - 49.9mAOD	Proved to a depth of 15.0-15.5m 54.9mAOD – 53.7mAOD	Proved to a depth of 20.8-15.7m 53.6 - 47.7mAOD



6.2.3 With reference to exploratory hole records and drawing ES04 it is noted the depth to rockhead varies across the site between 0.4 and 6.29m; when corrected into meters against OS datum (mAOD) to account for surface level variations results indicate rockhead varies between 62 and 69.5mAOD.

6.2.4 Generally speaking the depth to rockhead is at its shallowest toward the sites central and southern extent in the area around M56 junction. Levels fall slightly to the north and west and exhibited a marked fall to the north with thickest deposits of glacial drift noted across Goodman's land to the north and east.

Bollin Mudstone Formation

6.2.5 The Bollin Mudstone (Mercia Mudstone) has been proven to a depth in the range of 15.0m (54.9mAOD) and to 21.1m (49.9mAOD). In general the mass description is "Weak and moderately weak dark reddish brown thinly bedded Mudstone recorded gravel filled fractures"; gravel is recovered as fine to medium sub angular to tabular of Mudstone.

6.2.6 The core record sheets show the mechanical log of SCR (solid core recovery) TCR (total core recovery) RQD (rock quality designation) and Fracture Index (fracture spacing with maximum and minimum fracture spacing). The bedding and lamination discontinuities are generally sub-horizontal and result in low Rock Quality Designation (RQD) and highly variable Fracture Index values

6.2.7 The mudstone has been recovered as very weak, weak and locally medium strong, thinly bedded generally reddish brown. Locally the mudstone is a greenish grey. The bedding is generally sub-horizontal, low angle to core axis up to 15° relative to core axis. The core drilling has generated numerous Drilling Indiced Fractures. There were areas where the rock mass condition and the drilling process has resulted in core washout and erosion.

6.2.8 The details of core drilling, the mass and material properties and the mechanical log is presented on the borehole record sheets and rock core photographs are presented within Appendix B. Table 6.4 (provided overleaf) summaries rock recovery and core quality parameters.



Table 6.4: Rock Drilling & Quality Parameters

Statistics	TCR	SCR	RQD
Max	115*	100	100
Average	82	74	49
Min	0	0	0
*Note SCR > 100% where core recovered over 2 runs.			

6.2.9 The Total Core Recovery (TCR) results from the table above show up the core loss during drilling. The principal zone with core loss it at the interface with the drift. At low core recovery / core loss was noted in:

- BH201 - 3.0-8.0m TCR 23%, 12% and 0% from 3.0-8.0m
- BH202 - 12.0-14.0m TCR 35%

6.2.10 From the rock core recovered samples suitable for test were recovered and selected for tests. Tests undertaken were ISRM Point Load Index (I_{s50}) both axial (along the core) and diametral (across the core) and Unconfined Compressive Strength on whole core pieces. The results of the tests are presented on the Fig 6.1 to 6.3 in Appendix D. The results have been compiled and presented as a plot of strength versus depth. Figure 6.1 shows the plot of Point Load Index (I_{s50}), Figure 6.2 shows the plot of the Unconfined Compressive Strength and Figure 6.3 shows the plot of the estimated UCS from the PLT (Is50*24) and the Unconfined Compressive Strength.

6.2.11 Tables 6.5 to 6.7 (provided below and overleaf) give an overview to the results of laboratory strength testing of rock core samples

Table 6.5 Point Load Index (Is50) Results

Mudstone Point Load Test Is50 (MPa)		
	Axial (48 tests)	Diametral (47 tests)
Maximum	1.85	1.42
Average	0.33	0.13
Minimum	0.06	0.01



Table 6.6 Unconfined Compressive Strength Results

Mudstone Unconfined Compressive Strength MPa (20 tests)	
Maximum	10.5
Average	2.83
Minimum	0.50

Table 6.7 Unconfined Compressive Strength and Point Load Index Results

Mudstone UCS MPa		Is50*24 (axial) MPa	
Maximum	10.5	Maximum	44.4
Average	2.83	Average	7.95
Minimum	0.5	Minimum	1.4



6.3 Groundwater and Contamination Observations

6.3.1 The presence of made ground deposits was noted across the bulk of Jet parks 1 and 2 although these materials were found to comprise clean natural gravel aggregate associated with the car park construction. Demolition type fill material was noted in the area of the former nursery and farmstead across the Goodman's portion of the site although no visual or olfactory evidence of contamination was noted within this strata.

6.3.2 Site Investigation works revealed groundwater to be present in the Bollin Mudstone where rockhead was encountered c.6.0mbgl. A perched water table was also encountered in the zone between glacial clays and weathered mudstone at approximately 3mbgl.

6.3.3 At the time of writing a program of ground gas and monitoring works is on-going (the results from which will be issued as an addendum to the current report to follow). Table 6.7 provides details of groundwater observations made during the course of site investigation.

Table 6.7 Groundwater Strike Information

BH ID	Water Strike Depth		Resting Water Level		Comments
	mbgl	mAOD	mbgl	mAOD	
BH301	6	64.84	6	64.84	Ingress
BH303	6	63.26	6	63.26	Ingress
BH302	6	63.80	6	63.80	Ingress
BH101	6	64.93	6	64.93	Ingress
BH304	3	64.81	3	64.81	Ingress
BH102	6	64.40	6	64.40	Ingress
BH202	6	63.78	6	63.78	Ingress
BH201	3	66.24	3	66.24	Ingress
TP301	3	64.54			Slight Seepage
TP302	1.2	67.25			Slight Seepage
TP311	3.9	64.36			Ingress
TP312	2.5	67.66			Ingress
TP313	1.7	67.45			Seepage
TP314	2.5	67.64			Ingress



6.4 In Situ CBR Testing

6.4.1 It is noted the new development will include the construction of the "Jug Handle" main access road (the proposed location of which is indicated on drawing ES02 & ES03 provided within Appendix A). The road itself will link the site via the existing embankment of the M56 junction to the south and west sloping north across the site to the present day junction of Thornley and Bailey Lane; continuing at grade through the Airport City North site to the south and east.

6.4.2 A program of Dynamic Cone Penetration testing was undertaken along the proposed road alignment at roughly 25m centres to establish CBR values within the upper 1m of site soils. The California Bearing Ratio was determined using the TRL-Transport Research Dynamic Cone Penetration method with tests undertaken from surface the results from which are presented on drawing ES03 (within Appendix A) as well as in tabulated form (within Appendix D).

6.4.3 The results from CBR testing indicate two distinct ground models; in the area across Zone 2 (Jet Parks 2) results are characterised by initially very high values (>50%) associated with the existing car park construction. However, once penetrated CBR values decline to between 5 and 22% and it is considered these values are more representative of underlying glacial clays.

6.4.4 The portion of the road that crosses field works Zone 3 (Goodman's land) was found to be more variable with values fluctuating between 3 and 26% with a mean of 9.5%. Superficially topsoil and organic rich deposits indicate the poorest level of compaction with deeper glacial clays (circa 4-500mm below the sites surface) indicating an improved competency.



7.0 LABORATORY TESTING

7.0.1 To establish the physical and chemical properties of underlying soils a programme of laboratory analysis was completed utilising samples obtained during site investigation works. This analysis comprised the testing of soils samples to assist with the estimation of risks posed by contaminated land related concerns.

Chemical Testing

7.0.2 R²C Consulting submitted a total of 10 soil samples to a UKAS accredited testing facility for analysis against a range of determinands to establish the presence of (if any) elevated chemical concentrations.

Determinands	No. of Tests
Toxic and phytotoxic metals and metalloids	10
Total & Speciated Polycyclic Aromatic Hydrocarbons (PAH),	10
United Utilities Pipework Risk Assessment	2
Waste Acceptance Criteria	2
Leachate Analysis (Heavy Metals etc)	2
Water Soluble Sulfate & pH	10

7.0.3 Copies of chemical testing results have been provided within Appendix C. In addition to the above a program of geotechnical testing of soil and rock core samples obtained from site investigation works (the results from which are provided within Appendix D).



8.0 GEO-ENVIRONMENTAL ASSESSMENT

8.0.1 A geo-environmental risk assessment has been completed to quantify the risks posed to identified receptors (as outlined in the preliminary site conceptual model) using the information obtained during site investigation fieldworks. Broadly speaking this risk assessment process can be divided based on the receptor group in question between:

1) Risks posed to human health by soil contamination (both construction persons and future site users).

2) Risks posed to human health by hazardous ground gas ingress (both construction persons and future site users).

3) Risks posed to controlled waters by soil or groundwater contamination (both surface water features and bedrock aquifers).

4) Risks posed to new building construction by aggressive ground conditions (namely elevated sulphate concentrations).

8.0.3 Appropriate assessment have been completed for each of the above utilising the latest statutory and none statutory guidance documents; for details of risks posed to human health refer to Section 8.1 (soils) and Section 8.2 (ground gas), for details of risks posed to controlled waters refer to Section 8.3 and risks posed to new structures refer to Section 8.4.



8.1 Assessment of soil contamination

8.1.1 In order to estimate the risks posed to human health from soil contamination, a quantitative risk assessment has been completed utilising the latest Environment Agency CLEA methodology. The assessment utilises the chemical testing results obtained during the site investigation fieldworks to characterise site conditions and facilitate the completion of the risk assessment process.

8.1.2 The assessment is based on the comparison of soil chemical testing results with published Environment Agency Category Four Screening Levels (C4SL's) under the proposed end use scenario to determine the sites suitability for use. C4SL values represent the highest acceptable values for contaminants within site soils under the proposed end use and are derived using the Environment Agency CLEA risk assessment methodology. A result in exceedance of a C4SL level may indicate the presence of contaminants within site soils and require further assessment.

8.1.3 It is noted only a limited number of C4SL values have been derived by the Environment Agency, use and reference has been made to LQM/CIEH Suitable For Use Values (S4UL's) for a wider range of other contaminants (Heavy Metals, Poly Aromatic Hydrocarbons, TPH, SVOC and VOC's) to increase the depth and robustness of our assessment.

8.1.4 Chemical testing results are compared against C4SL and S4UL values for each determinant with any results reported in exceedance of screening criteria identified and their significance reviewed. Of particular interest in determining the significance of any exceedances is their magnitude and frequency within the dataset, for example a single exceedance of a screening value may be considered a localised hotspot whereas consistently elevated levels of a substance at multiple locations across the site may indicate a more prevalent contamination issue.

8.1.5 In addition to this assessment an Asbestos Identification test (via the visual inspection method) has been completed on all samples of made ground obtained during the investigation to determine risks posed. Any positive occurrences of Asbestos will be subject to quantification analysis to further assess the extent and significance of risks posed.



8.1.6 As required, for each exceedance reference will be made to the Conceptual Site Model to establish the most likely source of contaminants and initial commentary given as to the likely scope of remedial measures. In addition reference will also be made to the assumptions used to derive generic assessment criteria (C4Sl and S4UL values) to determine their comparability with the proposed end use.

8.1.7 For the purposes of this assessment we have assumed a "Commercial" end use scenario when reviewing chemical testing data against C4SL / S4UL values; a "worst case" Soil Organic Matter content value of 1% has been assumed for the initial assessment.

8.1.10 Results from chemical testing analysis indicate the following:

1) Slightly elevated concentrations of Poly Aromatic Hydrocarbons are reported in TP308 (0.30m) in demolition type fill material associated with the former Moss House Farm Buildings. Benzo(a)Pyrene (49mg/kg), Benzo(b/k)Fluoranthene (98mg/kg), and Dibenzo(ah)Anthracene (6.7mg/kg) exceed S4ULs for Commercial end use (1% SOM).

2) Slightly elevated concentrations of Total Cyanide are reported in TP303 (0.30m) at 11mg/kg sampled from topsoil material.

3) Slightly elevated concentrations of Barium and Lead are reported in TP303 (0.30m) at 380mg/kg and 630mg/kg respectively sampled from topsoil material.

4) A United Utilities Risk Assessment screening identified 1 SVOC exceedance for the Aliphatic Hydrocarbon C27 (1.2mg/kg) when screened against PE threshold of 0.5mg/kg.

8.1.12 The above findings have been used to update the Conceptual Site Model as outlined in Section 9.0



8.2 Ground Gas Risk Assessment

8.2.1 The Preliminary Conceptual Site model identified infilled features such as ponds and a clay pit as being a potential source of ground gas generation. The site is not said to be located within in an area at risk from Radon gas ingress.

8.2.2 It is considered the most probable exposure pathways are likely to be limited to construction workers during the sites redevelopment and future site users occupying buildings across the site.

8.2.3 To estimate the risks posed by ground gas generation a total of 7 were installed with gas monitoring wells (BH101, 201, 202, 301, 302, 303, 304). The purpose of these standpipes is to investigate ground gas generation potential of shallow and at depth soils and the associated implications this may have for new building design. Monitoring wells were sealed into the upper weathered fraction of Mudstone with superficial clay deposits within the well response zone.

8.2.4 At the time of writing, a total of 1 ground gas monitoring visits have been completed on site during varying weather conditions and atmospheric pressure (refer to Appendix E for further information). The results from these monitoring works revealed a maximum Carbon Dioxide concentration of 1.00% (BH301) with gas flow rates ranging between 0 and 1.5 l/hr. The results also indicated depleted oxygen levels of 7% (BH301) and an absence of methane, carbon monoxide and hydrogen sulphide gases.

8.2.5 The principal source of ground gas generation is considered to be features such as ponds which may have been infilled with unknown materials.

8.2.6 With reference to guidance provided in CIRIA C665 "*Assessing risks posed by hazardous ground gases to buildings*" and assuming the development comprises Commercial office buildings ; the above mentioned worst case gas levels and borehole flow rates equate to a gas screening value of 0.015l/hr. This value equates to a Characteristic 1 Situation with no remedial measures envisaged to control ground gas ingress.



8.3 Controlled Waters

8.3.1 It is understood the site is underlain by a Secondary B Aquifer and is not said to be located within any Environment Agency Zone source protection zones or in close proximity to sensitive groundwater abstraction boreholes. The nearest surface water feature is indicated on site in the form of several tributaries of the Bagley Brook.

8.3.2 Site investigation fieldworks have revealed the presence of limited (predominantly inert) made ground deposits overlying low permeability Glacial Boulder Clays. A series of perched groundwater tables have been noted on site, either resting on top of clay deposits or within sand bearing lenses. No visual or olfactory evidence of soil or groundwater contamination was noted during the course of site investigation fieldworks.

8.3.3 It is considered highly unlikely the site has the potential to impact on groundwater quality both within the perched and underlying bedrock aquifer water tables owing to an absence of any significant sources of mobile contamination on site. In addition the movement of any contaminated ground water or leachate is likely to be impeded by the widespread presence of low permeability glacial clays.

8.3.4 A number of surface water courses are noted across the site and it is probable their full or partial diversion will be required as part of the Airport City North development. These water features are considered to be at risk of contamination during the site development, either via the accidental spillage of fuel oils or chemicals in close proximity to the Brook or via the movement of sediment rich surface water run-off from areas where vegetation has been stripped.

8.3.5 Appropriate mitigation measures will be required by construction contractors when working in close proximity to surface water features to reduce risks posed including the use of spill kits and other controls. Similarly the control of surface water runoff will be necessary throughout the construction process to reduce sediment infiltration risks. The use of fuel interceptors will be required within car park and service yard drainage networks to reduce the risks of accidental spillage or leakage infiltrating the surface water network during the completed development phase.



8.4 Below ground concrete construction

8.4.1 Potential sulphate concentrations were consistently reported below the limits of detection with soil pH values ranging between 6.7 and 7.9. Based on these results it is considered that well compacted buried concrete should be designed in accordance with Class DS-1 AC1 requirements as specified in BRE Digest Special Digest 1:2005 *Concrete in aggressive ground: Version 3*.

8.5 Below ground utilities and service runs

8.5.1 A United Utility pipework risk assessment has been completed using two soil samples obtained from site investigation works (a completed copy of the form for which is provided within Appendix C). One of these samples was obtained from made ground deposits in the area of the former farmstead and the second was recovered from underlying glacial clays.

8.2.2 A single exceedance of the risk assessment screening criteria has been noted it should also be noted this sample was obtained from the site of a former farmstead and is not representative of site wide conditions. The majority of the site has remained largely un developed the results from testing in this area has failed to identify the need for protective pipe work.

8.2.3 It is considered the use of chemically resistant pipe work will be required for development within close proximity to the former farmstead however the remainder of the site is considered unlikely to pose a risk to below ground water supply pipe works. Supplementary testing should be undertaken on a plot by plot basis at such a time as detailed development layout has been realised.

8.2.4 Copies of chemical testing results have been provided as an inclusion to this form



9.0 REFINED CONCEPTUAL SITE MODEL

9.0.1 The Environmental Protection Act Part IIA: 1990, defines contamination as land containing levels of contamination which form a risk to human health, controlled waters or other ecosystems. Therefore, contamination in exceedance of the relevant screening values is considered a source. Table 9.0 assess and summarise the sources, pathways and receptors that may exist at the site;

TABLE 9.0: REFINED CONCEPTUAL SITE MODEL

Potential Sources		
Contamination Source	**Risks Posed**	**Comment**
Historical land use and recent operations as farmland and a farmstead	Low	Site investigation works have identified no significant sources of contamination with site soils, although made ground deposits and localised contamination hot spots were noted in the area of the former farmstead to the south and east of the site.
Proposed land use	Low	The site is to be developed for mixed commercial led end uses and is unlikely to impact on soil or groundwater quality. The development of the site presents a risk to the existing surface water course and appropriate mitigation measures will be required to ensure its protection. Similarly the use of fuel interceptors will be required within surface water drainage networks to reduce risk of accidental fuel or oil spillage during the sites operation.
Off-site sources	Low	A historical and now infilled clay pit was located off site to the south and east that could present a risk of ground gas ingress. At the time of writing monitoring works are on-going and a full gas risk assessment will be issued as an addendum report to follow.
Potential Receptors		
Human Health– Construction Process		Construction workers and members of the public could be at risk of exposure to contaminants during the redevelopment and subsequent operation. The main exposure pathways are considered to be via direct dermal contact, ingestion and inhalation of contaminated dust. In addition this group could be at risk of exposure to potentially hazardous ground gas during the sites development and subsequent operation. The main exposure pathways are considered to be via inhalation inside buildings and below ground excavations
Human Health– Operational Phase		Future site users and the general public are considered unlikely of being at risks of exposure to sources of contamination given the findings of the current program of investigation works and proposed development characteristics
Off-site properties		

Cont'd



Controlled waters - Surface waters & Secondary Aquifer		It is considered risks posed to surface and groundwater features are likely to be low owing to the presence of low permeability clays across the site and an absence of significant sources of contamination within site soils A number of surface water courses are noted across the site and it is probable their full or partial diversion will be required as part of the Airport City North development. These water features are considered to be at risk of contamination during the site development, either via the accidental spillage of fuel oils or chemicals in close proximity to the Brook or via the movement of sediment rich surface water run-off from areas where vegetation has been stripped
Below ground infrastructure & construction		All below ground concrete structures to be designed in accordance with a Class DS-1 AC-1 requirements as specified in BRE Digest Special Digest 1:2005 *Concrete in aggressive ground: Version 3*. The use of chemically resistant water supply pipe work is not considered necessary for the majority of the development, however localised sections may be required in areas of previous agricultural activity such as the former Moss House farmstead.
Potential Pathways		
Pathway route	**Likelihood of linkage**	**Reason**
Direct dermal contact, ingestion and inhalation of contaminated soil / dust Off-site inhalation of ground gas/vapour	Low to Medium	Construction Workers: It is considered the risks posed to construction personnel be sources of contamination can be adequately mitigated against via the use of full PPE and the adoption of good hygiene and site practises. Any sources of contamination uncovered during site development works should be brought to the immediate attention of RoC Consulting for consideration and comment. Appropriate personal ground gas detection equipment should be deployed by all site operatives when working in below ground or confined spaces.
	Very Low	Future site employees / users: The site is to be developed for commercial led end uses and it is unlikely site users will come into regular contact with site soils. In addition site investigation works have failed to identify any sources of contamination within soils.
Leaching of contaminated soil and impact to Aquifer beneath site	Very Low	The site is underlain by low permeability glacial clays and investigation works have failed to identify any significant sources of contamination within site soils. As such it is considered unlikely the Secondary Aquifer is at risk of contaminant ingress either in the current or proposed development configuration.
Migration of contaminated groundwater into surface water features	Medium	Surface water features crossing the site are considered to be the most sensitive receptor to contaminant ingress, particularly during the construction phase. Due consideration and mitigation measures will be required by contractors to ensure no pollution incidents occur to surface water features.
Below ground service runs	Low to Medium	As previously noted localised chemically resistant pipe work runs may be required in areas of previous development and particularly in the area around the former Moss Lane farm



9.0.2 Re-appraisal and reassessment of the conceptual site model (following completion of investigation works) has failed to reveal any specific sources of contamination that could require specific remedial measures. The use of chemically resistant water pipe work may be required across localised portions of the site and particularly the former Moss House farmstead.

9.0.3 It is recommended all construction contractors take reasonable precautions to control environmental impacts that may occur as a result of redevelopment works with respect of soil and groundwater quality. These measures should including (and not be limited to)

1) Any sources of contamination uncovered during site development works should be brought to the immediate attention of RoC Consulting for consideration and comment. As required the findings and recommendations of the current assessment may require amendment to reflect changes in site condition.

2) The operation of plant, refuelling facilities and general basement excavation works should include appropriate provision to reduce the risk of leakage / spillage, particularly into the sites groundwater table or exposed natural soils.

3) Appropriate dust mitigation measures should be deployed during basement excavation works, particularly when handling and excavating made ground deposits.

4) All excavated materials stockpiled should be periodically dampened down to control dust release. Similarly the disposal of any material from site should be completed using covered wagons.

5) The use of chemically resistant water supply pipe work may be required in areas of previous industrial activity. It is recommended additional chemical testing be undertaken along proposed water supply runs (once their precise alignment is identified) to confirm pipe design requirements.



10.0 GEOTECHNICAL & FOUNDATION DESIGN ASSESSMENT

Background Information

10.0.1 It is understood the site is to be redeveloped to comprise multiple commercial led developments split across 16 individual plots with associated a main access road (known as the Jug Handle), car parking and public realm space. At the time of writing detailed layouts for each development plot are to be confirmed although the Jug Handle road alignment is fixed (and is indicated on drawing ES03 within Appendix A).

10.0.2 The location of each development plot is indicated on drawing ES02 provided within Appendix A and it is understood these boundaries will remain largely unchanged as the project moves toward a detailed design phase. The bulk of the Airport City North development is to comprise multiple storey (up to 7/8 floors) commercial office and hotel development with surface and multi storey car parking. At the time of writing no specific building loadings are available and it is envisaged supplementary ground investigations will be completed on a plot by plot basis (at such a time when a detailed design is available) to support foundation design.

10.0.3 Generally speaking site investigation works have revealed the following ground conditions:

- Made Ground in the two Jet Parks area, granular fill for the parking surface (predominantly inert natural gravel). In addition made ground is likely in the area of the former Moss Lane farmstead across the southern and eastern portion of Goodman's site (Fieldworks Zone 3)

- Drift soils of weaker surface deposits e.g. loose sand mixtures and soft and soft-firm clay mixes. These near surface deposits overlie competent Cohesive Glacial Till stiff and very stiff. As discussed above the anticipated geology for the area is Made Ground and weaker agricultural soils. It is likely that the original ground surface was undulating with old ponds and infilled hollow.

- Bedrock weathered Bollin Mudstone – Triassic Area. a dominantly laminated reddish-brown and greenish-grey mudstone with siltstones. The lower part is a structure less and laminated, dominantly reddish-brown mudstone.



10.1 New building foundation design

10.1.1 It is not recommended new building foundations be constructed on top of made ground deposits. The variable composition and in situ strength of these materials is such that unacceptable levels of total and differential settlement will occur as a result.

Lightly Loaded Structures

10.1.2 Site investigation works have revealed glacial boulder clay beneath underlying topsoil and existing car parking surface materials the strength of which is generally observed as firm, becoming stiff to very stiff with depth. However, localised variability is noted within the clays including weaker bands (e.g. PB202 and 205) as well as sand pockets and lenses.

10.1.3 Assessing the overall competency of the clay deposits it is considered the use of shallow conventional foundations (either Pad, Strip or Raft footings) could be adopted for more lightly loaded structures, assuming foundations extend into competent glacial clays and any unsuitable soils (e.g. topsoil's, silt or peat deposits) encountered are removed. Allowable bearing capacities vary across the site depending on plot location and it is not possible to postulate a single site wide value that could be adopted. However an allowable bearing capacity between 100 and 150kN/m^2 seems reasonable for more competent clay deposits.

10.1.4 New building floor slab foundations will be dictated by loading requirements. As with building foundations the adoption of a ground bearing floor slab may be possible where competent clays are present at shallow depth, although this would need to be decided on a plot by plot basis. Where less competent soils are noted the use of Lime stabilisation or vibro improvement could be adopted to support new floor slabs.

10.1.5 A suitable stone blanket would need to be applied to clays and due care and attention taken during construction works to protect the formation layer from damage or localised weakening as a result of site vehicular movements and rainwater ingress.



Heavily Loaded Structures

10.1.6 It is considered the probable structural column loadings from multiple storey developments would exceed the bearing capacities of glacial clays and that un-acceptable levels of total and differential settlement would occur as a result. It is considered structural foundations would need to extend into the underlying Mudstone bedrock beneath the site. The principal geotechnical constraints, identified from the geotechnical investigation, can be summarised as follows:

- Variable surface geology with Made Ground over Granular Glacial Till (Fluvial) (sand and silt) and Cohesive Glacial Till over weathered Mercia Mudstone.
- High variability of shear strength in the soil groupings, limiting the option for a simple conventional founding solution.
- High variability in the rock mass quality and variable material rock strength.
- Potentially high loading from multi-storey commercial development.

10.1.7 As noted above (and explained in further detail within Section 6.2) the bedrock is shown to have a highly variable rock mass condition with parts of the bedrock being too weak to be successfully core drilled. Localised weaker and heavily weathered bands have also been noted at depth within the Mudstone that limited core recovery during the current program of ground investigation works.

10.1.8 As such, although theoretically possible, it is considered the construction of conventional foundations taken into the underlying Mudstone bedrock would not attain a sufficiently high bearing capacity (probable bearing capacity range <200kN/m^2). In addition, the depth to reach competent underlying Mudstone beneath the site varies between 0.4 and 6.29m with a mean depth circa 3.9m and would require considerable sized excavations to reach.

10.1.9 In view of the above the use of a piled foundation solution will be required for larger more heavily loaded structures. Pile design parameters such as length, diameter and bearing capacity will be dependent on individual development design requirements and it is recommended discussions be held with suitably qualified contractors to establish this information.



10.1.10 The use of either a driven or auger pile could be considered for the development although driven piles are more likely to encountered obstructions (e.g. boulders within glacial till) and require relocation. Auger piles are also likely to offer a higher bearing capacity for comparable pile lengths owing to the effects of increased surface area and shaft adhesion.

10.1.11 Site investigation works to date have identified localised weaker and highly weathered bands depth within the Mudstone formation that will require due consideration as part of the pile design process. Of particular concern in this regard is the potential for piles to be terminated in what appears to be more competent bedrock that is underlain by weaker zones, and the potential for pile failure once loading is applied as a result. Any pile contractor reviewing this (and supplementary plot specific site investigations) should be mindful of this issue within the Bolin Mudstone and ensure appropriate provision is made.



Jug Handle Road Construction

10.1.12 It is proposed to construction new access road from the M56 Spur in to the Airport City North (known as the Jug Handle road). At the airport spur the new road will be constructed on an embankment from the higher level and then reduce in elevation to the current grade level. The proposed new road alignment is shown on drawing ES03 (provided within Appendix A) and has been subject to investigation as part of both the current and previous 2012 URS study.

10.1.13 These investigations have revealed the presence of glacial boulder clay along the entire road length overlain by a combination of gravel hardstanding and organic rich topsoil, both of which extend to depths circa 0.3-0.4m below ground level. The glacial clays is generally described as firm, becoming firm to stiff with depth although localised weaker zones have also been noted within this formation.

10.1.14 The California Bearing Ratio was determined using the TRL-Transport Research Dynamic Cone Penetration method with tests undertaken from surface. The full results are presented in Appendix D and summarised in Section 6.4 of this report. In summary the DCP confirms the strong near surface granular layer of the car park with California Bearing Ratio greater than 50%. The natural ground CBR values are in the range 3-7%, these values would be commensurate with the typical Plasticity Indices and the values of Equilibrium Subgrade CBR given in table 5.1 of IAN73/06 Revision 1 (formerly HD25) "DESIGN GUIDANCE FOR ROAD PAVEMENT FOUNDATIONS".

10.1.15 The earthworks for the establishment of the roadway will require the removal of the weaker soils identified at shallow depth, and a review of the deeper and weaker soils also identified. As discussed in the summary of ground conditions it is considered highly likely that the historical land form had shallow waterlogged depressions which have been consolidated by the forming and the construction of the parking area. However these works would not be of a recognised engineering standard. Options for ground improvement will comprise conventional replacement of weak soils with stronger granular fill or soil modification (lime stabilisation and or cement binding).



10.1.16 The construction of the proposed embankment linking the site to the M56 junction will require due consideration with respect to the potential shear failure of underlying clay soils associated with the increase in stress applied. Exploratory holes formed in this area (PB106, 107, 108, 109, 113, 207 and 207) indicate predominantly stiff clay in the area of the proposed embankment although localised weaker zones are noted (e.g. PB107, 108 and 113).

10.1.17 Due consideration should be given to these issues during the embankment design and construction, as required it may be necessary to locally excavate weaker soils and replace with well compacted granular fill.



10.2 General Comments & Considerations

10.2.1 No entry should be permitted into excavations exceeding 1.2m depth without appropriate risk assessments, shoring and support. Whilst groundwater was not encountered in significant volumes during site investigation works the presence of a perched water table cannot be precluded. Appropriate provisions should be made to dewater excavations as and when required.

10.2.2 In addition it is not recommended foundation excavations to underlying clay be left open and exposed to the elements as rainwater ingress will damage and reduce its strength (and subsequent bearing capacity). Similarly no vehicular movements should permitted within exposed foundation locations.

10.2.3 As previously noted supplementary ground investigations will be required on a plot by plot basis to complement works completed to date. The current program of ground investigations encountered highly fractured bands within the Mudstone bedrock that limited core recovering for inspection and testing. Careful consideration should be given to the drilling techniques adopted in any supplementary site investigations going forward to ensure adequate samples of bedrock can be obtained for geotechnical analysis.

10.2.4 It is understood the development will require either the culverting or diversion of existing surface water features that cross the site. Where these water features are to be diverted and infilled it will be necessary to excavate and remove all poorly compact organic rich river terrace deposits down to either competent clay or mudstone strata. The redundant water course will require infilling once diverted and it may be possible to reuse with site won clay arising's from excavations elsewhere on the development site.

10.2.5 However, the alignment of the water course will create a localised weaker zone that cuts across the site and consideration should be given to ground improvement (either Lime Stabilisation of clay fill or vibro treatment) in areas of proposed development that fall along its historic alignment.



11.0 CONCLUSIONS AND RECOMMENDATIONS

11.0.1 The site is to be redeveloped for mixed commercial led end uses split between 16 development plots forming part of the overall Airport City North masterplan provided by 5Plus Architects. At the time of writing specific details regarding the proposed development layout, building size etc. were still to be decided, although it is noted the overall Airport City North development will comprise commercial end uses including office space, hotels and multiple storey car parking.

11.0.2 In addition public realm space and the "Jug Handle" access roads are proposed as well as possible connecting bridges linking the site over the M56 motorway to the main Airport terminal buildings. The development will require either the diversion or culverting of several surface water courses including the eastern and western tributaries of the Bagley Brook.

11.0.3 Site investigations have revealed the following ground conditions:

- Made Ground in the two Jet Parks area, granular fill for the parking surface (predominantly inert natural gravel). In addition made ground is likely in the area of the former Moss Lane farmstead across the southern and eastern portion of Goodman's site (Fieldworks Zone 3)

- Drift soils of weaker surface deposits e.g. loose sand mixtures and soft and soft-firm clay mixes. These near surface deposits overlie competent Cohesive Glacial Till stiff and very stiff. As discussed above the anticipated geology for the area is Made Ground and weaker agricultural soils. It is likely that the original ground surface was undulating with old ponds and infilled hollow.

- Bedrock weathered Bollin Mudstone – Triassic Area, a dominantly laminated reddish-brown and greenish-grey mudstone with siltstones. The lower part is a structure less and laminated, dominantly reddish-brown mudstone. The overall competency of this formation is considered to be "Weak" although numerous highly / completely weathered bands were noted (including several at depth within the formation) that locally reduce its strength down to "Very Weak".



11.0.4 Chemical assessment of site soils has failed to reveal any sources of soil contamination when compared against a *"Commercial"* end use scenario, although the use of chemically resistant water supply pipe work may be required in the area around the former farmstead. In addition protection of existing surface water features will be required during the development process to prevent sediment rich surface water run-off from areas of bare soil or chemical ingress from accidental spillage or leakages.

11.0.5 At the time of writing ground gas monitoring works are on-going (the results from which will be issued as an addendum to the current assessment). Preliminary indications show the site is not likely to require significant protective measures to control gas ingress.

11.0.6 It is considered small or lightly loaded structures could be founded using a conventional foundation solution, although detailed plot specific site investigations will be required once a detailed layout and design is realised to confirm this assumption.

11.0.7 Larger more heavily loaded structures will require a piled foundation solution taken to depth into the Mudstone bedrock that underlies the site. Discussions should be held with suitability qualified piling contractors to establish pile design parameters, however it is considered an augured pile is likely to present a cost effective solution for the development. As with smaller structures supplementary plot specific site investigation works will be required to confirm pile design parameters. Of particular concern in this respect is the locally weathered / weakened state of the Mudstone bedrock at depth beneath the site and the potential implications for pile design. Any future ground investigation works undertaken should be mindful of these concerns and conducted in such a way to enable the best rock core recovery possible.

11.0.8 A series of exploratory holes and CBR tests have been taken along the proposed "Jug Handle" access road alignment to support construction requirements. The results from CBR testing indicate two distinct ground models; in the area across Zone 2 (Jet Parks 2) results are characterised by initially very high values (>50%) associated with the existing car park construction. However, once penetrated CBR values decline to between 5 and 22% and it is considered these values are more representative of underlying glacial clays.



11.0.9 The portion of the road that crosses field works Zone 3 (Goodman's land) was found to be more variable with values fluctuating between 3 and 26% with a mean of 9.5%. Superficially topsoil and organic rich deposits indicate the poorest level of compaction with deeper glacial clays (circa 4-500mm below the sites surface) indicating an improved competency.

11.0.10 As required, any suspected sources of contamination discovered during the site development (outside those discussed in this report) should be brought to the attention of RoC Consulting and their implications assessed. Depending on the extent and severity, the findings and assessment of the current study may require re-interpretation and a remediation strategy proposed to support the sites development.

11.0.11 Copies of the current report, along with the Phase 1 Desktop Study, should be submitted to the local planning authority for consideration and comment. As required any feedback received from the local authority should be passed back to RoC Consulting for review.

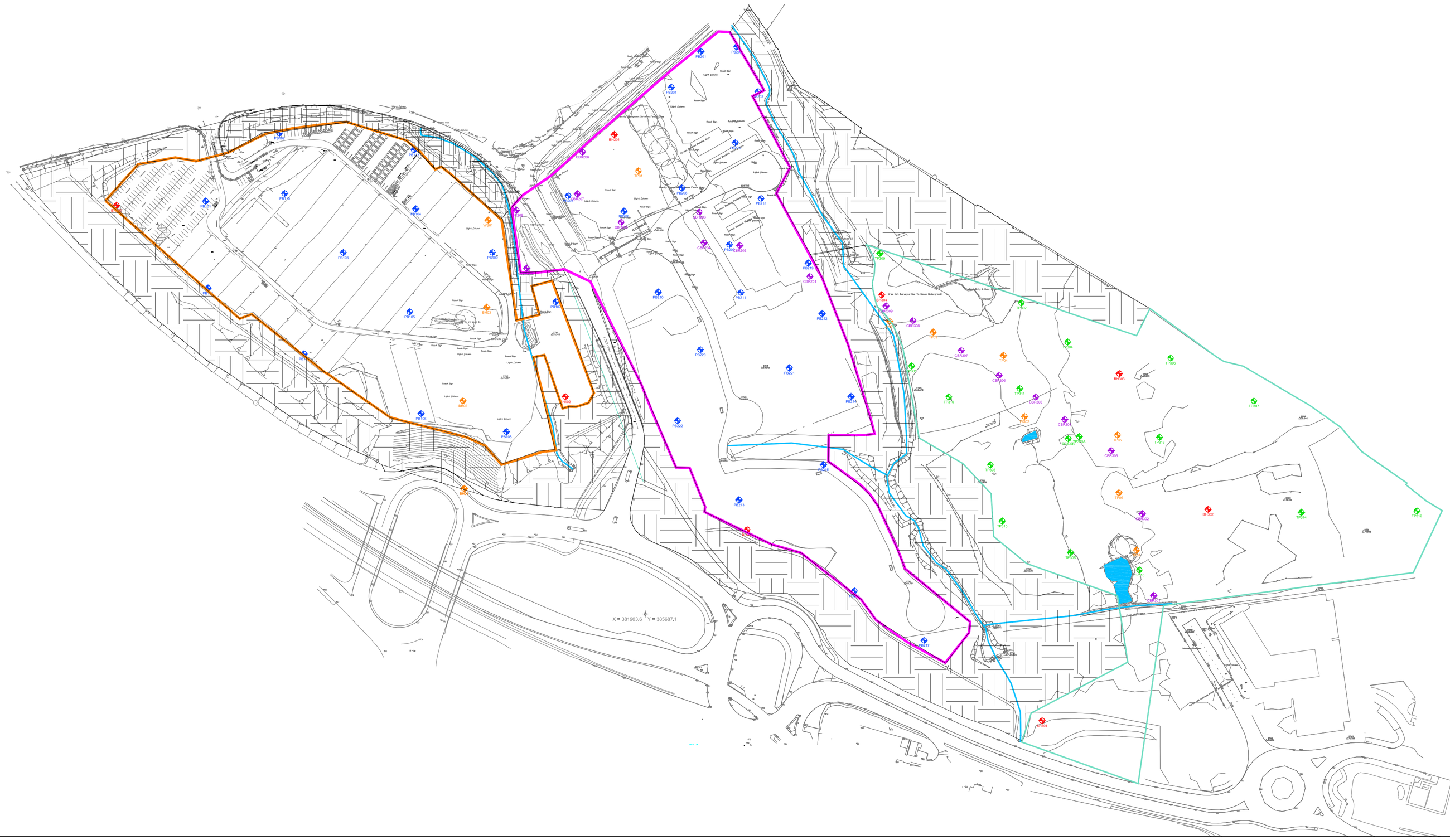


APPENDIX A

SITE DRAWINGS



THIS DRAWING IS THE PROPERTY OF RgCp. COPYRIGHT IS RESERVED BY THEM AND THE DRAWING IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRODUCED, RETAINED OR DISCLOSED TO ANY UNAUTHORISED PERSON EITHER WHOLLY OR IN PART WITHOUT THE WRITTEN CONSENT OF RgCp



NOTES

- 2012 COSTAIN BH OR TP LOCATION
- 2016 ROC CONSULTING ROTARY BOREHOLE LOCATION
- 2016 ROC CONSULTING CONE PENETRATION SAMPLE LOCATION
- 2016 ROC CONSULTING MACHINE EXCAVATED TRIAL PIT LOCATION
- 2016 ROC CONSULTING TRL CBR TEST LOCATION
- 2016 ROC CONSULTING ZONE 1 FIELD WORKS – JET PARKS 1
- 2016 ROC CONSULTING ZONE 2 FIELD WORKS – JET PARKS 2
- 2016 ROC CONSULTING ZONE 3 FIELD WORKS – GOODMANS LAND
- 2016 PROPOSED "JUG HANDLE" ACCESS ROAD ALIGNMENT
- 2016 AREA OF LIMITED / NO ACCESS FOR SITE INVESTIGATION
- SURFACE WATER OR POND FEATURE

1) PREVIOUS BOREHOLE LOCATIONS TAKEN FROM 2012 COSTAIN SITE INVESTIGATION REPORT (REF: 018936/5337 AND SHOULD BE CONSIDERED APPROXIMATE. THE FINDINGS OF THIS REPORT,

2) BOREHOLE LOCATIONS HAVE BEEN DICTATED BY DESIGN REQUIREMENTS AND LOCATED WITH REFERENCE TO THE FINDINGS OF THE AFOREMENTIONED COSTAIN SITE INVESTIGATION AND 2012 URS PHASE 1 DESKTOP STUDY.

3) PLEASE REFER TO ACCOMPANYING ROC CONSULTING PHASE 2 SITE INVESTIGATION REPORT FOR A DETAILED DESCRIPTION OF FIELDWORKS AND INFORMATION REGARDING GROUND CONDITIONS.

4) AREAS OF LIMITED ACCESS INDICATE PORTIONS OF THE SITE WHERE SITE INVESTIGATION WORKS COULD NOT BE COMPLETED. ACCESS WAS LIMITED FOR A NUMBER OF REASONS INCLUDING DENSE VEGETATION, SURFACE WATER FEATURES AND BELOW GROUND UTILITY CONSTRAINTS.

REV.	DATE	DETAILS	DRN.	CHK.

DRAWING STATUS
INFORMATION

RoC CONSULTING
Civil & Structural Engineers
6 Commercial Street, Manchester,
M15 4PZ
Tel: 0161 214 5390

DRAWN AS	DATE ARPIL 2016	SCALES NTS
CHECKED AS	DATE APRIL 2016	THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE
APPRVD.	DATE	EMAIL FOR DRAWINGS drawings@rocconsulting.com

CLIENT
AIRPORT CITY PARTNERSHIPS

PROJECT TITLE
AIRPORT CITY NORTH

DRAWING TITLE
BOREHOLE LOCATION PLAN : CURRENT SITE

PROJECT No.	DRAWING No.	REV.
3407	ES01	S1

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RoC Consulting

ACADFILE
PLOT DATE: PLOTDATE



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NOTES

- BH01 — 2012 COSTAIN BH OR TP LOCATION
- BH101 — 2016 ROC CONSULTING ROTARY BOREHOLE LOCATION
- PB201 — 2016 ROC CONSULTING CONE PENETRATION SAMPLE LOCATION
- TP301 — 2016 ROC CONSULTING MACHINE EXCAVATED TRIAL PIT LOCATION
- CBR301 — 2016 ROC CONSULTING TRL CBR TEST LOCATION
- PROP DEVELOPMENT PLOT BOUNDARY
- 2016 PROPOSED "JUG HANDLE" ACCESS ROAD ALIGNMENT
- SURFACE WATER OR POND FEATURE

1) PREVIOUS BOREHOLE LOCATIONS TAKEN FROM 2012 COSTAIN SITE INVESTIGATION REPORT (REF: 018936/5337 AND SHOULD BE CONSIDERED APPROXIMATE. THE FINDINGS OF THIS REPORT,

2) BOREHOLE LOCATIONS HAVE BEEN DICTATED BY DESIGN REQUIREMENTS AND LOCATED WITH REFERENCE TO THE FINDINGS OF THE AFOREMENTIONED COSTAIN SITE INVESTIGATION AND 2012 URS PHASE 1 DESKTOP STUDY.

3) PLEASE REFER TO ACCOMPANYING ROC CONSULTING PHASE 2 SITE INVESTIGATION REPORT FOR A DETAILED DESCRIPTION OF FIELDWORKS AND INFORMATION REGARDING GROUND

4) DEVELOPMENT PLOT NAMES AND BOUNDARIES ARE BASED ON LATEST 5PLUS ARCHITECTS MASTER PLAN LAYOUT (AS OF DEC 2015) AND MAY BE SUBJECT TO REVISION OR AMENDMENT.

REV.	DATE	DETAILS	DRN.	CHK.

DRAWING STATUS
INFORMATION

R2C CONSULTING
Civil & Structural Engineers
6 Commercial Street, Manchester,
M15 4PZ
Tel: 0161 214 5390

DRAWN AS	DATE ARPIL 2016	SCALES NTS
CHECKED AS	DATE APRIL 2016	THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE
APPRVD.	DATE	EMAIL FOR DRAWINGS drawings@rocconsulting.com

CLIENT
AIRPORT CITY PARTNERSHIPS

PROJECT TITLE
AIRPORT CITY NORTH

DRAWING TITLE
BOREHOLE LOCATION PLAN : PROP LAYOUT

PROJECT No.	DRAWING No.	REV.
3407	ES02	S1

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ACADFILE
PLOT DATE: PLOTDATE

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NOTES

KEY TO SYMBOLS

- BH101 — ROC ROTARY BOREHOLE LOCATION
- PB201 — ROC CPT PROBEHOLE LOCATION
- TP312 — ROC TRIAL PIT LOCATION
- +70.168 — EXISTING SURFACE LEVEL (mAOD)
- DEVELOPMENT PLOT (APPROX EXTENT)
- BRL = 66.65mAOD — ANTICIPATED DEPTH TO BEDROCK (mAOD)

DRAWING NOTES

Depth to bedrock (mAOD): 69.5, 69, 68.5, 68, 67.5, 67, 66.5, 66, 65.5, 65, 64.5, 64, 63.5, 63, 62.5, 62

1) DEVELOPMENT PLOT NAMES AND BOUNDARIES ARE BASED ON LATEST 5PLUS ARCHITECTS MASTER PLAN LAYOUT (AS OF DEC 2015) AND MAY BE SUBJECT TO REVISION OR AMENDMENT.

2) GEOLOGICAL CONTOUR PLOT IS BASED ON FINDINGS OF 2016 ROC CONSULTING SITE INVESTIGATION WORKS.

3) DEPTH TO BEDROCK IS TAKEN TO THE WEATHERED FRACTION OF THE MUDSTONE FORMATION AND SHOULD BE CONSIDERED APPROXIMATE.

4) INDICATIVE SITE LEVELS TAKEN FROM TOPOGRAPHICAL SURVEY OF THE SITE AND ARE SHOWN FOR COMPARATIVE PURPOSES.

REV.	DATE	DETAILS	DRN.	CHK.

DRAWING STATUS: INFORMATION

RgC CONSULTING
Civil & Structural Engineers
6 Commercial Street, Manchester, M15 4PZ
Tel: 0161 214 5390

DRAWN: AS	DATE: APRIL 2016	SCALES: NTS
CHECKED	DATE	THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE
APPRVD.: AS	DATE: APRIL 2016	EMAIL FOR DRAWINGS: drawings@rocconsulting.com

CLIENT: AIRPORT CITY PARTNERSHIPS

PROJECT TITLE: AIRPORT CITY NORTH

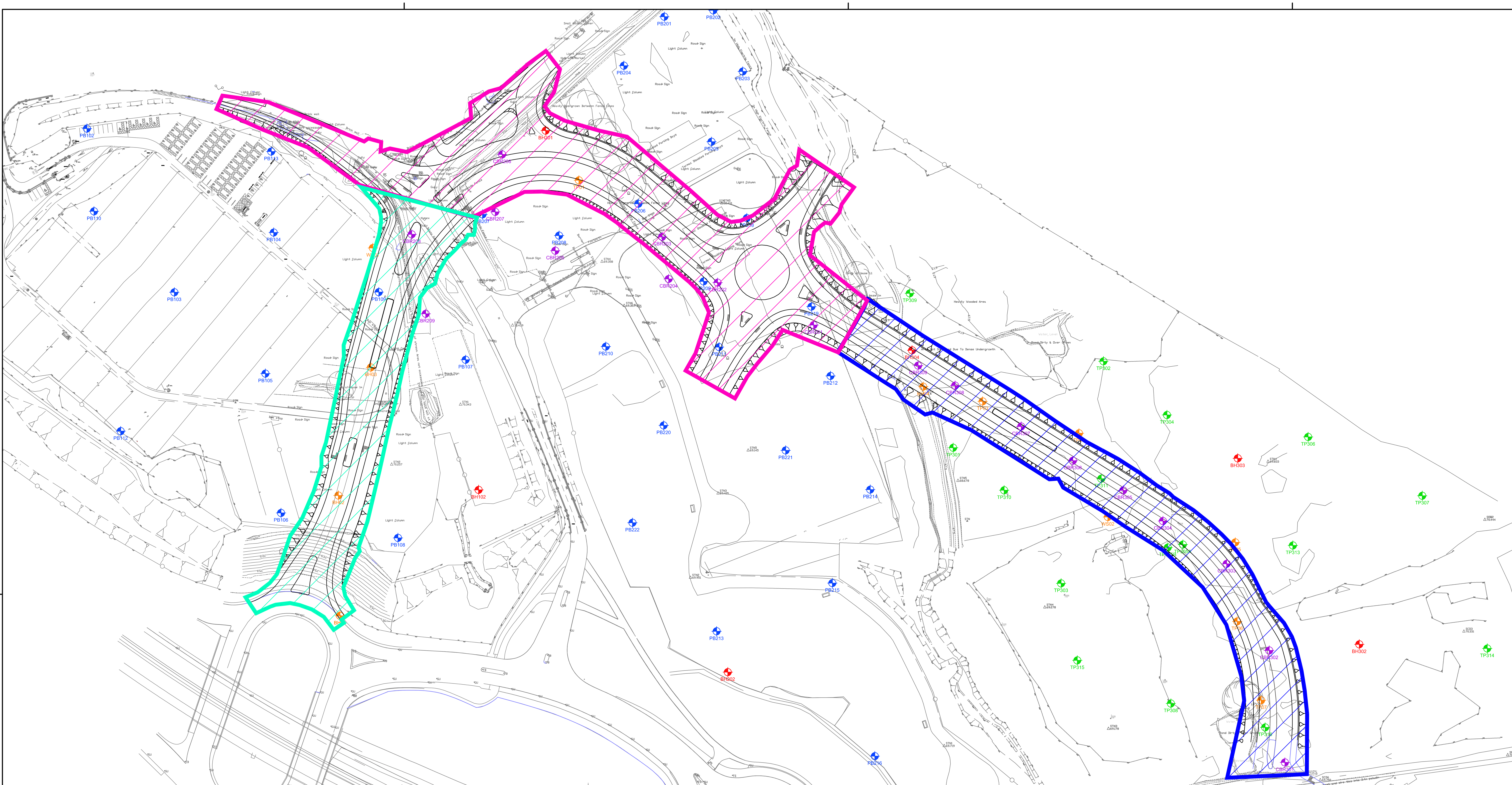
DRAWING TITLE: MUDSTONE BEDROCK COUNTOUR PLOT

PROJECT No.	DRAWING No.	REV.
3407	ES04	S1

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NOTES

- BH01 — 2012 COSTAIN BH OR TP LOCATION
- BH101 — 2016 ROC CONSULTING ROTARY BOREHOLE LOCATION
- PB201 — 2016 ROC CONSULTING CONE PENETRATION SAMPLE LOCATION
- TP301 — 2016 ROC CONSULTING MACHINE EXCAVATED TRIAL PIT LOCATION
- CBR301 — 2016 ROC CONSULTING TRL CBR TEST LOCATION
- PROP DEVELOPMENT PLOT BOUNDARY
- 2016 PROPOSED "JUG HANDLE" ACCESS ROAD ALIGNMENT
- SURFACE WATER OR POND FEATURE
- 2016 PROPOSED "JUG HANDLE" ROAD (EAST)
- 2016 PROPOSED "JUG HANDLE" ROAD (CENTRAL)
- 2016 PROPOSED "JUG HANDLE" ROAD (SOUTH)

1) CBR RESULTS DERIVED FROM DCP TESTING UNDERTAKEN BY ROC CONSULTING.

2) DEPTH TO BEDROCK HAS BEEN ESTABLISHED FROM CPT TESTING, EXPLORATORY BOREHOLES, AND TRIAL PIT WORKS.

3) BOREHOLE LOCATIONS HAVE BEEN DICTATED BY DESIGN REQUIREMENTS AND LOCATED WITH REFERENCE TO THE FINDINGS OF THE AFOREMENTIONED COSTAIN SITE INVESTIGATION AND 2012 URS PHASE 1 DESKTOP STUDY.

4) PLEASE REFER TO ACCOMPANYING ROC CONSULTING PHASE 2 SITE INVESTIGATION REPORT FOR A DETAILED DESCRIPTION OF FIELDWORKS AND INFORMATION REGARDING GROUND CONDITIONS.

5) DEVELOPMENT PLOT NAMES AND BOUNDARIES ARE BASED ON LATEST 5PLUS ARCHITECTS MASTER PLAN LAYOUT (AS OF DEC 2015) AND MAY BE SUBJECT TO REVISION OR AMENDMENT.

Jug-Handle Road (SOUTH)

BH ID.	Depth to bedrock mbgl.	Depth to bedrock mAOD
BH201	6.25	62.22
PB207	2.42	67
PB113	4.9	65.48
PB109	3.37	66.76
PB107	4.33	66.05
PB106	3.33	67.16
PB108	3.23	67.1
min	2.42	62.22
max	6.25	67.00
mean	4.34	64.61

BH ID.	Depth Range	California Bearing Ratio%
CBR208	GL-0.98m	5%
CBR209	GL-0.98m	5%

Jug-Handle Road (CENTRAL)

BH ID.	Depth to bedrock mbgl.	Depth to bedrock mAOD
PB219	5.08	63.2
PB211	3.72	65.42
PB209	3.65	65.09
PB218	4.45	63.85
PB206	2.7	66.3
BH201	0.8	68.37
PB205	5.5	62.75
min	3.72	63.20
max	5.08	65.42
mean	4.40	64.31

BH ID.	Depth Range	California Bearing Ratio%
CBR201A	GL - 0.07m	>50%
CBR201B	GL - 0.105m	>50%
CBR202	GL - 0.24m	>50%
CBR203	GL-0.46m	44%
	0.46-0.84m	16%
CBR204	GL-0.44m	43%
	0.44-0.86m	12%
CBR205	GL-0.28m	31%
	0.28-0.88m	6%
CBR206	GL-0.28m	53%
	0.28-0.81m	19%
CBR207	GL-0.35m	50%
	0.35-0.82m	22%

Jug-Handle Road (EAST)

BH ID.	Depth to bedrock mbgl.	Depth to bedrock mAOD
BH302	4.5	65.28
TP313	3.9	65.65
TP311	3.9	64.36
TP310	4.2	64.47
BH304	5.2	62.61
TP309	3.9	63.63
PB212	4.44	63.86
PB219	5.08	63.2
min	3.90	65.28
max	4.50	65.65
mean	4.20	65.47

BH ID.	Depth Range	California Bearing Ratio%
CBR301	GL-0.28m	26%
	0.28-0.81m	15%
CBR302	GL-0.97m	6%
CBR303	GL-0.97m	6%
CBR304	GL-0.50m	3%
	0.50-0.96m	20%
CBR305	GL-0.97m	9%
CBR306	GL-0.94m	5%
CBR307	GL-0.97m	7%
CBR308	GL-0.98m	7%
CBR309	GL-0.98m	6%
CBR310	GL-0.99m	5%

REV.	DATE	DETAILS	DRN.	CHK.

DRAWING STATUS: INFORMATION

RoC CONSULTING
Civil & Structural Engineers
6 Commercial Street, Manchester, M15 4PZ
Tel: 0161 214 5390

DRAWN: AS | DATE: ARPIL 2016 | SCALES: NTS
CHECKED: AS | DATE: APRIL 2016 | THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE
APPRVD. | DATE | EMAIL FOR DRAWINGS drawings@rocconsulting.com

CLIENT: AIRPORT CITY PARTNERSHIPS

PROJECT TITLE: AIRPORT CITY NORTH

DRAWING TITLE: JUG-HANDLE ROAD DEPTH TO ROCK AND CBR VALUES

PROJECT No. 3407 | DRAWING No. ES03 | REV. S1

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PLOT DATE: PLOTDATE

APPENDIX B

EXPLORATORY HOLE LOGSHEETS



ROC CONSULTING

Location **Airport City North Jetparks 1**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No. **BH101**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Casing Diameter **125mm** Depth **6.00m**

Start Date: **11/03/2016** End Date: **03/11/2016** Final Depth: **21.00m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
							Drillers Description Macadam Surfacing 100mm 0.1-0.5m Crushed graded granular Fill 0.5-1.0m dark brown soil Fill	(1.00)		
								1.00	69.93	
							Drillers Description grey silty Sand	(1.00)		
								2.00	68.93	
							Drillers Description brown sandy Clay	(2.00)		
								4.00	66.93	
							Weathered Mudstone Drillers Description	(2.00)		
CASED								6.00	64.93	
6.00					NI		Core loss	(0.40)		
								6.40	64.53	
					30 (70) [10]		Weak locally medium strength very thinly and thinly bedded reddish brown to core axis silty slightly fine sandy MUDSTONE, partially weathered, bedding 5-10º to axis. Numerous DIFs	(0.27) 6.67	64.26	
					NI		Weak thinly bedded greenish grey locally streaked reddish brown silty slightly fine sandy MUDSTONE partially weathered bedding 10-15º to core axis. Numerous DIFs BOLLIN MUDSTONE			
90mm	1	83	60	40	30 (40) [10]	.. 6.90 clay infilled bedding break .. 7.08m 20mm thick mudstone gravel infilled bedding break .. slump structures in the bedding. .. 7.36m 5mm clay infilled bedding break		(1.68)		
					90 (390)			8.35	62.58	
							Weak, locally moderate strong, thinly bedded reddish brown colour banded greenish grey silty MUDSTONE partially weathered, bedding 10º to axis. Numerous DIFs	(0.45) 8.80	62.13	
					NI		Very weak broken core thinly bedded reddish brown silty MUDSTONE partially weathered, low angle bedding. Numerous DIFs	(0.20) 9.00	61.93	
9.00					40 (90) [20]		Weak locally medium strong thinly bedded reddish brown silt fine sandy MUDSTONE, partially weathered, low angle bedding	(1.30)		

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 21m
6) Standpipe piezometer installed response zone 0.5-4.50m.

Logged by **NJ** Drilled by **DDSL**

Ground level **70.93mAD**

Co-ordinates: **E:381534** **N:385973**

Note: DIF's refer to Drilling Induced Fractures

DRAFT

ROC CONSULTING

Location **Airport City North Jetparks 1**

Client: **Airport City Partnerships** Project Ref.:

Borehole No. **BH101**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Diameter Casing Depth

Start Date: **11/03/2016** End Date: **03/11/2016** Final Depth: **21.00m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Strata: Reduced Level (m)	Legend
							BOLLIN MUDSTONE			
90mm	2	93	89	55	NI 50 (102) [10] NI	*continued - Weak locally medium strong thinly bedded reddish brown silt fine sandy MUDSTONE, partially weathered, low angle bedding* *.. 10.21-10.28 broken core recovered as mudstone gravel.*		10.30	60.63	
							Medium strong thinly bedded greenish grey silty slightly fine sandy MUDSTONE, partially weathered, bedding 5-10º to core axis BOLLIN MUDSTONE	(1.70)		
					60 (300) [5]	*.. 10.59 broken core recovered as mudstone gravel.* *.. 11.2-11.7m occasional 2-5mm stringers of gypsum*		12.00	58.93	
12.00							Core loss	(0.20)		
					NI	*.. 12.26m broken core recoverd as mudston gravel*		12.20	58.73	
					30 (100) [10]		Medium strong thinly bedded light greenish grey silty fine sandy MUDSTONE, partially weathered. Numerous DIFs			
					NI	*.. 12.54m broken core recoverd as mudston gravel*		(1.69)		
						.. 13.18-13.23m broken recovered as mudstone gravel				
90mm	3	98	87	63	60 (300) [40]	*.. 13.54-13.66m broken core recovered as mudstone gravel*				
						.. 13.87-13.89 broken core recovered as mudstone gravel		13.89	57.04	
							Weak thinly bedded reddish brown silty MUDSTONE partially weathered low angle bedding. Numerous DIFs	(0.18)	56.86	
					NI	*. 14.10m 5mm wide bedding break infilled with stiff clay*		14.07		
					70 (200) [40]		Weak locally medium strong thinly bedded light greenish grey silty slightly fine sandy MUDSTONE, partially weathered, low angle bedding, some slump structures. Numerous DIFs BOLLIN MUDSTONE	(1.91)		
15.00										
					NI	*.. 14.62m 10mm wide bedding break infilled with stiff clay* *.. 15.25m broken core recovered as mudstone gravel*				
					40 (100) [10]			15.98	54.95	
90mm	4	99	96	67			Weak thinly bedded reddish brown with darker brown bands silty MUDSTONE, unweathered, low angle bedding with slump structures, core side washouts of mud pellets. Numerous DIFs			
					NI	*.. 16.60 20mm clay filled bedding break*		(2.02)		
					60 (301)					
					NI	*.. 17.23m stiff clay infilled bedding break*				
					85 (370) [50]	*.. 17.70-17.77m washout along core side*				
						.. 17.98m broken core recovered as mudstone gravel. *.. 18.0-18.16m core loss*		18.00	52.93	
18.00					NI			(0.16)	52.77	
					NI		Core Loss Medium strong thinly bedded broken core reddish brown silty slightly fine sandy MUDSTONE, unweathered. Numerous DIFs	18.16		
					NI	*.. 18.5-18.60m mudstone gravel in bedding break*		(1.10)		
					20	*.. 18.6-18.74m broken core with subvertical jointing*				
					NI	*.. 18.74-19.0m mudstone gravel in bedding break*		19.26	51.67	
90mm	5	79	39	16	60 (70) [0]	*.. 19.05-19.26m broken core mudstone gravel on bedding break*				
							Weak and medium strong thinkly bedded greenish grey light colour banded silty fine sandy MUDSTONE,			

Remarks
1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 21m
6) Standpipe piezometer installed response zone 0.5-4.50m.

Logged by **NJ** Drilled by **DDSL**

Ground level **70.93mAD**

Co-ordinates: **E:381534** **N:385973**

Note: DIF's refer to Drilling Induced Fractures

ROC CONSULTING

Location **Airport City North Jetparks 1**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No.

BH101

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Casing Diameter Casing Depth

Start Date: **11/03/2016** End Date: **03/11/2016** Final Depth: **21.00m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Strata: Reduced Level (m)	Strata: Legend
					90 (90) [0] NI		partially weathered, Broken Core. Numerous DIFs BOLLIN MUDSTONE	(1.74)		
					50 (60) [40] NI	.. 19.94-20.0m reddish brown stiff clay on bedding break CORE LOSS OVER CORE DEPTH 20.0-21.0m .. 20.12-20.65m clay infilled bedding break, drill cuttings. .. 20.8-20.95m broken core recovered as mudstone gravel	**Borehole Complete**	21.00	49.93	
-{11/03/2016}-										

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 21m
6) Standpipe piezometer installed response zone 0.5-4.50m.

Note: DIF's refer to Drilling Induced Fractures

Logged by **NJ** Drilled by **DDSL**

Ground level **70.93mAD**

Co-ordinates: **E:381534** **N:385973**

ROC CONSULTING

Location **Airport City North Jetparks 1**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No. **BH102**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Casing Diameter **125mm** Depth **6.00m**

Start Date: **15/03/2016** End Date: **15/03/2016** Final Depth: **15.30m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Strata: Reduced Level (m)	Legend
							Drillers Description: large stone Fill	(2.00)		
							Drillers Description: brown clay	2.00 (1.50)	68.40	
							Drillers Description: siltstone (reddish brown)	3.50 (2.50)	66.90	
CASED 6.00					NI	.. 6.0-6.12m core loss	missing core	6.00 (0.12)	64.40 64.28	
					30 (60) [10]		Weak thinly bedded silty slightly fine sandy MUDSTONE, partially weathered low angle bedding, Numerous DIFs	6.12 (0.36)	63.92	
90mm	1	53	84	43	40 (160) [0]	.. 8.2-8.3m broken core recovered as mudstone gravel on bedding break .. 8.65-9.0m broken core recovered as mudstone gravel	Weak thinly bedded reddish brown silty slightly fine sandy MUDSTONE, partially weathered, low angle bedding, Numerous DIFs BOLLIN MUDSTONE	6.48 (2.72)		
9.00							Weak locally very weak light brown colour banded thinly bedded silty slightly fine sandy MUDSTONE, partially weathered, low angle bedding, Numerous DIFs	9.20 (0.22)	61.20 60.98	
							Weak thinly bedded weak reddish brown silty MUDSTONE, partially weathered, low angle bedding. Core broken	9.42		

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 15.3m
5) Borehole backfilled to surface with bentonite pellets

Logged by **NJ** Drilled by **Danbar**

Ground level **70.40mAD**

Co-ordinates: **E:381848** **N:385839**

Note: DIF's refer to Drilling Induced Fractures

DRAFT

ROC CONSULTING

Location **Airport City North Jetparks 1**

Client: **Airport City Partnerships** Project Ref.:

Borehole No. **BH102**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Diameter: Casing Depth:

Start Date: **15/03/2016** End Date: **15/03/2016** Final Depth: **15.30m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
90mm	2	42	77	22	50 (160) [0]		and significant core loss, Numerous DIFs BOLLIN MUDSTONE	(1.18)		
								10.60	59.80	
							Weak thinly bedded reddish brown colour banded silty MUDSTONE, partially weathered, low angle bedding	(0.10)	59.70	
							Weak and medium strong thinly bedded greenish grey silty slightly fine sandy MUDSTONE, partially weathered, low angle bedding, Numerous DIFs BOLLIN MUDSTONE	10.70		
11.30					NI	.. broken core				
					40	.. 11.54-11.65m broken core recovered as mudstone gravel		(2.25)		
					NI					
					60 (155) [10]	12.3-12.4m 60º cross cutting smooth joint				
						.. 12.45-12.5m stiff clay infill on bedding				
90mm	3	94	74	50		.. 12.65-12.8m subvertical joint with core loss				
					50 (101) [20]	..12.95-13.12m broken core recovered as mudstone gravel		12.95	57.45	
					NI		Weak and medium strong thinly bedded reddish brown silty slightly fine sandy MUDSTONE, partially weathered low angle bedding. , Numerous DIFs. Grey banding noted below 15.2m. BOLLIN MUDSTONE			
					30 (50) [10]					
					NI					
					90 (430) [50]	..13.3m possible core loss		(2.35)		
14.30						.. 14.5-14.67m wedge set of joints subhorizontal				
90mm	4	91	86	82	150 (600) [0]					
							Borehole Complete	15.30	55.10	
-{15/03/2016}-										

Remarks
1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 15.3m
5) Borehole backfilled to surface with bentonite pellets

Logged by **NJ** Drilled by **Danbar**

Ground level **70.40mAD**

Co-ordinates: **E:381848** **N:385839**

Note: DIF's refer to Drilling Induced Fractures

ROC CONSULTING

Location **Airport City North Jetparks 2**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No. **BH201**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Casing Diameter **125mm** Depth **3.00m**

Start Date: **16/03/2016** End Date: **17/03/2016** Final Depth: **15.50m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Strata: Reduced Level (m)	Legend
							Drillers Description: road stone	(0.30)		
								0.30	68.87	
							Drillers Description: brown clay	(0.50)		
								0.80	68.37	
							Drillers Description: red mudstone			
								(2.20)		
CASED										
3.00						.. 3.0-5.30m Assumed core los		3.00	66.17	
							Core Loss			
					0			(2.30)		
90mm	1	23	60	0						
					30 (60) [30]			5.30	63.87	
					NI	.. 5.4-5.72m broken core, disturbed on bedding	Weak greenish grey thinly bedded silty slightly fine sandy MUDSTONE, partially weathered, very poor core recovery. Numerous DIFs	(0.41)		
					NI			5.71	63.46	
					NI	.. 5.78-5.78m broken core		(0.29)		
6.00								6.00	63.17	
							Weak thinly bedded reddish brown light brown colour banded silty MUDSTONE, partially weathered, low angle bedding. Numerous DIFs			
90mm	2	12	75	0	0	..6.0-7.0m core loss		(0.85)		
							Core Loss			
					NI	.. 6.9-7.0m broken core followed by total core loss		6.85	62.32	
								(0.15)	62.17	
7.00							Weak thinly bedded greenish grey silty MUDSTONE, partially weathered, low angle bedding	7.00		
	3	0	0	0		.. 7.0-8.0m total core loss	Core loss	(1.00)		
								8.00	61.17	
8.00					NI	.. 8.0-8.1m broken core after total core loss				
					40 (65) [30]		Weak thinly bedded greenish grey silty MUDSTONE, partially weathered, low angle bedding. Numerous DIFs BOLLIN MUDSTONE	(0.95)		
90mm	4	87	73	0	30 (60) [0]	..8.6-8.60m broken core recovered as mudstone gravel .. 8.74-8.86m broken core recovered as mudstone gravel		8.95	60.22	
					NI	.. 8.95-9.0m brown core recovered as cubic mudstone fragments				
					50 (65) [40]		Weak thinly bedded reddish brown light brown colour banded silty slightly fine sandy MUDSTONE, partially weathered, low angle bedding. Numerous DIFs			
9.50					NI		BOLLIN MUDSTONE			

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 3.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 15.5m
5) Standpipe piezometer installed response zone 0.5-3.5m

Logged by **NJ** Drilled by **Danbar**

Ground level **69.17mAD**

Co-ordinates: **E:381882** **N:386022**

Note: DIF's refer to Drilling Induced Fractures

ROC CONSULTING

Location **Airport City North Jetparks 2**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No. **BH201**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core** Casing Diameter Casing Depth

Start Date: **16/03/2016** End Date: **17/03/2016** Final Depth: **15.50m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	RUN No	TCR %	SCR %	RQD %	Mechanical Log: If mm (Imax) [Imin]	Description: Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Strata: Reduced Level (m)	Strata: Legend
90mm	5	115	85	55	90 (135) [20] NI 40 (60) [20] NI 100 (130) [40]	.. 9.4-9.48m broken core recovered as mudstone gravel .. 10.55-10.57m clay with mudstone gravel infill on bedding break	continued:Weak thinly bedded reddish brown light brown colour banded silty slightly fine sandy MUDSTONE, partially weathered, low angle bedding. Numerous DIFs BOLLIN MUDSTONE	(3.55)		
11.50 90mm	6	92	77	54	NI 60 (60) [30] NI 100 (100) [30] NI 60 (70) [30] NI 100 (160) [60] NI 120 (230) [30]	.. 9.72-7.74m 60º cross cutting slightly rough joint. .. 10.28-10.4m 60º-65º cross cutting slightly rough joint .. 10.42-10.44m clay with mudstone gravel infilled bedding break .. 10.6-10.71m 60º slightly rough cross cutting joint plane .. 10.81-11.0m 65-70º cross cutting slightly rough joint .. 11.38m slump structures in the mudstone 11.5-11.68m broken core recovered as mudstone gravel .. 11.8-11.93m mudstone gravel infilled bedding break	Weak thinly bedded greenish grey silty slightly fine sandy MUDSTONE, partially weathered, numerous DIFs. Some gypsum infilled bedding breaks and cross cutting joints BOLLIN MUDSTONE	12.50 (3.00)	56.67	
14.00 90mm	7	90	82	39	100 (310) [30] 30 NI 100 (320) [40]	.. 13.14-13.23m 50º cross cutting joint slightly rough .. 14.17-14.31m broken core recovered as mudstone gravel .. 14.62-14.68m broken core recovered as mudstone gravel .. 14.78-14.80m washout of core in very weak band .. 14.9-15.1m side of core washed out .. 15.0-15.2m 15mm 25mm and 35mm siltstone bands	**Borehole Complete**	15.50	53.67	
-{17/03/2016}-										

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 3.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 15.5m
5) Standpipe piezometer installed response zone 0.5-3.5m

Logged by **NJ** Drilled by **Danbar**

Ground level **69.17mAD**

Co-ordinates: **E:381882** **N:386022**

Note: DIF's refer to Drilling Induced Fractures

ROC CONSULTING

Location **Airport City North Jetparks 2**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No. **BH202**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Casing Diameter	Casing Depth
125mm	6.00m

Start Date:	End Date:	Final Depth:
16/03/2016	16/03/2016	15.00m

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
							Drillers Description: road stone, 300mm over 100mm of granular fill	(0.30) 0.30	69.57	
							Drillers Descriptions: weathered grey mudstone	(2.70)		
								3.00	66.87	
3.00					0	..3.0-3.18m lost core	Weak and medium strong thinly bedded silty slightly fine sandy MUDSTONE, partially weathered, broken core low angle bedding	(0.40) 3.40	66.47	
					80 (80) [80]					
					NI	.. 3.18-3.30m broken core recovered as mudstone gravel .. 3.4-3.5m broken on bedding				
90mm	1	67	71	0	200 (490) [70]	.. 3.5-3.67m subvertical slightly rough .. 3.67-3.75m broken core recovered as mudstone gravel .. 3.7-3.95m two cross cutting joint sets 40º and 50º to core axis	Weak and medium strong thinly bedded reddish brown some dark brown banding silty slightly fine sandy MUDSTONE, partially weathered, low angle bedding BOLLIN MUDSTONE	(2.60)		
					NI	.. 4.9m 10mm stiff clay infilled bedding break .. 5.05-5.15m broken core recovered as mudstone gravel				
					100 (340) [30]	5.5m DIF at 60º to core axis .. 5.67-5.7m broken core recovered as mudstone gravel				
CASED					NI			6.00	63.87	
6.00					40 (40) [0]	.. 6.3-6.36m broken core recovered as mudstone gravel	Core Loss Weak thinly bedded reddish brown silty slightly fine sandy MUDSTONE, partially weathered, low angle bedding	(0.12) 6.12 (0.13) 6.25	63.75 63.62	
							Medium strong greenish grey thinly bedded silty slightly fine sandy MUDSTONE, partially weathered, horizontal bedding	(1.05)		
								7.30	62.57	
	2	89	40	88	NI	.. 7.33-7.4m broken core on bedding, 40º	Weak thinly bedded greenish grey silty MUDSTONE partially weathered broken and some washouts BOLLIN MUDSTONE	(1.25)		
					40 (40) [30]					
					NI	.. 7.55-7.74m broken core recovered as mudstone gravel				
					60 (100) [30]	.. 8.28-8.47m cross cutting joint slightly rough 70º to core axis				
					NI	.. 8.47-8.56m broken core recovered as mudstone gravel		8.55	61.32	
					60 (60) [40]		Weak and medium strong thinly bedded greyish brown and reddish brown silty slightly fine sandy MUDSTONE, partially weathered, some washouts on core	(0.45) 9.00	60.87	
9.00					NI	.. 8.87-9.14 broken core recovered as mudstone gravel	Weak thinly bedded reddish brown some greenish grey spots silty MUDSTONE, partially weathered low angle bedding steep angle cross cutting gypsum veins. Numerous DIFs	(1.35)		
					80 (104) [70]	.. 9.2-9.38m subvertical joint slightly				

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 3.0m water flush with dragbit
3) Cased to 3.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 15.0m
5) Standpipe piezometer installed response zone 0.5-6.0m

Logged by **NJ**

Drilled by **Danbar**

Ground level **69.87mAD**

Co-ordinates: **E:381975** **N:385746**

Note: DIF's refer to Drilling Induced Fractures

ROC CONSULTING

Location **Airport City North Jetparks 2**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No. **BH202**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Casing Diameter / Casing Depth

Start Date: **16/03/2016** End Date: **16/03/2016** Final Depth: **15.00m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
					NI	*rough*				
						.. 9.75-9.90 80º joint slightly rough				
90mm	3	85	65	42	100 (380) [60]	*.. 10.37-10.44 broken core recovered as mudstone gravel*	Medium strong thinly bedded reddish brown silty fine sandy MUDSTONE, partially weathered. Low angle bedding. Numerous DIFs BOLLIN MUDSTONE	10.35 (1.65)	59.52	
					NI					
					150 (200) [85]	*.. 10.72-10.84, 70º slightly rough joint, to core axis*				
						.. 11.28-11.40 Joint slightly rough 50º to core axis				
						.. 11.6m broken core with 40º joint				
						.. 11.66 subvertical joint on face of core.				
					100 (140) [60]					
12.00						*..12.0-12.3m broken core with mudstone lumps*		12.00 (0.28)	57.87	
					NI		Weak thinly bedded greenish grey silty slightly fine sandy MUDSTONE, partially weathered, core broken.	12.28 (0.42)	57.59	
					100 (160) [100]	*.. 12.3-12.45m broken core recovered as mudstone gravel, 50º joint*				
90mm	4	35	71	23			Weak thinly bedded reddish brown silty MUDSTONE partially weathered, bedding 50º-60º to core axis Significant core loss core recovered is reddish brown mudstone gravel with silty fine sandy clay BOLLIN MUDSTONE	12.70 (1.30)	57.17	
					NI	*.. 13.0-14.0m core loss*				
14.00							Weak thinly bedded reddish brown colour banded silty slightly fine sandy MUDSTONE, partially weathered bedding, 40º to core axis	14.00 (0.50)	55.87	
90mm	5	100	81	35		*.. Broken core on 40º bedding*		14.50 (0.30)	55.37	
					60 (30) [100]		Weak medium strong reddish brown, some light brown colour banding silty fine slightly fine sandy MUDSTONE, partially weathered low subhorizonal bedding 60º to axis. Numerous DIFs	14.80 (0.20)	55.07	
-{16/03/2016}-						*.. 14.6-14.7m broken core on bedding, 40º*		15.00	54.87	
							Weak thinly bedded greenish grey silty MUDSTONE, partially weathered low angle bedding **Borehole Complete**			

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 3.0m water flush with dragbit
3) Cased to 3.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 15.0m
5) Standpipe piezometer installed response zone 0.5-6.0m

Logged by **NJ** Drilled by **Danbar**

Ground level **69.87mAD**

Co-ordinates: **E:381975** **N:385746**

Note: DIF's refer to Drilling Induced Fractures

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ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No.

BH301

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Start Date:	End Date:	Final Depth:	Casing Diameter	Casing Depth
03/07/2016	**03/08/2016**	**20.80m**	**125mm**	**6.00m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
							Drillers Description: Topsoil	(0.20)	70.64	
							Drillers Description: clay fill	0.20		
								(0.60)		
								0.80	70.04	
							Drillers Description: red brown silty clay			
								(3.20)		
								4.00	66.84	
							Drillers Description: weathered red mudstone			
								(2.20)		
CASED								6.20	64.64	
6.20							Weak and medium strong thinly bedded reddish brown MUDSTONE, partially weathered low angle bedding numerous steeply inclined cross cutting gypsum veins. Some DIFs			
					140 (300) [10]	*..7.0m clay infilled bedding break, 10mm*	BOLLIN MUDSTONE			
90mm	1	97	99	85	NI	*.. 7.43-7.5m broken core recovered as mudstone gravel, with stiff clay*		(3.00)		
					150 (440) [20]	*.. 8.69m cross cutting slightly rough joint 50º to axis*				
9.00 90mm	2	100	100	100	NI			9.20	61.64	
9.20							Very weak and weak thinly bedded reddish brown silty MUDSTONE, partially weathered, subhorizontal bedding, some steep angled gypsum veins			

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.2m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 20.8m
5) Standpipe piezometer installed response zone 0.5-4.2m

Logged by **NJ**

Drilled by **Danbar**

Ground level **70.84mAD**

Co-ordinates: **E:382181** **N:385613**

Note: DIF's refer to Drilling Induced Fractures

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ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No. **BH301**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Diameter Casing Depth

Start Date: **03/07/2016** End Date: **03/08/2016** Final Depth: **20.80m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Strata: Reduced Level (m)	Legend
90mm	3	100	100	95	200 (440) [160]		continued. Very weak and weak thinly bedded reddish brown silty MUDSTONE, partially weathered, subhorizontal bedding, some steep angled gypsum veins BOLLIN MUDSTONE			
11.80					NI	*..12.0-12.1m low angle gypsum infilled joint*		(6.95)		
90mm	3	98	86	76	100 (150) [80]					
					NI	*.. 14.4-14.6m wash out zone with low angle joints*				
14.80					400 (720) [100]					
90mm	4	98	86	77	NI	*.. 16.18m joint slightly rough 40º to axis*	Weak locally very weak thinly bedded greenish grey silty MUDSTONE, partially weathered low angle bedding steep angle cross cutting gypsum veins. Numerous DIFs	16.15 (1.01)	54.69	
					200 (330) [50]	*.. 16.3-16.35m broken core recovered as mudstone gravel* *.. 20mm thick gypsum vein 40º to core axis*		17.16 (0.34)	53.68	
					NI		Weak thinly bedded reddish brown with greenish grey banding silty MUDSTONE, partially weathered, subhorizontal bedding	17.50 (0.30)	53.34	
17.80						*.. 17.4-17.64m broken core recovered as mudstone gravel* *.. 17.5-17.53m reddish brown stiff clay on bedding*	Very weak thinly bedded greenish brown silty MUDSTONE, distinctly weathered subvertical joints gypsum infilled subhorizontal bedding.	17.80	53.04	
					200 (400) [140]		Weak and medium strong thinly reddish brown greenish grey banded silty MUDSTONE, partially weathered subhorizontal bedding 70º to core axis BOLLIN MUDSTONE	(1.90)		
90mm	5	99	96	89				19.70	51.14	
							Medium strong steeply inclined gypsum infilled joint in weak reddish brown silty MUDSTONE, partially	(0.45)		

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.2m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 20.8m
5) Standpipe piezometer installed response zone 0.5-4.2m

Logged by **NJ** Drilled by **Danbar**

Ground level **70.84mAD**

Co-ordinates: **E:382181** **N:385613**

Note: DIF's refer to Drilling Induced Fractures

ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No.

BH301

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Diameter | Casing Depth

Start Date: **03/07/2016** End Date: **03/08/2016** Final Depth: **20.80m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
					150 (207) [85]	.. 19.8-21.5m 50-70mm high angle 30º to axis gypsum vein	weathered	20.15	50.69	
					NI		Weak and medium strong thinly bedded dark brown colou banded silty MUDSTONE, partially weathered, subhorizontal bedding	(0.65) 20.80	50.04	

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.2m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 20.8m
5) Standpipe piezometer installed response zone 0.5-4.2m

Logged by **NJ** Drilled by **Danbar**

Ground level **70.84mAD**

Co-ordinates: **E:382181** **N:385613**

Note: DIF's refer to Drilling Induced Fractures

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ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No.

BH302

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Start Date:	End Date:	Final Depth:	Casing Diameter	Casing Depth
03/10/2016	**03/10/2016**	**19.50m**	**125mm**	**6.00m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
							Drillers Description: topsoil	(0.20)	69.58	
							Drillers Description: clay fill	0.20		
								(0.80)		
								1.00	68.78	
							Drillers Description: brown clay with gravel bands			
								(3.50)		
								4.50	65.28	
							Drillers Description: weathered red mudstone			
								(2.00)		
CASED								6.50	63.28	
6.50					NI	.. 1.6-6.62m core loss	Weak thinly bedded reddish brown with light brown banding silty slightly fine sandy MUDSTONE, slightly weathered subhorizontal bedding broken core present. Numerous DIFs BOLLIN MUDSTONE			
					100					
					NI					
					50 (60) [10]	.. 6.76m 25mm clay infilled bedding break .. 6.90m clay infilled, 30mm bedding break				
					NI					
90mm	1	90	85	82	500 (585) [40]	.. 8.1-8.26m broken core recovered as mudstone gravel		(3.00)		
						.. 8.50m slightly rough joint 30° to axis .. 8.64-8.74m subvertical slightly rough joint terminates at subhorizontal bedding break .. 8.7-9.12m broken core at 40° joints				
					NI					
9.00					110					
					NI			9.50	60.28	
							Weak thinly bedded reddish brown silty slightly fine sandy MUDSTONE partially weathered stiff clay bedding partings, Numerous DIFs			

Remarks
1) Inspection pit to 1.0m
2) Open-hole drilled to 6.5m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 19.50m
5) Standpipe piezometer installed response zone 0.5-8.0m

Logged by **NJ** Drilled by **Danbar**

Ground level **69.78mAD**

Co-ordinates: **E:382297** **N:385760**

Note: DIF's refer to Drilling Induced Fractures

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ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

Borehole No. **BH302**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core** Diameter Casing Depth

Start Date: **03/10/2016** End Date: **03/10/2016** Final Depth: **19.50m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Strata: Reduced Level (m)	Legend
90mm	2	89	90	42	60 (140) [25]	.. 9.89-9.91m 10-20mm clay infilled bedding break .. 10.45m higher angle slump structure bedding	BOLLIN MUDSTONE	(1.10)		
							Weak thinly bedded light reddish brown with greenish grey colour banded silty slightly fine sandy MUDSTONE, partially weathered, subhorizontal bedding, Numerous DIFs	10.60	59.18	
12.00					NI	.. 12.17-12.3m broken core, discs of mudstone .. 12.4-12.6m subvertical joint slightly rough		(1.90)		
90mm	3	83	85	50	100 (200) [25]		Weak thinly bedded greenish grey light grey colour banded silty MUDSTONE, partially weathered some 2-5mm gypsum veining, Numerous DIFs	12.50	57.28	
					50 (140) [0]		Weak thinly bedded reddish brown silty MUDSTONE, partially weathered subhorizontal bedding, some slump structures, Numerous DIFs BOLLIN MUDSTONE	(1.10) 13.60 (1.40)	56.18	
15.00					10 (20) [0]	.. 15.0-15.5m core broken on discs		15.00	54.78	
90mm	4	96	29	19	70 (150) [40]	.. 16.64-15.9m distinctly weather very weak	Weak thinly bedded greenish grey colour banded silty MUDSTONE, partially weathered, subhorizontal bedding, Numerous DIFs			
16.50					NI	.. 16.45m 10mm clay infilled bedding break				
					80 (100) [20]	.. 16.5-16.58m broken core recovered as mudstone gravel		(3.45)		
					NI	.. 17.0-17.04m broken core recovered as mudstone gravel				
90mm	5	73	26	15	70 (110) [20]	.. 17.35m red colour banding .. 18.0m clay infilled bedding break .. 18.04-18.1m joint slightly rough 30° to axis				
					40 (40) [0]	.. 18.5m core loss	Weak thinly bedded reddish brown silty MUDSTONE, partially weathered, subhorizontal bedding. Numerous DIFs BOLLIN MUDSTONE	18.45 (1.05)	51.33	
-{10/03/2016}-							**Borehole Complete**	19.50	50.28	

Remarks
1) Inspection pit to 1.0m
2) Open-hole drilled to 6.5m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 19.50m
5) Standpipe piezometer installed response zone 0.5-8.0m

Logged by **NJ** Drilled by **Danbar**

Ground level **69.78mAD**

Co-ordinates: **E:382297** **N:385760**

Note: DIF's refer to Drilling Induced Fractures

ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No. **BH303**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Casing Diameter **125mm** Depth **6.00m**

Start Date: **03/09/2016** End Date: **03/09/2016** Final Depth: **15.70m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Strata: Reduced Level (m)	Strata: Legend
							Drillers Description: topsoil	(0.20) 0.20	69.06	
							Drillers Description: clay fill	(0.30) 0.50	68.76	
							Drillers Description: brown clay	(4.00) 4.50	64.76	
							Drillers Description: weathered red mudstone	(1.50) 6.00	63.26	
CASED 6.00					60 (100) [20]		Weak thinly bedded light reddish brown greenish brown colour banded silty slightly fine sandy MUDSTONE, partially weathered subhorizontal bedding. Some medium strong bands 10mm thick	(1.00) 7.00	62.26	
90mm	1	91	52	33	NI 60 (100) [0] NI	.. 6.9-6.93m broken core recovered as mudstone gravel .. 7.5-7.7m extremely weak core with mudstone gravel in clay	Very weak and weak thinly bedded reddish brown silty slightly fine sandy MUDSTONE, partially weathered subhorizontal bedding	(0.68) 7.68	61.58	
					NI 100 (180) [20] NI	.. 7.79-7.82m broken core recovered as mudstone gravel .. 8.1-8.15m stiff clay infill on bedding break .. 8.8-10.12m broken core .. 9.0-9.1m band of reddish brown siltstone	Weak to medium strong thinly bedded reddish brown greenish grey colour banded silty slightly fine sandy MUDSTONE partially weathered subhorizontal bedded, thin siltstone bands BOLLIN MUDSTONE	(1.42) 9.10	60.16	
9.00					100		Extremely weak reddish brown streaked greenish grey silty MUDSTONE, destructured, infill on bedding	(0.44) 9.54	59.72	
90mm	2	71	10	0	NI		Weak broken thinly bedded greenish grey silty MUDSTONE destructured, mudstone gravel in stiff clay	(0.49)		
9.70										

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.5m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 15.70m
5) Standpipe piezometer installed response zone 0.5-6.0m

Logged by **NJ** Drilled by **Danbar**

Ground level **69.26mAD**

Co-ordinates: **E:382235** **N:385855**

Note: DIF's refer to Drilling Induced Fractures

DRAFT

ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

Borehole No. **BH303**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Diameter Casing Depth

Start Date: **03/09/2016** End Date: **03/09/2016** Final Depth: **15.70m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
					NI	.. 10.2-10.55m subvertical joint slightly rough 20º to axis	Very weak thinly bedded reddish brown silty MUDSTONE partially weathered subhorizontal bedding	10.03	59.23	
								(0.47)		
								10.50	58.76	
							Weak and medium strong thinly bedded reddish brown silty MUDSTONE, partially weathered subhorizontal bedding	(0.40)		
								10.90	58.36	
						.. 10.6-10.96m joint slightly rough 30º to core axis		(0.10)	58.26	
90mm	3	91	70	36	60 (240) [20]		Core loss	11.00		
							Extremely weak and weak thinly bedded reddish some greenish grey spots brown silty slightly fine sandy MUDSTONE, distinctly weathered subhorizontal bedding BOLLIN MUDSTONE			
					60 (120) [30]			(2.95)		
12.70					NI					
					60	..13.1-13.21m joint slightly rough 30º to core axis				
					NI	.. 13.34-13.45m Joint slightly rough 30º to core axis				
					200 (350) [60]	.. 13.95-14.63m locally weaker, possible coring damage		13.95	55.31	
90mm	4	90	82	67			Weak thinly bedded silty reddish brown locally greenish grey silty Mudstone distinctly weathered subhorizontal bedding	(0.67)		
					200 (360) [20]	.. Vertical joint slightly rough		14.62	54.64	
							Weak thinly bedded reddish brown silty slightly fine sandy MUDSTONE, partially weathered subhorizontal bedding BOLLIN MUDSTONE	(1.08)		
					NI					
					320	.. 15.0-15.17m joint slightly rough 30º to core axis				
					NI	.. 15.48-15.7m subvertical joint slightly rough				
-{03/09/2016}-							**Borehole Complete**	15.70	53.56	

Remarks
1) Inspection pit to 1.0m
2) Open-hole drilled to 6.5m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 15.70m
5) Standpipe piezometer installed response zone 0.5-6.0m

Logged by **NJ** Drilled by **Danbar**

Ground level **69.26mAD**

Co-ordinates: **E:382235** **N:385855**

Note: DIF's refer to Drilling Induced Fractures

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ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No.

BH304

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Start Date:	End Date:	Final Depth:	Casing Diameter	Casing Depth
08/03/2016	**14/03/2016**	**20.10m**	**125mm**	**6.00m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
							Drillers Description: Topsoil (200mm) over brown clay fill (600mm)	(0.80)		
								0.80	67.01	
							Drillers Description: red/brown clay	(4.40)		
								5.20	62.61	
							Drillers Description: weathered red mudstone stronger with depth	(0.80)		
CASED								6.00	61.81	
6.00					50 (210) [40]		Weak thinly bedded dark reddish brown with thin greenish grey colour banding silty MUDSTONE, partially weathered, horizontal bedding. numerous DIFs. BOLLIN MUDSTONE			
					NI					
					150 (220) [100]	.. 6.2-6.26m Cross cutting joint set				
					NI					
90mm	1	100	96	86	200 (303) [177]	.. 7.7-7.76m broken core recovered as mudstone gravel		(3.00)		
					NI					
					280 (350) [220]	.. 8.37-8.56m vertical joint slightly rough				
					NI					
9.00					300 (630) [190]		Weak thinly bedded reddish brown darker brown colour banded silty MUDSTONE, partially weathered, subhorizontal bedding. Some thin medium strong reddish brown siltstone. numerous DIFs. BOLLIN MUDSTONE	9.00	58.81	

Remarks

1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 20.10m
5) Standpipe piezometer installed response zone 0.5-6.0m

Logged by **NJ** Drilled by

Ground level **67.81mAD**

Co-ordinates: **E:382069** **N:385910**

Note: DIF's refer to Drilling Induced Fractures

ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No. **BH304**

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Diameter Casing Depth

Start Date: **08/03/2016** End Date: **14/03/2016** Final Depth: **20.10m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Description: Stratum Descriptions	Strata: Depth & Thickness m	Strata: Reduced Level (m)	Legend
					NI					
90mm	2	100	96	78	350 (400) [170]	..10.18-10.27m Subvertical drilling induced fracture .. 10.78-10.85m subvertical joint slightly rough 20º to core axis .. 11.08-11.25m subvertical joint slightly rough 30º to core axis .. 11.5-11.6m subvertical joint slightly rough 30º to core axis .. 11.75-11.84m broken core recovered as mudstone gravel	continued: Weak thinly bedded reddish brown darker brown colour banded silty MUDSTONE, partially weathered, subhorizontal bedding. Some thin medium strong reddish brown siltstone. numerous DIFs. BOLLIN MUDSTONE	(3.58)		
12.00						.. 12.3-12.36m broken core recovered as mudstone gravel		12.58	55.23	
							Weak thinly bedded reddish brown with greenish grey colour banded silty MUDSTONE partially weathered, subhorizontal bedding, numerous DIFs.	(0.67)		
90mm	3	100	98	86	200 (600) [10]	.. 12.7-12.76m extremely weak reddish brown wedge infill .. 13.14-13.18m extremely weak distinctly weathered infilled bedding break		13.25	54.56	
						.. 14.0-14.41m joint slightly rough 40º to core axis .. 14.2-14.5m subvertical joint slightly rough 20º to core axis.	Weak thinly bedded reddish brown silty MUDSTONE, partially weathered subhorizontal bedding, numerous DIFs.	(2.15)		
15.00						.. Subvertical joint slightly rough 30º to core axis		15.40	52.41	
							Weak thinly bedded reddish brown , brown colour banded fine sandy SILTSTONE, partially weathered, subhorizontal bedding. numerous DIFs. BOLLIN MUDSTONE	(1.45)		
90mm	4	100	99	62	70 (700) [30]	.. many drilling induced fractures		16.85	50.96	
							Weak thinly bedded greenish grey, some thin reddish brown colour banding, silty fine sandy MUDSTONE, partially weathered, subhorizontal bedding. numerous DIFs.	(1.85)		
							Weak and medium strong thinly bedded greyish ping colour banded fine sandy SILTSTONE, partially weathered subhorizontal bedding. numerous DIFs. BOLLIN MUDSTONE	18.70	49.11	
								(0.92)		
							Weak thinly bedded greenish grey colour banded slightly fine sandy SILTSTONE, partially weathered	19.62	48.19	
								(0.48)		

Remarks
1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 20.10m
5) Standpipe piezometer installed response zone 0.5-6.0m

Logged by **NJ** Drilled by

Ground level **67.81mAD**

Co-ordinates: **E:382069** **N:385910**

Note: DIF's refer to Drilling Induced Fractures

ROC CONSULTING

Location **Airport City North Jetparks Goodman's Land**

Client: **Airport City Partnerships** Project Ref.:

DRAFT

Borehole No.

BH304

Job No.: **ROC3407**

Equipment and methods **Rotary Diamond Core**

Diameter | Casing Depth

Start Date: **08/03/2016** End Date: **14/03/2016** Final Depth: **20.10m**

Field Records: Drilling Records {Casing} Depth (m) Core Dia. mm	Mechanical Log: RUN No	TCR %	SCR %	RQD %	If mm (Imax) [Imin]	Description: Detail Descriptions	Stratum Descriptions	Strata: Depth & Thickness m	Reduced Level (m)	Legend
-{14/03/2016}-							subhorizontal bedding. numerous DIFs. **Borehole Complete**	20.10	47.71	

Remarks
1) Inspection pit to 1.0m
2) Open-hole drilled to 6.0m water flush with dragbit
3) Cased to 6.0m, 125mm dia
4) Core drilled using PWF (90mm) water flush to 20.10m
5) Standpipe piezometer installed response zone 0.5-6.0m

Note: DIF's refer to Drilling Induced Fractures

Logged by **NJ** Drilled by

Ground level **67.81mAD**

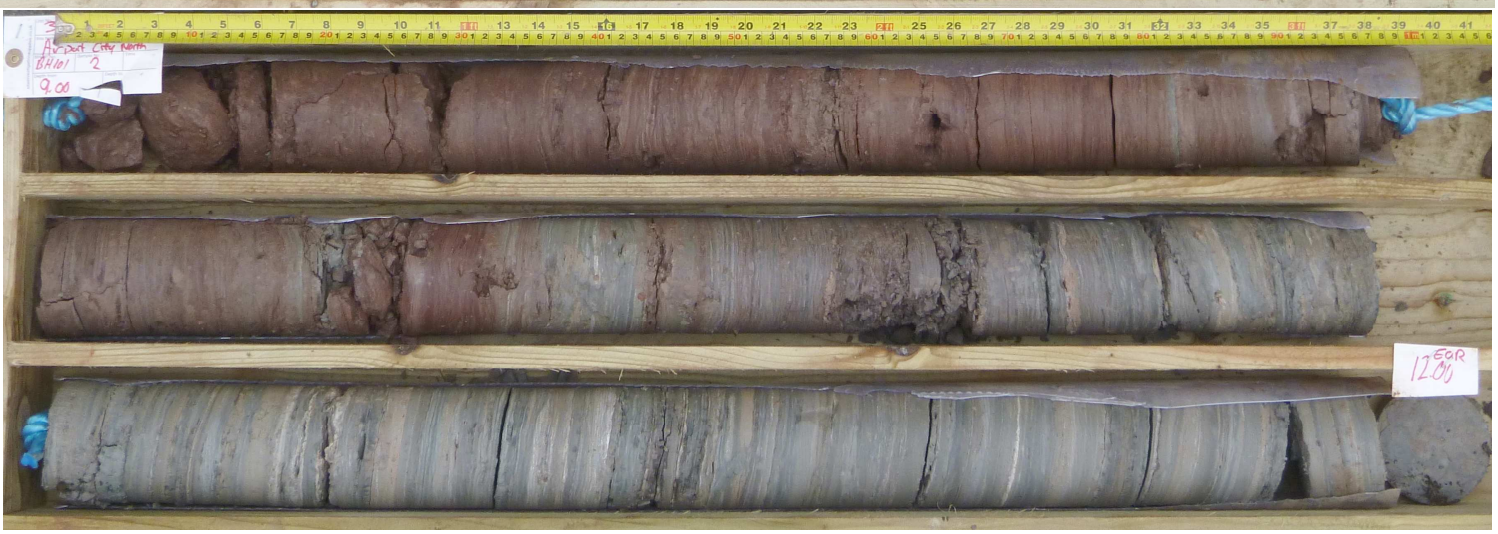
Co-ordinates: **E:382069** **N:385910**

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CORE RECORD PHOTOGRAPHS

Borehole Nº 101



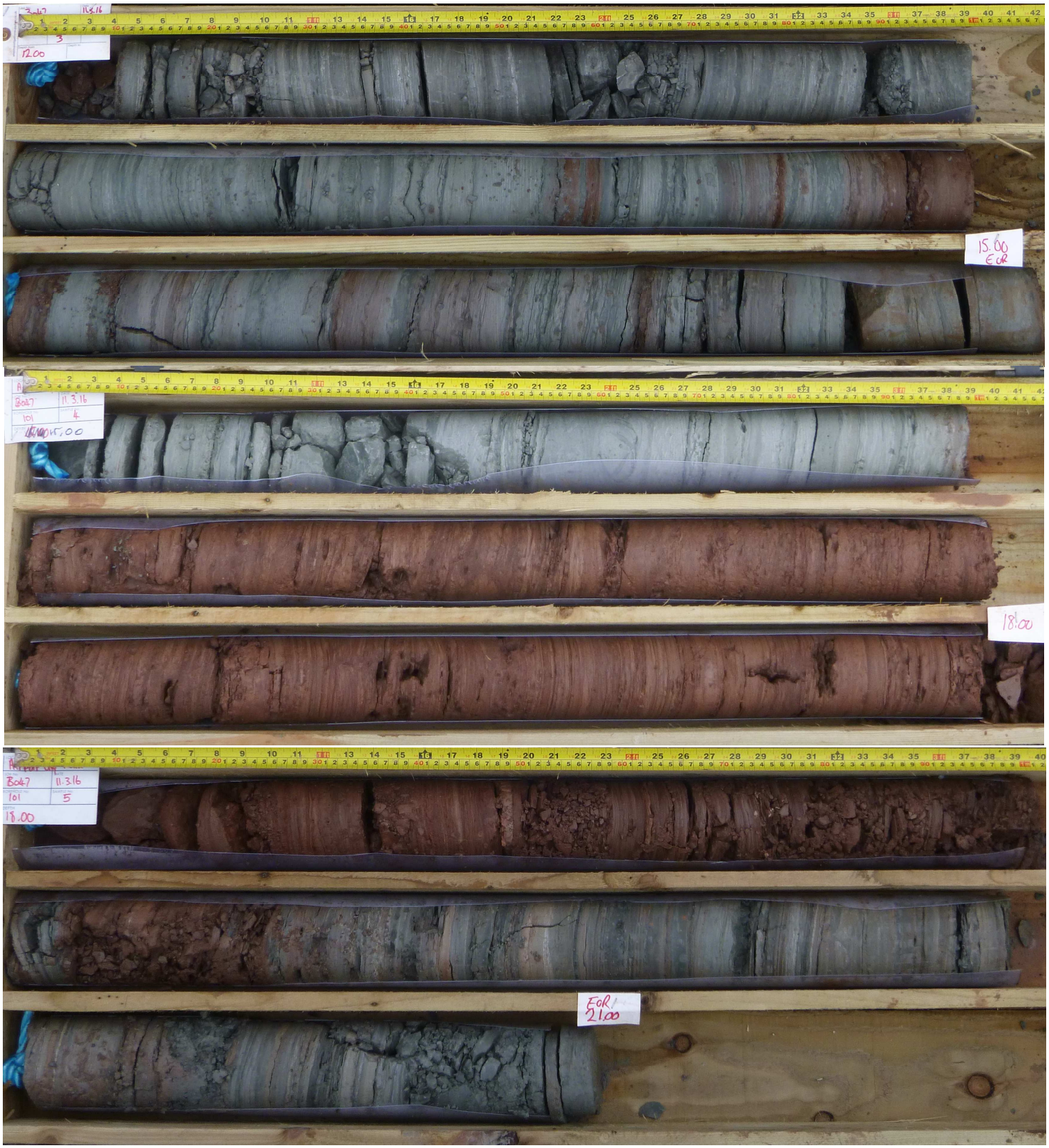


ROC CONSULTING

INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 101



INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 102

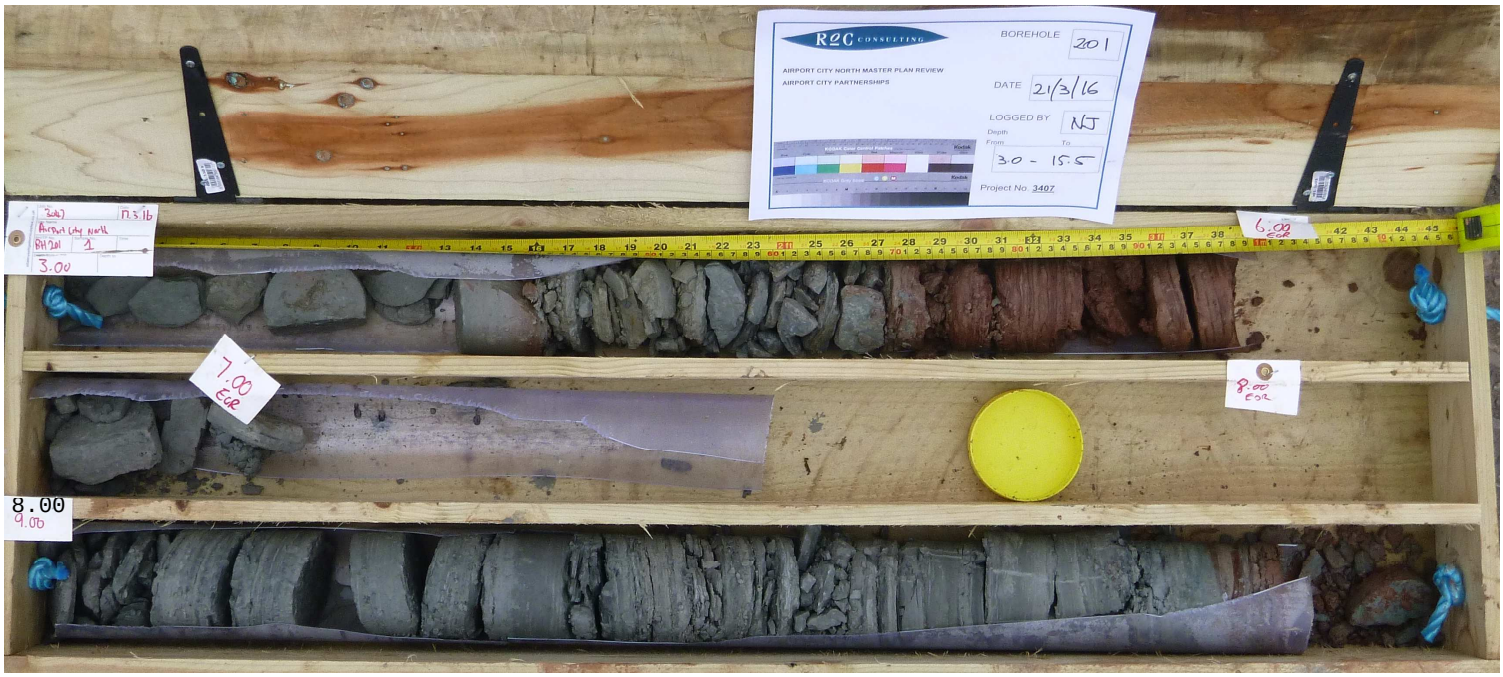


RoC CONSULTING

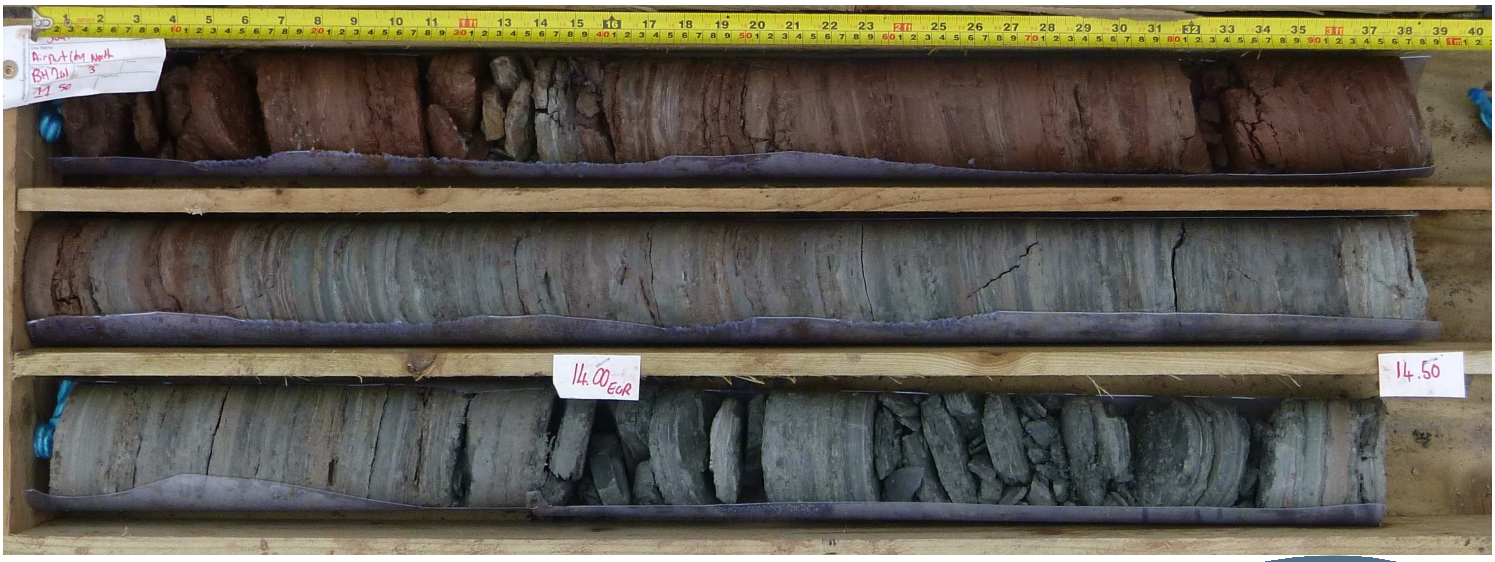
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Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 201







ROC CONSULTING

INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 201

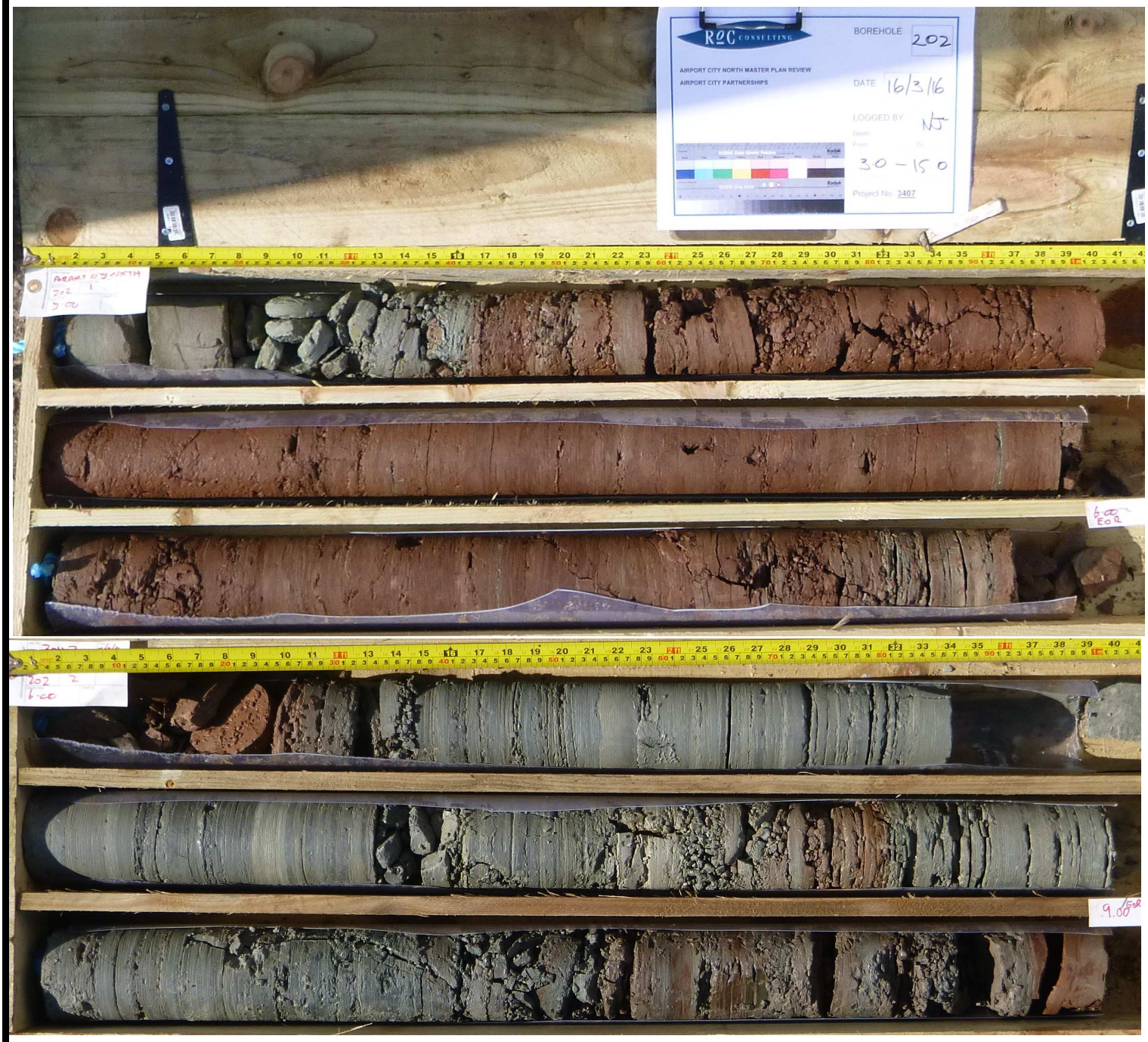


ROC CONSULTING

INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

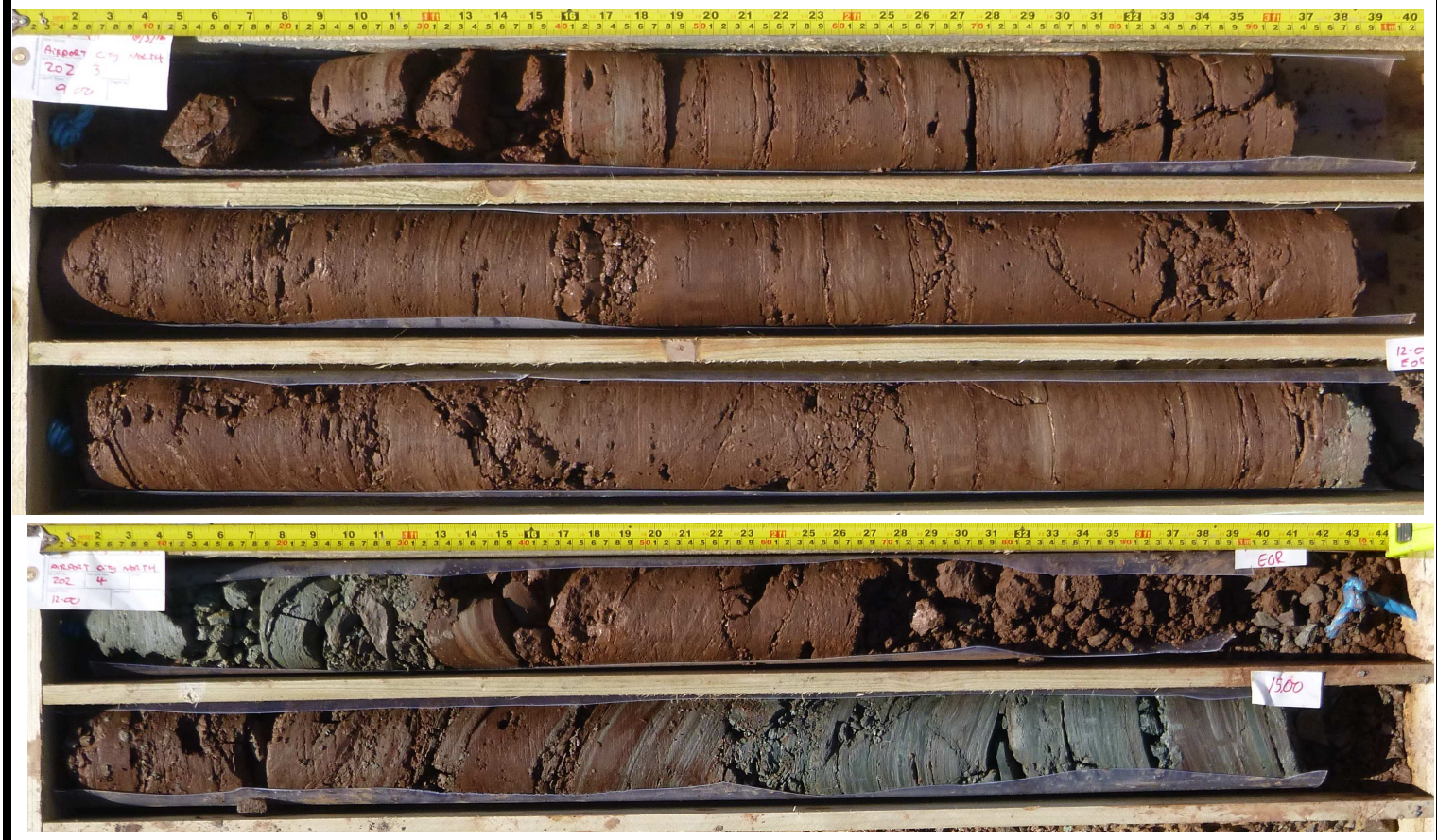
Borehole Nº 202



INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 202



INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 301

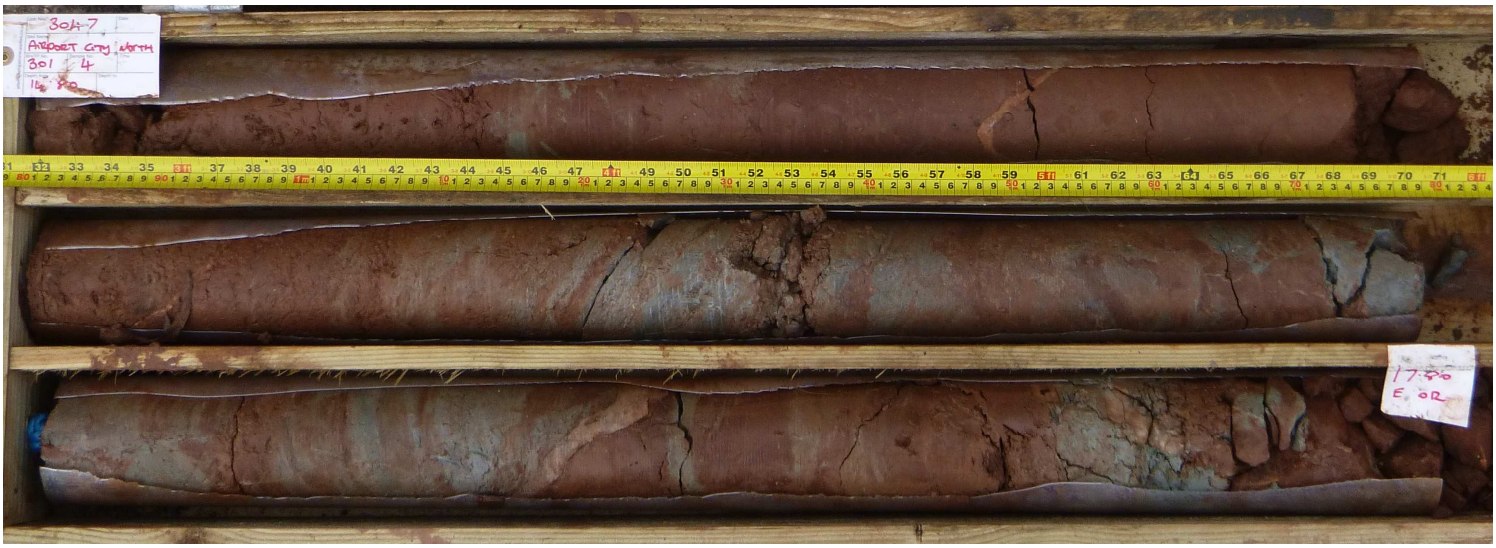


RoC CONSULTING

INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 301





ROC CONSULTING

INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 302



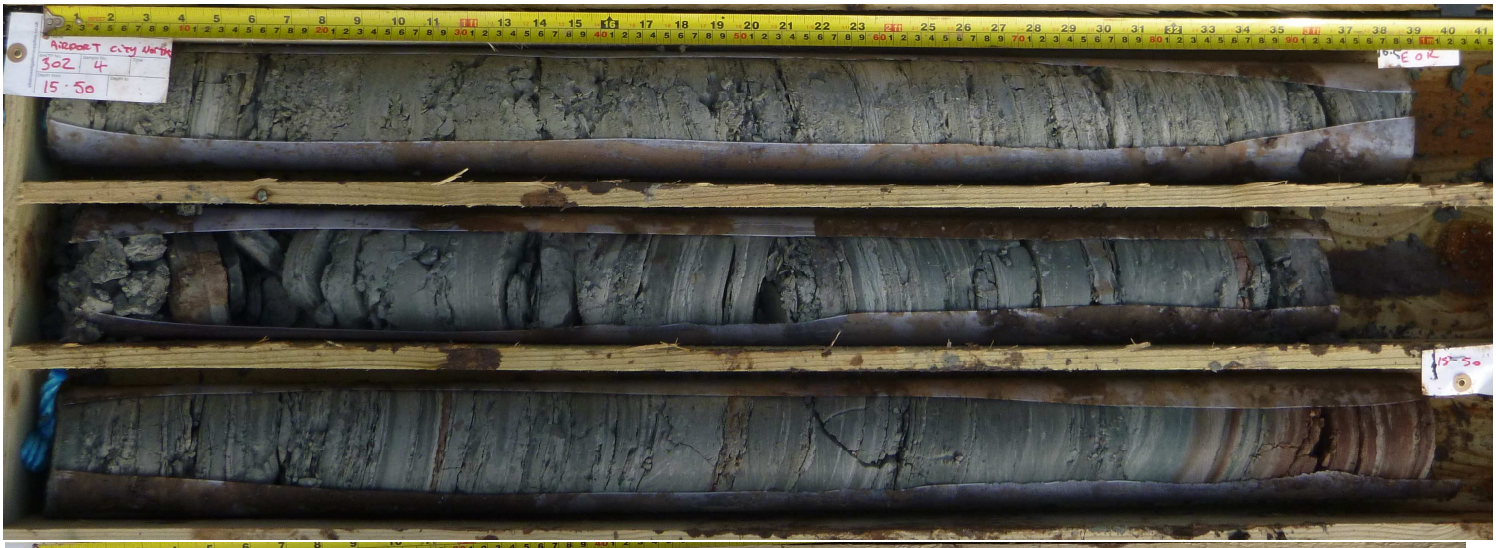
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INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 302







ROC CONSULTING

INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 303





ROC CONSULTING

INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 303



ROC CONSULTING

INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 1

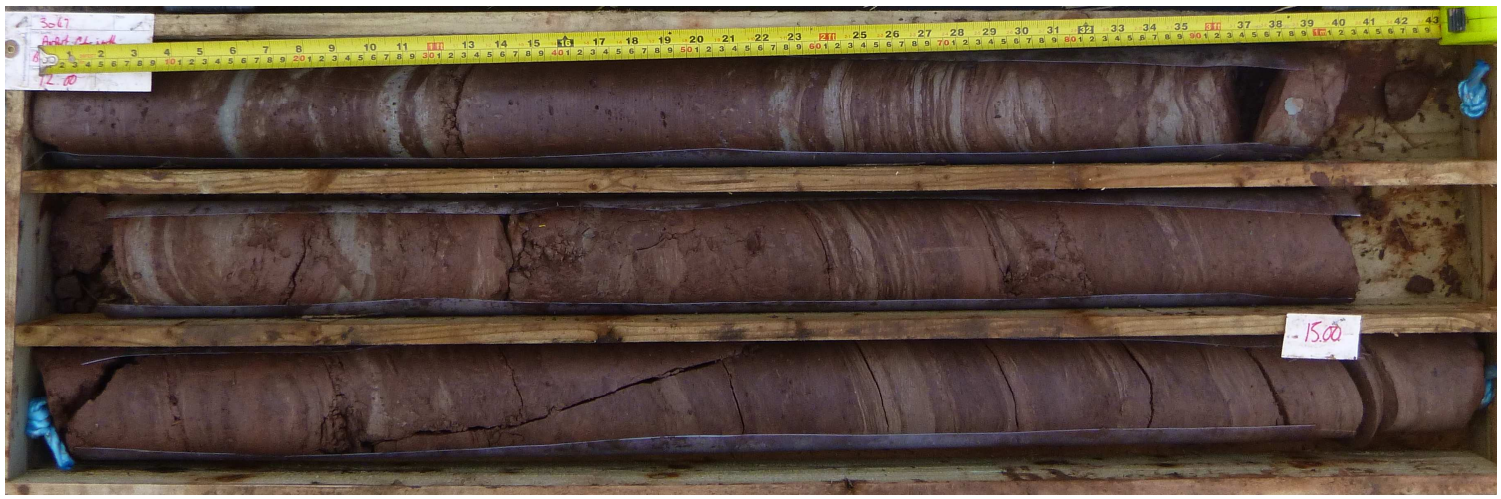
INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 304





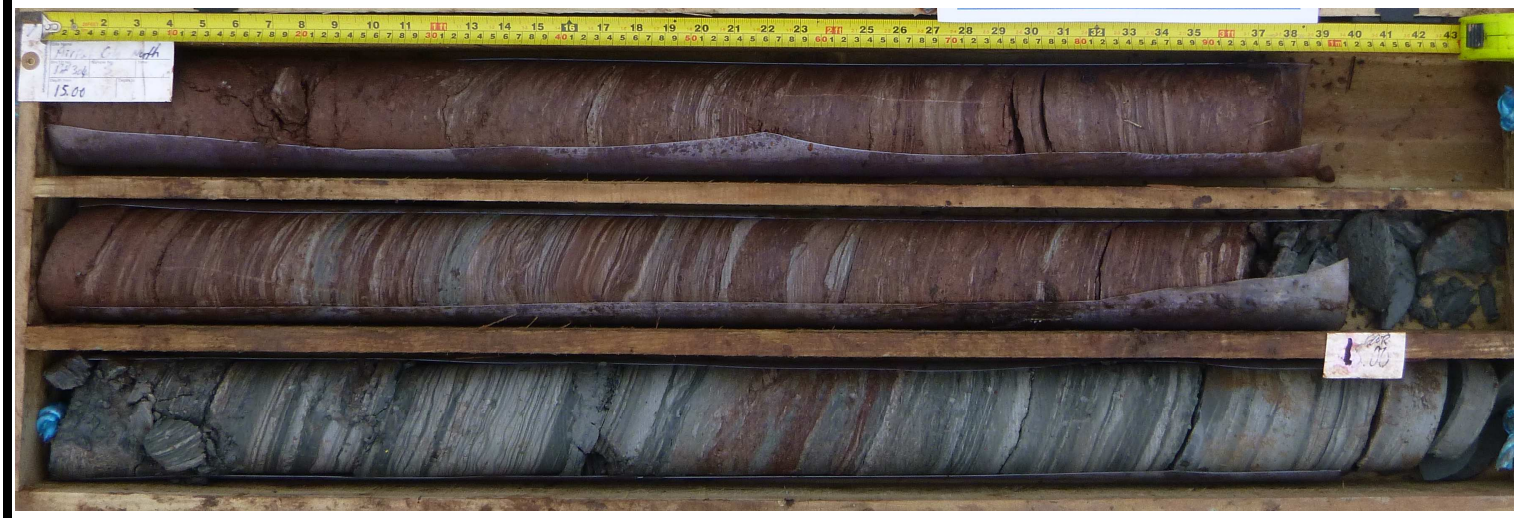


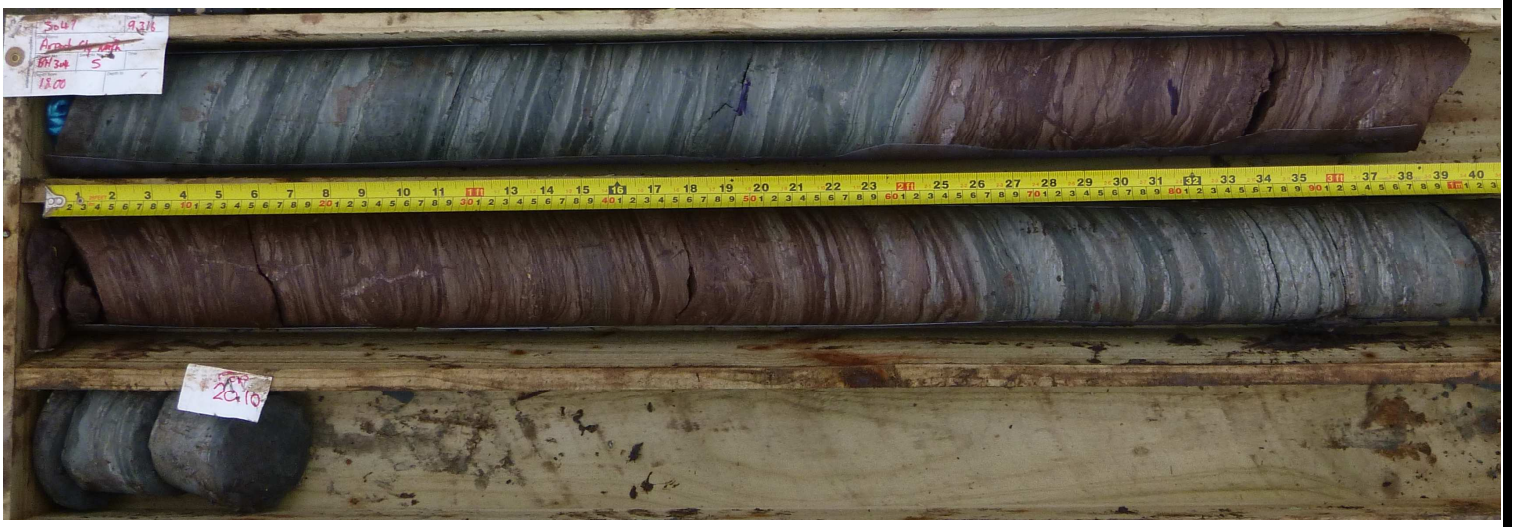
R2C CONSULTING

INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

CORE RECORD PHOTOGRAPHS

Borehole Nº 304





INFORMATION	
Job No.	3407
Project Title	Airport City North
Sketch Title	Rock Core Photographs.

Trial Pit Log

Trialpit No **TP301**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382079.30 - 385888.43 Level: 67.51	Date 15/03/2016
Location: Manchester		Dimensions (m): 2.5 × 0.9, Depth 3.10	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.25	ES		0.30	67.21		Dark brown very clayey SAND (TOPSOIL)
							Dark reddish brown sandy CLAY with rare fine to medium sub angular mudstone and siltstone fragments (GLACIAL CLAY).
							...Horizontal bluish green silty band
▼				3.00	64.51		Very weak weathered thinly laminated fine grained reddish brown locally bluish grey MUDSTONE Recovered as sandy gravel (WEATHERED MUDSTONE).
				3.10	64.41		*... slight groundwater seepage*
							End of pit at 3.10 m

Remarks: Trial Pit terminated at 3.10mbgl due to clay stiffness and difficulty of excavation. Slight groundwater seepage at 3.00m

Stability: Very Good

Trial Pit Log

Trialpit No **TP302**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382166.80 - 385904.70 Level: 68.45	Date 15/03/2016
Location: Manchester		Dimensions (m): Depth 1.50, 2.1 × 0.6	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown very clayey SAND (TOPSOIL)
				0.35	68.10		Yellowish orange slightly silty sandy CLAY with occasional fine to medium sub rounded sandstone and mudstone fragments (FLUVIO-GLACIAL DEPOSITS).
							...disused land drainage pipe noted
▼				0.90	67.55		Dark reddish brown sandy CLAY with rare fine to medium sub angular mudstone and siltstone fragments (GLACIAL CLAY).
							...slight groundwater seepage
				1.50	66.95		End of pit at 1.50 m

Remarks: Trial Pit terminated at 1.50mbgl due to clay stiffness and difficulty of excavation. Slight groundwater seepage at 1.20m

Stability: Poor

Trial Pit Log

Trialpit No **TP303**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382145.20 - 385791.40 Level: 68.98	Date 15/03/2016
Location: Manchester		Dimensions (m): 2.2 x 1 Depth 2.10	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	ES		0.35	68.63		Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
				0.75	68.23		Yellowish orange slightly silty sandy CLAY with occasional fine to medium sub rounded sandstone and mudstone fragments (FLUVIO-GLACIAL DEPOSITS).
				2.10	66.88		Dark reddish brown sandy CLAY with rare medium sub rounded sandstone and shale cobbles (GLACIAL CLAY). End of pit at 2.10 m

1 2 3 4 5

Remarks: Trial Pit terminated at 2.10mbgl due to clay stiffness and difficulty of excavation. No groundwater encountered

Stability: Good

Trial Pit Log

Trialpit No **TP304** Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382199.20 - 385877.30 Level: 69.05	Date 15/03/2016
Location: Manchester		Dimensions (m): 2.4 × 0.9, Depth 2.60	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00	69.05		Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
	0.40	ES		0.45	68.60		Yellowish orange slightly silty sandy CLAY with occasional fine to medium sub rounded sandstone fragments (FLUVIO-GLACIAL DEPOSITS). *...Occasional greyish blue sandy silty pockets*
			HVP=70				
				1.40	67.65		Dark reddish brown sandy CLAY with rare medium sub rounded sandstone and shale cobbles (GLACIAL CLAY). *...rare pockets of medium to coarse orangish red sand*
			HVP=81				
				2.60	66.45		End of pit at 2.60 m

Remarks: Trial Pit terminated at 2.60mbgl due to clay stiffness and difficulty of excavation. No groundwater encountered

Stability: Good

Trial Pit Log

Trialpit No **TP305A**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382207.30 - 385811.20 Level: 69.12	Date 15/03/2016
Location: Manchester		Dimensions (m): 2 × 0.75 Depth 0.35	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.35	68.77		Dark brown very clayey SAND with occasional rootlets (TOPSOIL) End of pit at 0.35 m

1
2
3
4
5

Remarks: Trial Pit terminated at 0.35mbgl due to metal cable encountered during excavation. No groundwater encountered

Stability: Good

Trial Pit Log

Trialpit No **TP305B** Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382199.60 - 385809.70 Level: 69.05	Date 15/03/2016
Location: Manchester		Dimensions (m): 2.2 × 0.8, Depth 2.25	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.40	68.65		Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
				0.80	68.25		Orangish brown slightly silty sandy CLAY with occasional greyish blue silty sandy pockets (FLUVIO-GLACIAL DEPOSITS). *...band of greyish blue silty sand*
			HVP=60				Dark reddish brown sandy CLAY with rare medium sub rounded sandstone and shale cobbles (GLACIAL CLAY).
			HVP=88				
				2.25	66.80		End of pit at 2.25 m

1 2 3 4 5

Remarks: Trial Pit terminated at 2.25mbgl due to clay stiffness and difficulty of excavation. No groundwater encountered

Stability: Fair

Trial Pit Log

Trialpit No **TP306**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382271.20 - 385866.10 Level: 69.65	Date 15/03/2016
Location: Manchester		Dimensions (m): 2.3 × 0.8, Depth 3.30	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
				0.55	69.10		Orangish brown slightly silty sandy CLAY with occasional greyish blue silty sandy pockets (FLUVIO-GLACIAL DEPOSITS).
							...band of greyish blue silty sand
			HVP=40	0.95	68.70		Dark reddish brown sandy CLAY with rare medium sub rounded sandstone and shale cobbles (GLACIAL CLAY).
			HVP=60				
				3.30	66.35		End of pit at 3.30 m

Remarks: Trial Pit terminated at 3.30mbgl due to clay stiffness and difficulty of excavation. No groundwater encountered

Stability: Very Good

Trial Pit Log

Trialpit No **TP307**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382329.40 - 385836.10 Level: 70.04	Date 15/03/2016
Location: Manchester		Dimensions (m): 2.3 × 0.85, Depth 2.40	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.45	69.59		Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
	0.60	ES	HVP=35	1.10	68.94		Yellowish orange slightly sandy CLAY with occasional medium to coarse sandstone gravel (FLUVIO-GLACIAL DEPOSITS).
			HVP=77	2.40	67.64		Dark reddish brown sandy CLAY with occasional medium to coarse sub rounded gravel of sandstone and shale fragments (GLACIAL CLAY).
							End of pit at 2.40 m

1 2 3 4 5

Remarks: Trial Pit terminated at 2.40mbgl due to clay stiffness and difficulty of excavation. No groundwater encountered

Stability: Good

AGS

Trial Pit Log

Trialpit No **TP308**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382201.20 - 385730.10 Level: 69.07	Date 15/03/2016
Location: Manchester		Dimensions (m): Depth 2.40; 1.8 × 0.85	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.05	69.02		Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
	0.30	ES					Fine to coarse grey GRAVEL. Gravel is angular to sub rounded of mixed demolition type materials including concrete, brick and sandstone (MADE GROUND).
				0.35	68.72		Yellowish orange slightly sandy CLAY with occasional medium to coarse sandstone gravel (FLUVIO-GLACIAL DEPOSITS).
							...band of medium to coarse orange sand
				1.25	67.82		Dark reddish brown sandy CLAY with occasional pockets of fine to medium bluish grey silty sand (GLACIAL CLAY).
			HVP=73				
				2.40	66.67		End of pit at 2.40 m

Remarks: Trial Pit terminated at 2.40mbgl due to clay stiffness and difficulty of excavation. no groundwater encountered

Stability: Good

Trial Pit Log

Trialpit No **TP309**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382068.01 - 385939.36 Level: 67.59	Date 22/03/2016
Location: Manchester		Dimensions (m): Depth 4.00	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
				0.45	67.14		Dark reddish brown sandy CLAY with rare fine to medium sub angular mudstone and siltstone fragments (GLACIAL CLAY).
							...Occasional greyish green thin silt bands
				3.10	64.49		Very weak weathered thinly laminated fine grained reddish brown locally bluish grey MUDSTONE Recovered as sandy gravel (WEATHERED MUDSTONE).
				3.90	63.69		
				4.00	63.59		Weak dark reddish brown thinly bedded MUDSTONE recovered as fine to medium sub angular to tabular mudstone gravel (BOLLIN MUDSTONE).
							End of pit at 4.00 m

1 2 3 4 5

Remarks: Trial Pit terminated at 4.00mbgl on encountered bedrock. No groundwater encountered

Stability:

Trial Pit Log

Trialpit No **TP310**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382110.71 - 385843.53 Level: 68.78	Date 22/03/2016
Location: Manchester		Dimensions (m): 2.45 × 0.9, Depth 4.35	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
				0.35	68.43		Dark reddish brown sandy CLAY with rare fine to medium sub angular mudstone and siltstone fragments (GLACIAL CLAY).
							...band of greenish grey silty sand
				2.50	66.28		Very weak weathered thinly laminated fine grained reddish brown locally bluish grey MUDSTONE Recovered as sandy gravel (WEATHERED MUDSTONE).
				4.20	64.58		Weak dark reddish brown thinly bedded MUDSTONE recovered as fine to medium sub angular to tabular mudstone gravel (BOLLIN MUDSTONE).
				4.35	64.43		End of pit at 4.35 m

Remarks: Trial Pit terminated at 4.35mbgl on encountered bedrock. No groundwater encountered

Stability: Good

Trial Pit Log

Trialpit No **TP311**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382165.69 - 385844.81 Level: 68.26	Date 22/03/2016
Location: Manchester		Dimensions (m): 2.5 × 0.9, Depth 4.00	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
							...band of black silty organic clay
				0.55	67.71		Dark reddish brown sandy CLAY with rare fine to medium sub angular mudstone and siltstone fragments (GLACIAL CLAY).
				3.35	64.91		Very weak weathered thinly laminated fine grained reddish brown locally bluish grey MUDSTONE Recovered as sandy gravel (WEATHERED MUDSTONE).
▼				3.90	64.36		
				4.00	64.26		Weak dark reddish brown thinly bedded MUDSTONE recovered as fine to medium sub angular to tabular mudstone gravel (BOLLIN MUDSTONE).
							End of pit at 4.00 m

1 2 3 4 5

Remarks: Trial Pit terminated at 4.00mbgl on encountered bedrock. Groundwater ingress at 3.90m

Stability: Good

Trial Pit Log

Trialpit No **TP312**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382443.27 - 385759.20 Level: 70.16	Date 22/03/2016
Location: Manchester		Dimensions (m): 2.3 × 0.8, Depth 4.10	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
				0.45	69.71		Dark reddish brown sandy CLAY with rare fine to medium sub angular mudstone and siltstone fragments (GLACIAL CLAY). *...band of yellowish orange sandy clay*
▼							
				2.50	67.66		Fine to medium yellowish orange slightly silty SAND with rare sub rounded gravel of sandstone and siltstone (FLUVIO-GLACIAL DEPOSITS)
				3.20	66.96		Very weak weathered thinly laminated fine grained reddish brown locally bluish grey MUDSTONE Recovered as sandy gravel (WEATHERED MUDSTONE).
				3.90	66.26		Weak dark reddish brown thinly bedded MUDSTONE recovered as fine to medium sub angular to tabular mudstone gravel (BOLLIN MUDSTONE).
				4.10	66.06		End of pit at 4.10 m

1 2 3 4 5

Remarks: Trial Pit terminated at 4.10mbgl on encountered bedrock. Slight groundwater seepage at 2.50m

Stability: Good

Trial Pit Log

Trialpit No **TP313**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382263.41 - 385810.74 Level: 69.55	Date 22/03/2016
Location: Manchester	Dimensions (m): Depth 4.00	2.3 × 0.9	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
				0.30	69.25		Dark reddish brown sandy CLAY with rare fine to medium sub angular mudstone and siltstone fragments (GLACIAL CLAY).
							...becoming slightly silty
▼							
				2.90	66.65		Very weak weathered thinly laminated fine grained reddish brown locally bluish grey MUDSTONE Recovered as sandy gravel (WEATHERED MUDSTONE).
							...bluish green banding
				3.90	65.65		Weak dark reddish brown thinly bedded MUDSTONE recovered as fine to medium sub angular to tabular mudstone gravel (BOLLIN MUDSTONE).
				4.00	65.55		End of pit at 4.00 m

1 2 3 4 5

Remarks: Trial Pit terminated at 4.00mbgl on encountered bedrock. Groundwater seepage at 1.70m

Stability: Good

Trial Pit Log

Trialpit No **TP314**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382362.56 - 385758.19 Level: 70.36	Date 22/03/2016
Location: Manchester		Dimensions (m): 2.5 × 0.6 Depth 3.95	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
				0.40	69.96		Dark reddish brown sandy CLAY with rare fine to medium sub angular mudstone and siltstone fragments (GLACIAL CLAY).
							...becoming sandy
▼				3.00	67.36		Very weak weathered thinly laminated fine grained reddish brown locally bluish grey MUDSTONE Recovered as sandy gravel (WEATHERED MUDSTONE).
				3.80	66.56		Weak dark reddish brown thinly bedded MUDSTONE recovered as fine to medium sub angular to tabular mudstone gravel (BOLLIN MUDSTONE).
				3.95	66.41		End of pit at 3.95 m

Remarks: Trial pit terminated at 3.95 on encountered bedrock. Groundwater ingress at 2.50m

Stability: Good

Trial Pit Log

Trialpit No **TP315**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382153.47 - 385752.10 Level: 68.89	Date 22/03/2016
Location: Manchester		Dimensions (m): 2.45 × 0.85, Depth 4.65	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
							...Concrete floor slab encountered. Suspected relic farmhouse structure slab
				0.45	68.44		Dark reddish brown sandy CLAY with rare fine to medium sub angular mudstone and siltstone fragments (GLACIAL CLAY).
							...becoming sandy
				3.00	65.89		Very weak weathered thinly laminated fine grained reddish brown locally bluish grey MUDSTONE Recovered as sandy gravel (WEATHERED MUDSTONE).
				4.65	64.24		End of pit at 4.65 m

1 2 3 4 5

Remarks: Trial pit terminated at 4.65 on encountered bedrock. Groundwater not encountered

Stability: Very Good

Trial Pit Log

Trialpit No **TP316**

Sheet 1 of 1

Project Name: ACN Zone 2 Masterplan	Project No. 3407	Co-ords: 382249.29 - 385717.91 Level: 69.67	Date 22/03/2016
Location: Manchester		Dimensions (m): 2.2 × 0.85 Depth 0.70	Scale 1:25
Client: Manchester Airport Group			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.40	69.27		Dark brown very clayey SAND with occasional rootlets (TOPSOIL)
				0.70	68.97		Yellowish orange slightly silty sandy CLAY with occasional fine to medium sub rounded sandstone and mudstone fragments (FLUVIO-GLACIAL DEPOSITS).
							End of pit at 0.70 m

1
2
3
4
5

Remarks: Trial Pit terminated at 0.70mbgl due to encountered land drainage pipe. Groundwater not encountered

Stability: Good

AGS

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AIRPORT CITY NORTH

SOIL INVESTIGATION

CPT REPORT

Cone Penetration Test
Standard Data Interpretation
Geotechnical Parameter Interpretation

Project Ref.: P-106347-1






PROJECT:	Airport City North

CLIENT:	ROC Consulting

FIELDWORK

CPT Rig	20.5 tonne track-truck mounted CPT unit (UK3)
Date Fieldwork Started	9th March 2016
Date Fieldwork Completed	10th March 2016
Lankelma's Representative	Emma Stickland
Client's Representative	Alex Smiles

REPORT

Status	Revision	Action	Date	Name
Final	00	**Completed**	16/03/16	Chris Player
		Checked	16/03/16	Emma Stickland
		Approved	16/03/16	Joseph Hobbs

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APPENDIX A General Information
APPENDIX B Cone Penetration Test Results – Raw Data Plots
APPENDIX C Standard Interpretation Results
APPENDIX D Geotechnical Parameter Results

1 INTRODUCTION

At the request of ROC Consulting, a CPT led soils investigation was carried out on project *Airport City North*.

Site location:

Manchester Airport
Outwood Lane and/or Thorley Lane
Manchester
M90 4WP

1.1 COMPLETED WORKS

- 35 nr. Cone Penetration Tests (CPT); and
- Factual report plus standard geotechnical data interpretation.

The *Summary Tables* section details the field records.

2 FIELDWORK

2.1 CONE PENETRATION TESTING

Cone Penetration Tests were performed with a 20.5 tonne track-truck mounted CPT unit (UK3) equipped with a 17 tonne capacity hydraulic ram set.

An electric penetrometer of a type conforming to the requirements of BS ISO 22476-1:2012 was used on this project. Cone measurements included cone tip resistance and friction sleeve resistance at a 10mm resolution. Cone maintenance, checks and calibrations were carried out in accordance with recommendations of BS8422:2003, and ASTM E74-13a as referenced by the British Standard. The management of calibration records is in accordance with ISO10012. Copies of all calibration certificates for the cones used are presented in Appendix A. Refer to the cone calibration certificates for the cone type and dimensional data.

2.2 FIELD LOGISTICS

The client was responsible for the positioning and re-survey of all investigative locations.

The target depth for the investigation was 4 m. Table 1 details the final test depths and reasons for test termination (*Refusal Factor).* Termination depths were advised to, and agreed with, the client's on-site representative.

3 RAW DATA REDUCTION AND PRESENTATION

The CPT results are presented in Appendix B. The corrected cone resistance (q_t), local side friction, friction ratio and inclination are all presented against depth and elevation in accordance with recommendations of the BS ISO 22476-1:2012. CPT data and the associated derived geotechnical parameters are included in the AGS 3.1 and 4.0 data files provided.

Penetration length readings are corrected for inclination and sleeve readings are depth corrected for the dimensional offset between cone tip and sleeve during post processing. An additional shift of -80mm is applied to the sleeve to account for tip failure zone offset (see 'CPT Interpretation Notes'). 'Rod spikes' (artefacts of the 1 m interval pause for rod string addition) are filtered from the cone tip and sleeve data.

4 INTERPRETATIVE DATA

4.1 IN-SITU STRESS CONDITIONS

The in-situ total and effective stress states are calculated based on an assumed total unit weight of soil (17 kN/m^3 above the inferred piezometric surface and 18 kN/m^3 below) and a hydrostatic pore pressure state. The data are applied in calculation of stress normalised geotechnical parameters.

4.2 SOIL BEHAVIOUR TYPE

The Soil Behaviour Type (SBT) has been interpreted using the Robertson 1990 classification system based on the stress normalised cone resistance (Qt) and Normalised friction sleeve resistance (Fr).

(See glossary of terms and symbols Appendix A)

The results are presented on the plots of Appendix C – *Standard Interpretation Results*.

4.3 SOIL BEHAVIOUR TYPE – *Ic* INDEX

The Soil Behaviour Type (SBT) is presented as the Soil Behaviour Type Index, $\boldsymbol{I_C}$, for both stress-normalised and non-normalised evaluations according to the charts of Robertson (1998 & 2010) applicable to predominantly silicate soils.

The $\boldsymbol{I_c}$ provides a continuous profile of SBT variation with depth such that the end user may choose appropriate stratigraphic subdivisions. The basis of $\boldsymbol{I_c}$ and its approximation of the original chart classification zones may be seen from Appendix A figure 'CPT Soil Behaviour Type Chart'. The loss of fidelity is dominantly in zones 1 (*sensitive fine grained)* and zones 8 & 9 (*overconsolidated or cemented*). To account for this approximation a profile of sensitivity and OCR is provided in the Standard Interpretation Results (see section 'Geotechnical Parameters').

Non-stress normalised SBT index $\boldsymbol{I_C}$**:**

$$I_c = \left[\left(3.47 - \log\left(\frac{q_c}{\sigma_{atm}}\right)^2\right)^2 + (\log R_f + 1.22)^2\right]^{0.5}$$

Stress-normalised SBT index I_c:

$$I_c = ((3.47 - \log Q_t)^2 + (\log F_r + 1.22)^2)^{0.5}$$

(See glossary of terms and symbols Appendix A)

The results are presented on the plots of Appendix C – *Standard Interpretation Results*.

4.4 GEOTECHNICAL PARAMETERS

4.4.1 RELATIVE DENSITY

The relative density of sands is calculated based on an empirical relationship proposed by Jamiolkowski *et al.* (2001) based on a large database of undisturbed frozen samples and calibration chamber tests. The expected accuracy may be evaluated from the distribution of calibration data in the figures presented below. The relationship has the following form:

$$D_r = 100\left[0.268 \cdot \ln\left(\frac{q_t/\sigma_{atm}}{\sqrt{\sigma_{vo}'/\sigma_{atm}}}\right) - k\right]$$

(See glossary of terms and symbols Appendix A – *General Information*)

K = Compressibility dependant constant. For medium compressibility = -0.675 (applied generic value), for high compressibility and sands with significant carbonate or calcareous composition <=1, for low compressibility >=-2.0

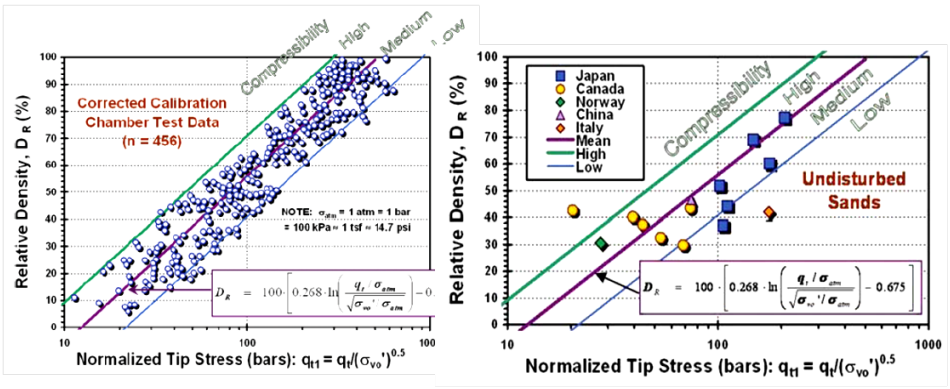


Figure 4-1 Relative density with normalised tip stress and sand compressibility from calibration chamber tests (left) and undisturbed frozen samples (right). Jamiolkowski *et al.* (2001) (Reproduced from NCHRP Synthesis 368 (2007)).

The results are presented on the plots of Appendix C – *Standard Interpretation Results*.

4.4.2 UNDRAINED SHEAR STRENGTH

S_u is estimated from the net cone tip resistance using the following equation:

$$s_u = \frac{(q_c - \sigma_{vo})}{N_k}$$ (Lunne *et al*. (1981))

where N_k is an empirical cone factor.

Research has shown that the cone factor N_k varies between 11 and 21 for normally to moderately overconsolidated soils with an average value of 15. For moderately to heavily overconsolidated soils the N_k factor may range from 20 to 30+. S_U values are presented for N_k factors of 15 and 20.

The results are presented on the plots of Appendix C – *Standard Interpretation Results*.

4.4.3 OVERCONSOLIDATION RATIO

The preconsolidation stress of clays is calculated based on the method proposed by Mayne (1995) and Demers and Leroueil (2002) and has the following form:

$$\sigma_p' = k \cdot (q_t - \sigma_{vo}) = 0.33(q_t - \sigma_{vo})$$

$$OCR = \sigma_p'/\sigma_{v0}'$$

(See glossary of terms and symbols Appendix A)

The factor k may be expected to lie in the range 0.2 to 0.5 with 0.33 representing the average.

Higher values of k are recommended for aged heavily overconsolidated clays (Robertson, 2009) and may be calibrated accordingly. The figure below demonstrates the expected accuracy of the above methods in prediction of preconsolidation stress, of particular note is the under prediction for fissured clays.

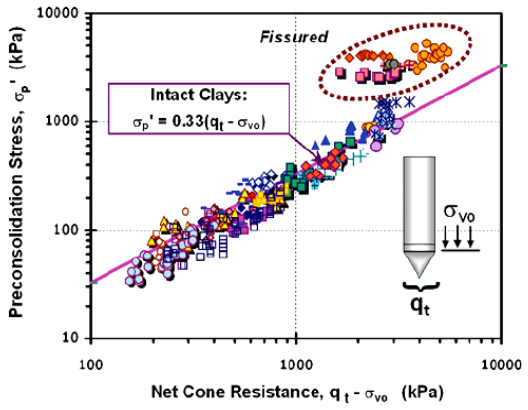


Figure 4-2 Preconsolidation stress from net cone resistance in clays (Reproduced from Mayne (2007)).

4.4.4 SENSITIVITY

The sensitivity of the soil, as defined by the ratio of undrained shear strength to remoulded shear strength, is calculated using the factored normalised cone resistance (S_u) and remoulded shear strength taken as equal to the direct friction sleeve measurement. The relationship has the following form (Mayne, 2007):

$$s_t = 0.073 \cdot (q_t - \sigma_{v0})/f_s$$

(See glossary of terms and symbols Appendix A – *General Information*)

The results are presented on the plots of Appendix C – *Standard Interpretation Results*.

4.4.5 COEFFICIENT OF VOLUME CHANGE

Coefficient of volume change (m_v) defined as the inverse of the constrained modulus (M), is evaluated taking the constrained modulus method proposed by Robertson (2010) having the following form:

$$M = \alpha \cdot (q_t - \sigma_v)$$

Where:

For I_c > 2.2:

$\alpha = 14$ Q_{tn} > 14

$\alpha = 14$ Q_{tn} > 14

For I_c < 2.2

$$\alpha = 0.0188 \cdot 10^{0.55 I_c + 1.68}$$

Q_{tn} = Normalised cone resistance $= \frac{(q_t - \sigma_v)}{\sigma'_v}$

q_t = Corrected cone resistance (uncorrected where piezocone not used)

I_c = Soil Behaviour Type Index (Robertson 2010)

The results are presented on the plots of Appendix D – *Geotechnical Parameter Results*.

5 CPT DATA INTERPRETATION NOTES

Provided below is an inexhaustive set of cautionary notes on interpretation of the acquired CPT data with reference to examples within the dataset where appropriate.

SOIL BEHAVIOUR TYPE

The soil behaviour type (SBT) as defined by Robertson *et al.* (1986) is not intended to replace soil classification based on particle size fractions. Rather, the SBT will generally show bias in the classification towards the soil fraction that dominates soil behaviour in response to cone penetration (Cone tip: analogous to bearing capacity failure, friction sleeve: analogous to remoulded S_u or simple shear). In general the stress-normalised SBT will be more accurate, but may be less reliable at very shallow depths (1-2 m) due to the particular stress normalisation procedure applied.

DRAINED AND UNDRAINED SOIL BEHAVIOUR

Geotechnical parameters appropriate for drained and undrained cone penetration conditions are derived for drained and undrained soil behaviour types (SBTs) respectively, however to account for uncertainty in the SBT correlation with drainage behaviour, all parameters are derived over the range of mixed soil types 'Silt Mixtures' and 'Sand Mixtures' or *Ic* 2.05-2.95 (Robertson, 2010). For partially drained conditions, or for partially saturated low permeability soils, error will be introduced within derived parameters.

Piezocone dynamic pore water pressures behaviour, dissipations or other site specific observations may be used to identify the appropriate limits of application. Dissipations to t_{50} exceeding 30 seconds indicate undrained penetration behaviour (Kim *et al.,* 2010).

DYNAMIC PORE PRESSURE DATA

During penetration, strong dilation in shear at the cone shoulder may result in cavitation and desaturation of the piezo system and may take time to recover (up to 1 m penetration). Penetration through soils of partial saturation will provide unrepresentative readings and may desaturate the piezo system introducing variable error.

CONE TIP AND SLEEVE OFFSET

The accuracy of the SBT is sensitive to offset error in the friction ratio. Penetration through zones of anisotropic soil stiffness may lead to offset of the cone tip and sleeve readings due to variation in the tip failure zone shape/depth. For low to moderate risk projects this is generally insignificant. The friction ratio is often inaccurate in heavily disturbed soils with a 'blocky' macro fabric.

For this investigation a friction sleeve depth offset correction of -80mm was applied together with a 5 data point moving average on the friction ratio to minimise the influence of this effect on derived parameters.

CONE TYPE

The reference cone type has a 10 cm^2 projected cone tip area and 150 cm^2 friction sleeve area, however it is common to use the larger 15 cm^2 cone with 225 cm^2 friction sleeve area for improved sensitivity and penetration depth potential. Use of the 15 cm^2 cone will have the following known influences on data with respect to the reference 10 cm^2:

- More pronounced transitions zones and thin layer effects (larger zone of influence and failure zone).
- Possible marginal increase in u_2 position dynamic pore pressures during undrained/partially drained penetration.

TRANSITION ZONES AND THIN LAYER EFFECTS

During penetration at the boundary between soils of contrasting stiffness, a transition zone is often evident prior to mobilization of the true soil stiffness. These should be cautiously ignored in assessment of soil behaviour type and parameter evaluation. Where the stiff layer is thin (<~0.5m) the true stiffness will not be fully mobilised. The effect for thin low stiffness layers is less significant. Procedures for thin-layer effect correction are provided by Robertson and Wride (1998). In choosing characteristic values of the tip, sleeve and derived parameter results, large scale peak and trough values may be more representative of the local value.

GRAVELS

The presence of gravel or larger clasts in a soil is often characterised by short peaks in the CPT tip and sleeve readings, possibly with associate inclinometer 'shake' and/or sharp reductions in pore water readings due to dilation effects. Frequent gravels in soft or loose soils may generate highly erroneous friction ratio values. Where gravels are matrix supported the tip and sleeve peaks may be ignored or filtered in choosing characteristic values for bulk behaviour. **Illustration of behaviour indicative of gravels is displayed for PB218 at 0.20 m.**

6 REFERENCES

ASTM E74-13a (2013), Standard Practice of Calibration of Force-Measuring Instruments for Verifying the Force Indication of Testing Machines, ASTM International, West Conshohocken, PA.

Baldi, G., Bellotti, R., Ghionna, V.N., Jamiolkowski, M. and Pusqualini, E. (1986) "Interpretation of CPT's and CPTU's, 2nd Part: Drained Penetration of Sands". Proceedings of the 4th International Geotechnical Seminar, Singapore. pp. 143-156.

British Standards Institution (2003) BS 8422:2003, Force measurement – Strain gauge load cell systems – Calibration method. London: British Standards Institution.

Houlsby, G.T. and Teh, C.I. (1988) "Analysis of the Piezocone in Clay". Proceedings of the International Symposium on Penetration Testing (ISOPT-1), Orlando, Vol. 2, pp. 777-783. Balkema Pub., Rotterdam.

ISO 10012:2003 Measurement management systems - Requirements for measurement processes and measuring equipment. New Delhi: Bureau of Indian Standards (2003).

ISO 22476-1:2012 Geotechnical investigation and testing - Field testing - Part 1: Electrical cone and piezocone penetration test. New Delhi: Bureau of Indian Standards (2012).

ISSMGE, 1999. International reference test procedure for the cone penetrometer test CPT and the cone penetration test CPTU, Report of ISSMGE TC16 on Ground Property Characterisation for In situ Testing, In *Proceedings of the 12th European conference on Soil Mechanics and Geotechnical Engineering* 3:2195-222 (1999).

Jamiolkowski, M., LoPresti, D.C.F., and Manassero, M. (2001) "Evaluation of Relative Density and Shear Strength of Sands from Cone Penetration Test and Flat Dilatometer Test". Soil Behaviour and Soft Ground Construction (GSP119), American Society of Civil Engineers, pp. 201-238. Reston, Va. 2001

Kim, K., Prezzi, M., Salgado, R., and Lee, W. (2008) "Effect of Penetration Rate on Cone Penetration Resistance in Saturated Clayey Soils", Journal of Geotech. Geoenviron. Eng., Vol. 134(8), pp. 1142-1153.

Kulhawy, F.H. and Mayne, P.W. (1990) "Manual on Estimating Soil Properties for Foundation Design". Report EPRI EL-6800 Research Project 1493-6, Electric Power Research Institute, Palo Alto, CA, pp. 306.

Ladd, C.C. and DeGroot, D.J. (2003) "Recommended Practice for Soft Ground Site Characterization: Arthur Casagrande Lecture". Soil & Rock America 2003 (Proceedings. 12th Pan American Conference on Soil Mechanics and Geotechnical Engineering, Boston, MA). Verlag Glückauf, Essen, Germany. pp. 3-57.

Lunne, T., Robertson, P.K. and Powell, J.J.M. (1997) "Cone Penetration Testing in Geotechnical Practice" Blackie Academic, New York 1997.

Lunne, T. and Kleven, A. (1981) "Role of CPT in North Sea Foundation Engineering". Session at the ASCE National Convention: Cone Penetration Testing and Materials. pp. 76-107. American Society of Engineers (ASCE).

Mayne, P.W. and Campanella, R.G. (2005) "Versatile Site Characterisation by Seismic Piezocone". Proceedings of the 16th International Conference on Soil Mechanics and Geotechnical Engineering, Vol. 2. Millpress, Rotterdam, The Netherlands 2005. pp 721-724.

Mayne, P.W. (2007) "Cone Penetration Testing – A Synthesis of Highway Practice". NCHRP Synthesis 368, Transportation Research Board, Washington, D.C.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J. (1986) "Use of Piezometer Cone Data". Proceedings of the ASCE Specialty Conference, In Situ '86: Use of In-Situ Testing in Geotechnical Engineering. Blacksburg, pp. 1263-1280, American Society of Engineers (ASCE).

Robertson. P.K., (2010) "Soil Behaviour Type from the CPT: an update". 2nd International Symposium on Cone Penetration Testing. Huntingdon Beach, CA, USA.

Robertson, P.K. (2012). Interpretation of in-situ tests – some insights, Proc. 4th Int. Conf. on Geotechnical & Geophysical Site Characterization, ISC'4, Brazil, 1.

Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J. (1999) "An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils". Canadian Geotechnical Journal. Vol. 36, pp. 369-381.

SUMMARY TABLES

Table 1 CPT Test Summary

TEST ID	FINAL DEPTH (mBGL)	**Cone ID {C**=Cone tip; **F**=Friction Sleeve; **I**= Inclination; **P** = Piezo; **S**=Subtraction cone; **15/10** = cone projected area (cm2))}	CPT RIG	PRE DRILLED / INSPECTION PIT (m)	CASING DEPTH (m)	REFUSAL FACTOR	DISSIPATIONS	SEISMIC CONE	SAMPLES	EASTING	NORTHING	ELEVATION (m)	DATE OF TEST	REMARKS
PB101	3.10	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB102	3.58	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB103	3.54	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB104	4.17	S15-CFIP.1333	UK3			Total reaction load							09/03/2016	
PB105	3.53	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB106	3.33	S15-CFIP.1333	UK3			Total reaction load							09/03/2016	
PB107	4.33	S15-CFIP.1333	UK3			Total reaction load							09/03/2016	
PB108	3.23	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB109	3.37	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB110	3.28	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB111	3.42	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB112	3.36	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB113	4.90	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB201	6.25	S15-CFIP.1333	UK3			Total cone load							09/03/2016	
PB202	6.29	S15-CFIP.1333	UK3			Tip load							10/03/2016	
PB203	4.45	S15-CFIP.1333	UK3			Total cone load							10/03/2016	
PB204	3.15	S15-CFIP.1333	UK3			Tip load							09/03/2016	
PB205	5.59	S15-CFIP.1333	UK3			Total cone load							09/03/2016	
PB206	2.70	S15-CFIP.1333	UK3			Tip load							10/03/2016	
PB207	2.42	S15-CFIP.1333	UK3			Tip load							10/03/2016	
PB208	3.95	S15-CFIP.1333	UK3			Total cone load							10/03/2016	
PB209	3.65	S15-CFIP.1333	UK3			Tip load							10/03/2016	
PB210	2.84	S15-CFIP.1333	UK3			Tip load							10/03/2016	
PB211	3.72	S15-CFIP.1333	UK3			Tip load							10/03/2016	

PB212	4.44	S15-CFIP.1333	UK3	Tip load	10/03/2016
PB213	1.96	S15-CFIP.1333	UK3	Tip load	10/03/2016
PB214	5.37	S15-CFIP.1333	UK3	Tip load	10/03/2016
PB215	5.35	S15-CFIP.1333	UK3	Sleeve load	10/03/2016
PB216	3.46	S15-CFIP.1333	UK3	Tip load	10/03/2016
PB217	4.15	S15-CFIP.1333	UK3	Total cone load	10/03/2016
PB218	4.45	S15-CFIP.1333	UK3	Sleeve load	10/03/2016
PB219	5.08	S15-CFIP.1333	UK3	Total cone load	10/03/2016
PB220	3.35	S15-CFIP.1333	UK3	Tip load	10/03/2016
PB221	5.99	S15-CFIP.1333	UK3	Total cone load	10/03/2016
PB222	3.25	S15-CFIP.1333	UK3	Tip load	10/03/2016

CPT Test Plots are presented in Appendices B & C

APPENDIX A GENERAL INFORMATION

LIST OF FIGURES

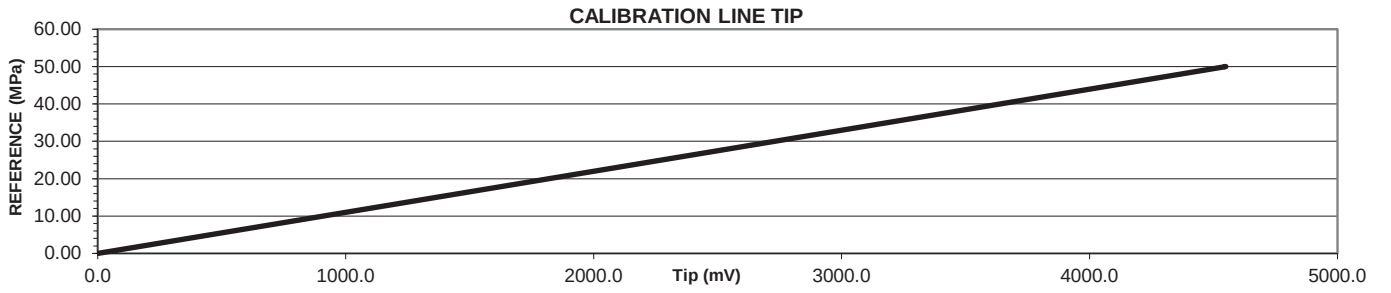
Description	Pages Included
Cone Calibration Certificate: S15-CFIP.1333	1
Data Sheet: 20.5 Tonne Track-Truck Mounted CPT Unit (UK3)	1
CPT Soil Behaviour Type Chart	1
Glossary of Terms	1

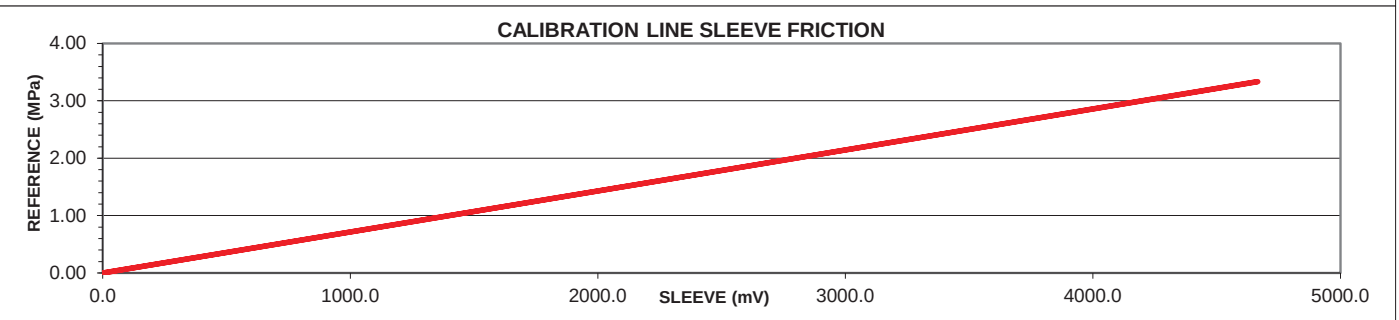
CALIBRATION CERTIFICATE

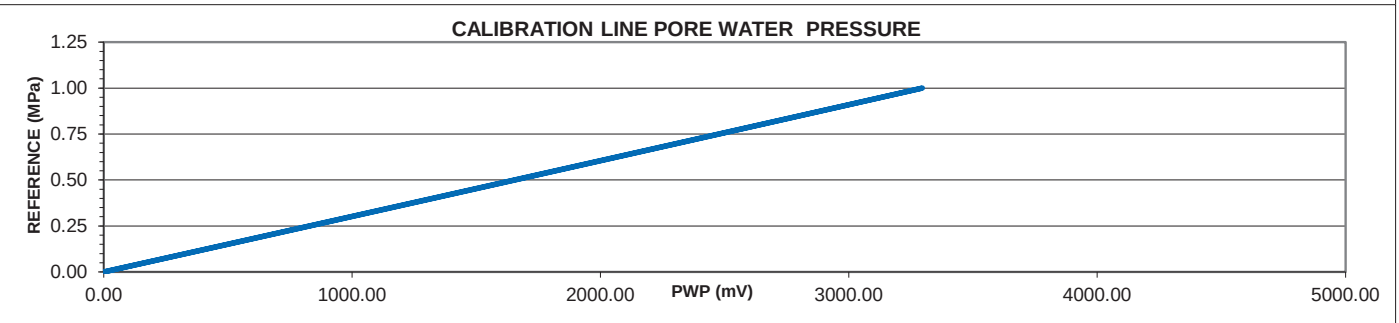
Geopoint-S15-150kN-2MPa

Cone Serial Number: S15-CFIIP.1333

REFERENCE INSTRUMENTS:	CONE END RESISTANCE	SLEEVE FRICTION	PORE WATER PRESSURE
ID	5623	5623	4009509
TYPE	Richmond 300	Richmond 300	Druck DPI 104
UNCERTAINTY (±%)	0.1	0.1	0.05
Nominal pressure (MPa,MPa,MPa)	50.00	3.33	1.00
Maximum pressure (MPa,MPa,MPa)	100.00	6.67	2.00
Area (cm^2)	15	225	N/A
Sensitivity (mV/MPa)	90.95	1399.06	3294.94
Calibration file scaling factor:			
Nominal cal force (kN, kN, BAR)	75	75	10
Calibration number (mV)	4547	4664	3295
Zero point (mV)	253	251	256
Sensitivity (mV/kN, mV/kN, mV/BAR)	60.632	62.181	329.494
Inclination factors (mV)	X -20°= 468, 0°= 2466, 20°= 4523	/ Y -20°= 451, 0°= 2428, 20°= 4491	
Measured alpha factor:	0.69		
Uncertainty (%):			
Reproducibility	0.14	0.14	0.07
Linearity	0.18	0.17	0.20
Hysteresis	0.14	0.15	0.18
Combined expanded (k=2)	0.58	1.14	0.58
Application class	1	1	1







Instrument:	S15-150kN	Location:	Lankelma Calibration Laboratory
Serial Number:	S15-CFIIP.1333	Temperature(° C)	20.0
Manufacturer:	Geopoint	Calibration Engineer	A Harman
Date of calibration:	31/12/2015	Calibration Expiry	30/03/2016

Calibration signed and dated by:

A Harman

Digitally signed by Alastair Harman
DN: cn=Alastair Harman, o=Lankelma Ltd, ou=Instrument Engineer, email=Alastairharman@lankelma.com, c=GB
Date: 2016.01.03 10:39:51 Z

Calibration checked and dated by:

E Stickland

Digitally signed by Emma Stickland
DN: cn=Emma Stickland, o=Lankelma, ou=Engineering, email=emmastickland@lankelma.com, c=GB
Date: 2016.01.06 09:03:08 Z

UK3
TRACK-TRUCK RIG



Our track-truck is suitable for most geotechnical sites. This rig is driven as a self-contained HGV to site where it can deploy its tracks to cope with soft or uneven terrain.

The track-truck can be driven from the front and back, and is fitted with a chalwyn valve and spark arrestor to enable testing on potentially hazardous sites such as oil and gas refineries.

Performance Rates

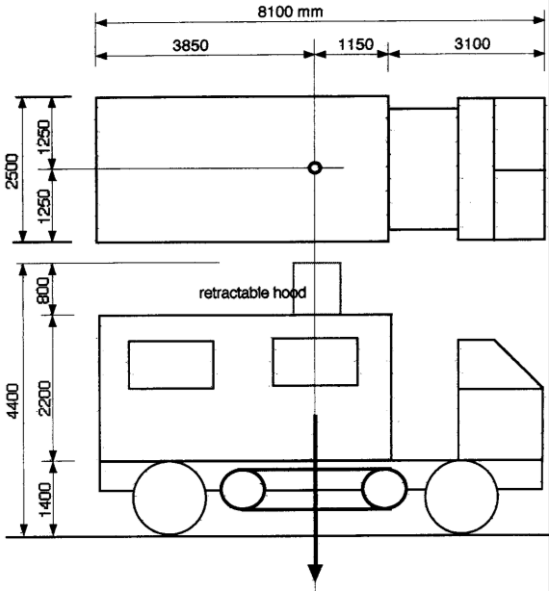
An expected 120 to 150m of standard CPTu testing can be executed in a day (dependent on site conditions and access).

Applications

- Specialist testing
  - Seismic
  - Pressuremeter
  - Magnetometer
  - Videocone
  - Wing cone
  - Push-in Vane
- Installations
  - VWP
  - Piezometer
  - Inclinometer
- Sampling
  - MOSTAP
  - Shelby

TECHNICAL DETAILS

RIG WEIGHT	20.5 T
MAX. OPERATING RAM CAPACITY	17 T
MAX. TRAVELLING SPEED	86 km/h
TRACK MATERIAL	STEEL
TRACK LENGTH	3.30 m
TRACK WIDTH	0.65 m
JACK PLATE DIMENSIONS	TRACKS ACT AS JACKS
JACK ARRANGEMENTS	1 ON EACH SIDE
MAX. GROUND CLEARANCE ON JACKS	0.21 m
MAX. GROUND BEARING PRESSURE	TRACKING / PUSHING – 47 kPa PULLING – 88 kPa
MAX. TESTING GRADIENT	10 DEGREES
MAX. TRAVERSING GRADIENT	30 DEGREES (OPERATOR ASSESSED)
NOISE OUTPUT AT 2M	TESTING – 74 dBA DRIVING – 87 dBA
CLAMP ARRANGEMENT	36/55 PUSH PULL CLAMP
RAM STROKE	1.20 m
MAX. CASING SIZE	55 mm

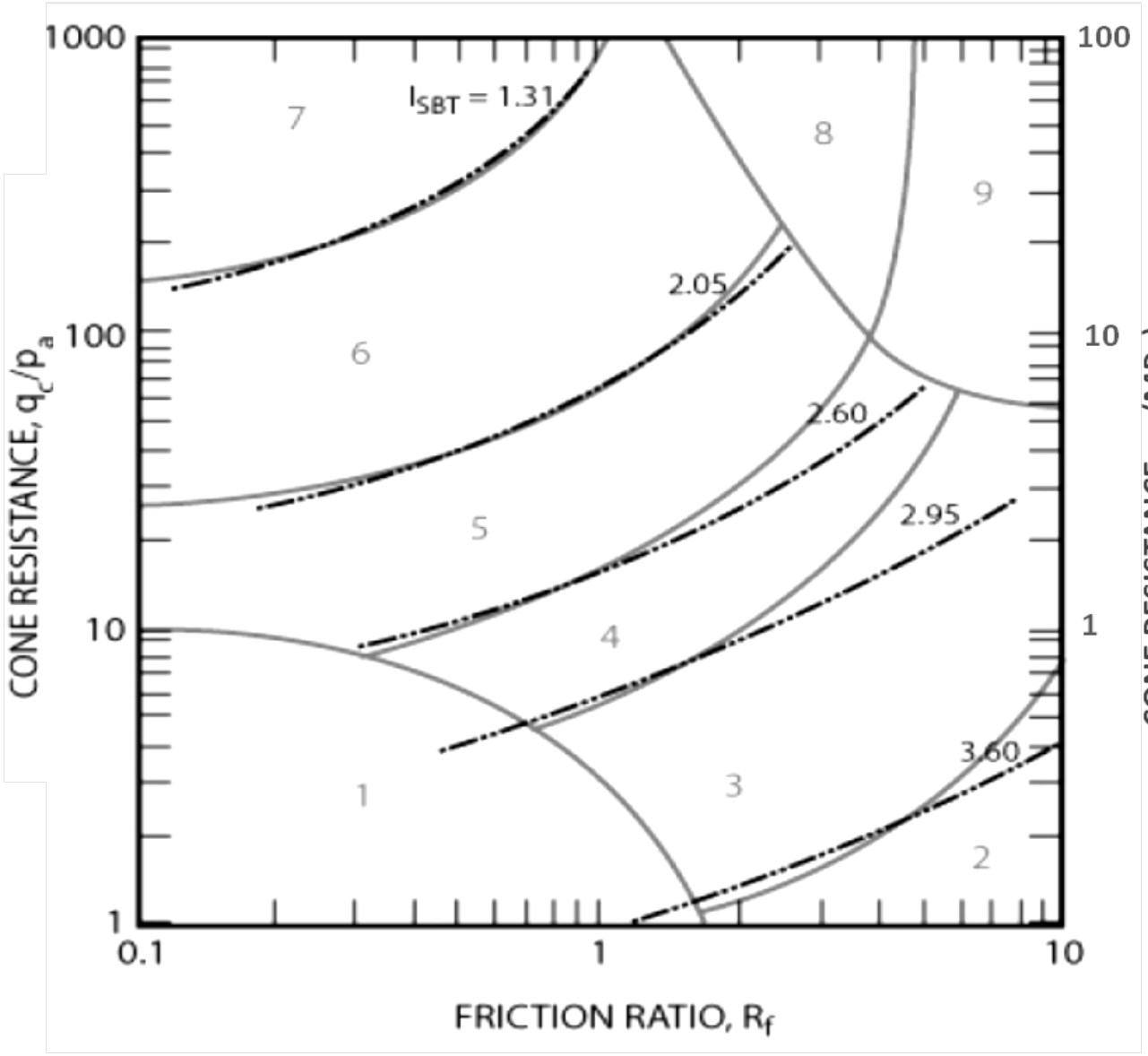


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Lankelma Limited, Cold Harbour Barn, Cold Harbour Lane, Iden, East Sussex. TN31 7UT

CPT SOIL BEHAVIOUR TYPE CHART



Non-normalised SBT chart by Robertson *et al.* (2010) based on dimensionless cone resistance (qc/Pa) and friction ration, Rf, showing contours of *Ic* index. The chart is also applicable to stress-normalised tip/sleeve values Q_t and F_r.

Zone	Soil Behaviour Type (SBT)		
1	Sensitive fine-grained	6	Sands: clean sand to sandy silt
2	Clay – organic soil	7	Dense sand to gravelly sand
3	Clays: Clay to silty clay	8	Stiff sand to clayey sand*
4	Silt mixtures: clayey silt to silty clay	9	Stiff fine grained*
5	Sand mixtures: Silty sand to sandy silt	*Overconsolidated or cemented	

GLOSSARY OF CPT TERMS AND SYMBOLS

SYMBOLS

q_c :- **Cone resistance.** The total force acting on the cone Q_c, divided by the projected area of the cone, A_c; **(q_c=Q_c/A_c)**.

f_s :- **Friction sleeve resistance.** The total frictional force acting on the friction sleeve, F_s, divided by its surface area, A_s.**f_s= F_s/A_s**.

q_t :- **Corrected cone resistance.** The cone resistance q_c corrected for unequal pore water pressure effects on the cone face and shoulder.

R_f :- **Friction ratio** The ratio, expressed as a percentage, of the sleeve friction, f_s, to the cone resistance, q_c, both measured at the same depth; **[R_f= (f_s/q_c) · 100].**

Q_t :- **Stress normalised cone resistance** (Method 1) **= (q_c – σ_v)/σ'_v**

q_{t1}:- **Stress normalised cone resistance** (Method 2) **= (q_t)/(σ'_v)$^{0.5}$**

F_r:- **Normalised friction sleeve resistance = f_s /(q_c- σ_v)**

σ_v:- **Total overburden stress**

σ'_v:- **Effective overburden stress**

σ_{atm}, or, P_a:- **Reference atmospheric stress = 100kPa**

***I_c*:-** **Soil Behaviour Type Index**

B_q :- **Pore pressure ratio.** The net pore pressure normalized with respect to the net cone resistance. = **(u_2 – u_0)/(q_t -σ_v)**

TERMS

Cone Tip:- The conical tip section of the cone penetrometer.

Friction sleeve:- The section of the cone penetrometer upon which the sleeve friction is measured, located behind the cone tip.

Piezocone:- A cone penetrometer with a pore pressure measurement system.

Dynamic pore pressure:- The pore pressure generated during penetration and measured by a pore pressure sensor. u_1 when measured on the conical tip face, u_2 when measured just behind the conical tip.

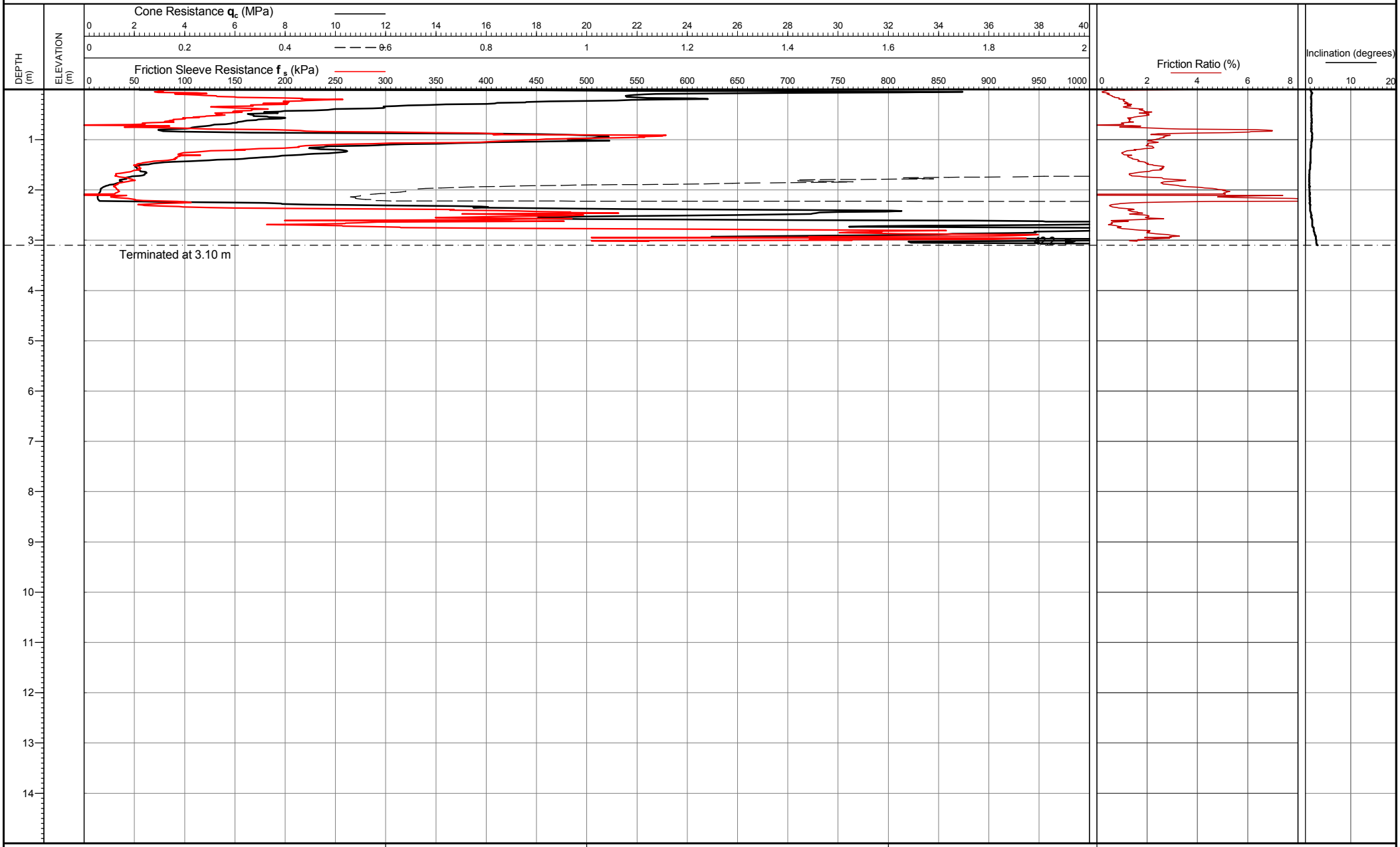
APPENDIX B CONE PENETRATION TEST RESULTS

RAW DATA PLOTS

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



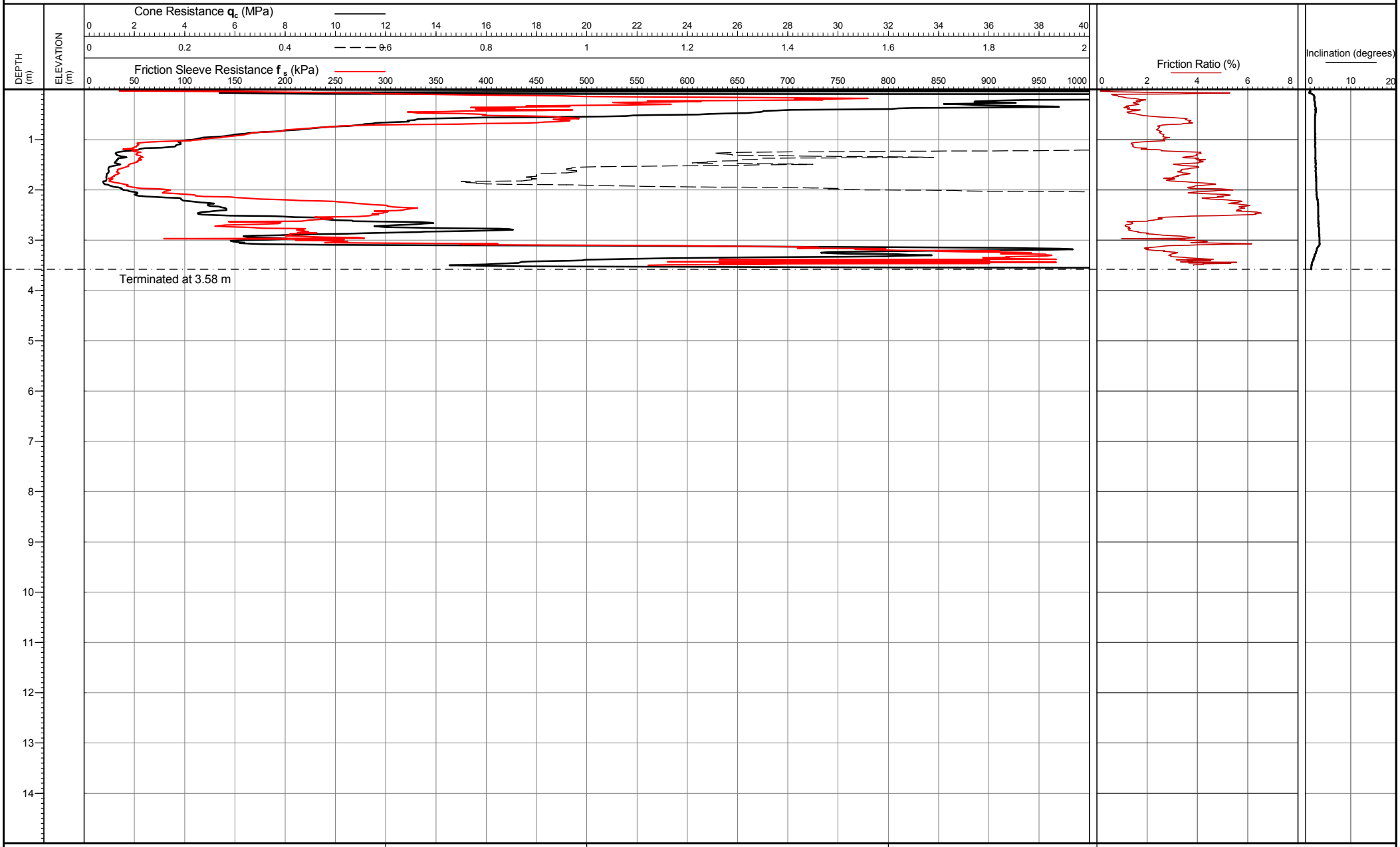
Cone area (mm2):1500 Cone ID: S15-CFIP.1333 Operator: Craig Drummond Rig Used: UK3 Date of test: 09/03/2016 09:21:12	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: Refusal criteria: Tip load	Date of plot: 10-03-16 Checked by: Chris Player	Lankelma Project Ref: P-106347-1

TEST ID: PB101

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 09:39:06

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

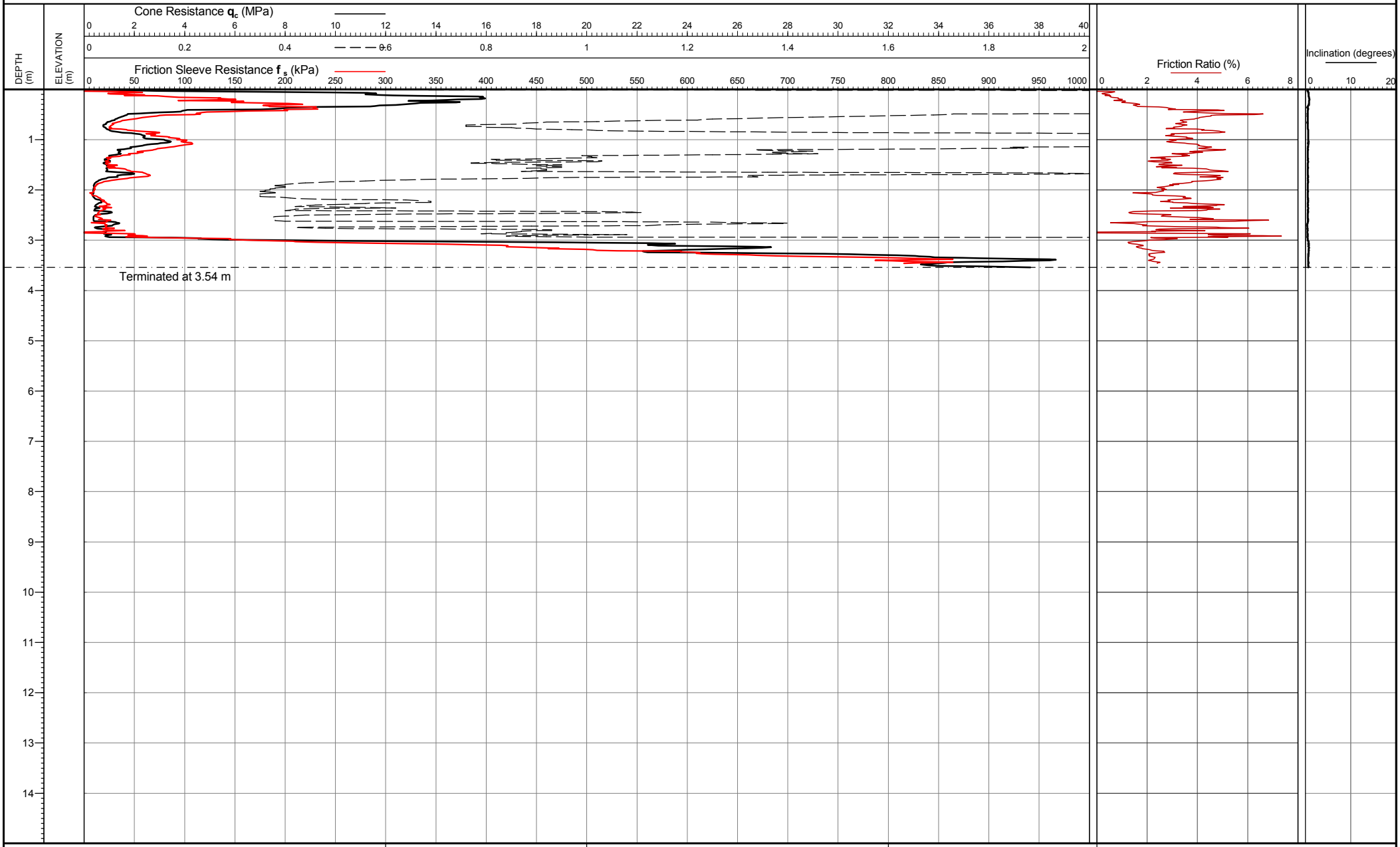
Checked by: Chris Player

TEST ID: PB102

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 09/03/2016 13:36:39

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

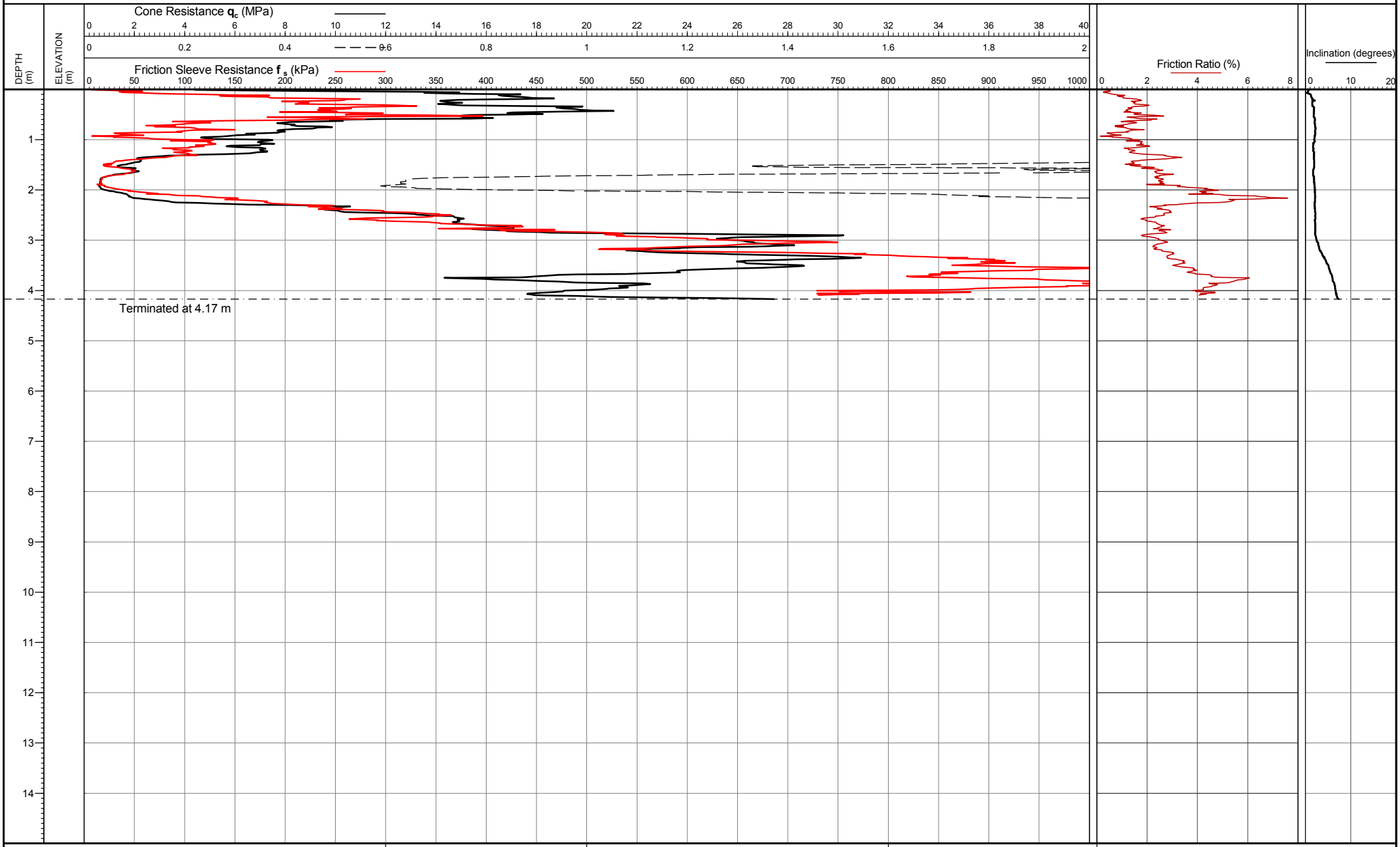
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TEST ID: PB103

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



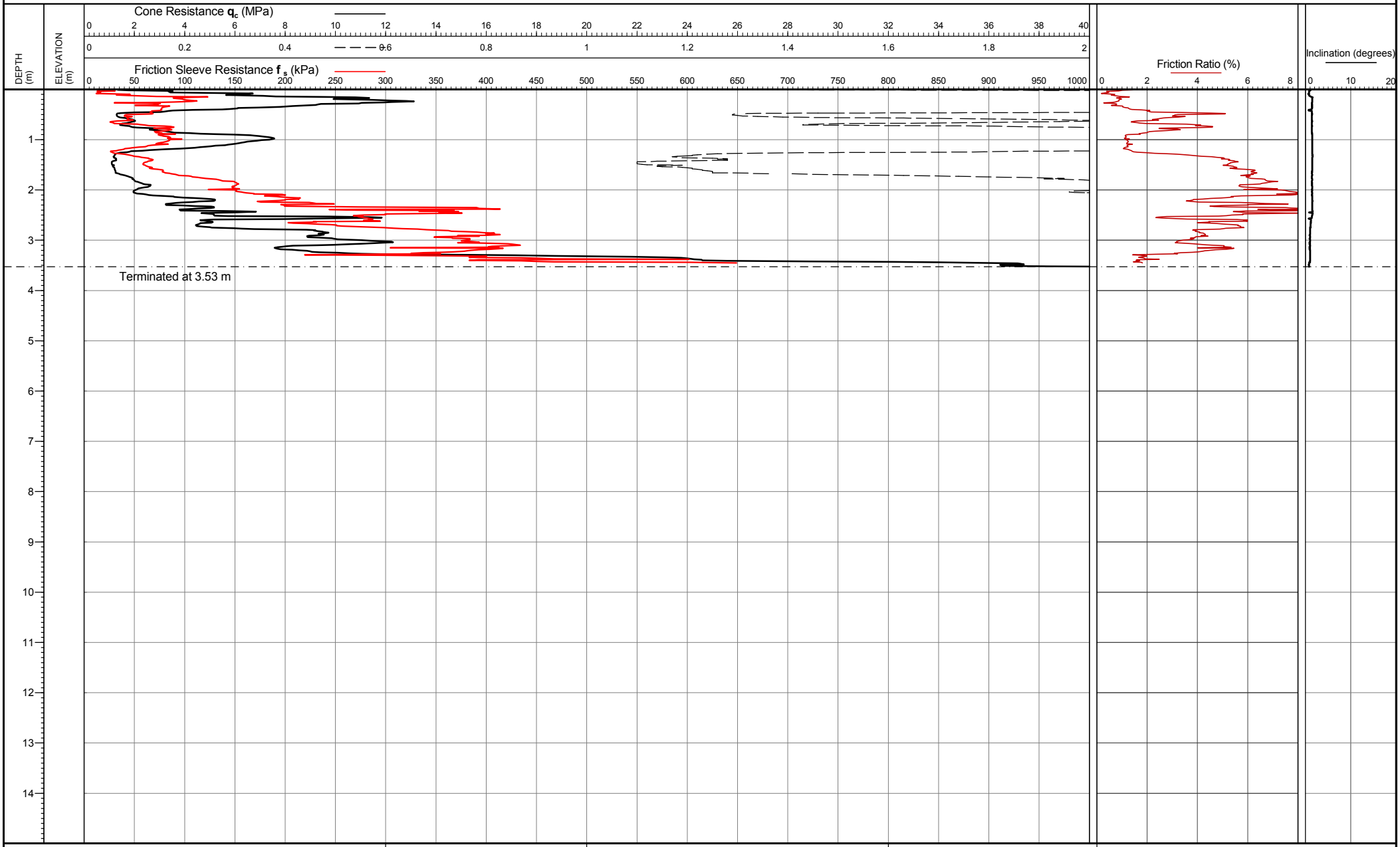
Cone area (mm2):1500 Cone ID: S15-CFIP.1333 Operator: Craig Drummond Rig Used: UK3 Date of test: 09/03/2016 10:57:33	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: Refusal criteria: Total reaction load	Date of plot: 10-03-16 Checked by: Chris Player	Lankelma Project Ref: P-106347-1

TEST ID: PB104

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



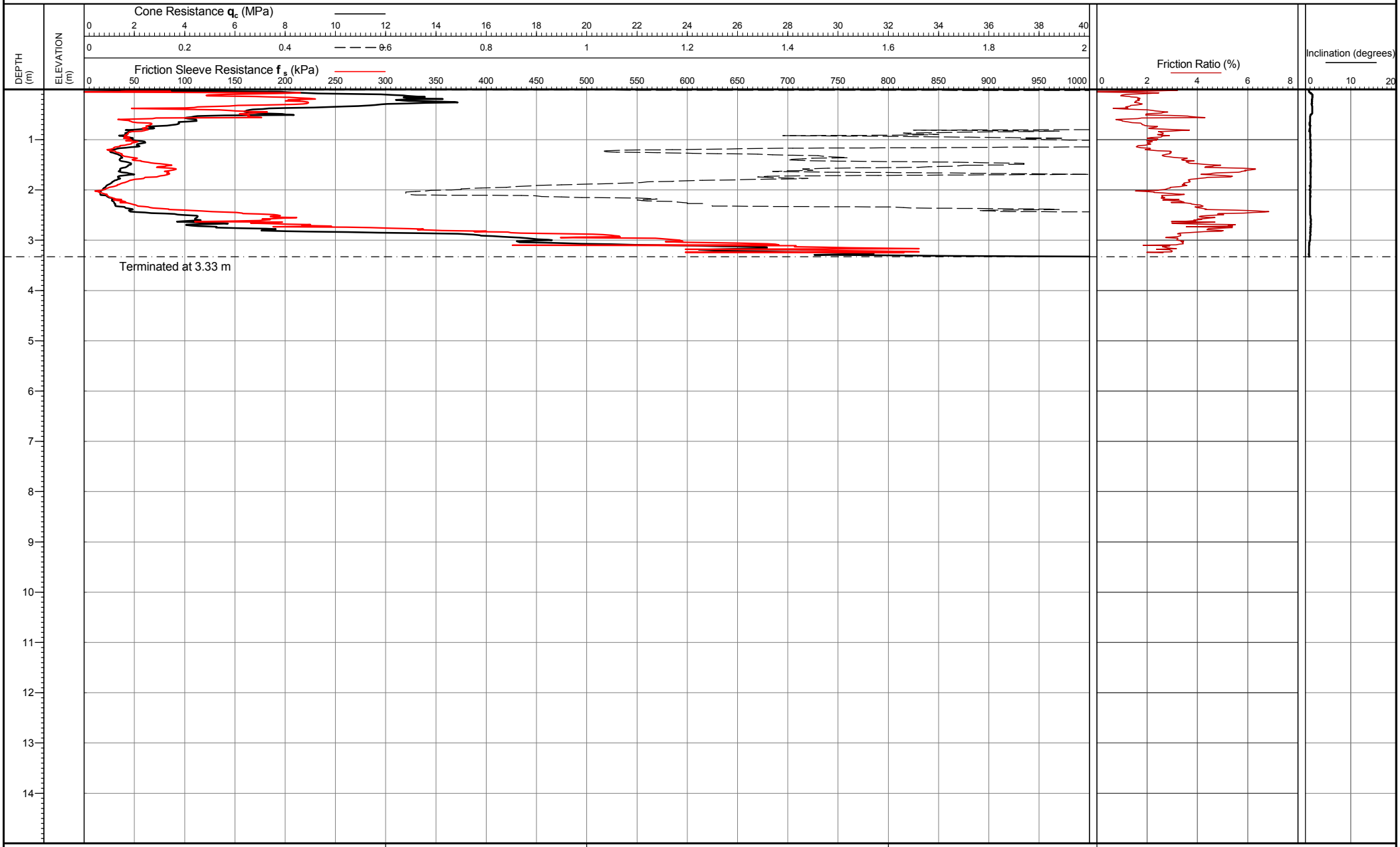
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TEST ID: PB105

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



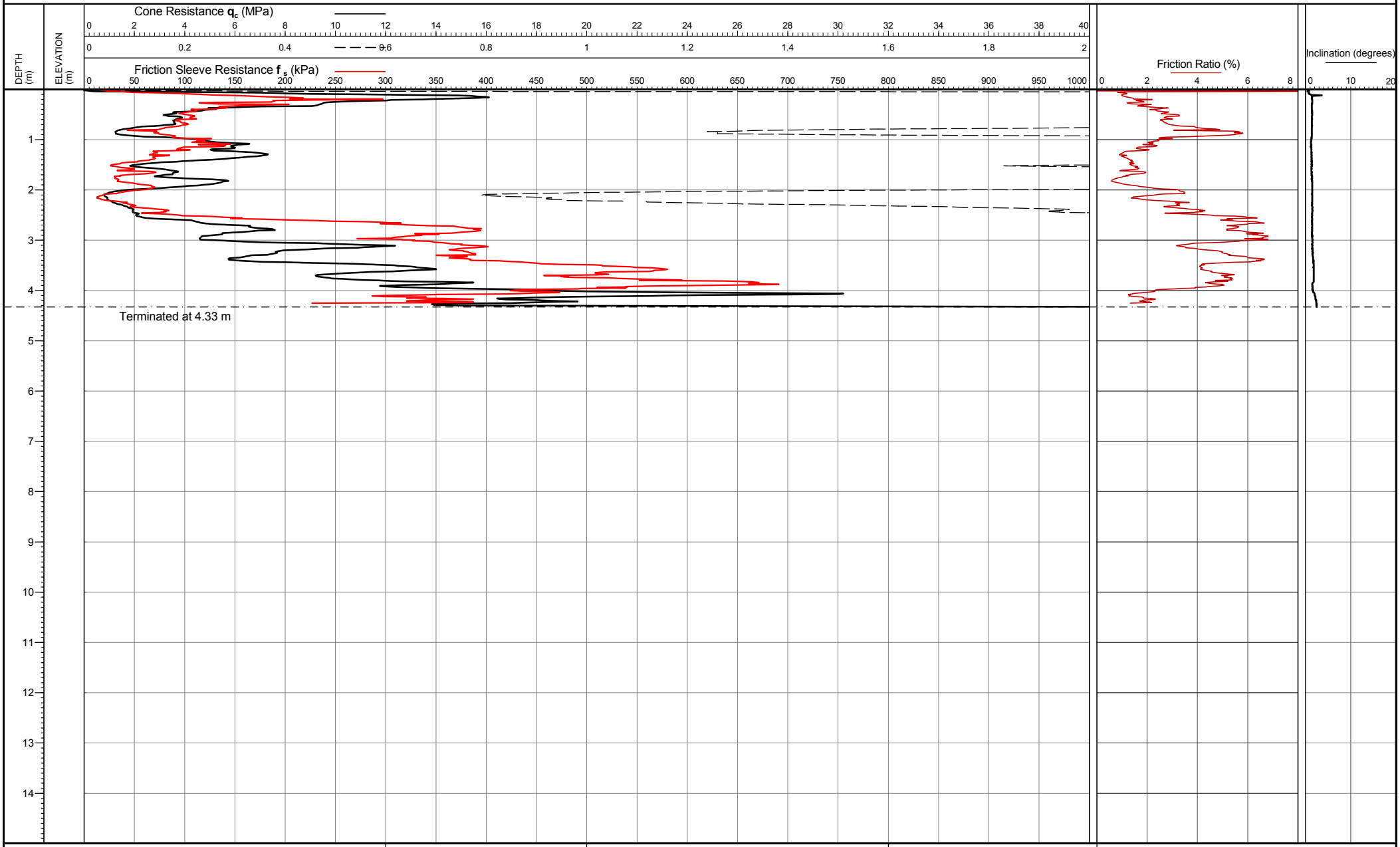
Cone area (mm2):1500 Cone ID: S15-CFIP.1333 Operator: Craig Drummond Rig Used: UK3 Date of test: 09/03/2016 12:12:39	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: Refusal criteria: Total reaction load	Date of plot: 10-03-16 Checked by: Chris Player	Lankelma Project Ref: P-106347-1

TEST ID: PB106

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 11:25:22

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Total reaction load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

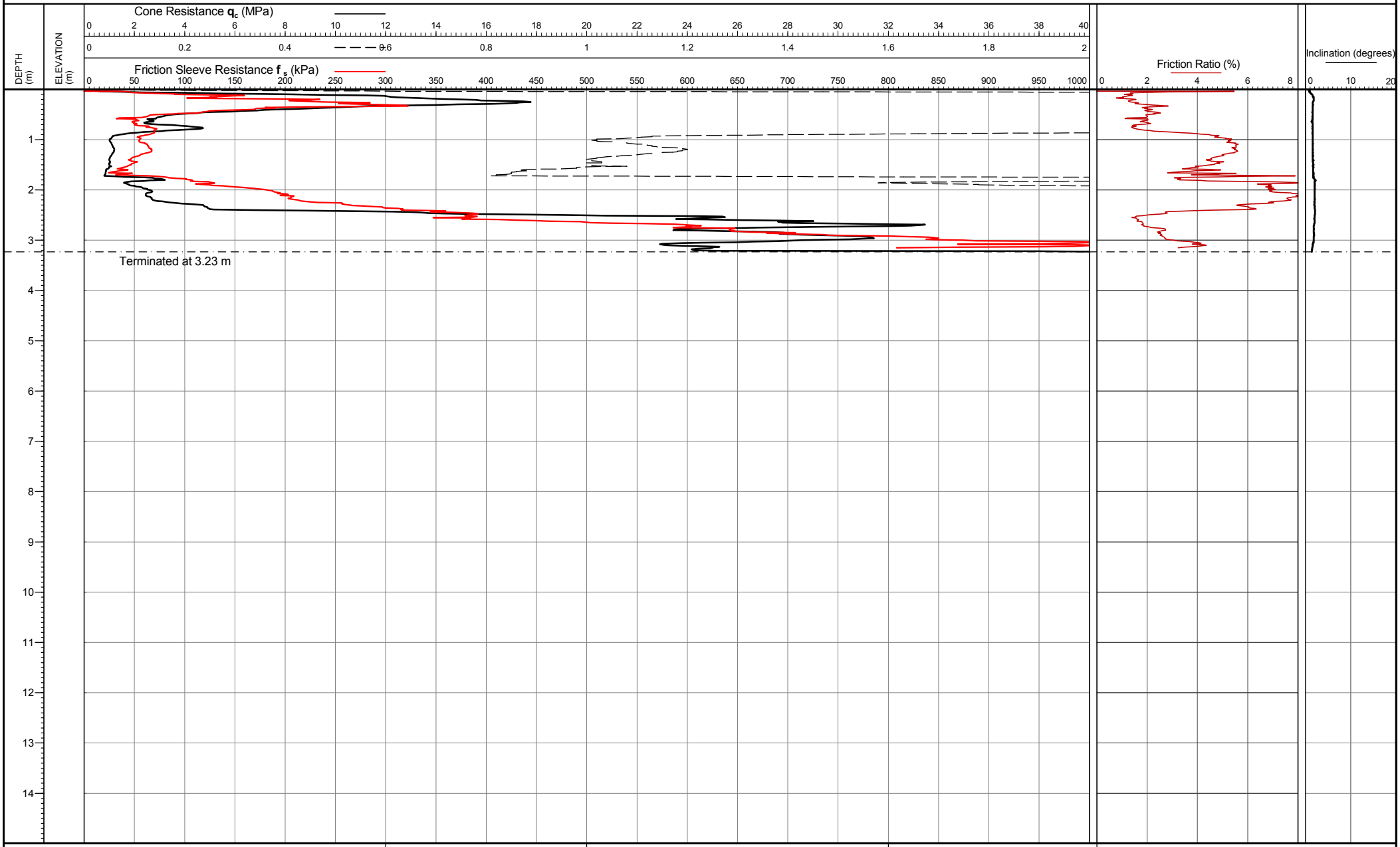
Checked by: Chris Player

TEST ID: PB107

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 11:44:53

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

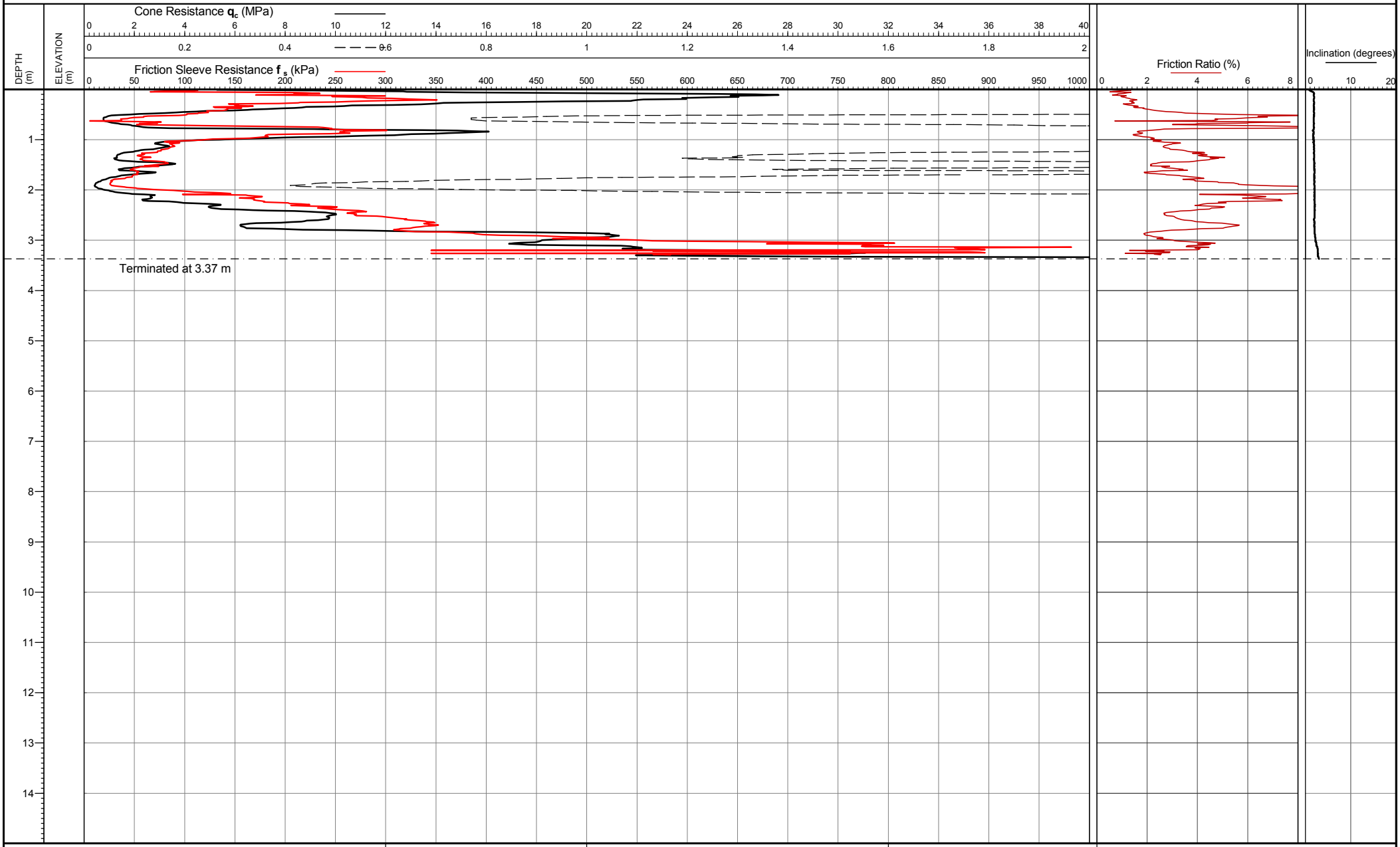
Checked by: Chris Player

TEST ID: PB108

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 10:37:04

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

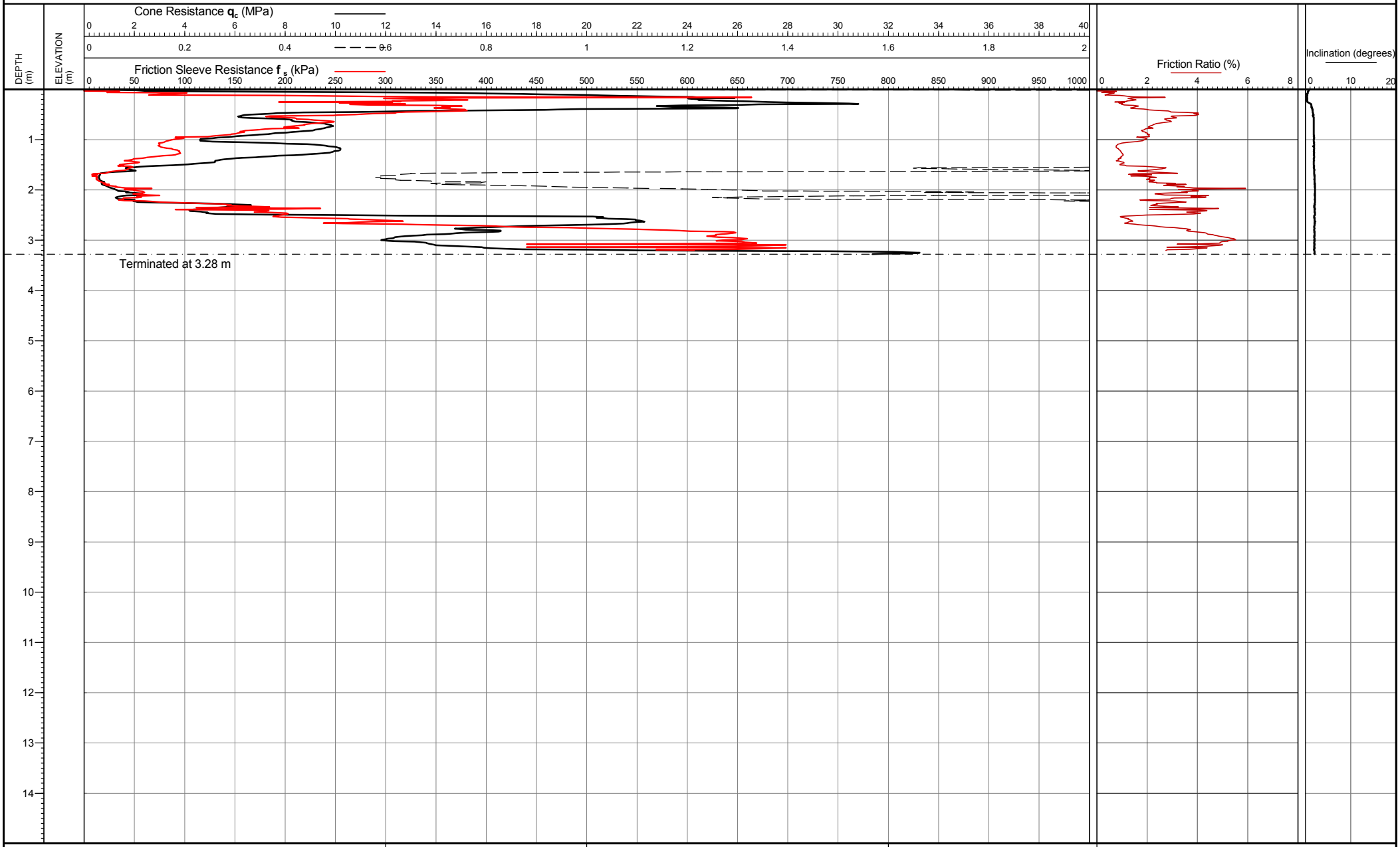
Checked by: Chris Player

TEST ID: PB109

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 09/03/2016 14:18:26

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

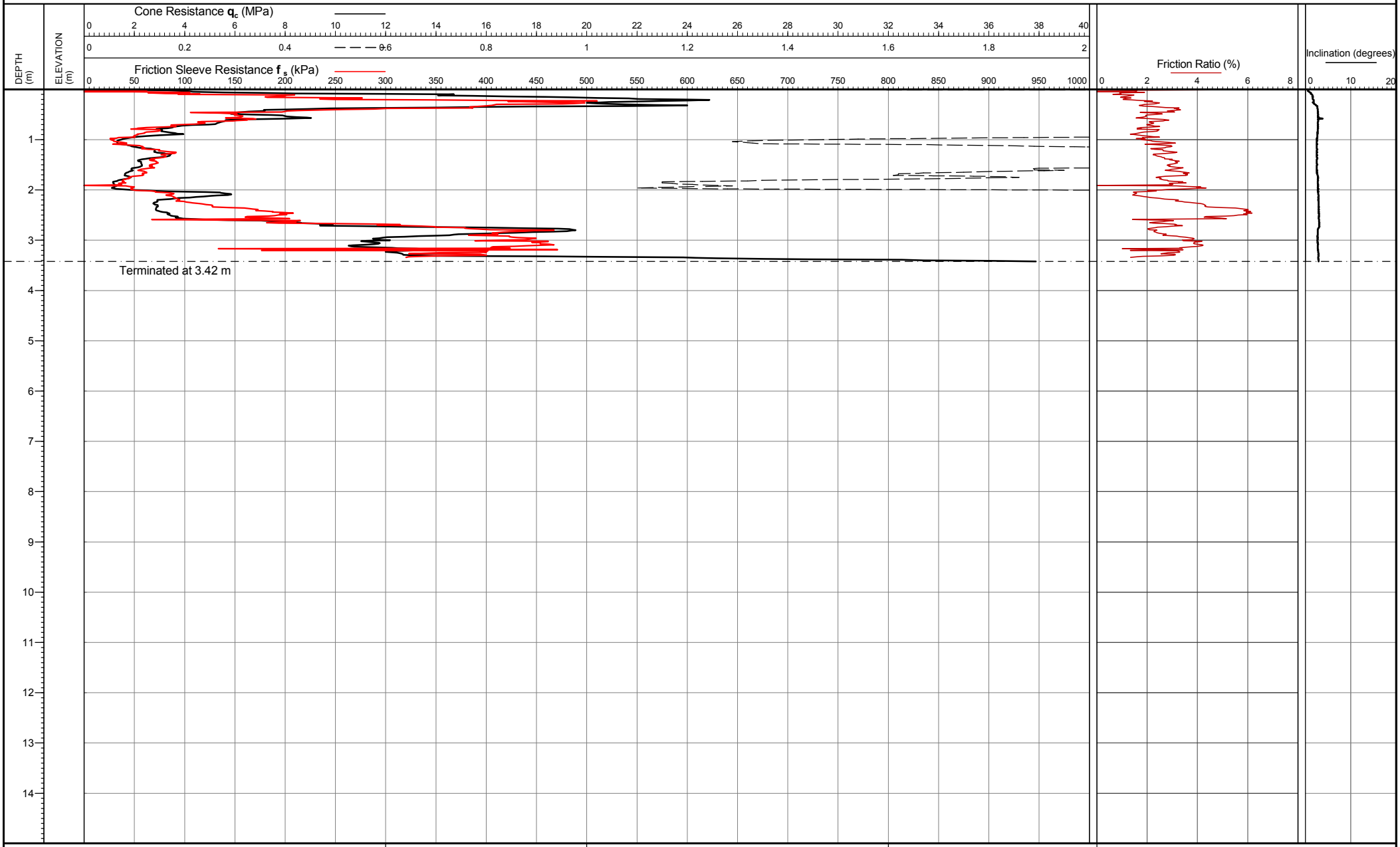
Checked by: Chris Player

TEST ID: PB110

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 13:57:55

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

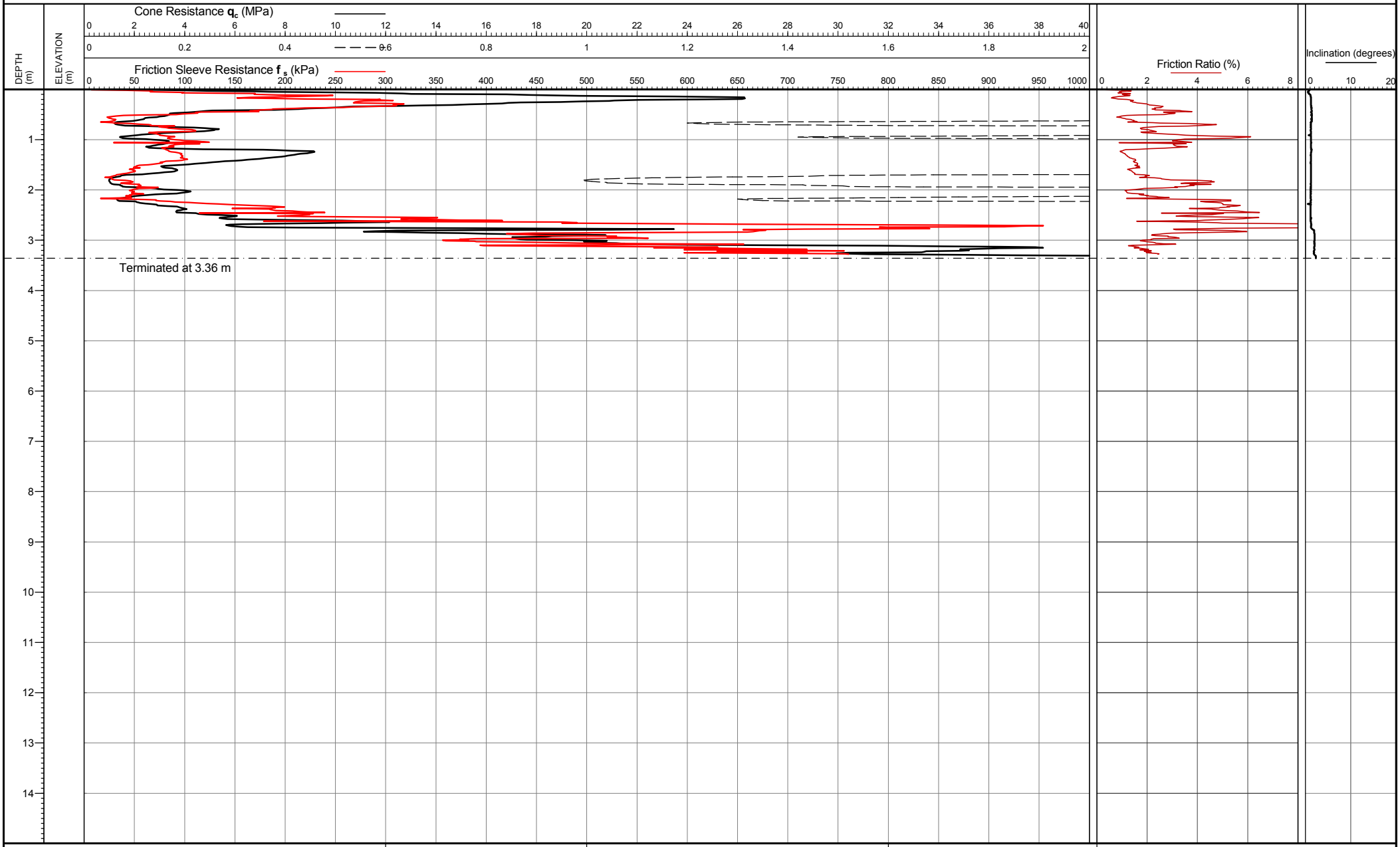
Checked by: Chris Player

TEST ID: PB111

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 13:12:28

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

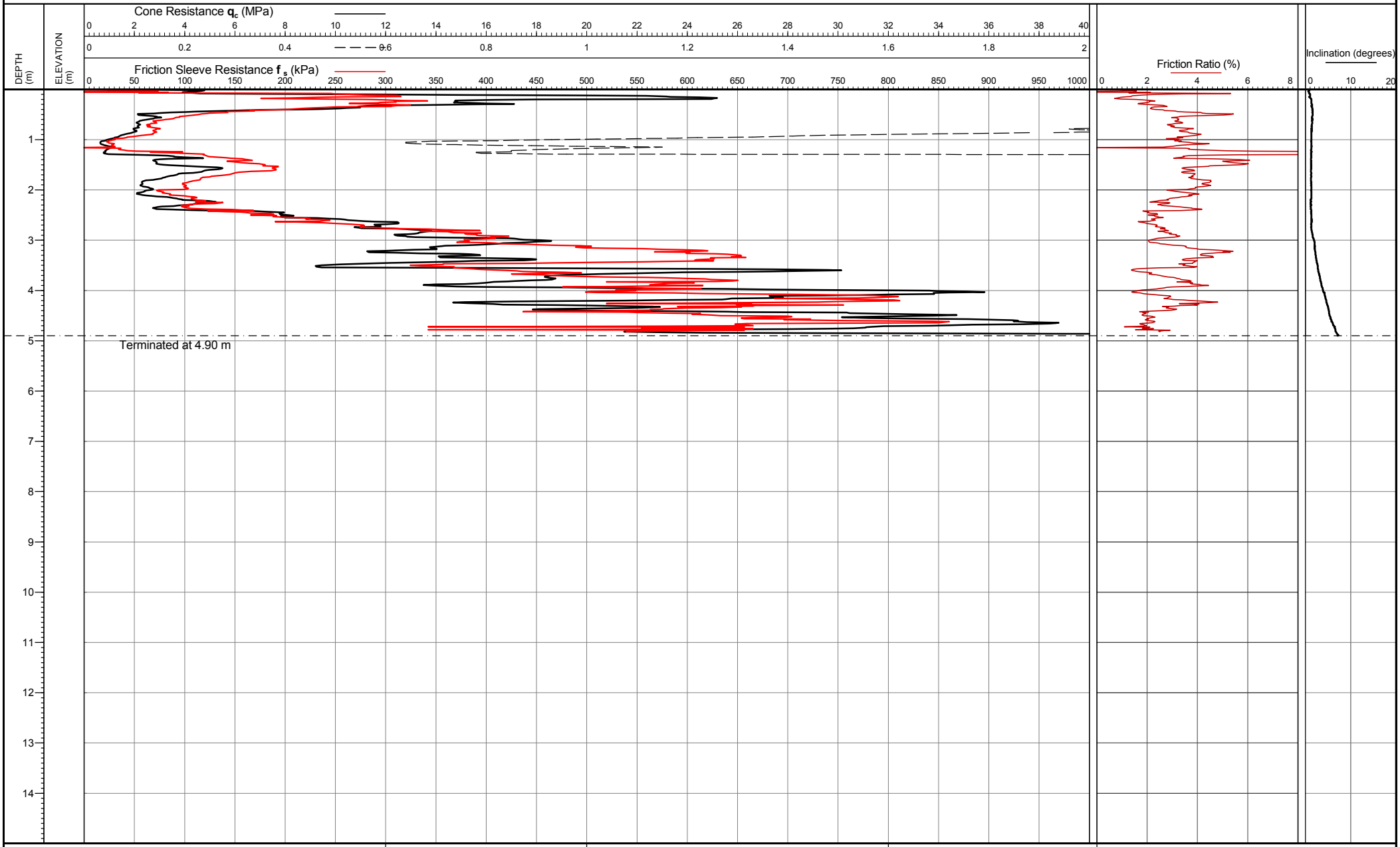
Checked by: Chris Player

TEST ID: PB112

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 10:09:24

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

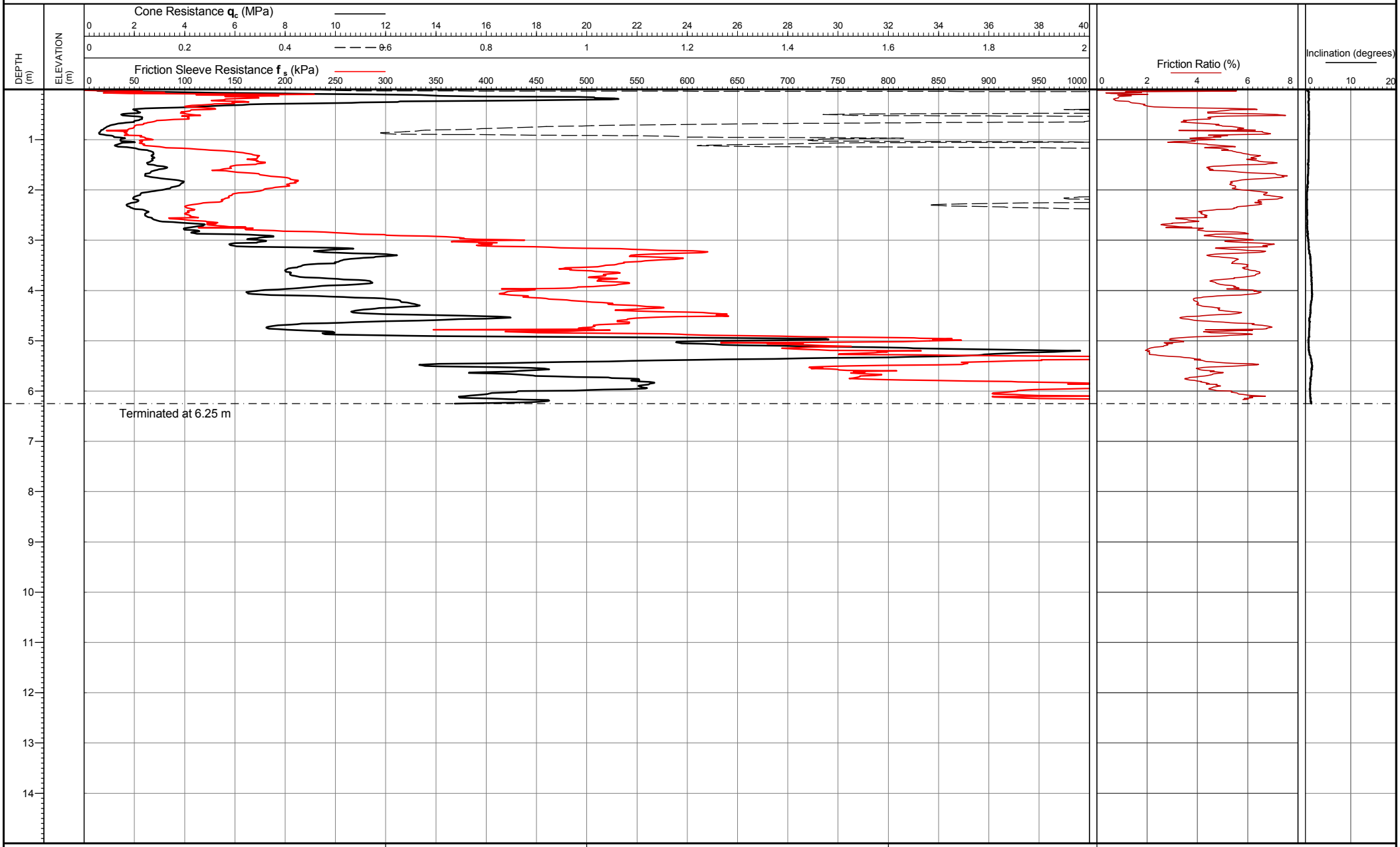
Checked by: Chris Player

TEST ID: PB113

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 15:38:41

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Total cone load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

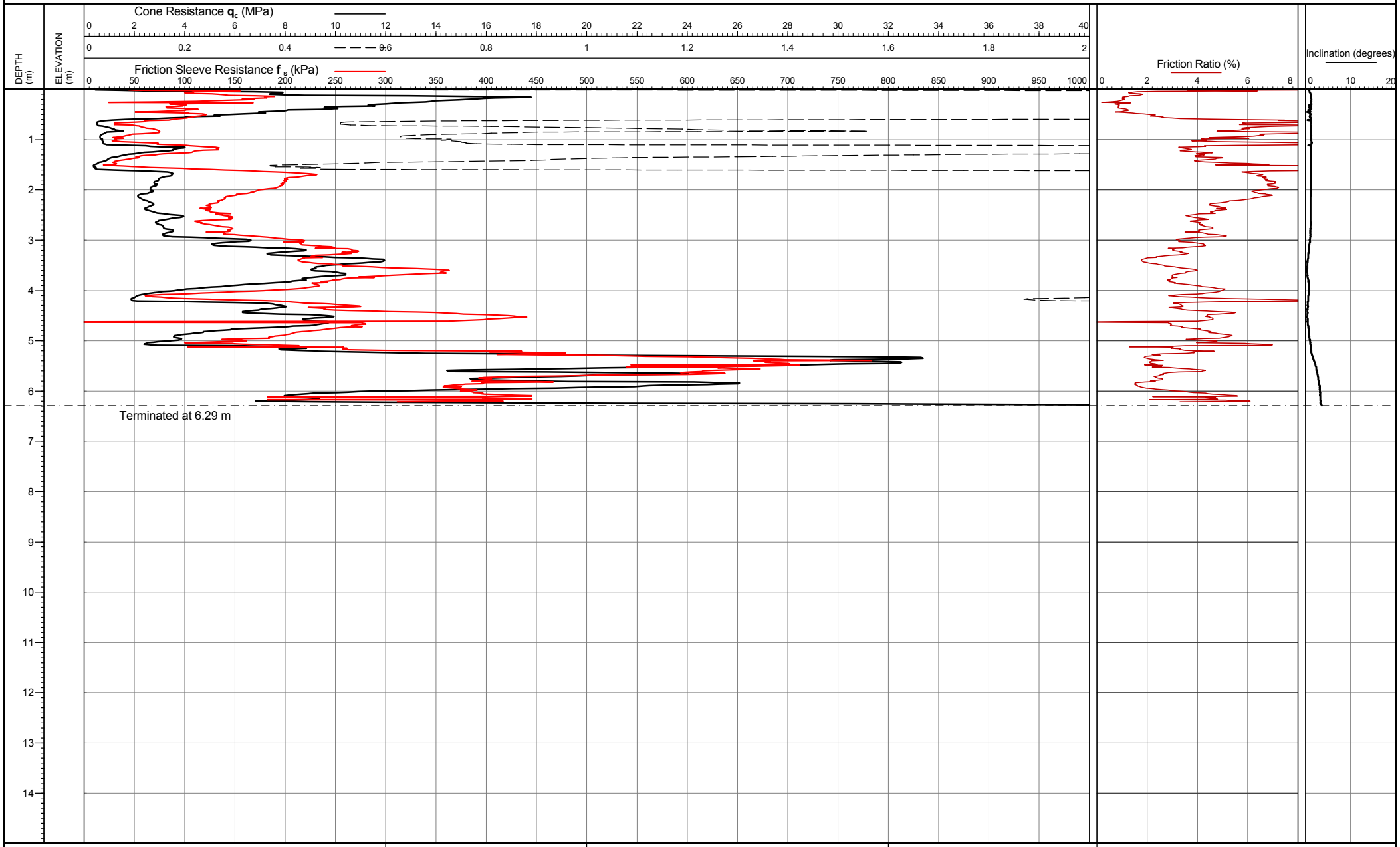
Checked by: Chris Player

TEST ID: PB201

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 08:44:44

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

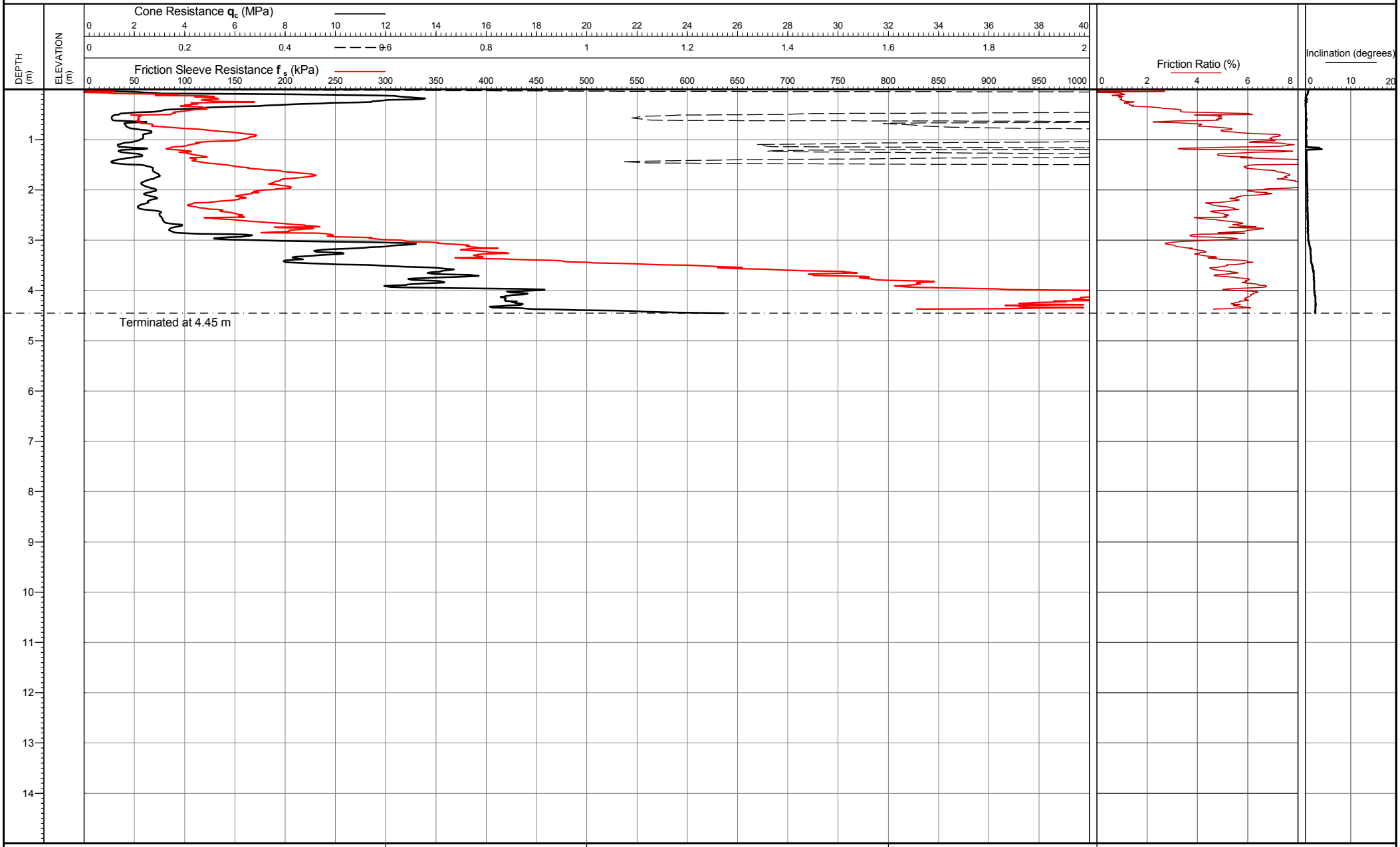
Checked by: Chris Player

TEST ID: PB202

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 08:24:36

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Total cone load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

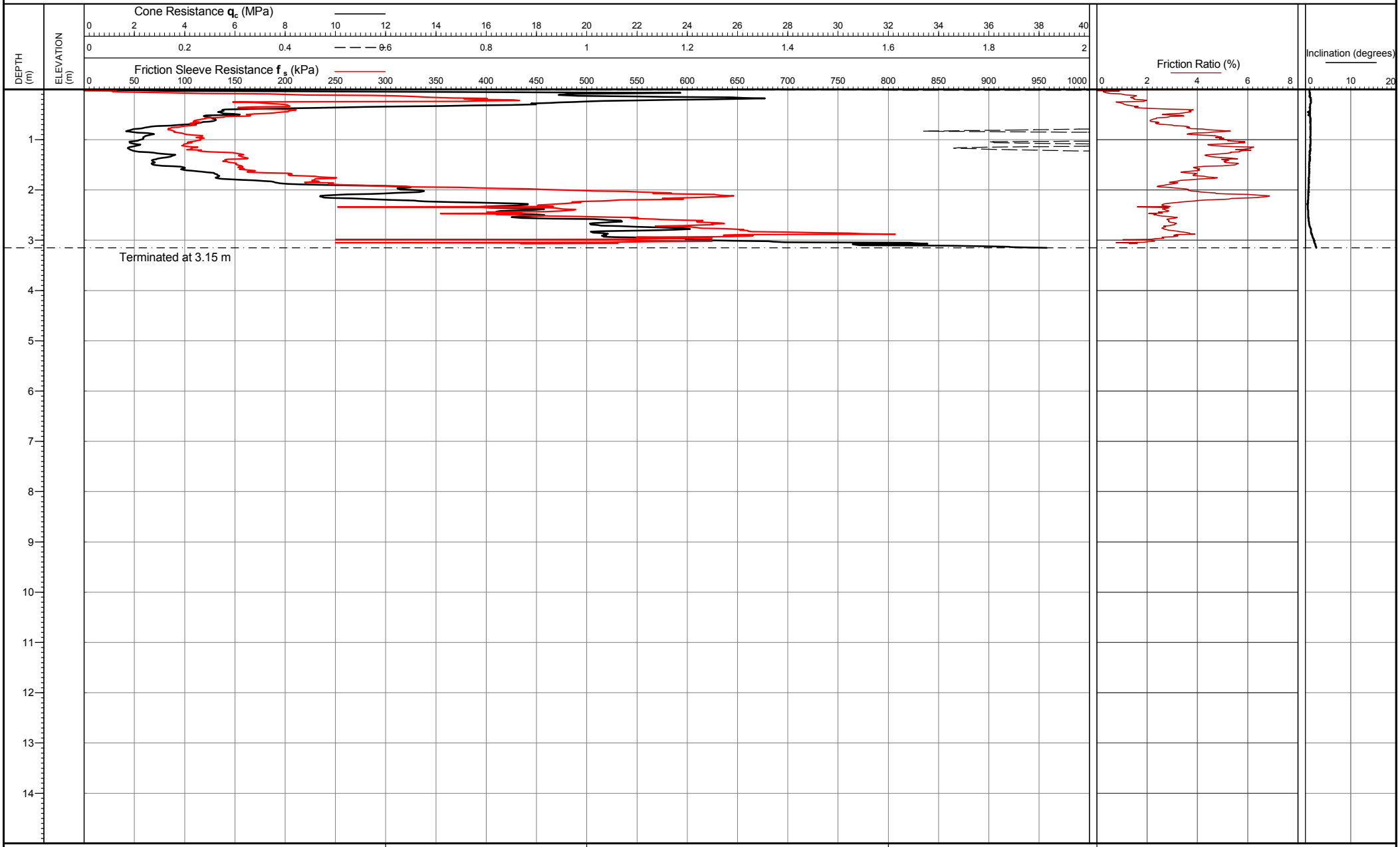
Checked by: Chris Player

TEST ID: PB203

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 09/03/2016 15:54:14

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

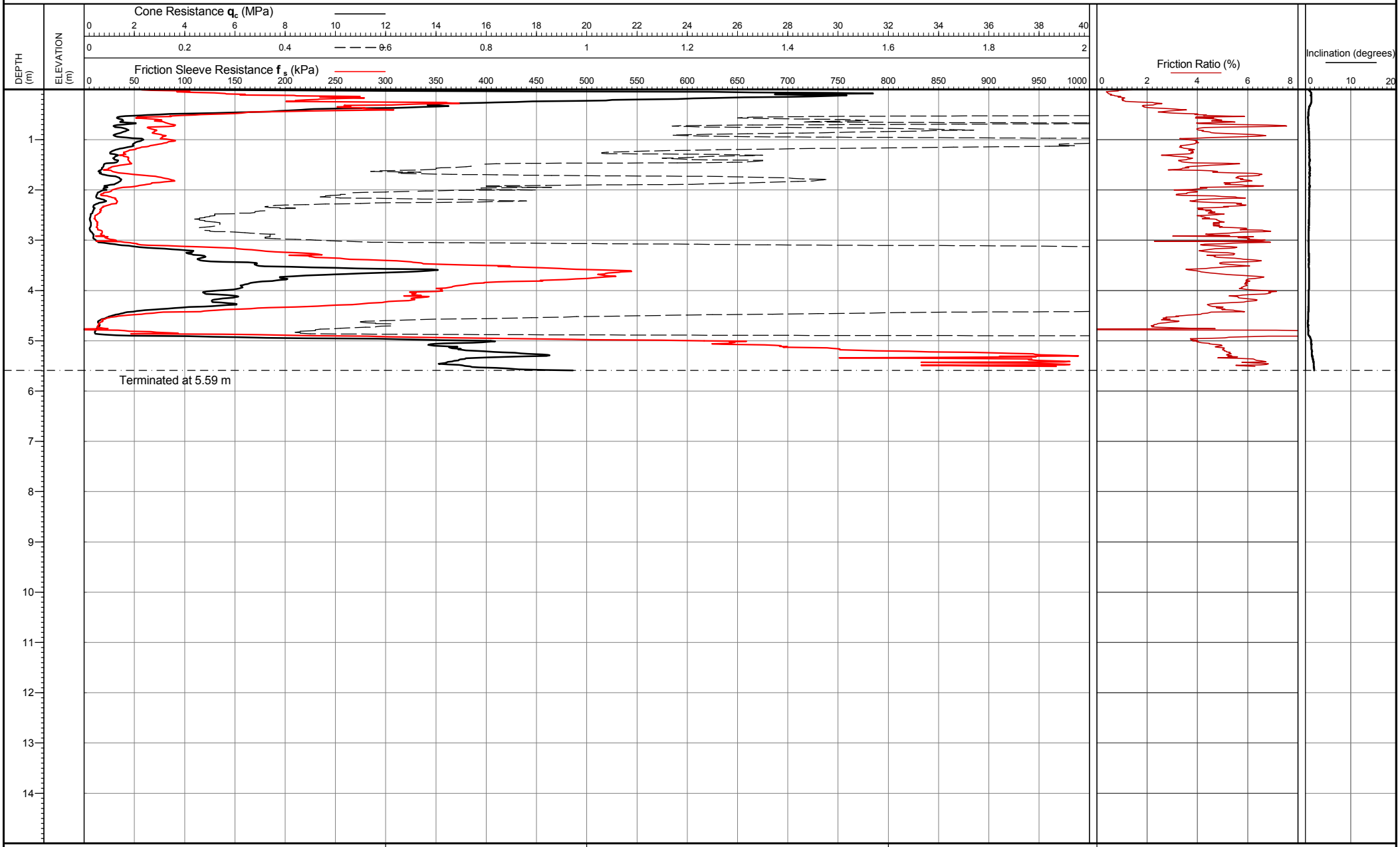
Checked by: Chris Player

TEST ID: PB204

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 09/03/2016 16:10:46

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Total cone load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

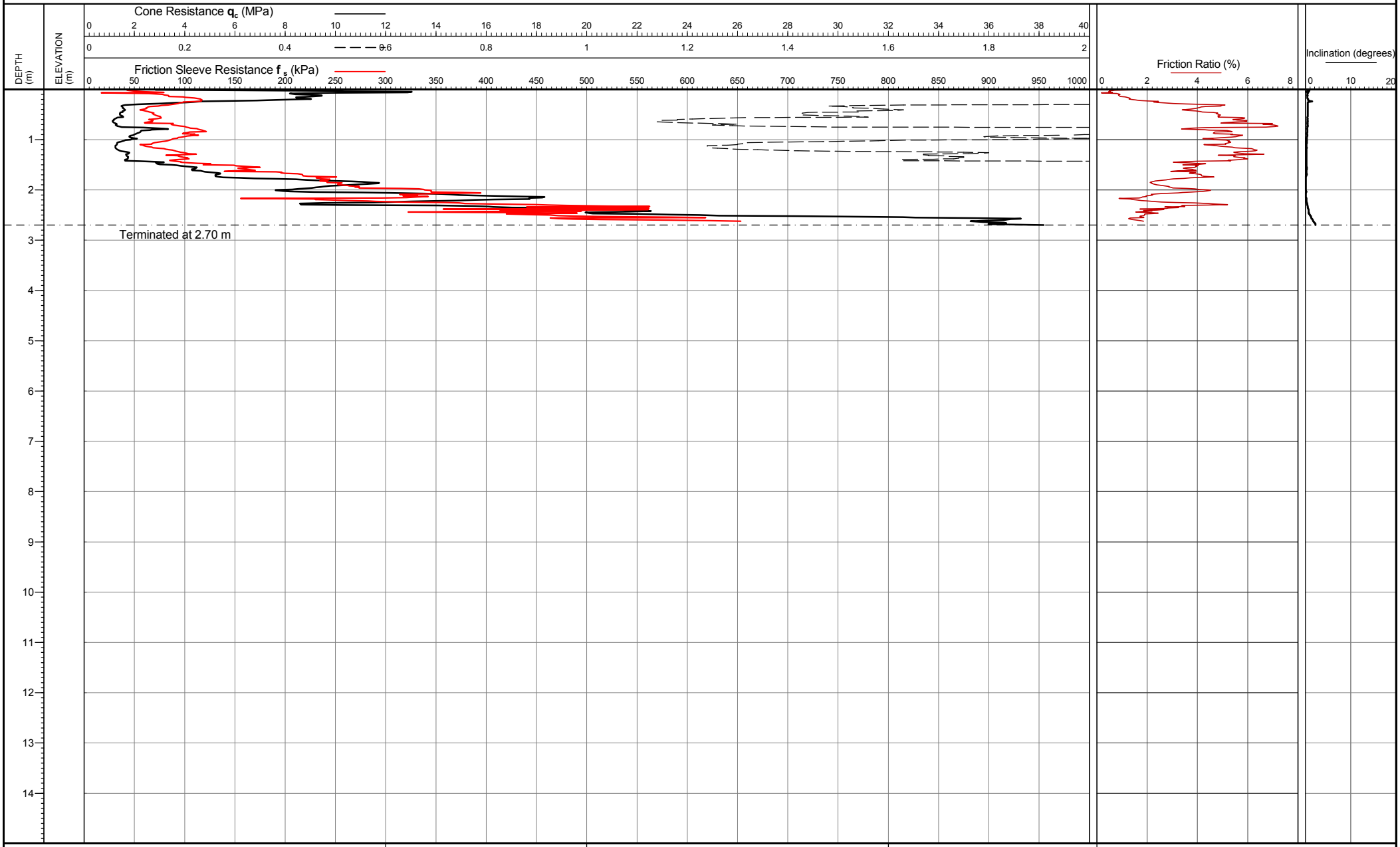
Checked by: Chris Player

TEST ID: PB205

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 09:03:08

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

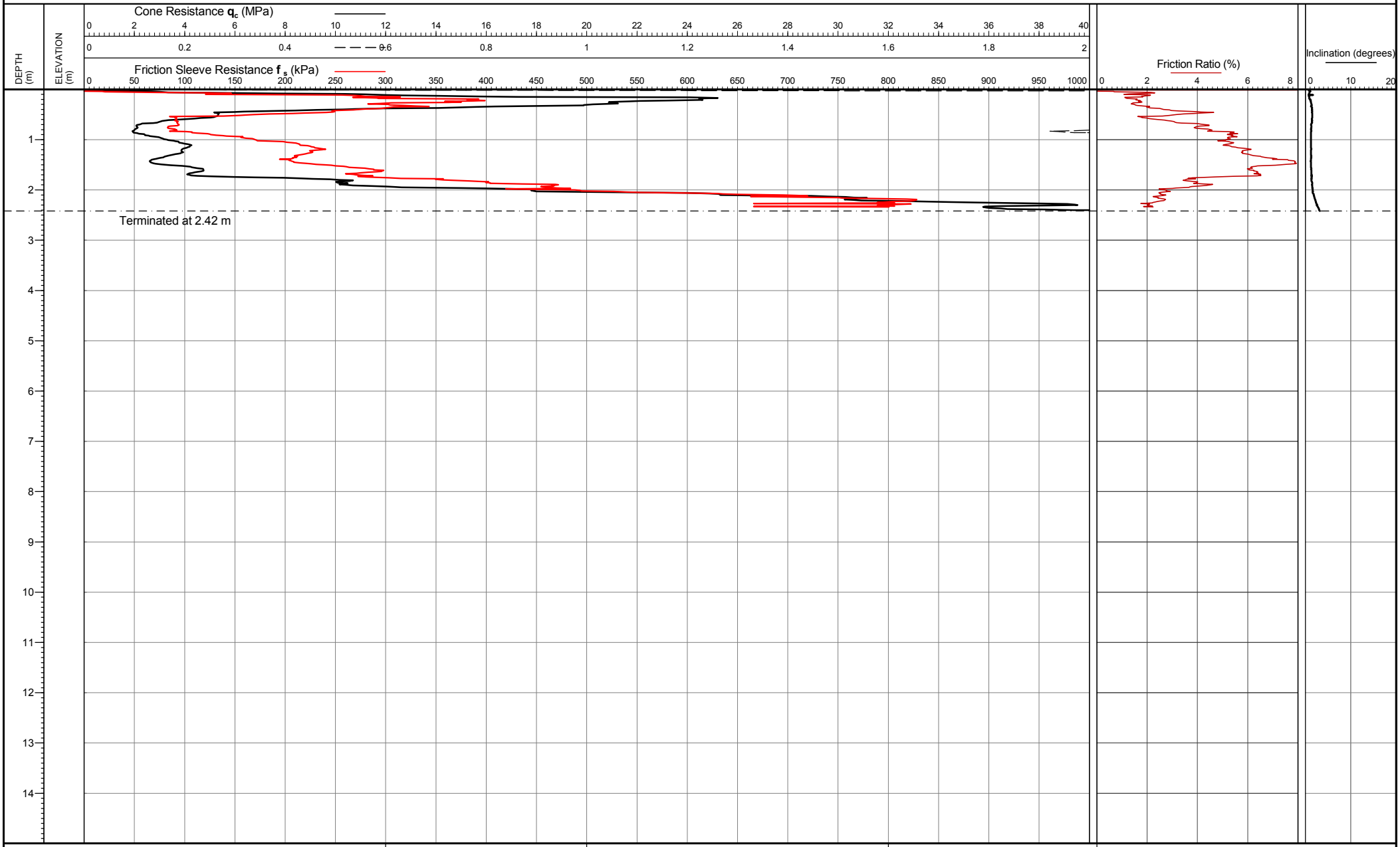
Checked by: Chris Player

TEST ID: PB206

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 09:39:49

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

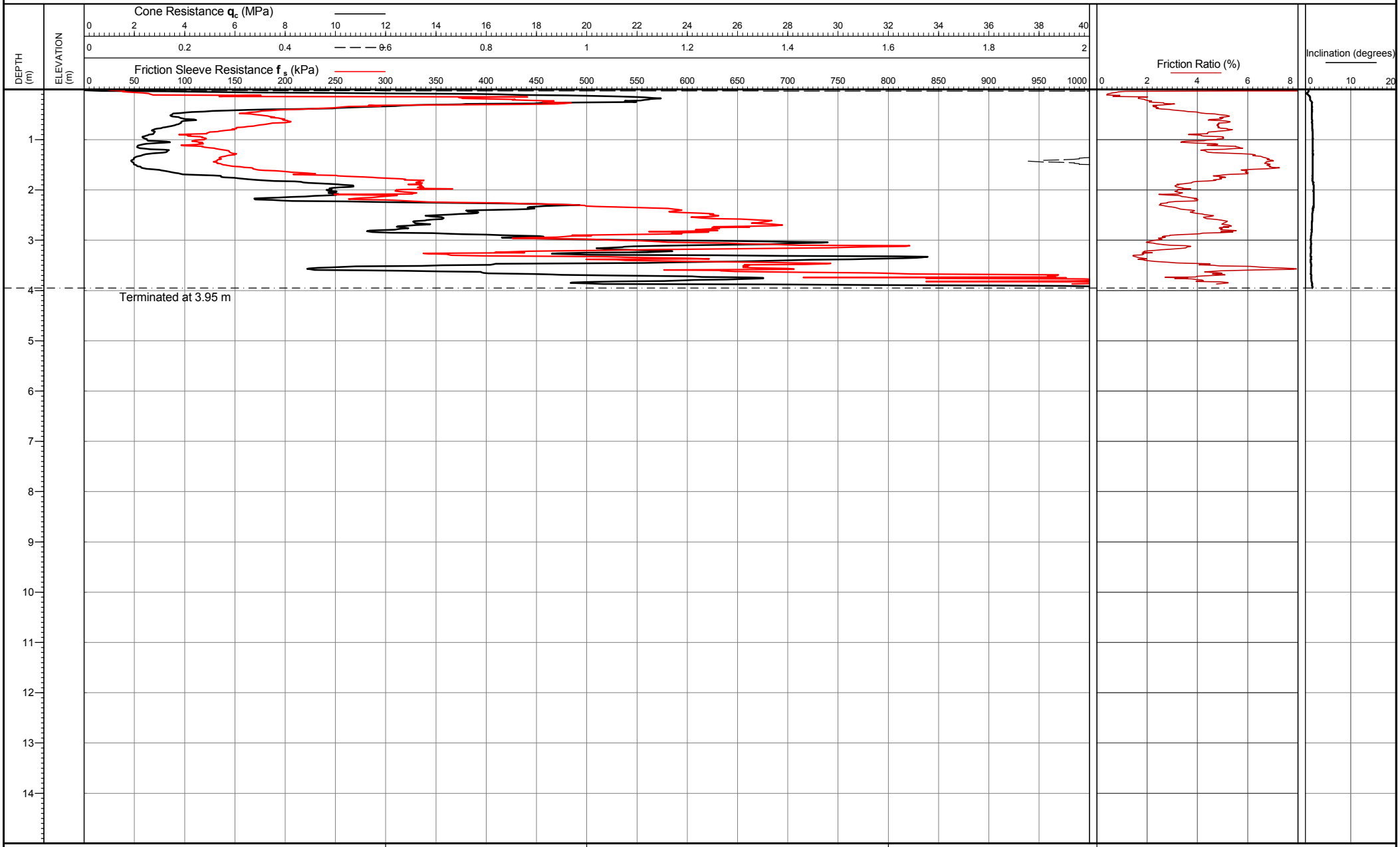
Checked by: Chris Player

TEST ID: PB207

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



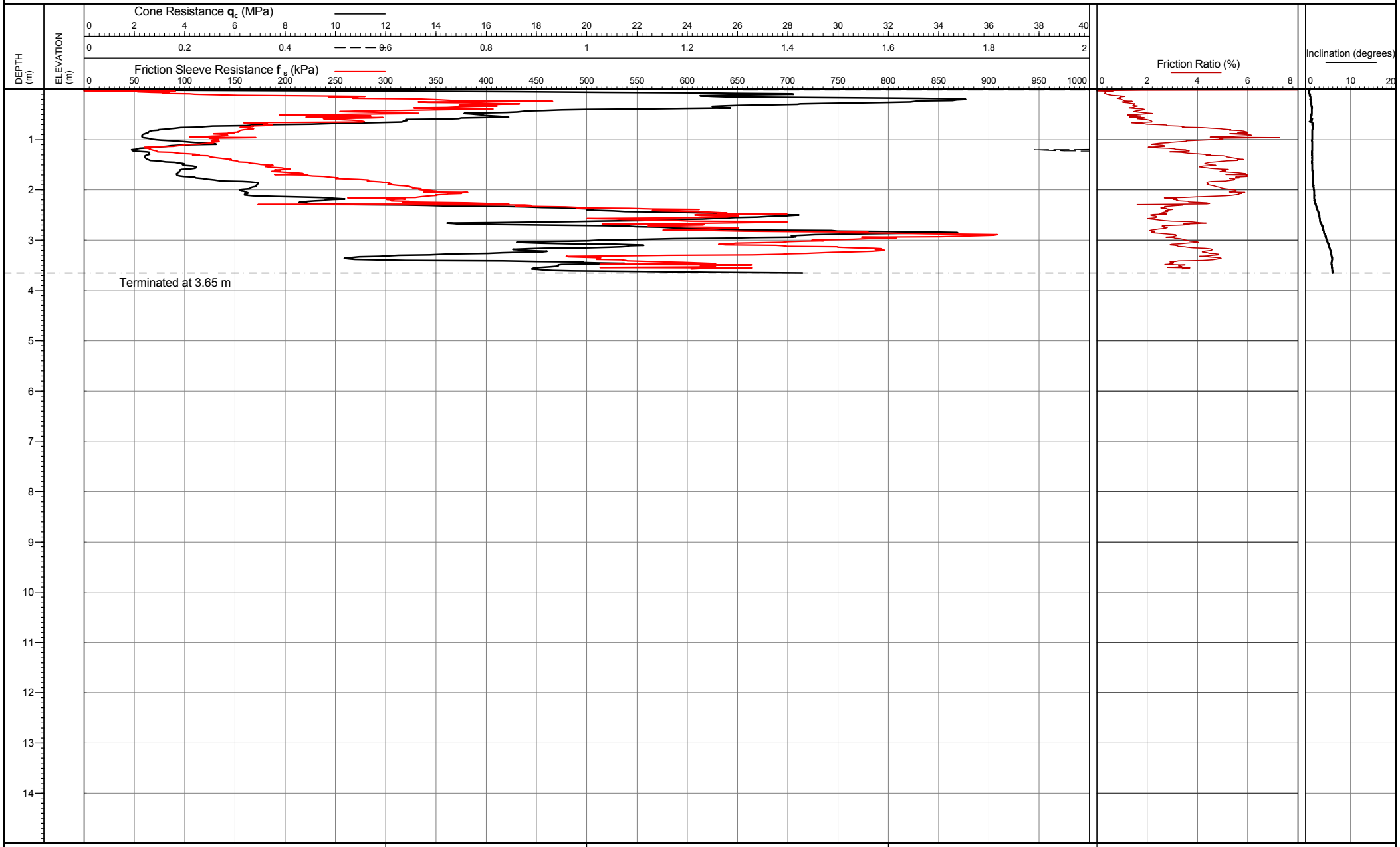
Cone area (mm2):1500 Cone ID: S15-CFIP.1333 Operator: Craig Drummond Rig Used: UK3 Date of test: 10/03/2016 09:18:12	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: Refusal criteria: Total cone load	Date of plot: 10-03-16 Checked by: Chris Player	Lankelma Project Ref: P-106347-1

TEST ID: PB208

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 10:03:15

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

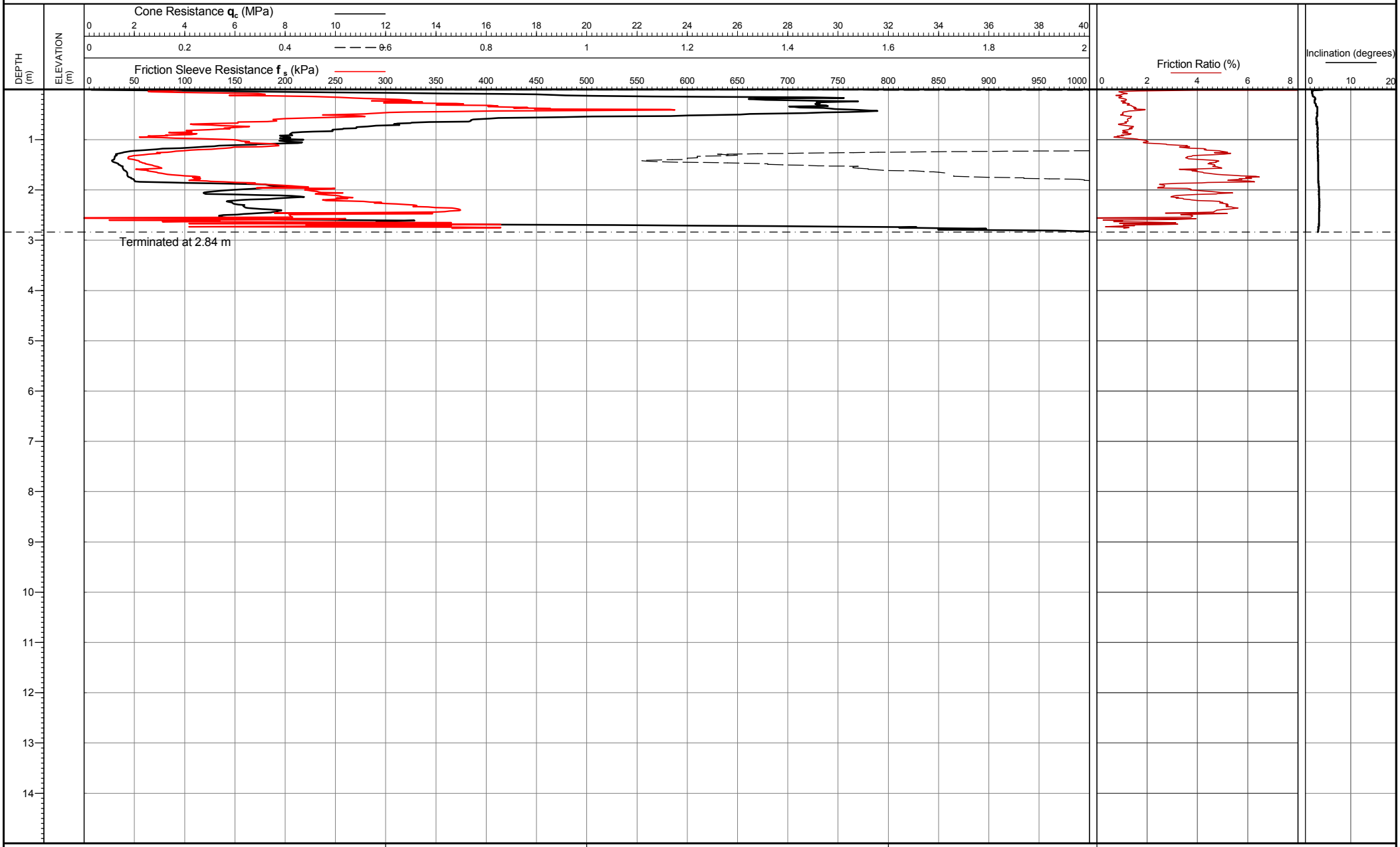
Checked by: Chris Player

TEST ID: PB209

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 10:51:43

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

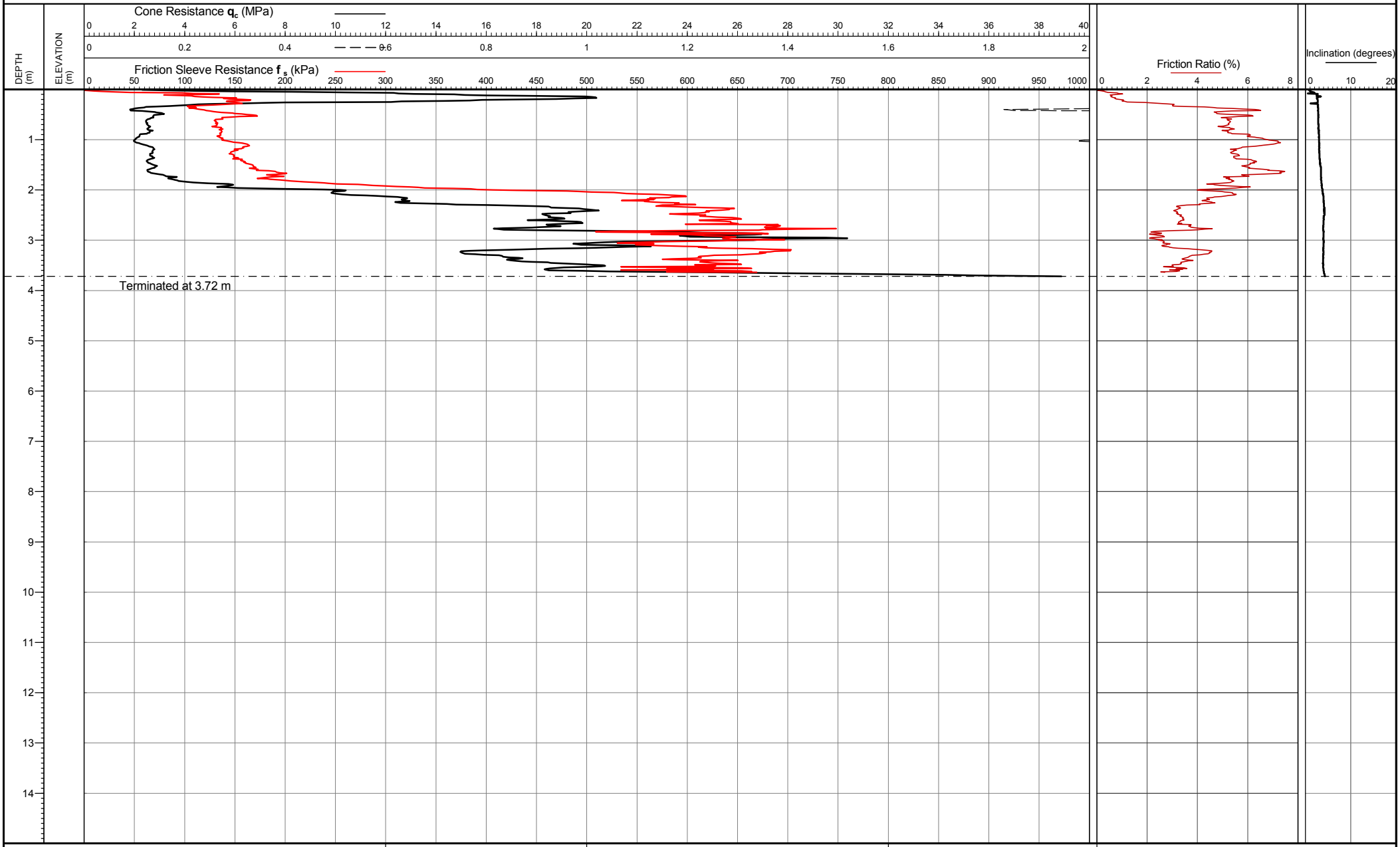
Checked by: Chris Player

TEST ID: PB210

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 11:15:23

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

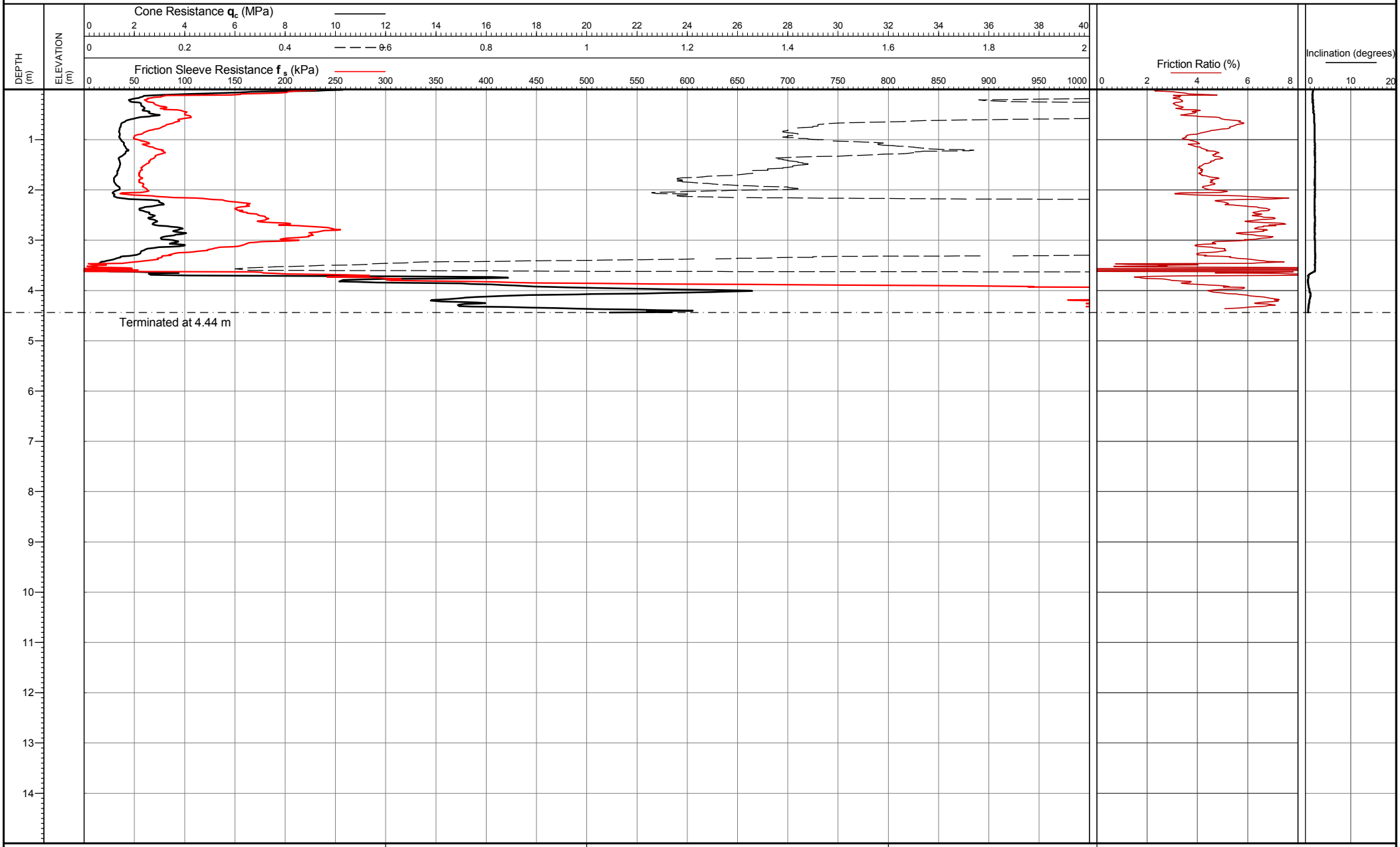
Checked by: Chris Player

TEST ID: PB211

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 12:52:28

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

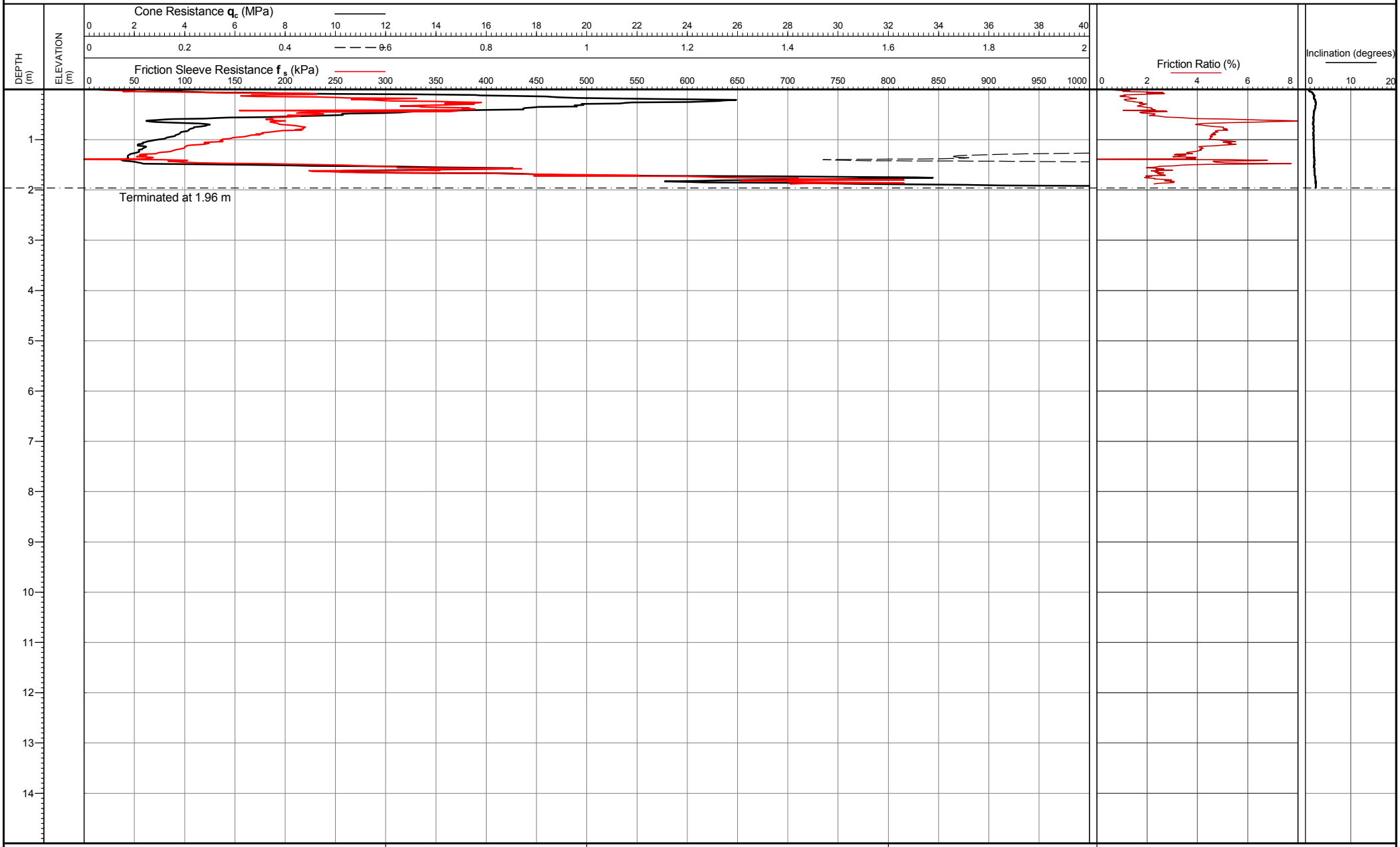
Checked by: Chris Player

TEST ID: PB212

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 14:18:12

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

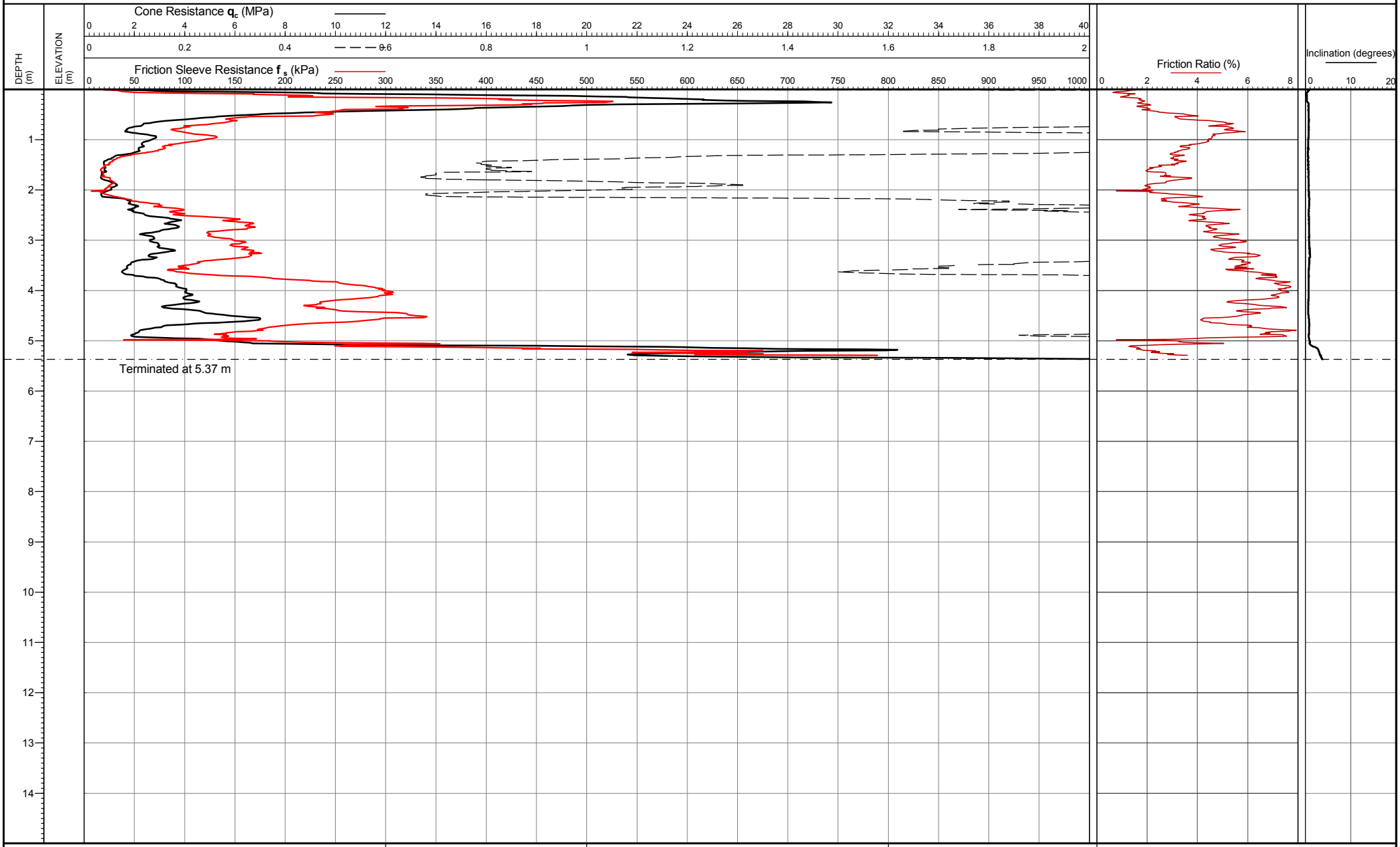
Checked by: Chris Player

TEST ID: PB213

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



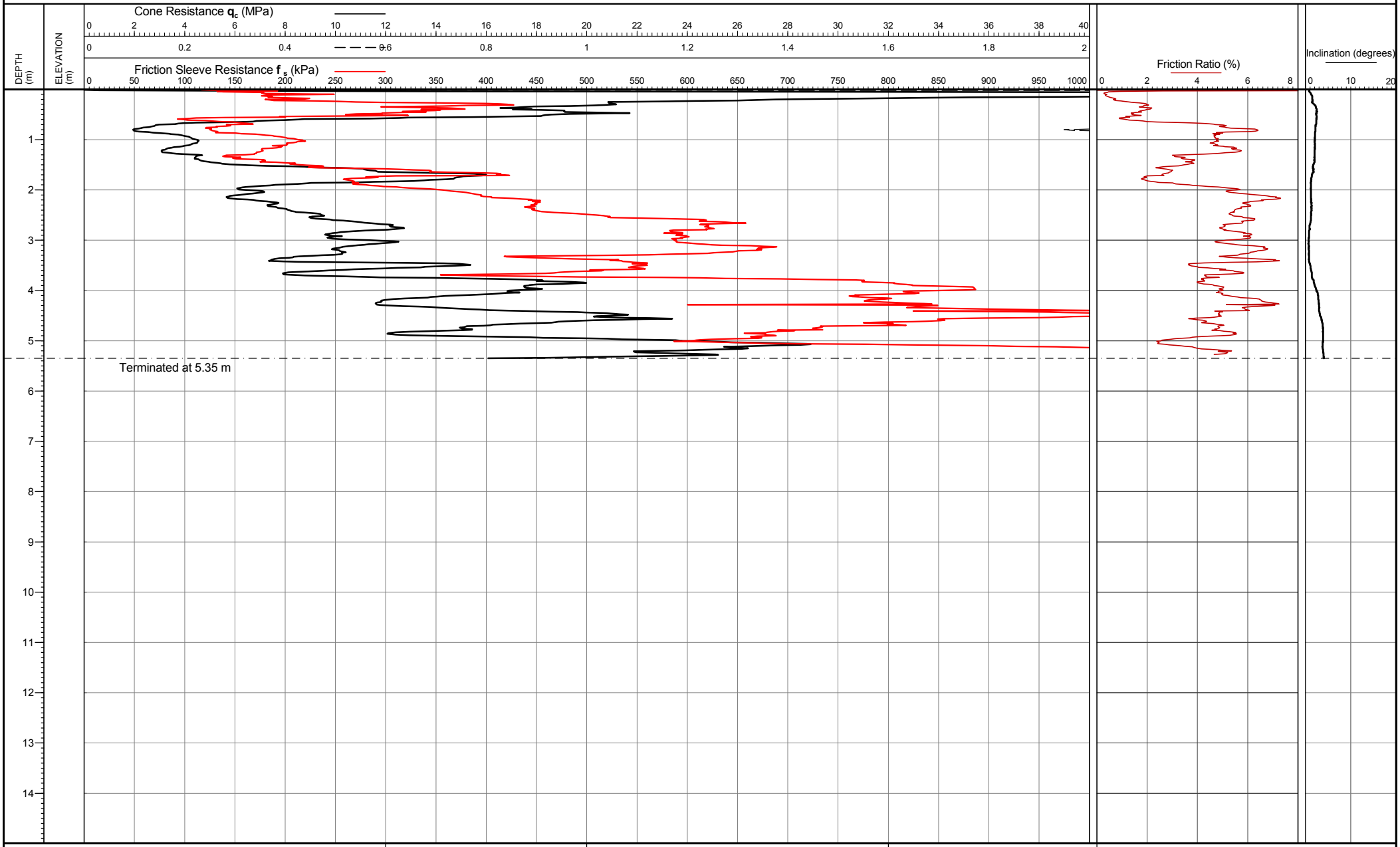
Cone area (mm2):1500 Cone ID: S15-CFIP.1333 Operator: Walter Geddes Rig Used: UK3 Date of test: 10/03/2016 13:51:57	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: Refusal criteria: Tip load	Date of plot: 10-03-16 Checked by: Chris Player	Lankelma Project Ref: P-106347-1

TEST ID: PB214

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



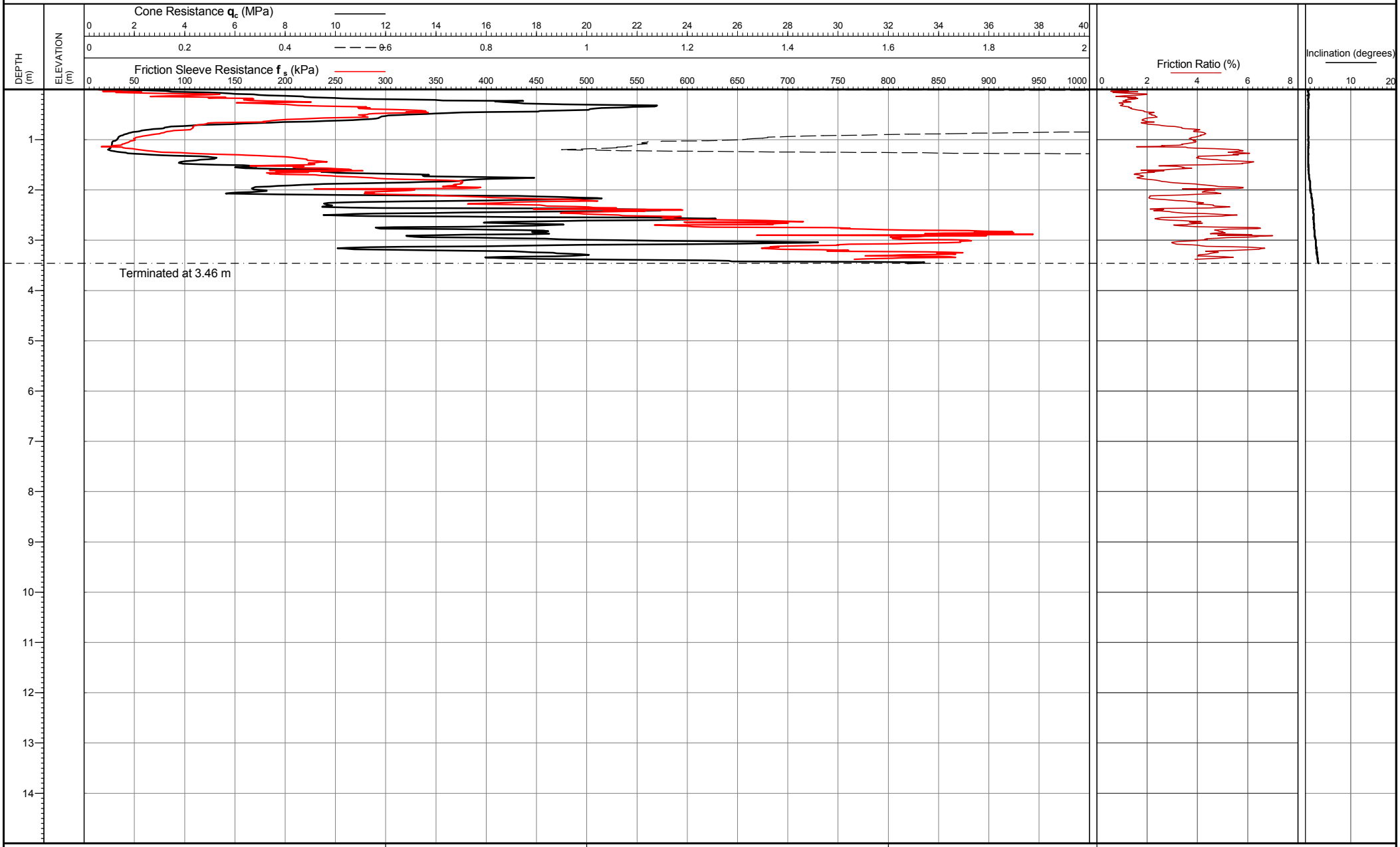
Cone area (mm2):1500 Cone ID: S15-CFIP.1333 Operator: Craig Drummond Rig Used: UK3 Date of test: 10/03/2016 14:33:06	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: Refusal criteria: Sleeve load	Date of plot: 10-03-16 Checked by: Chris Player	Lankelma Project Ref: P-106347-1

TEST ID: PB215

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 15:00:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

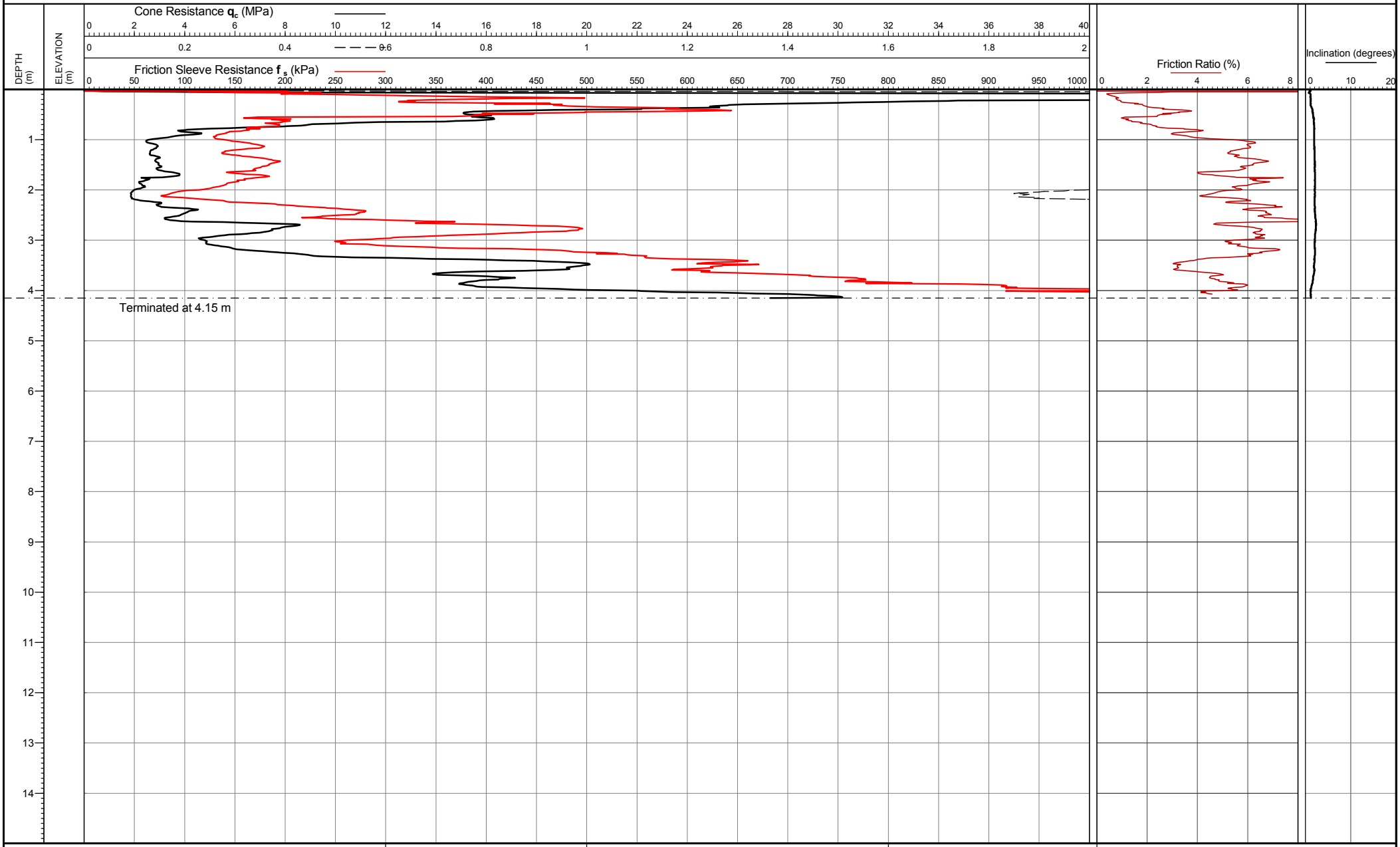
Checked by: Chris Player

TEST ID: PB216

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



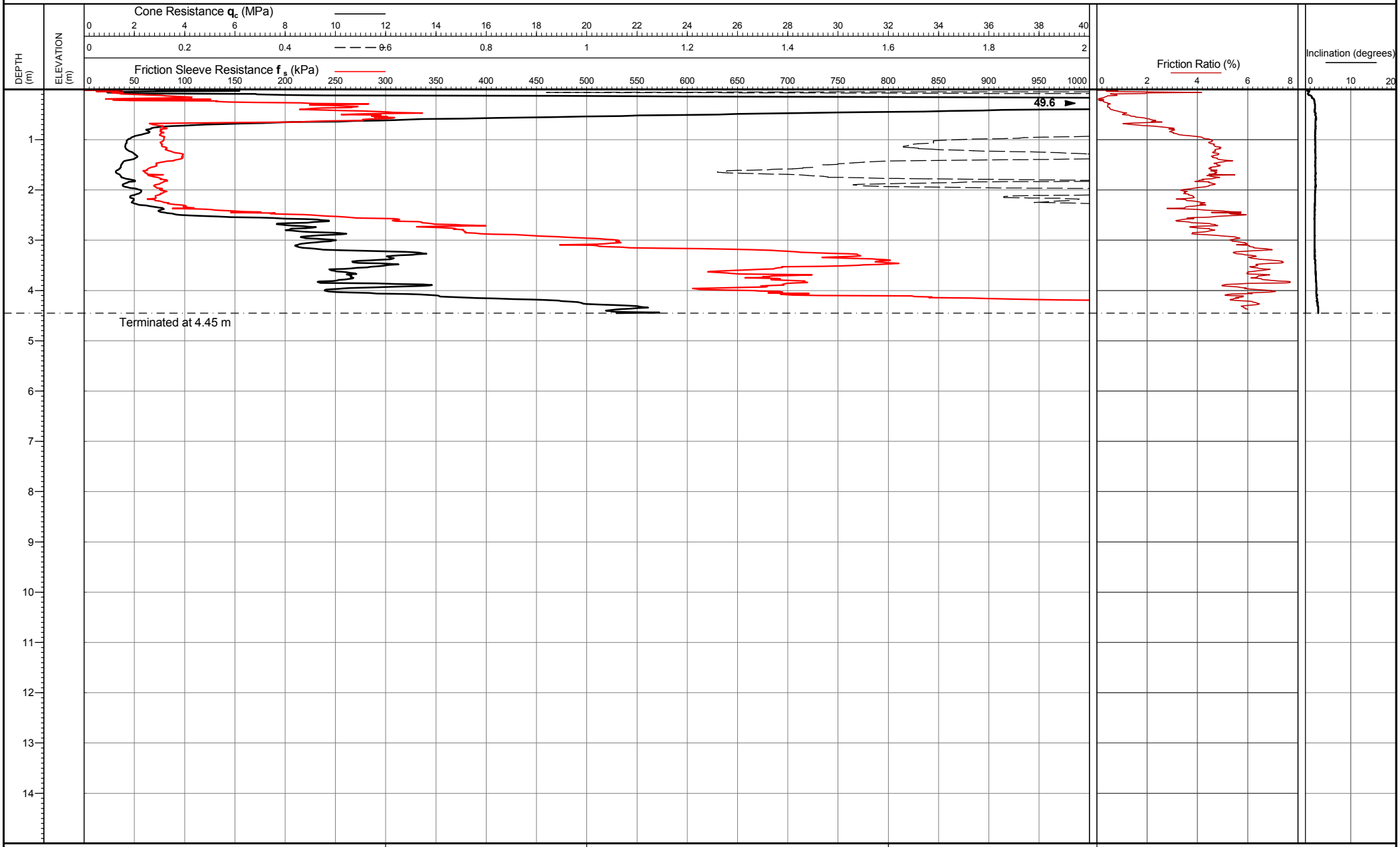
Cone area (mm2):1500 Cone ID: S15-CFIP.1333 Operator: Craig Drummond Rig Used: UK3 Date of test: 10/03/2016 15:28:53	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: Refusal criteria: Total cone load	Date of plot: 10-03-16 Checked by: Chris Player	Lankelma Project Ref: P-106347-1

TEST ID: PB217

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 10:30:39

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Sleeve load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

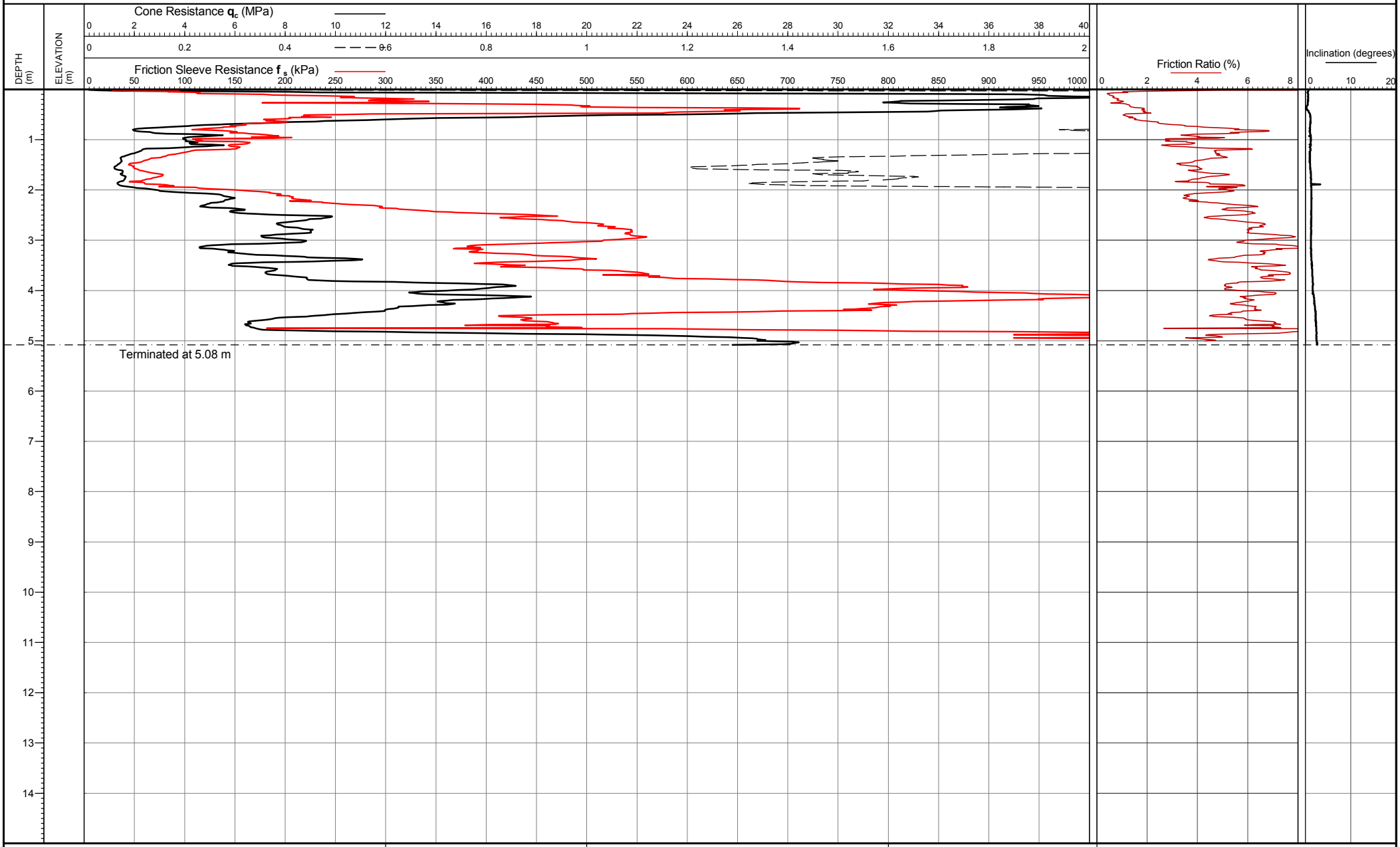
Checked by: Chris Player

TEST ID: PB218

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 12:17:15

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Total cone load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

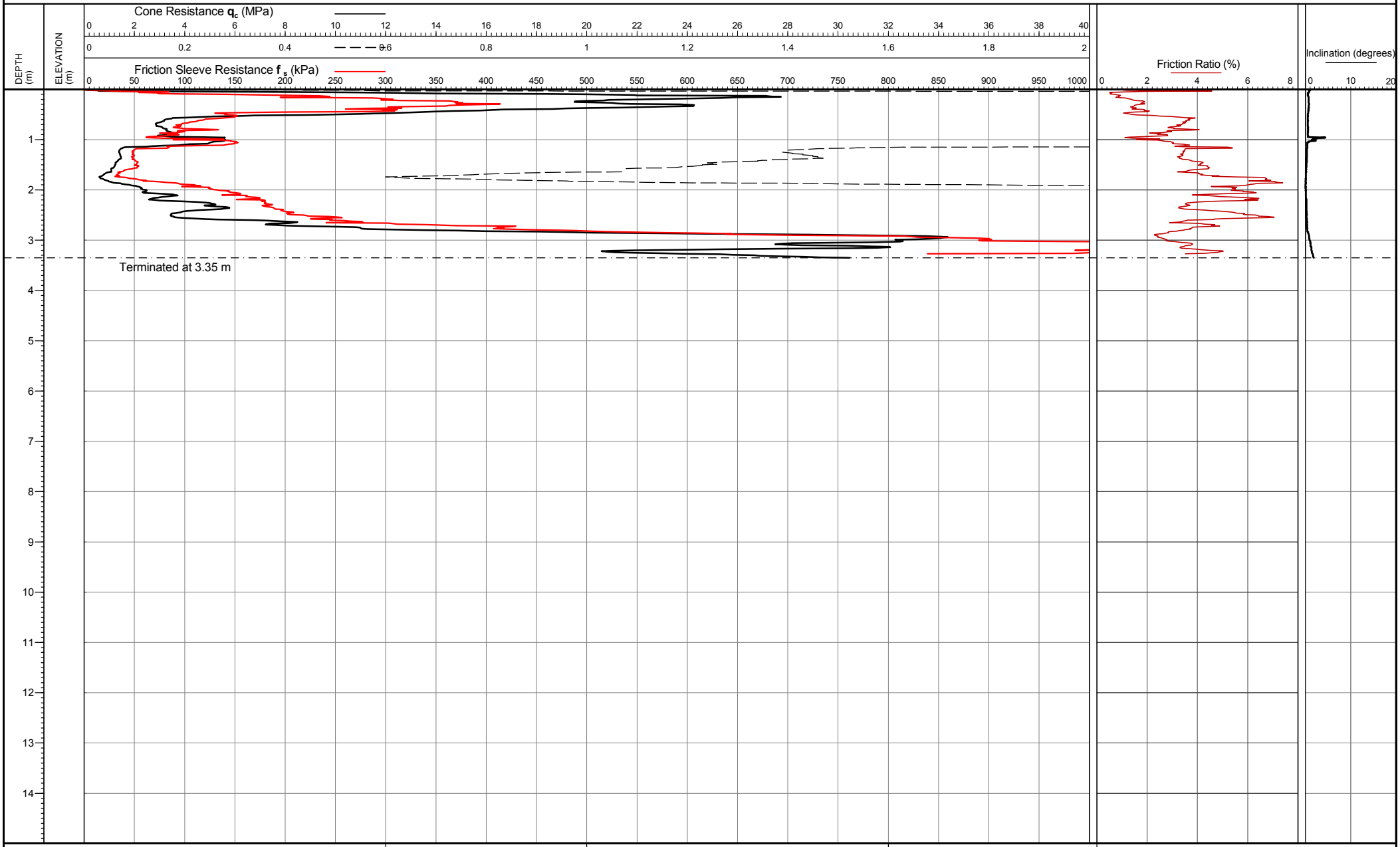
Checked by: Chris Player

TEST ID: PB219

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 12:35:41

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

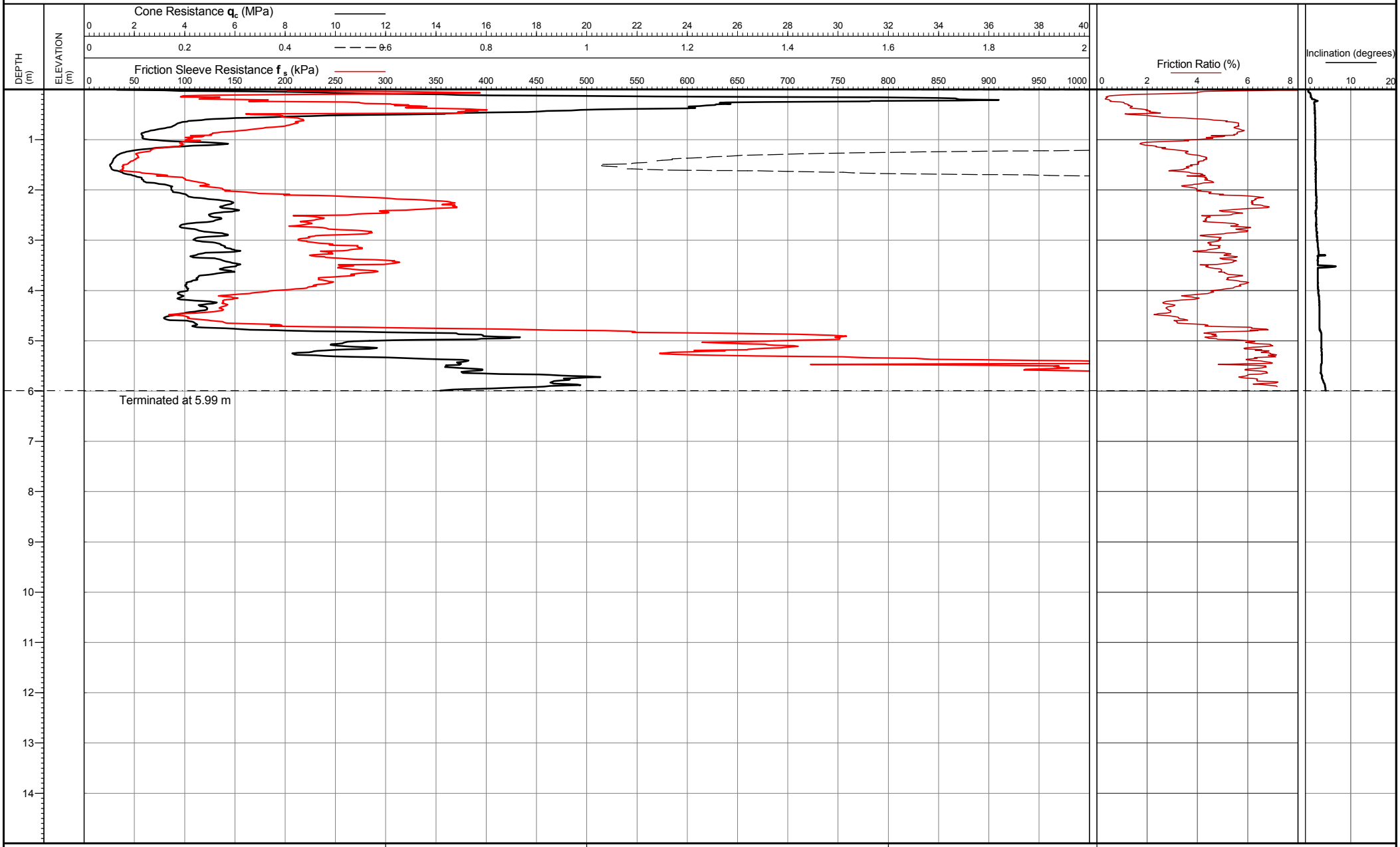
Checked by: Chris Player

TEST ID: PB220

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



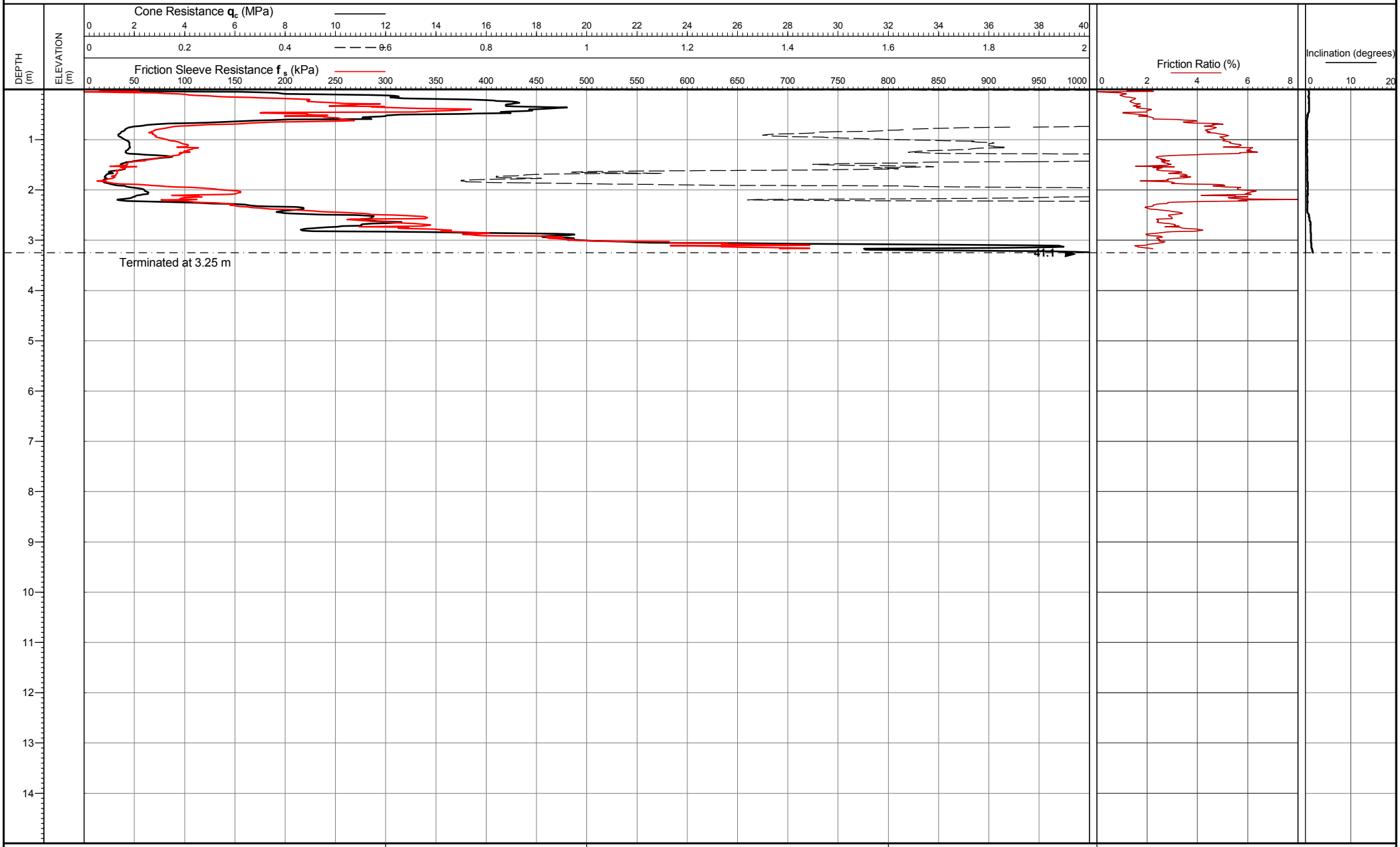
Cone area (mm2):1500 Cone ID: S15-CFIP.1333 Operator: Walter Geddes Rig Used: UK3 Date of test: 10/03/2016 13:18:18	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: Refusal criteria: Total cone load	Date of plot: 10-03-16 Checked by: Chris Player	Lankelma Project Ref: P-106347-1

TEST ID: PB221

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 13:37:14

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Refusal criteria: Tip load

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

Checked by: Chris Player

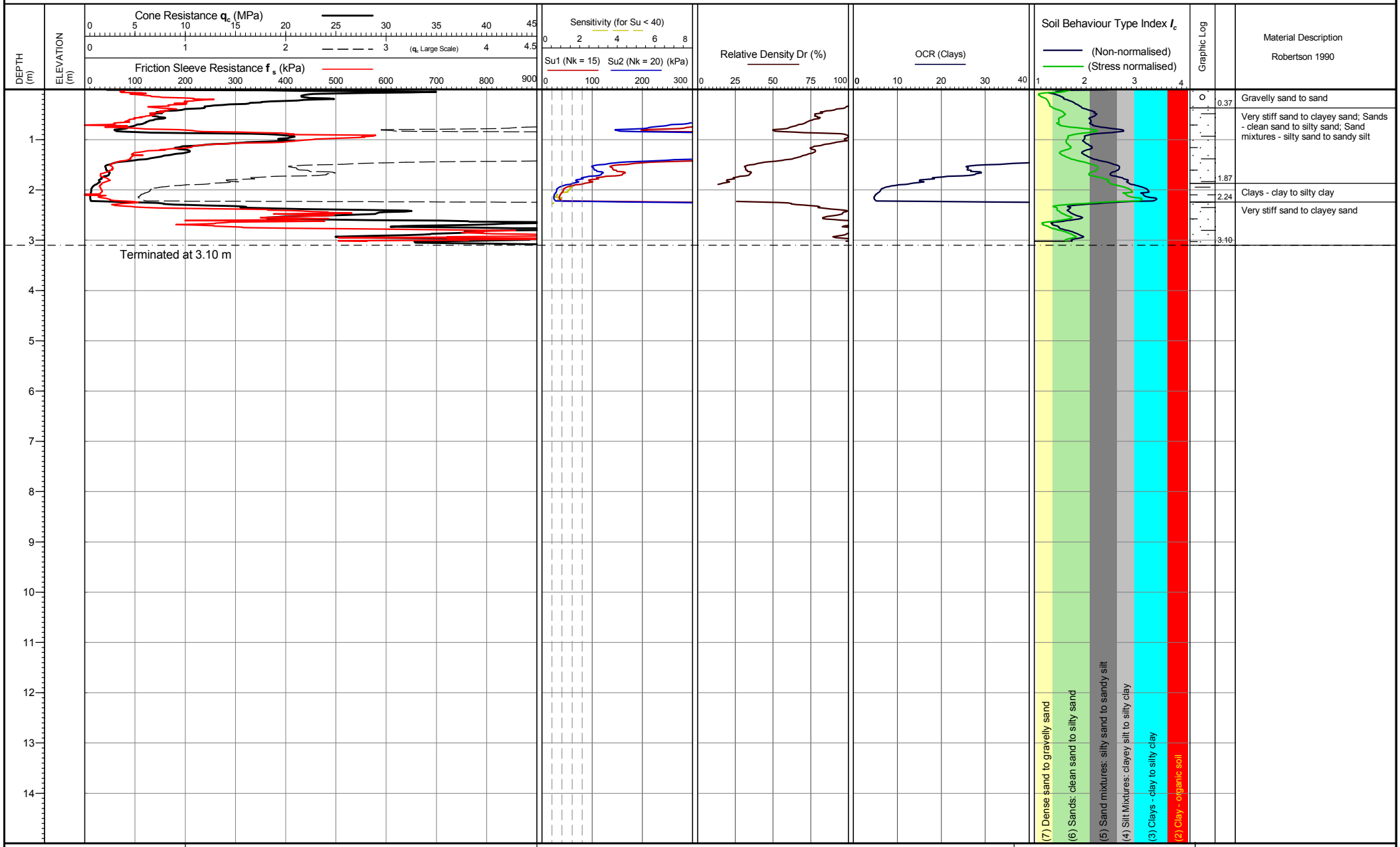
TEST ID: PB222

APPENDIX C STANDARD INTERPRETATION RESULTS

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 09:21:12

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

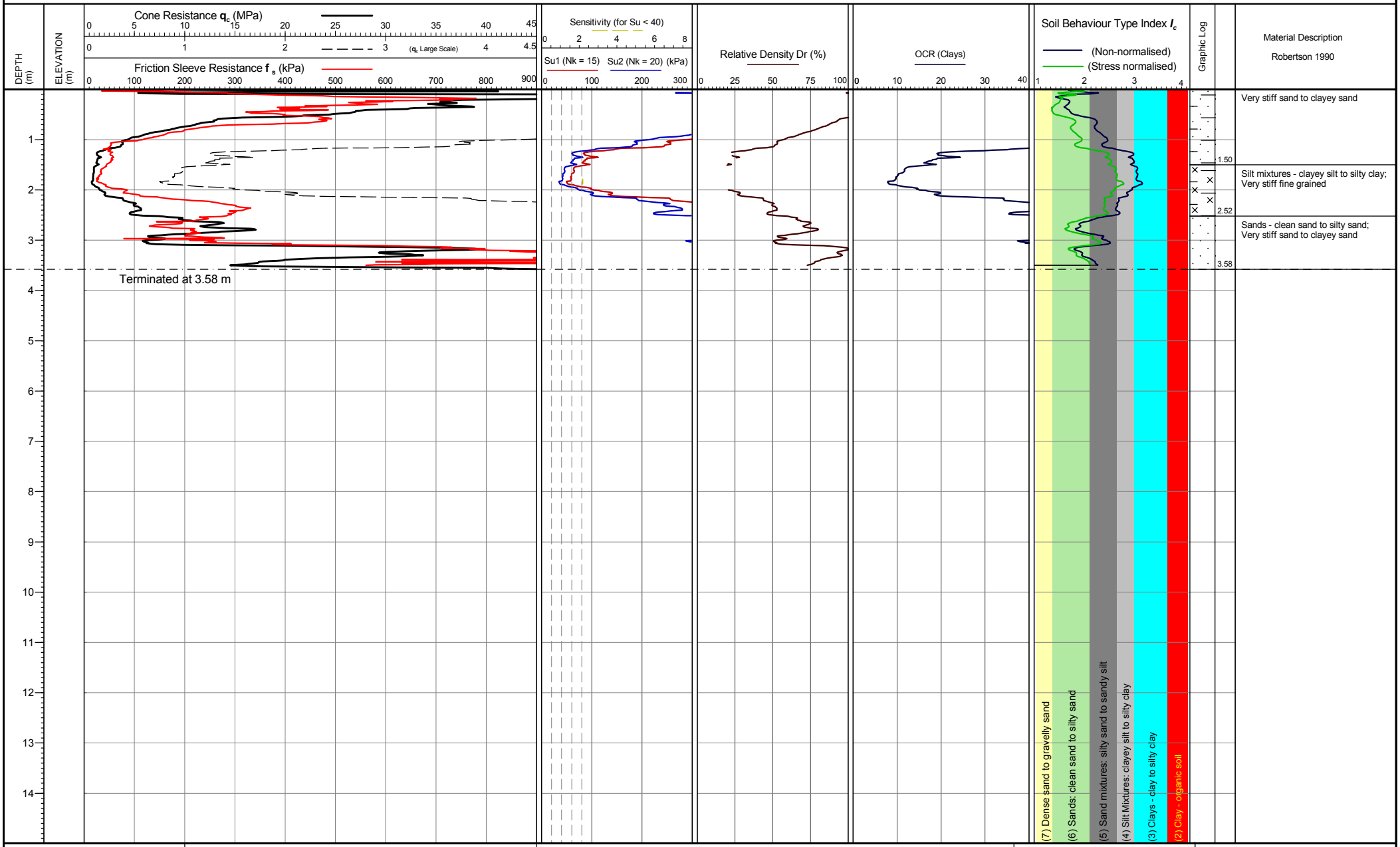
Checked by: Chris Player

TEST ID: PB101

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 09:39:06

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

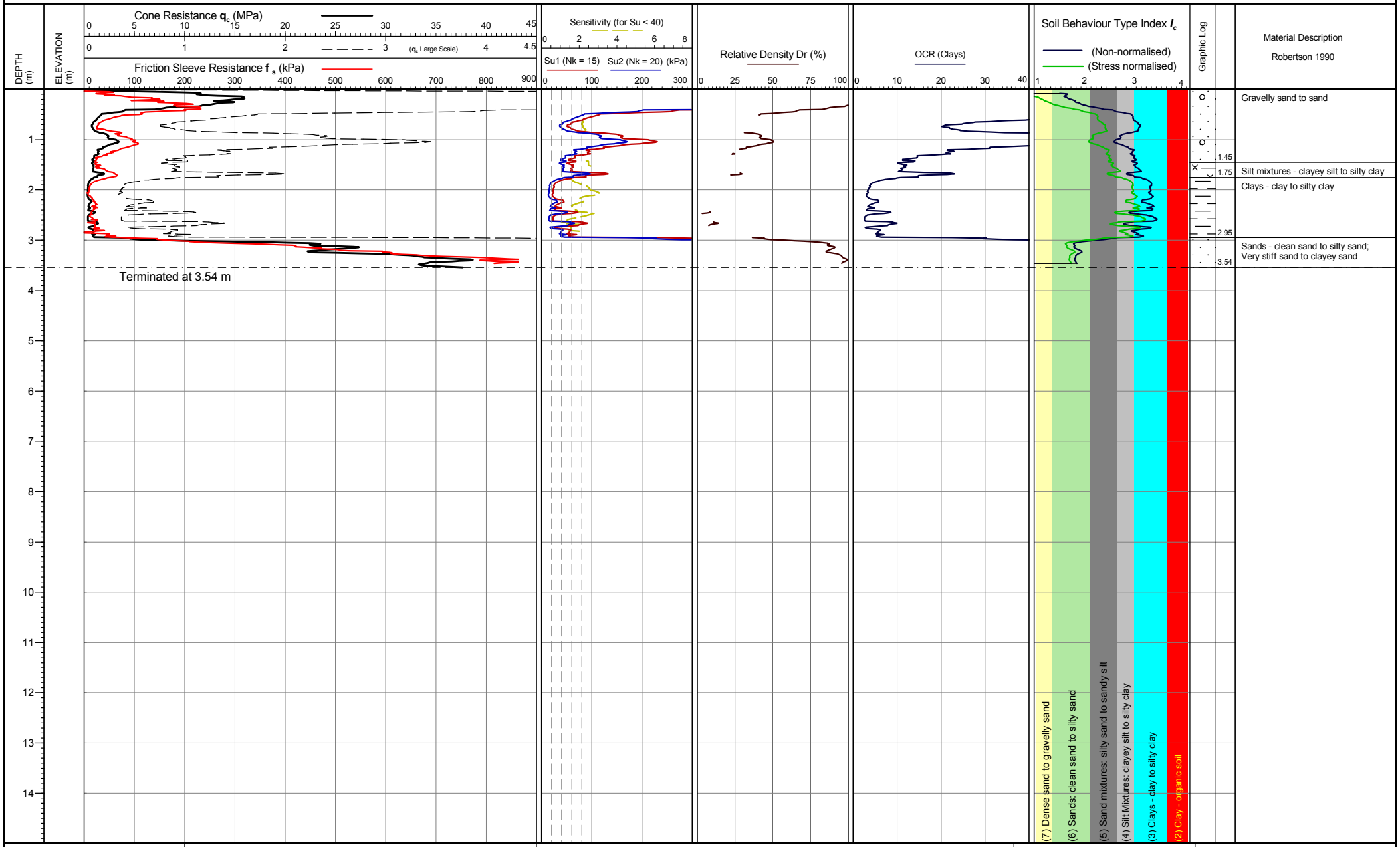
Checked by:
Chris Player

TEST ID: PB102

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 09/03/2016 13:36:39

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

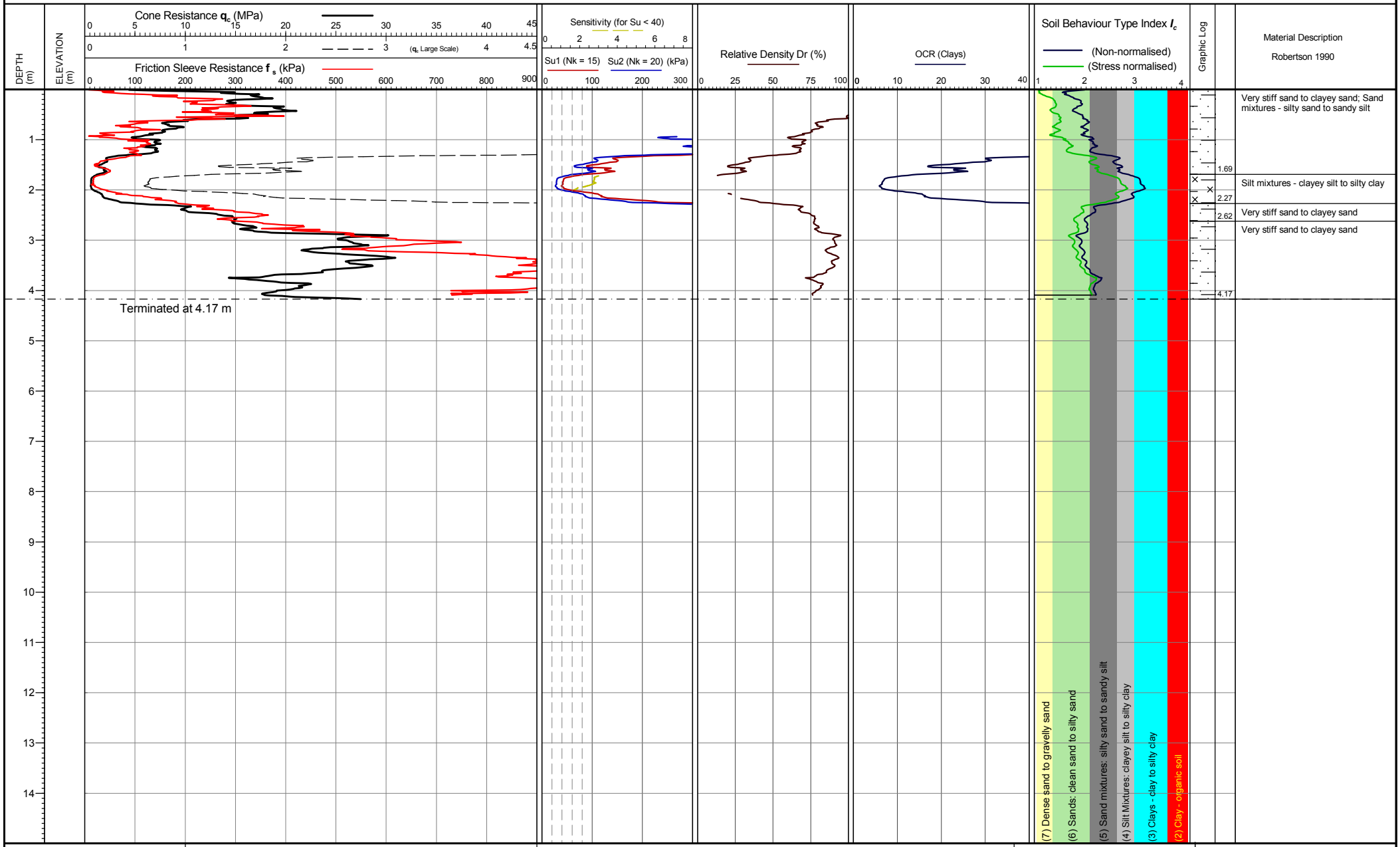
Checked by:
Chris Player

TEST ID: PB103

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 10:57:33

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total reaction load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

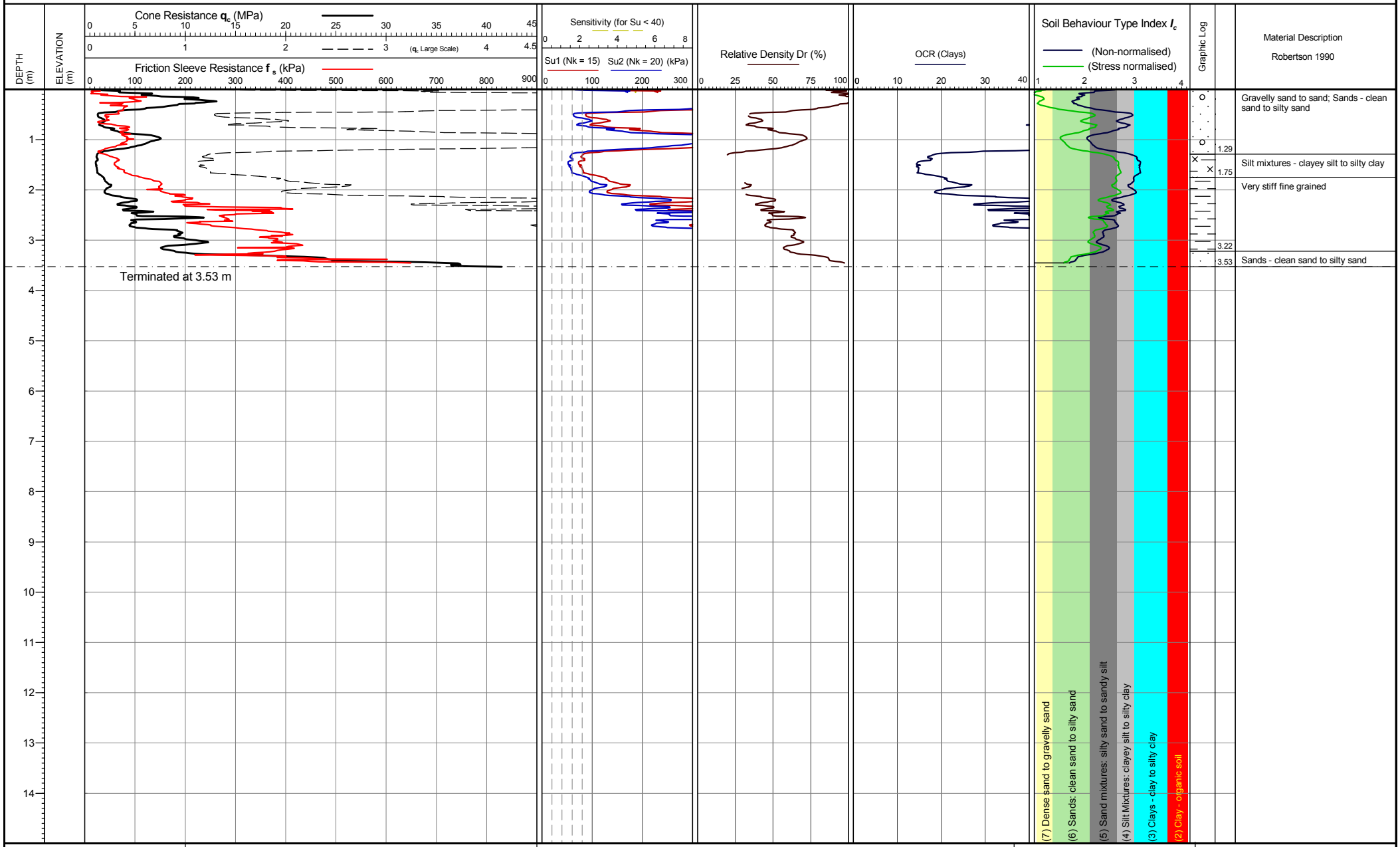
Checked by:
Chris Player

TEST ID: PB104

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 09/03/2016 12:57:48

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

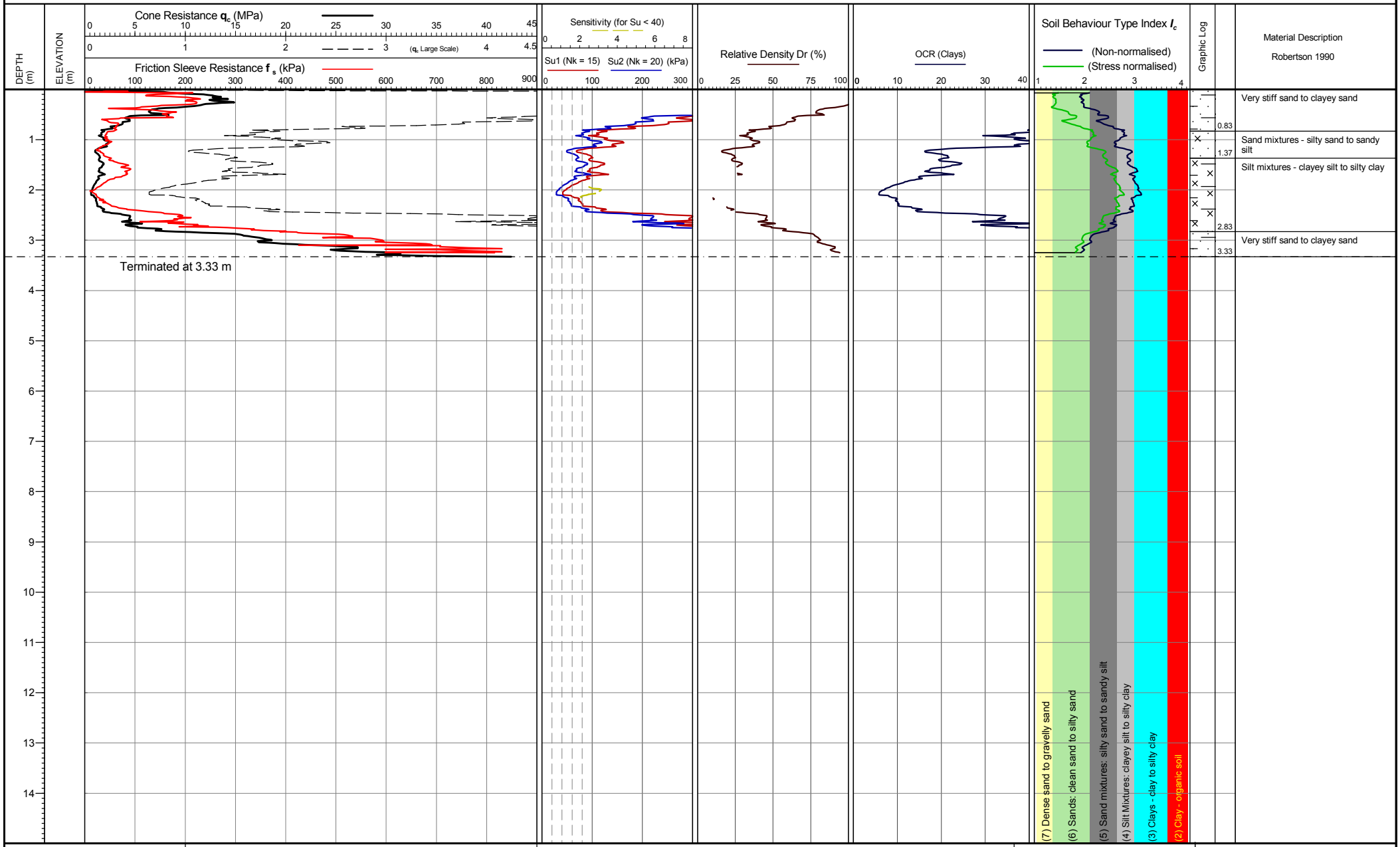
Checked by:
Chris Player

TEST ID: PB105

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 12:12:39

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total reaction load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

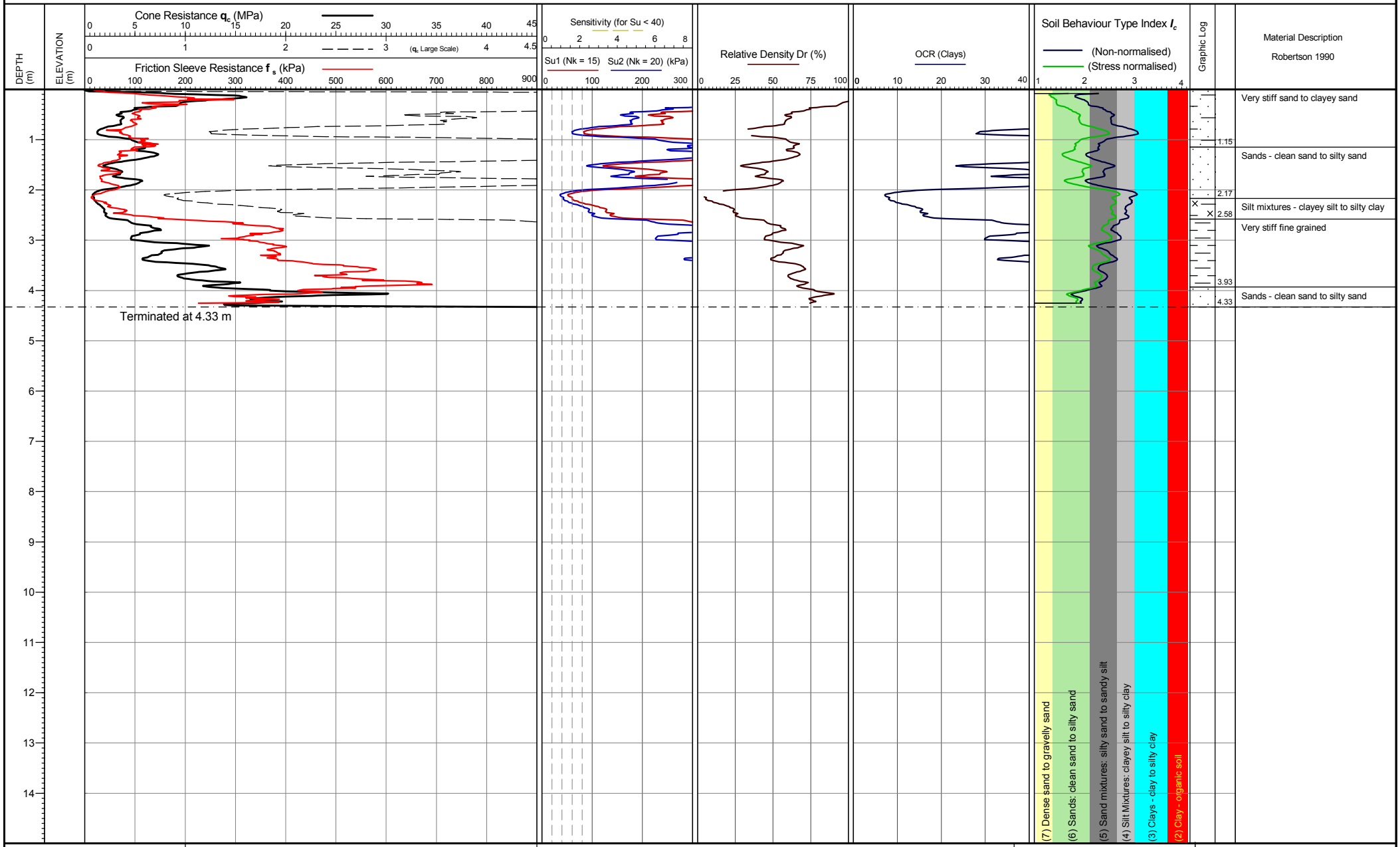
Checked by:
Chris Player

TEST ID: PB106

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 11:25:22

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total reaction load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

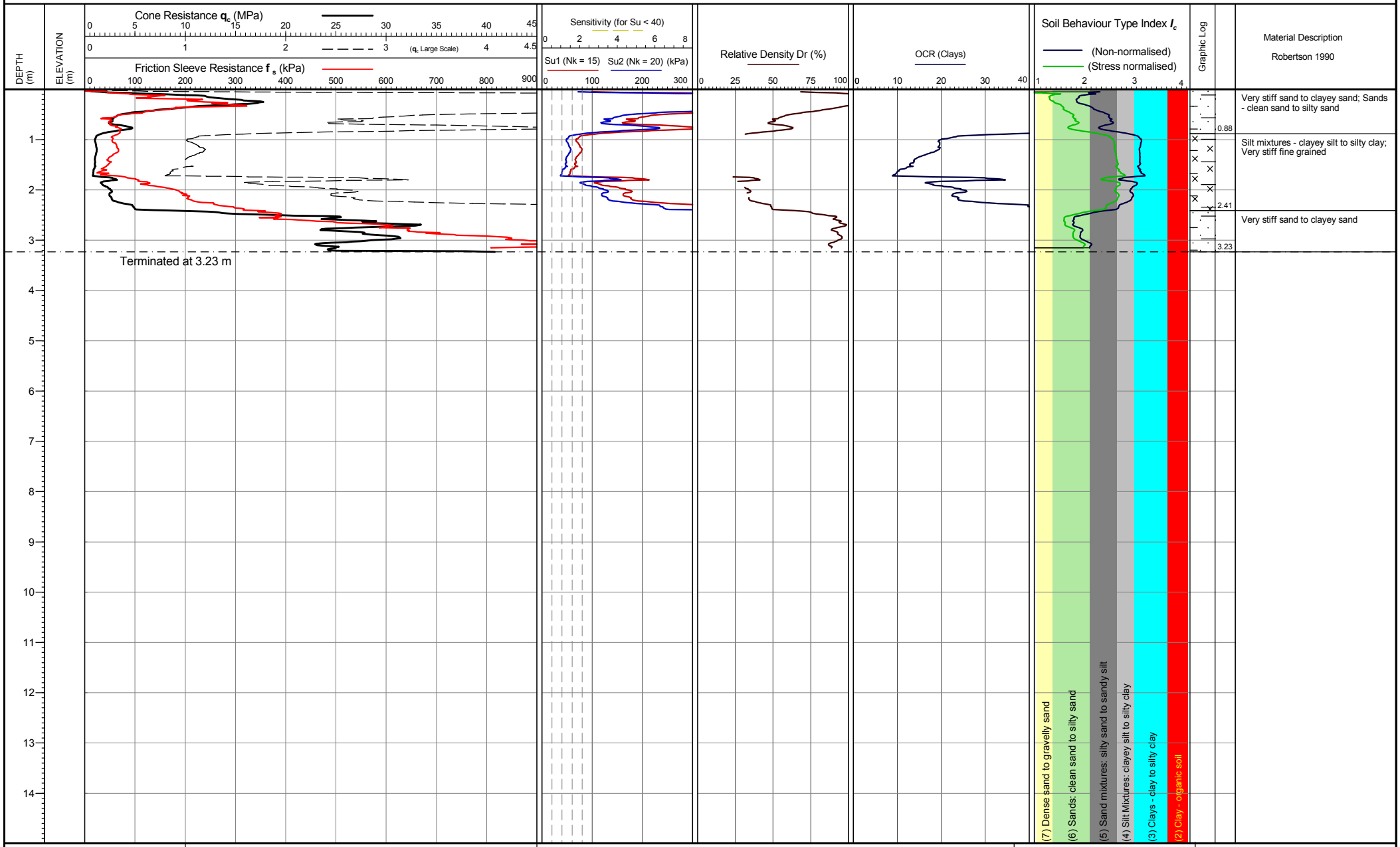
Checked by:
Chris Player

TEST ID: PB107

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 11:44:53

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

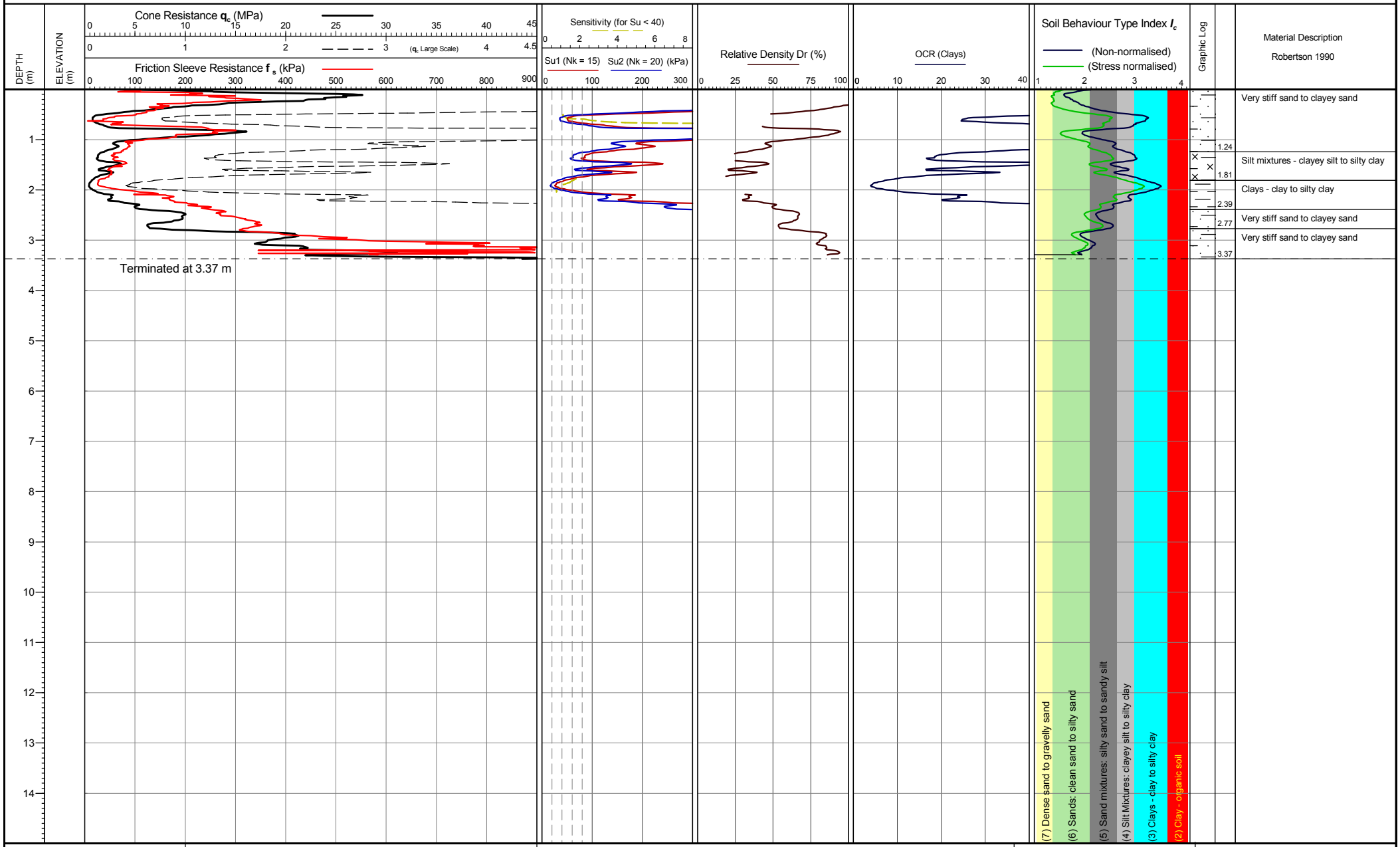
Checked by:
Chris Player

TEST ID: PB108

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 10:37:04

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

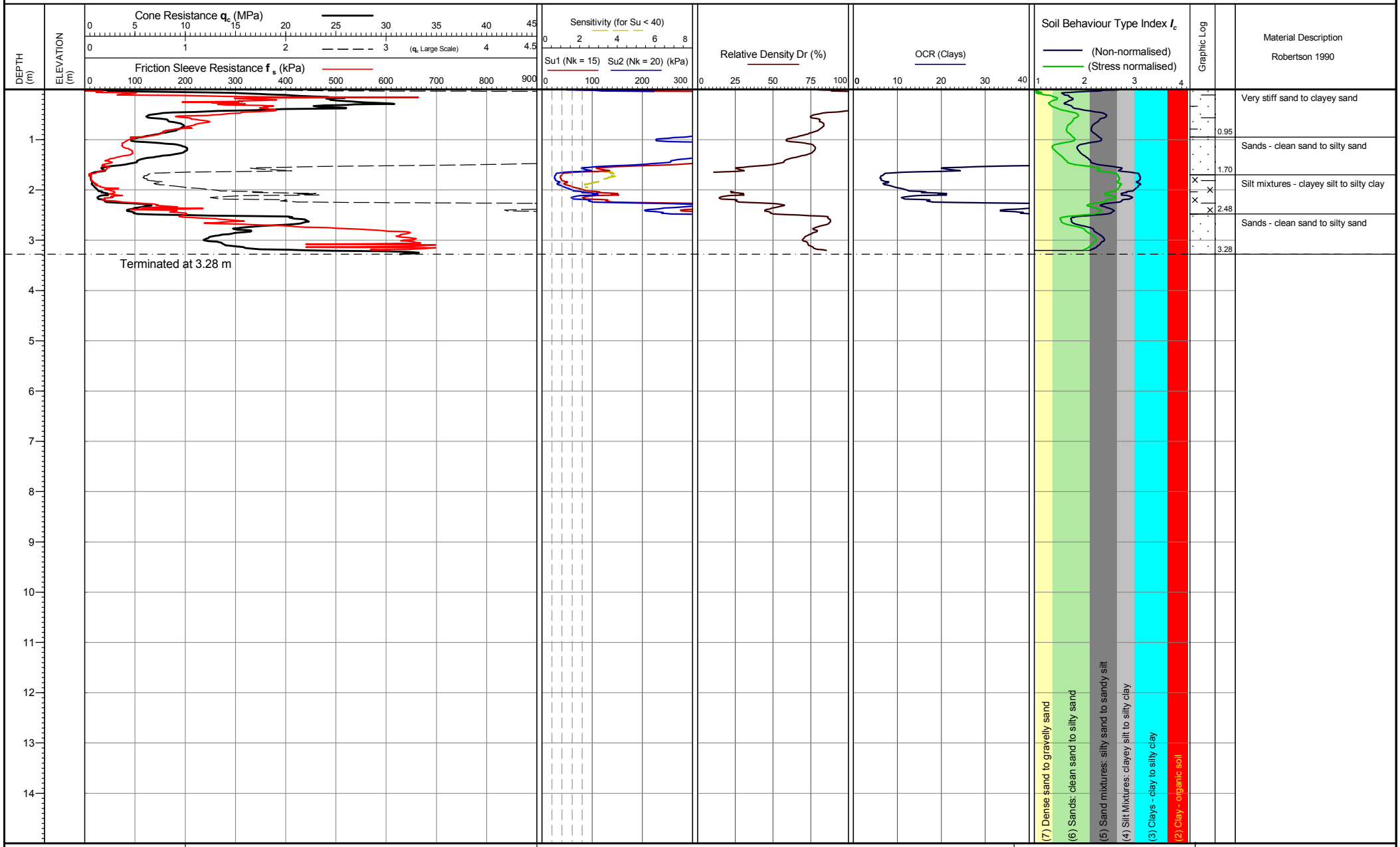
Checked by:
Chris Player

TEST ID: PB109

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 09/03/2016 14:18:26

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

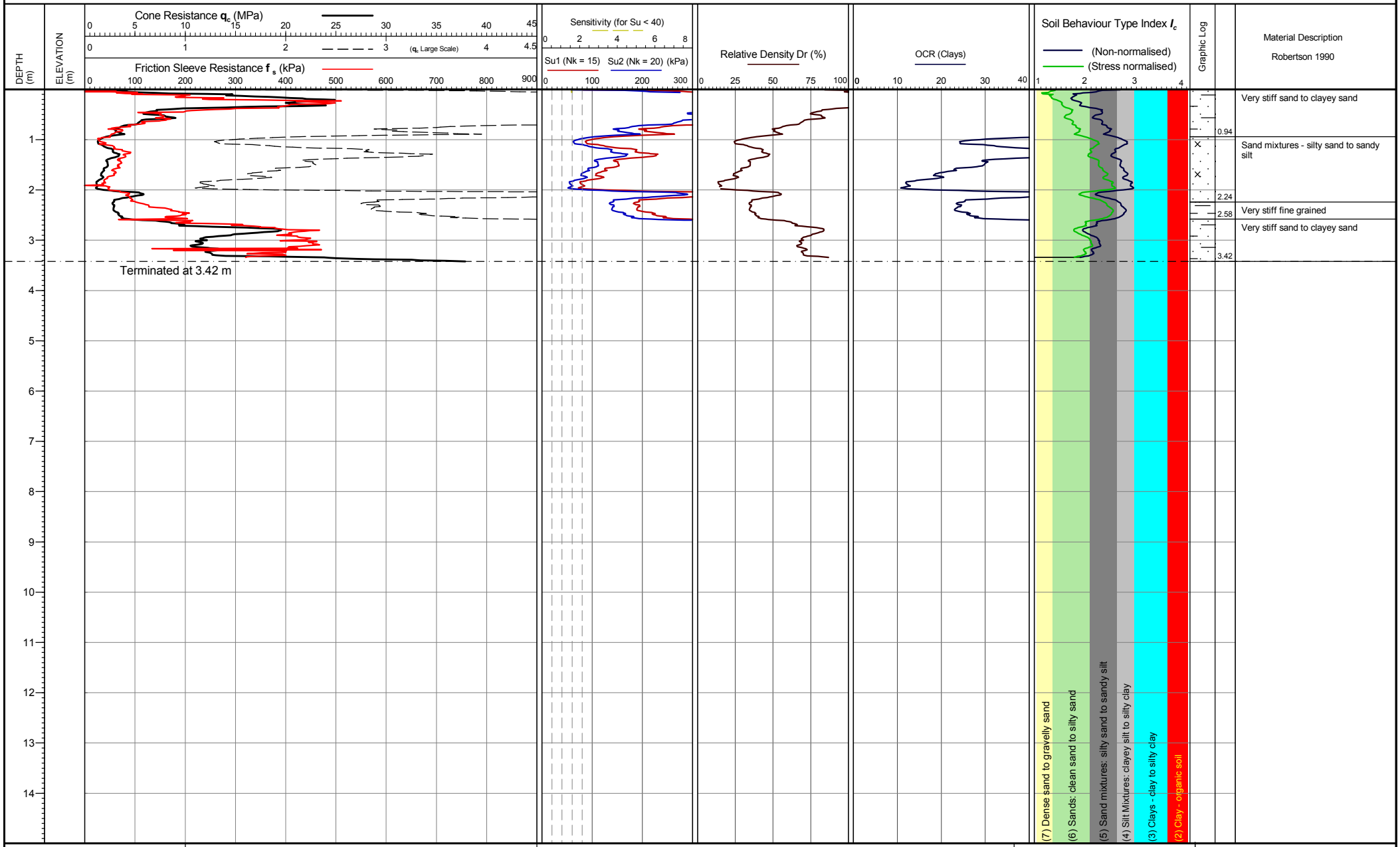
Checked by:
Chris Player

TEST ID: PB110

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 13:57:55

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

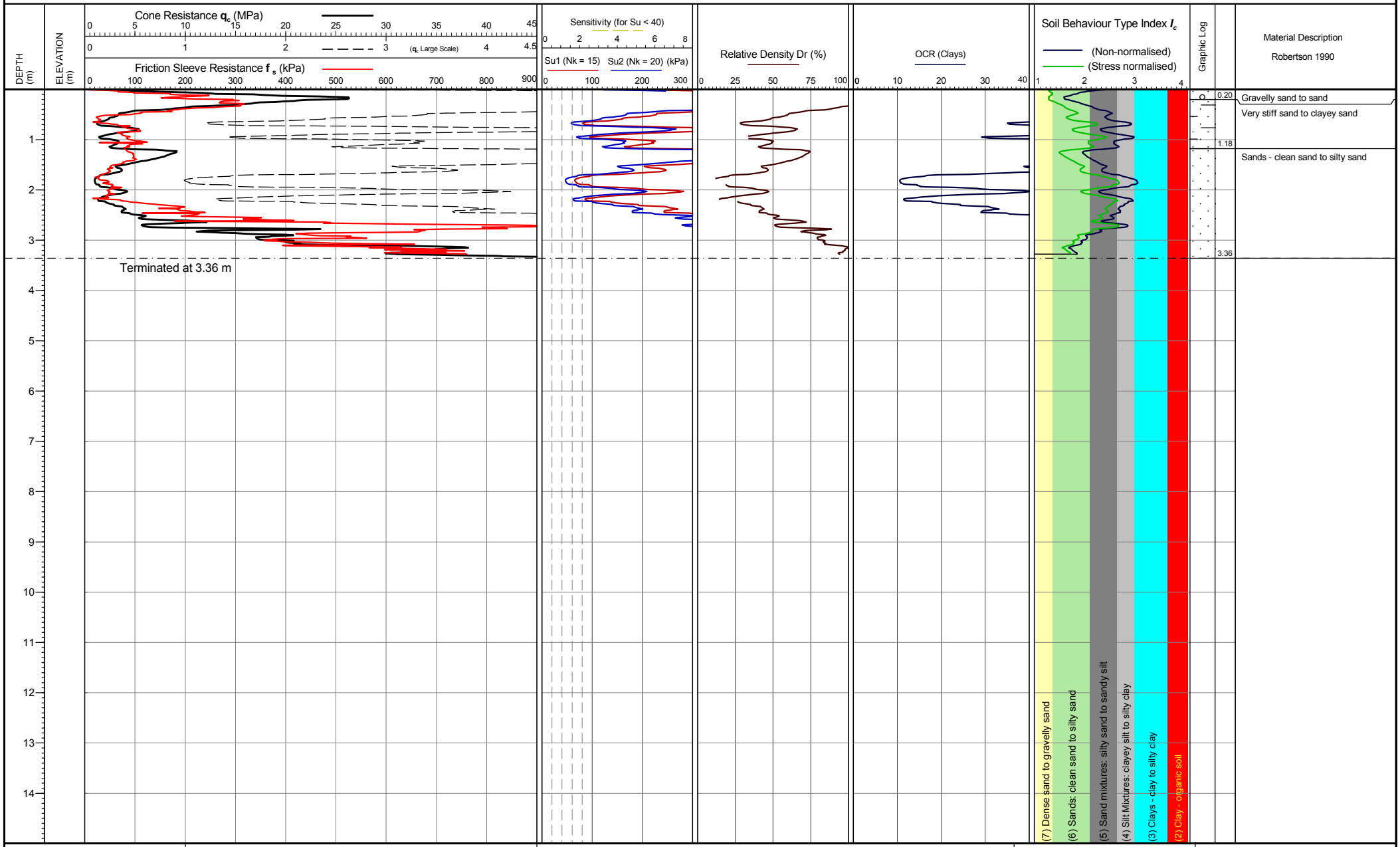
Checked by:
Chris Player

TEST ID: PB111

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 13:12:28

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

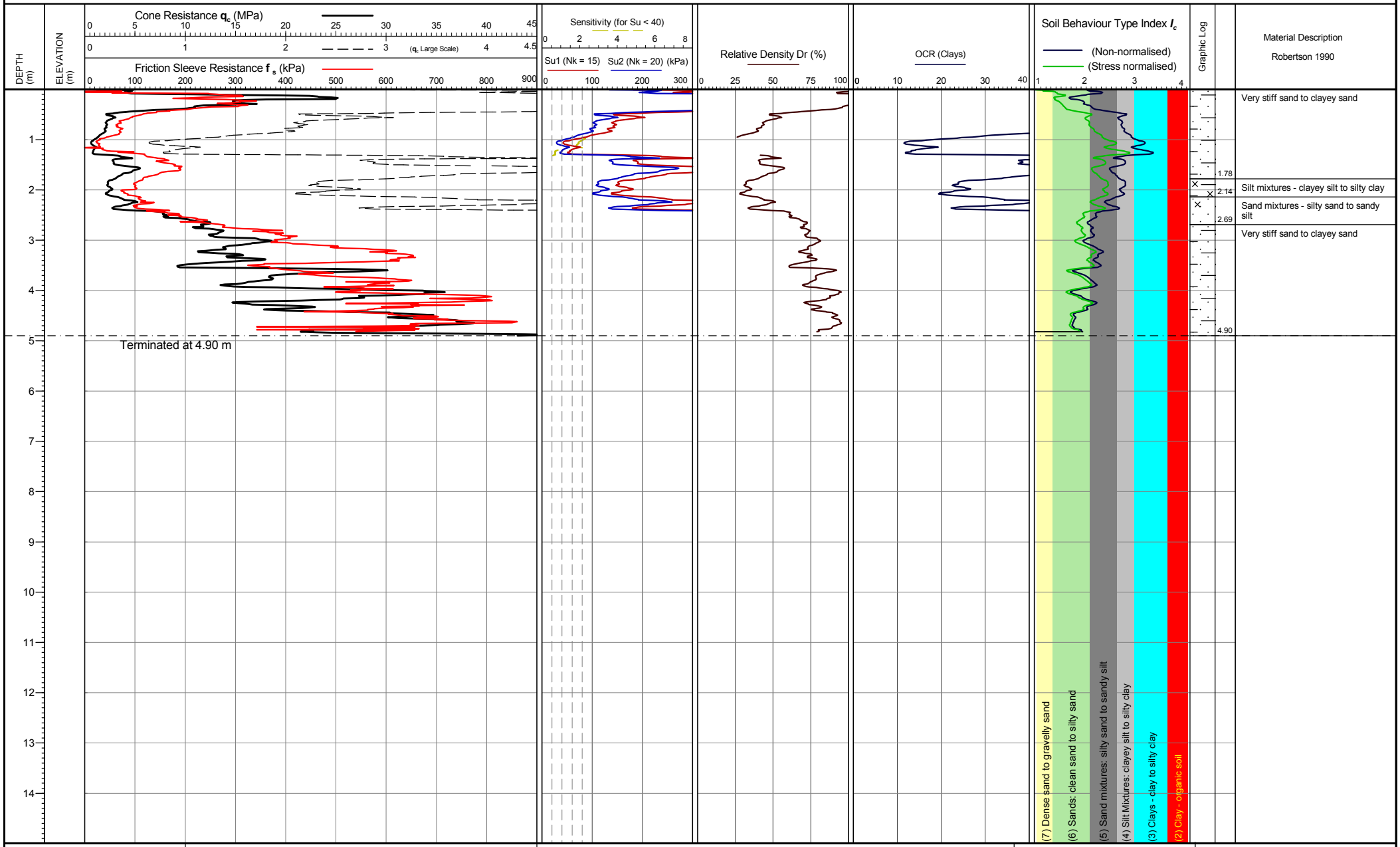
Checked by:
Chris Player

TEST ID: PB112

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 10:09:24

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

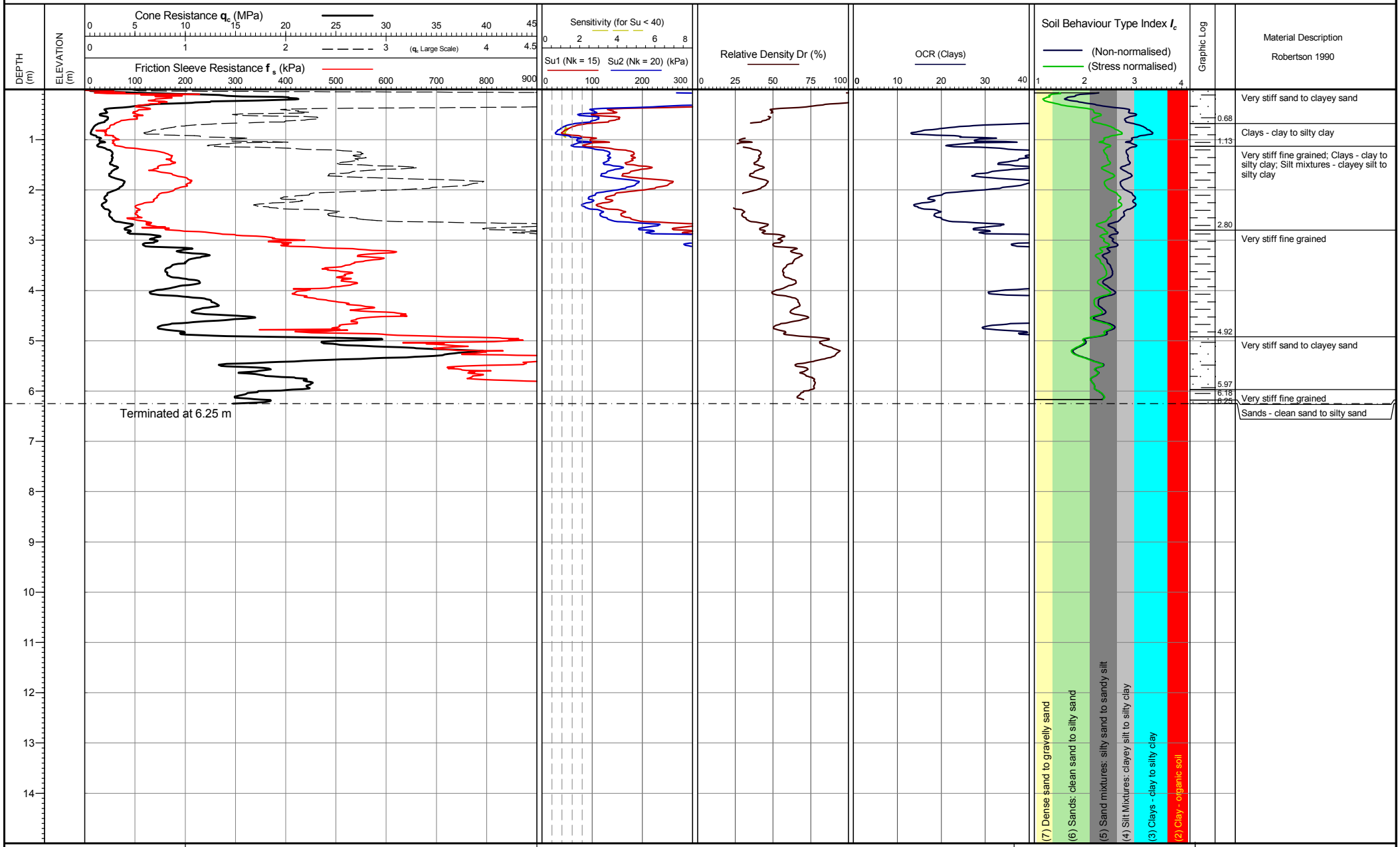
Checked by:
Chris Player

TEST ID: PB113

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 09/03/2016 15:38:41

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total cone load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

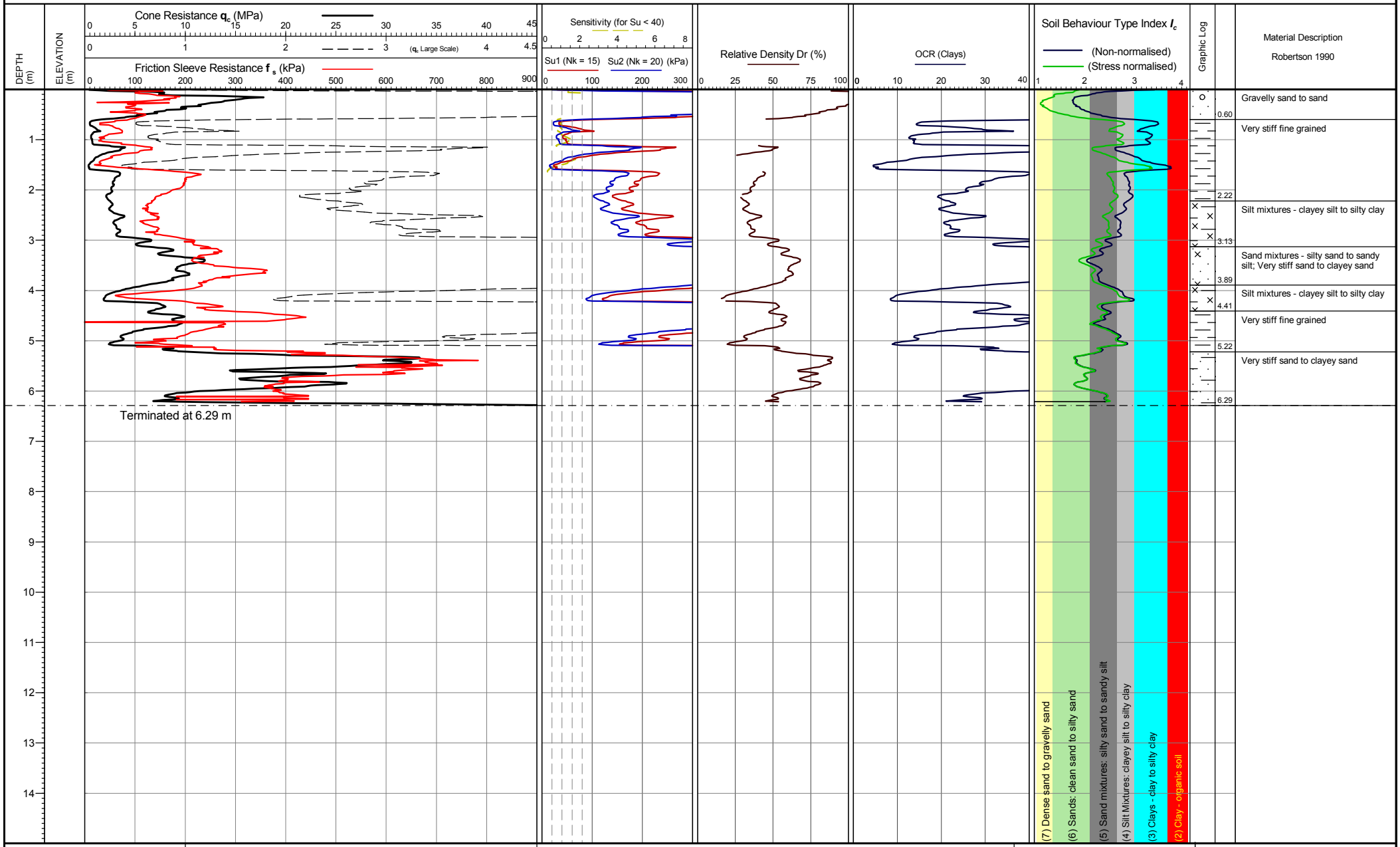
Checked by:
Chris Player

TEST ID: PB201

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 08:44:44

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

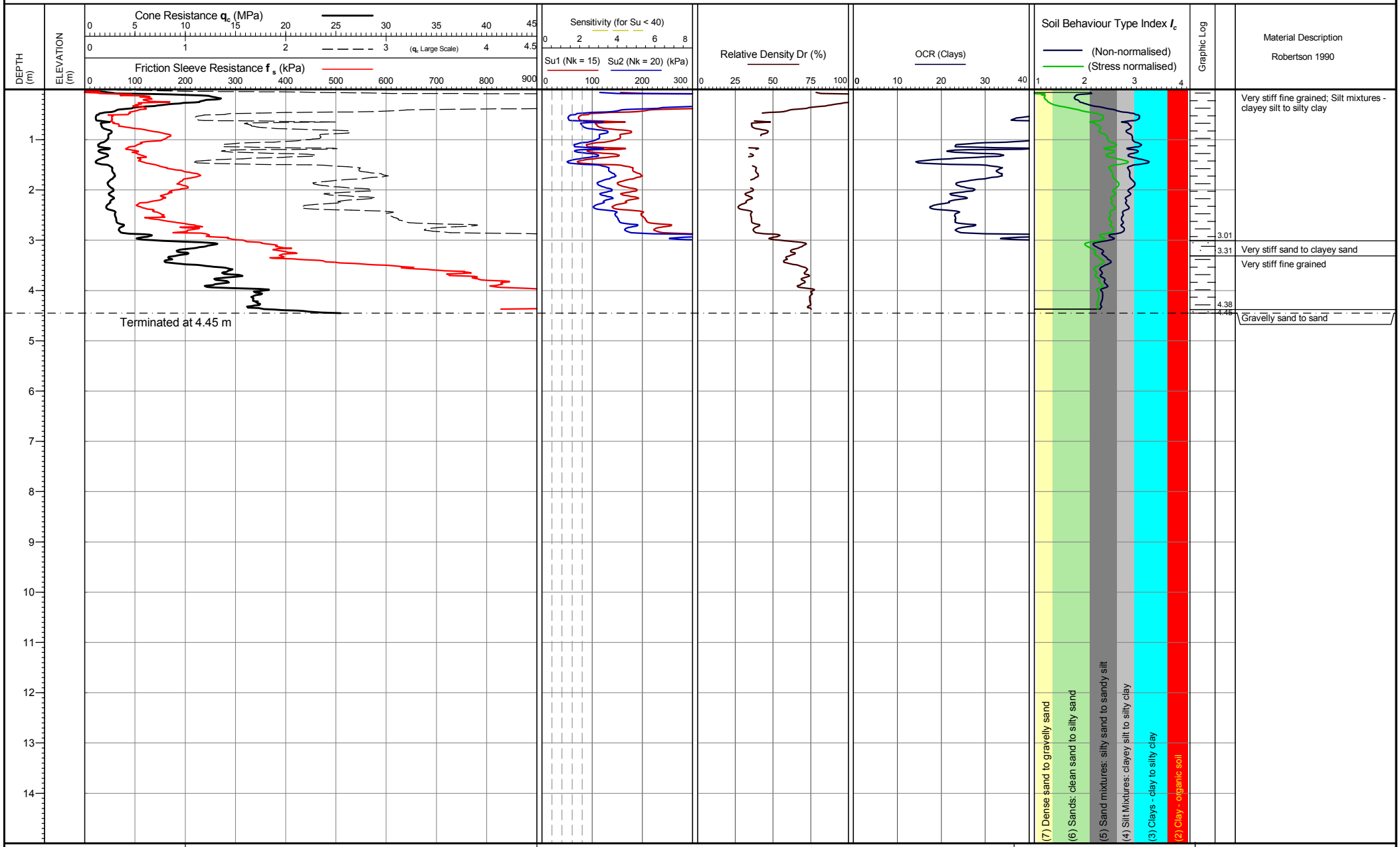
Checked by:
Chris Player

TEST ID: PB202

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 08:24:36

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total cone load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

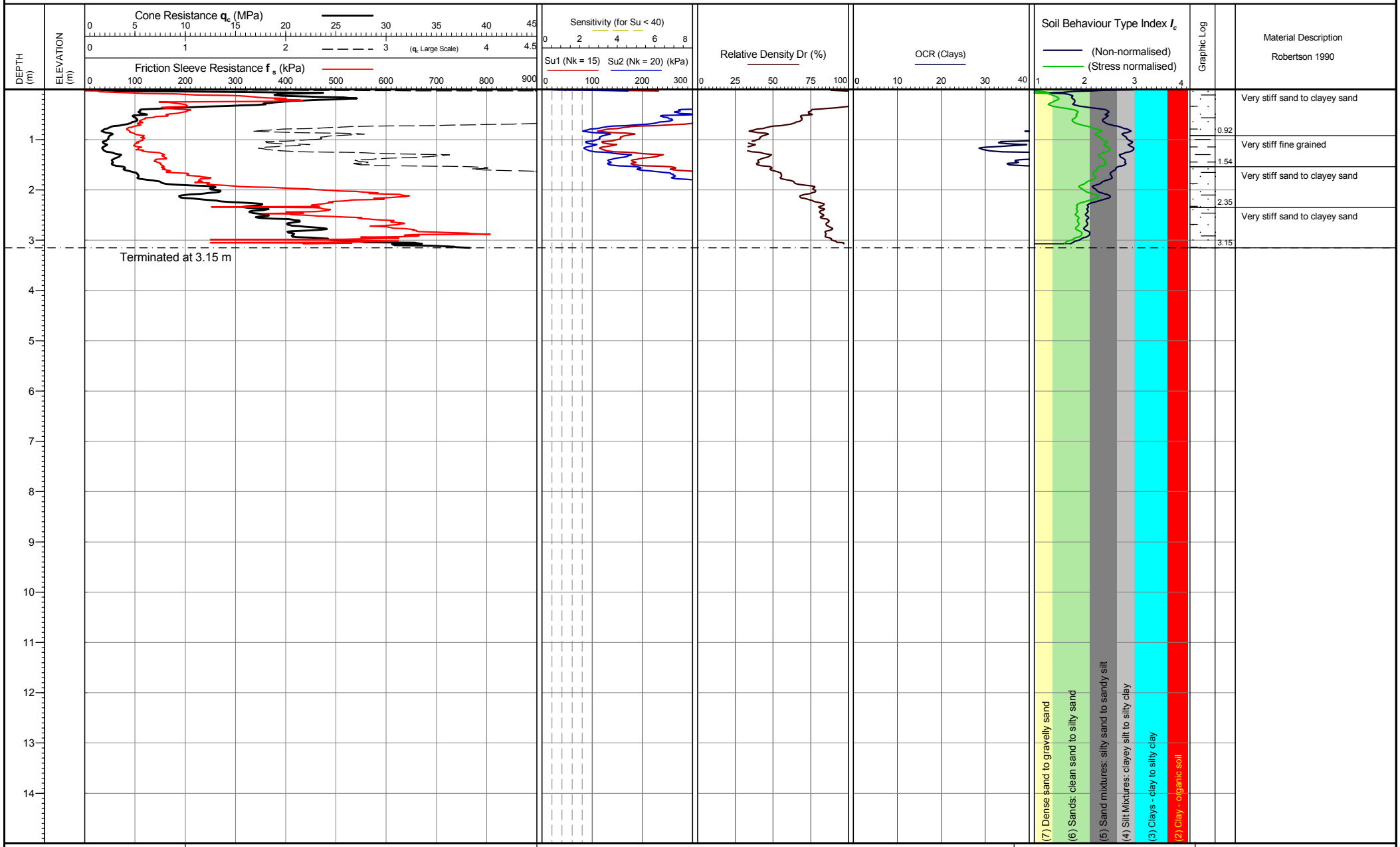
Checked by:
Chris Player

TEST ID: PB203

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 09/03/2016 15:54:14

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

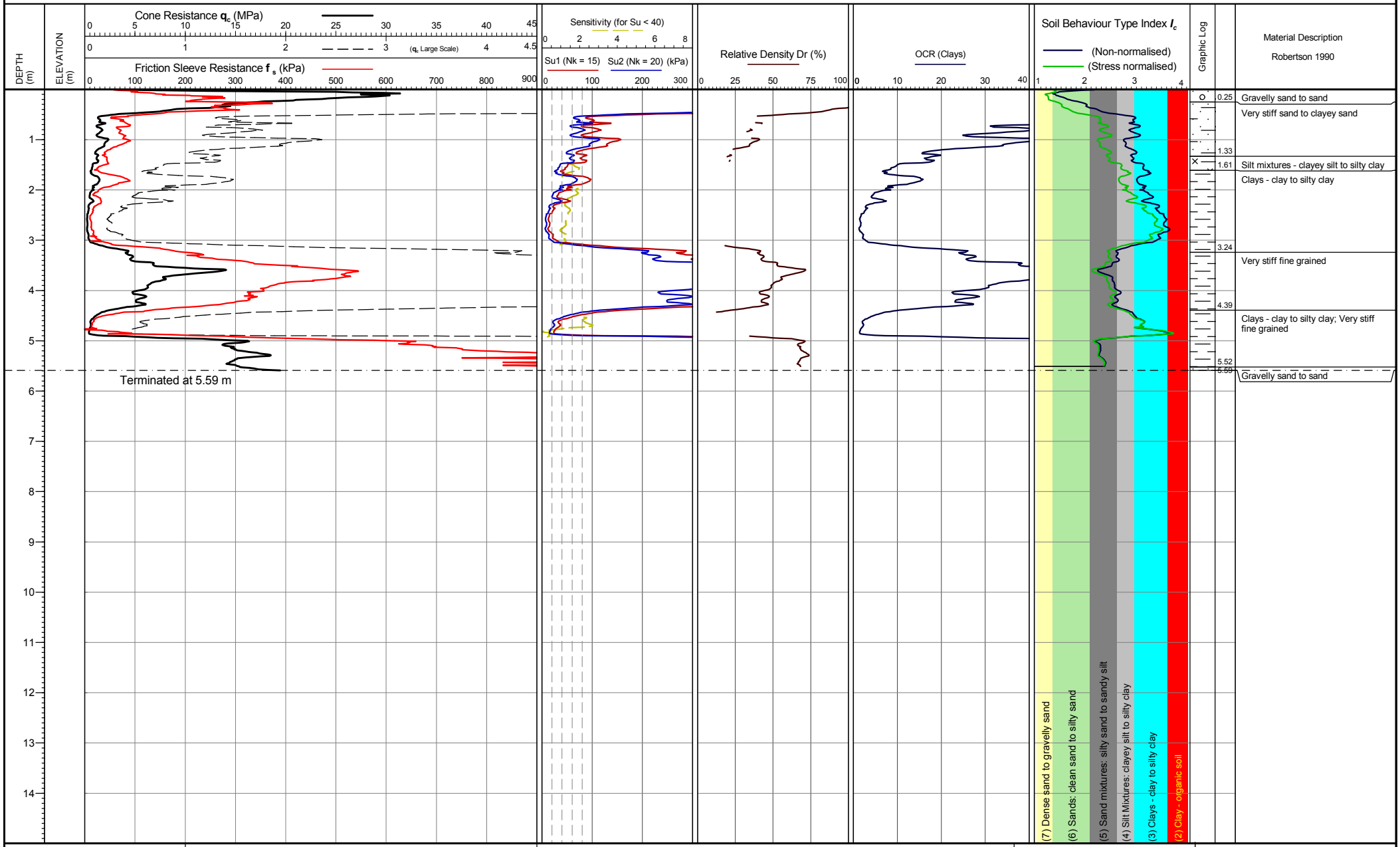
Checked by:
Chris Player

TEST ID: PB204

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 09/03/2016 16:10:46

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total cone load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

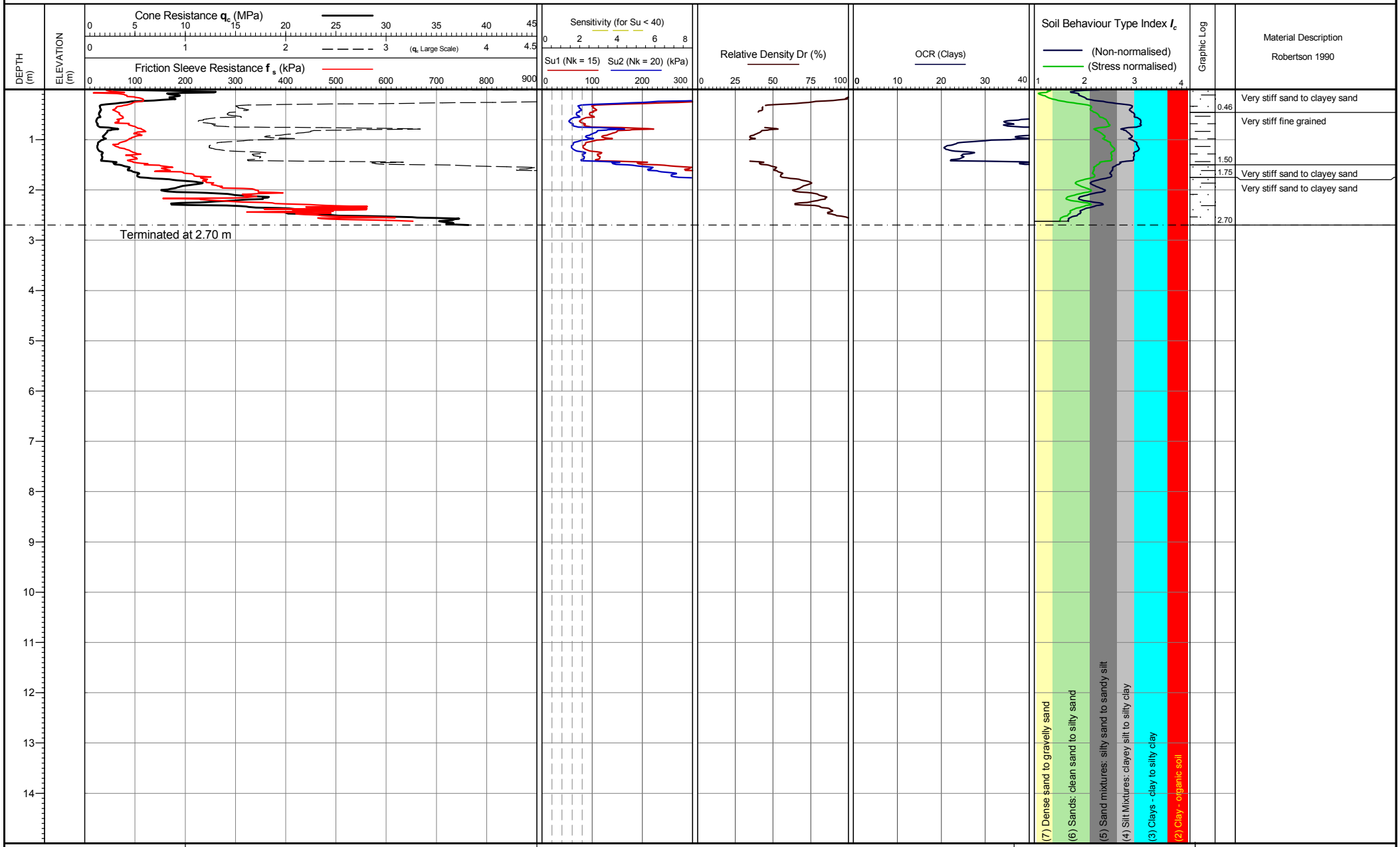
Checked by: Chris Player

TEST ID: PB205

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 09:03:08

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

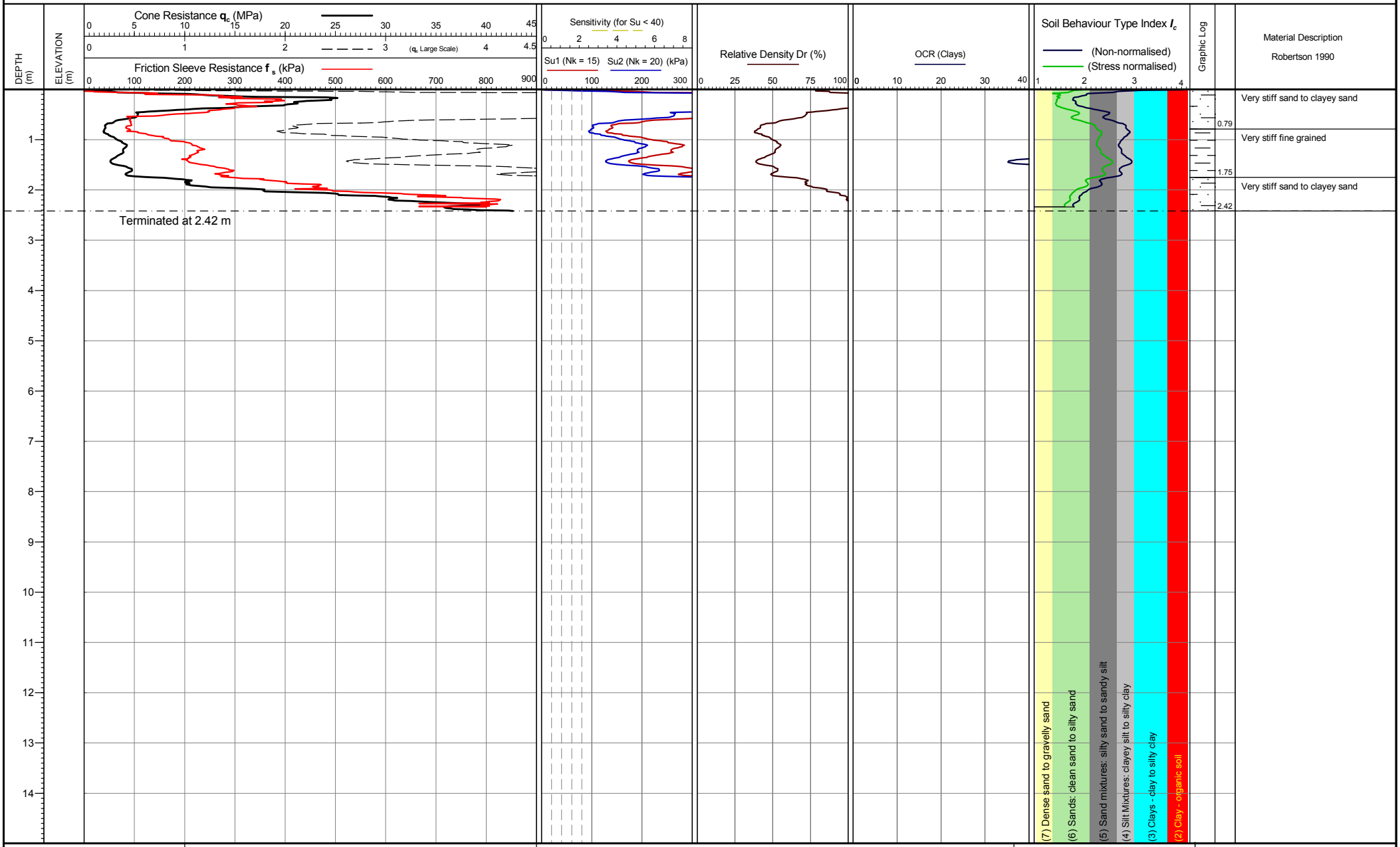
Checked by:
Chris Player

TEST ID: PB206

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 09:39:49

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

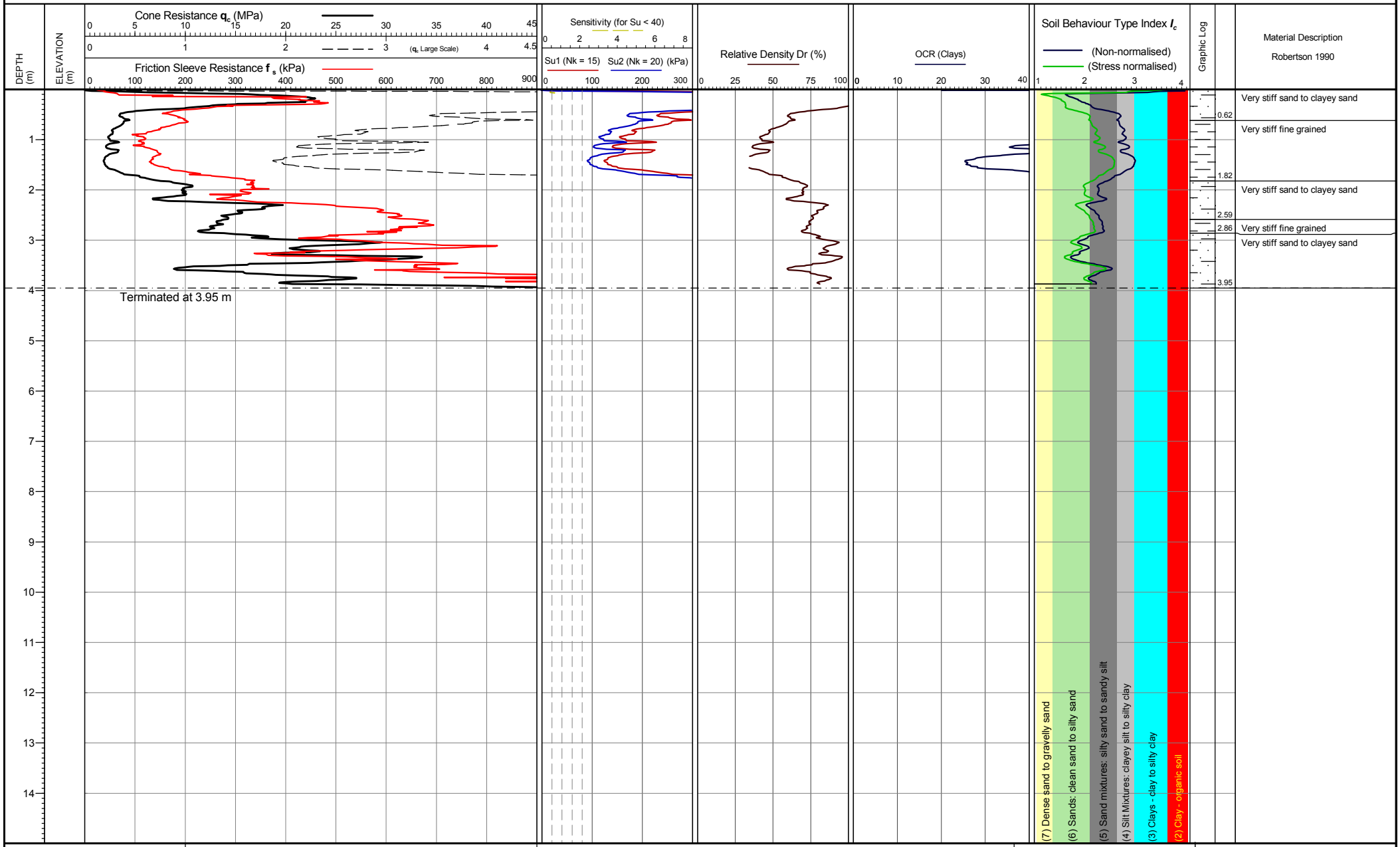
Checked by:
Chris Player

TEST ID: PB207

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 09:18:12

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total cone load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

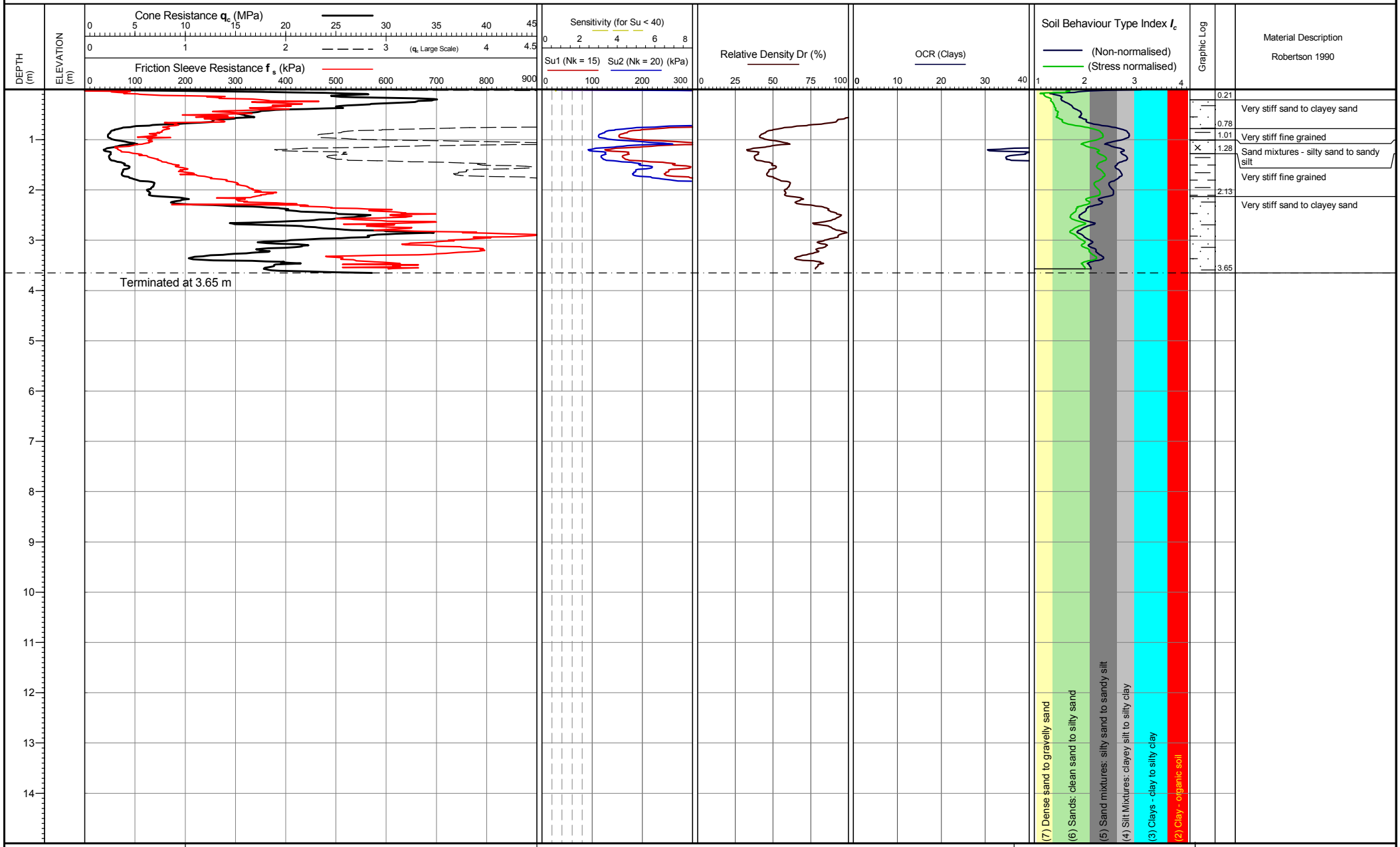
Checked by: Chris Player

TEST ID: PB208

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 10:03:15

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

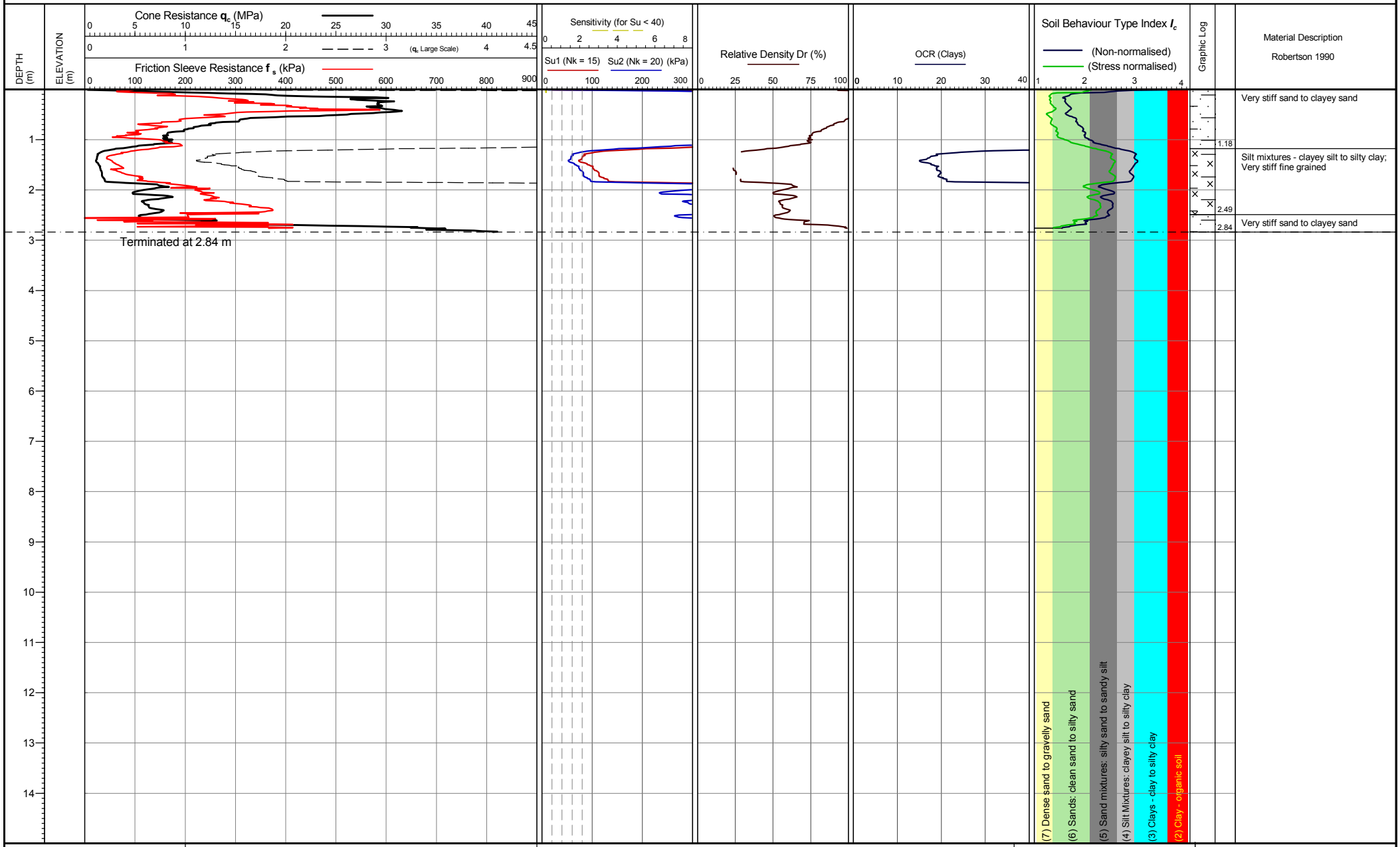
Checked by:
Chris Player

TEST ID: PB209

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 10:51:43

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

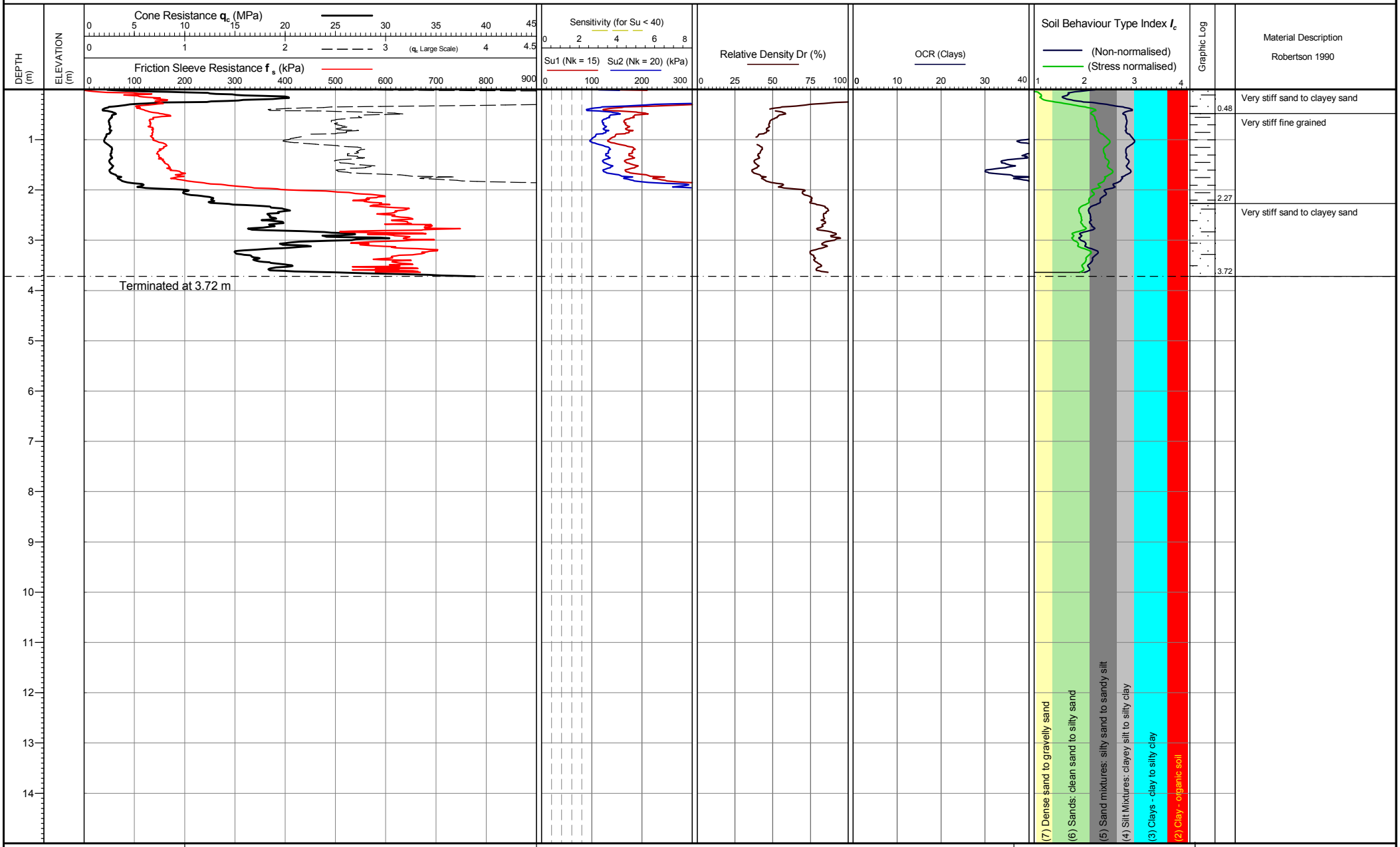
Checked by:
Chris Player

TEST ID: PB210

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 11:15:23

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

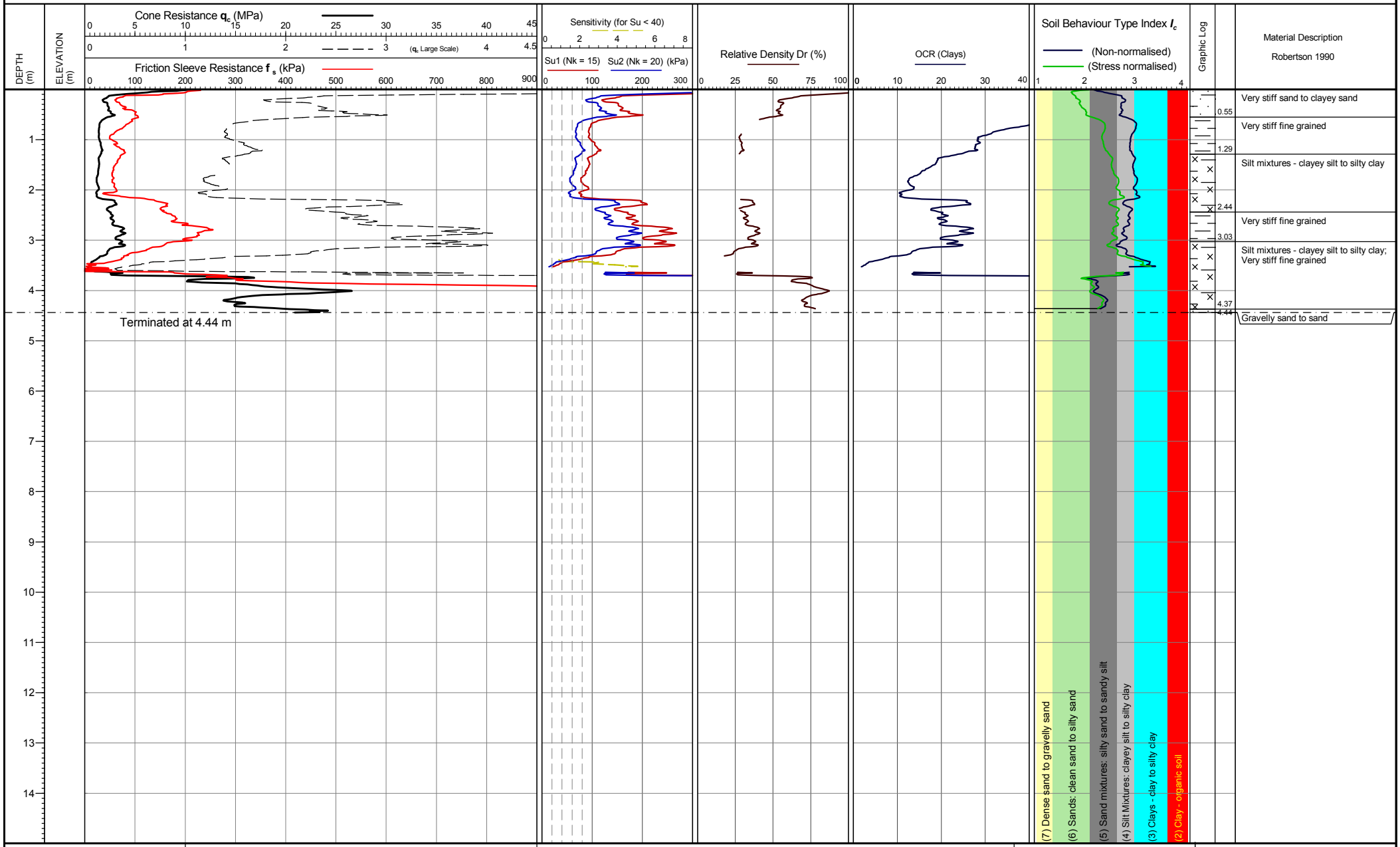
Checked by:
Chris Player

TEST ID: PB211

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 12:52:28

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

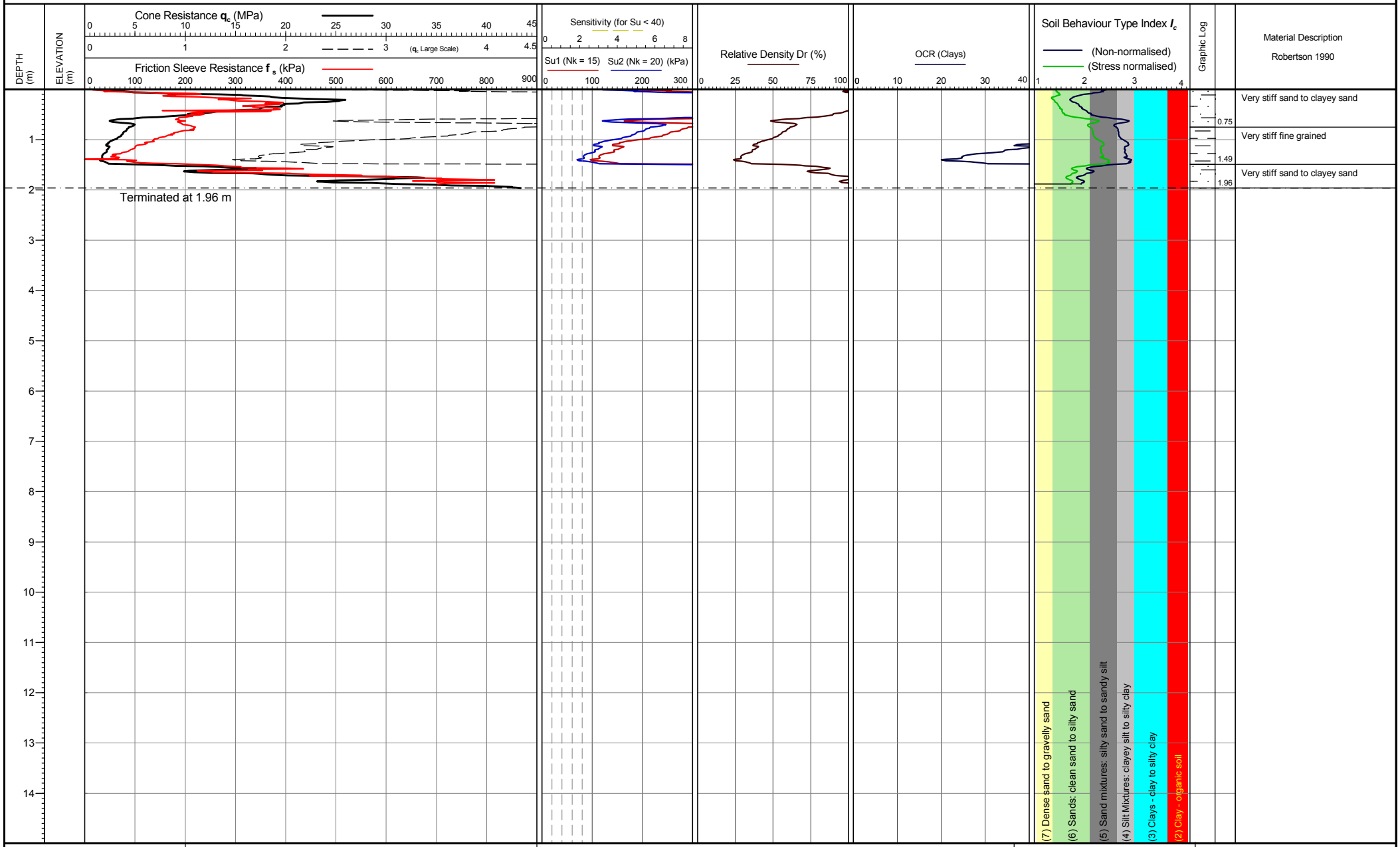
Checked by:
Chris Player

TEST ID: PB212

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 14:18:12

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

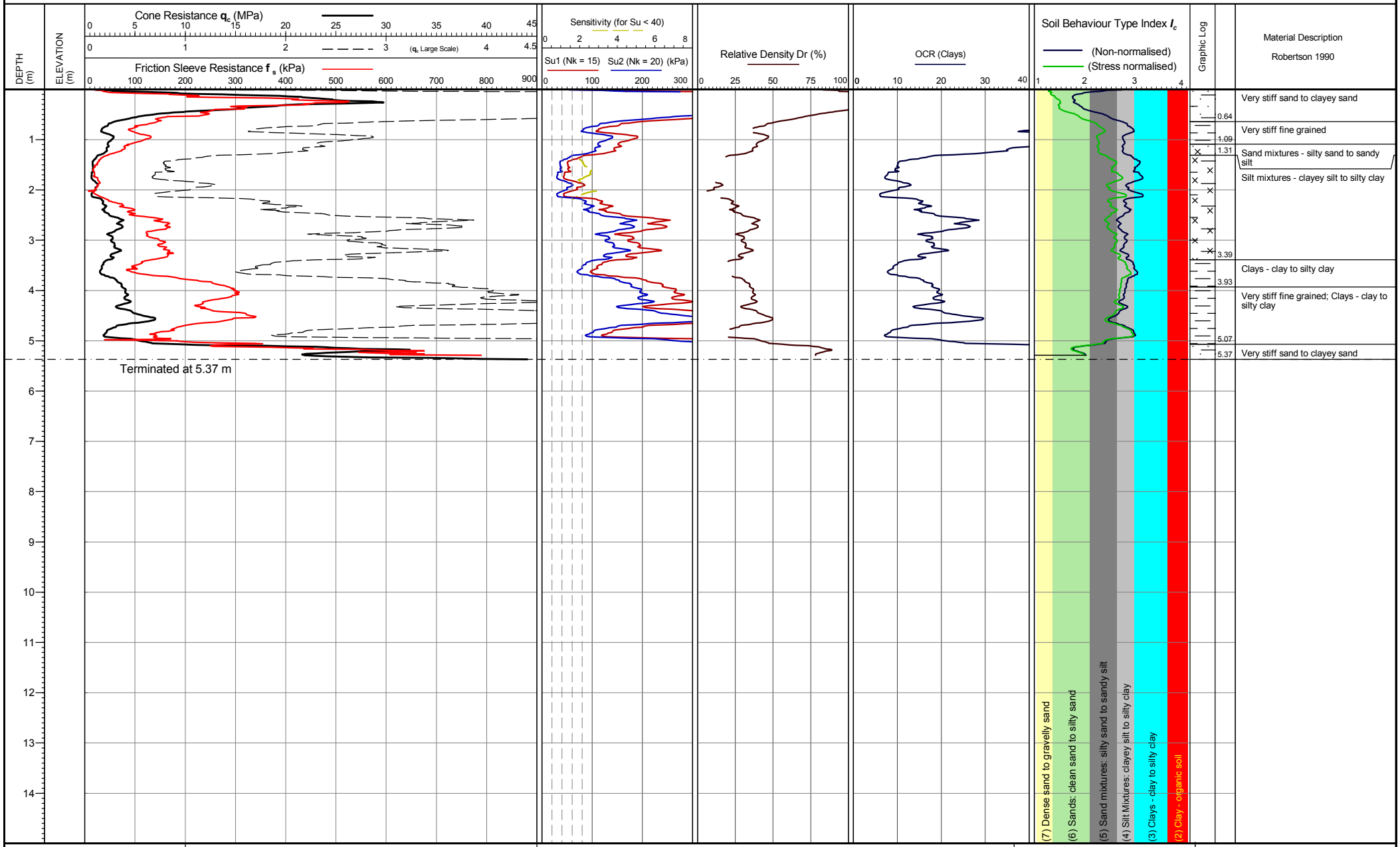
Checked by:
Chris Player

TEST ID: PB213

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 13:51:57

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

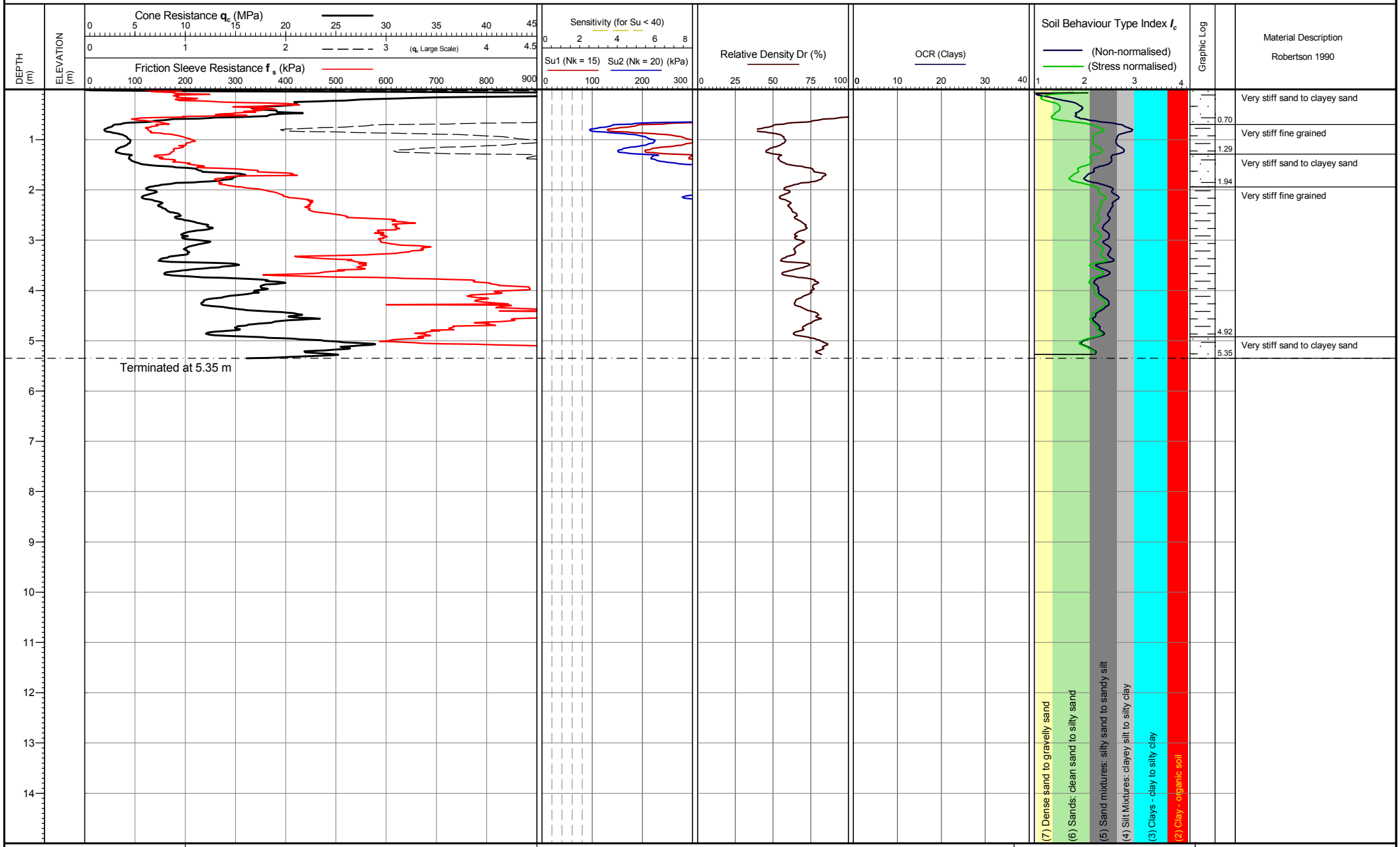
Checked by:
Chris Player

TEST ID: PB214

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 14:33:06

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Sleeve load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

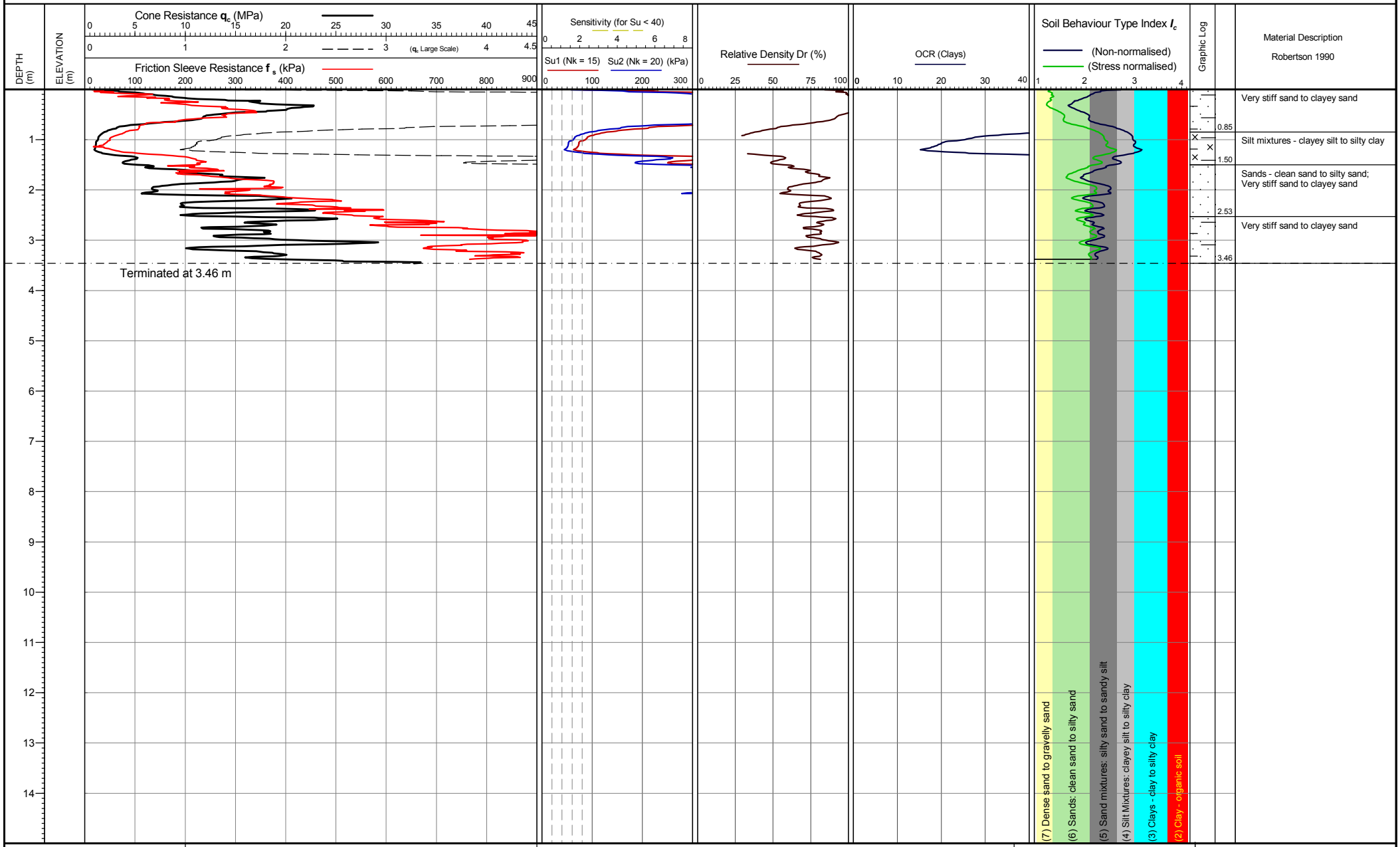
Checked by:
Chris Player

TEST ID: PB215

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 15:00:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

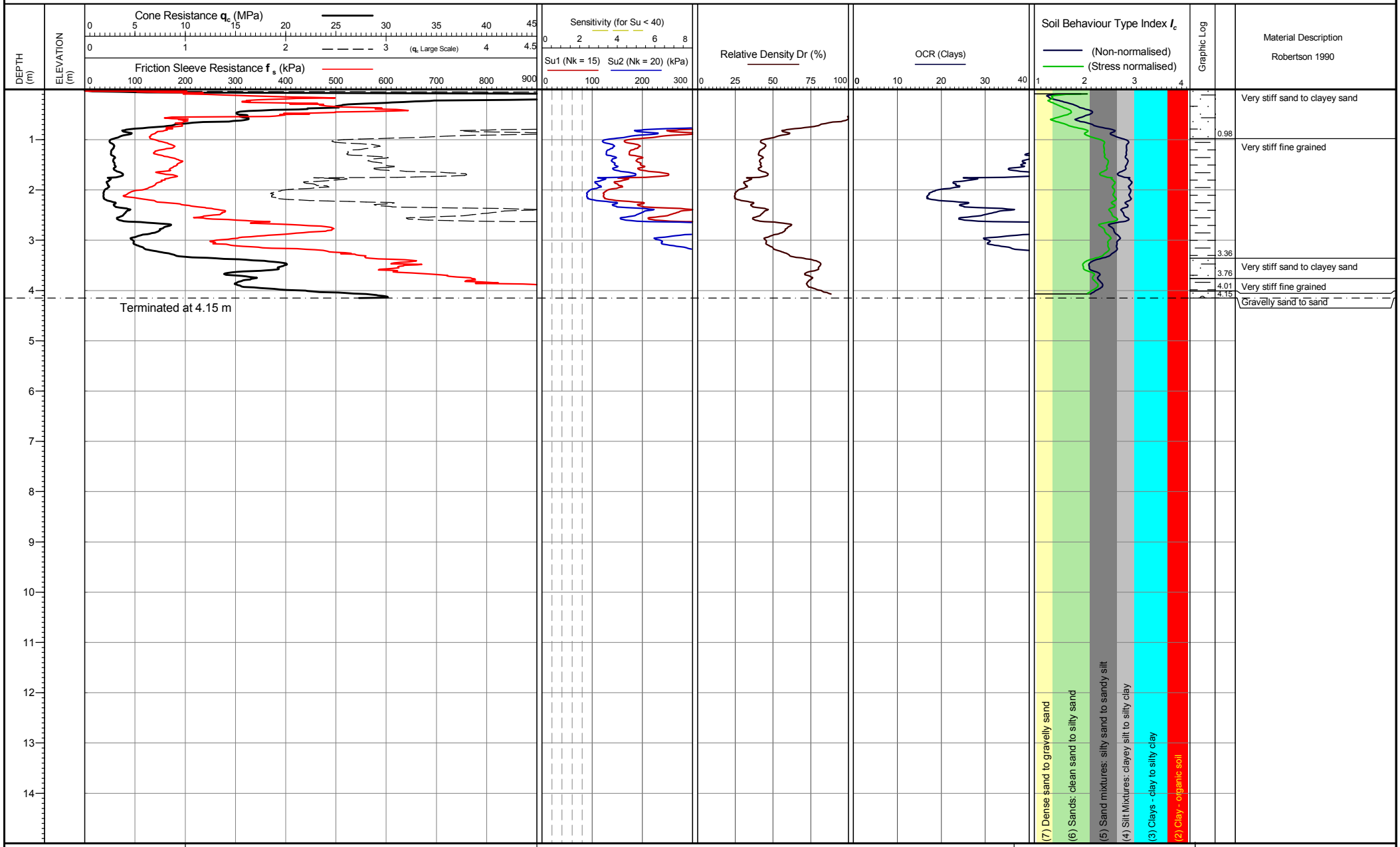
Checked by:
Chris Player

TEST ID: PB216

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 15:28:53

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total cone load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

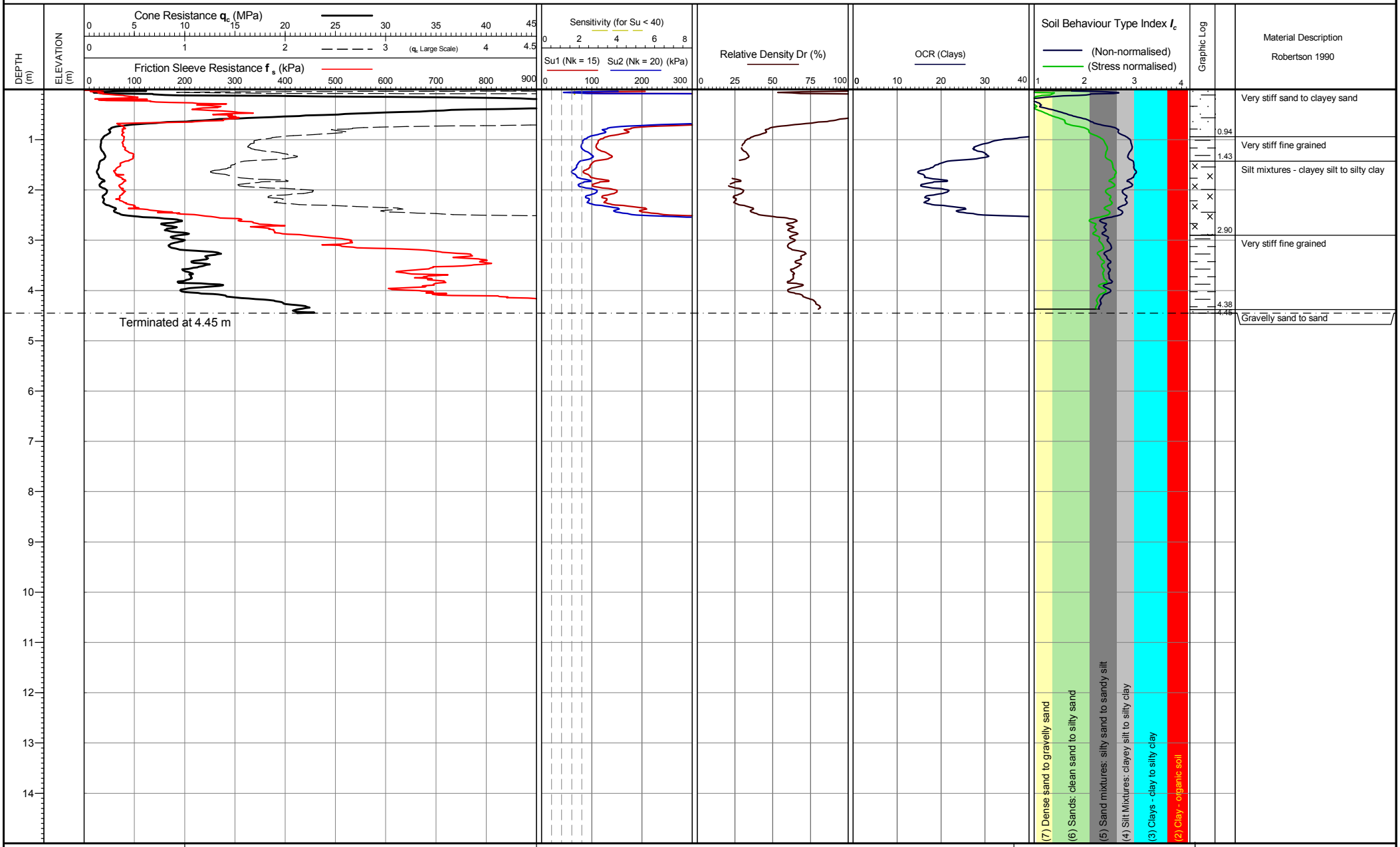
Checked by: Chris Player

TEST ID: PB217

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 10:30:39

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Sleeve load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

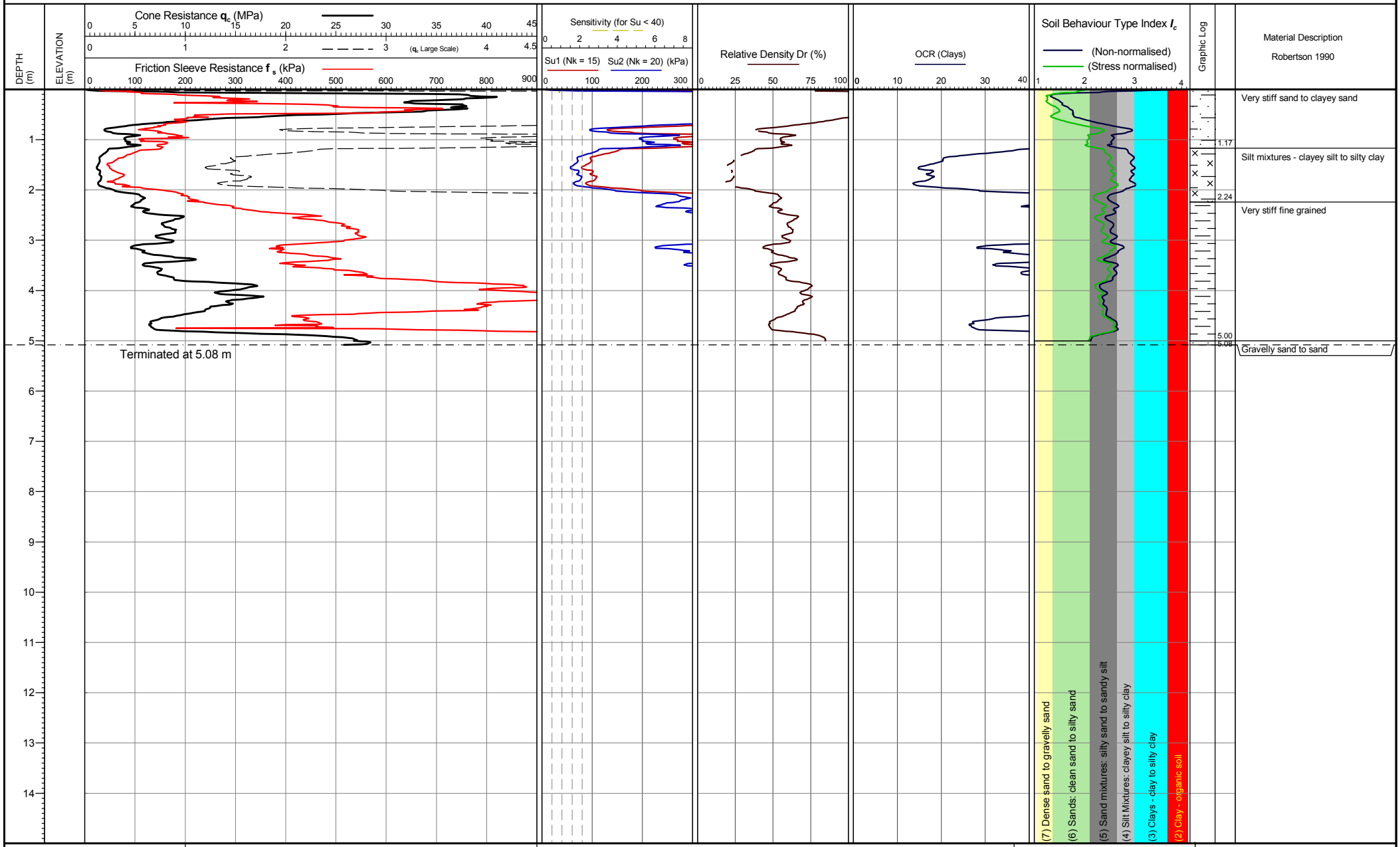
Checked by: Chris Player

TEST ID: PB218

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Craig Drummond
Rig Used: UK3
Date of test: 10/03/2016 12:17:15

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total cone load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

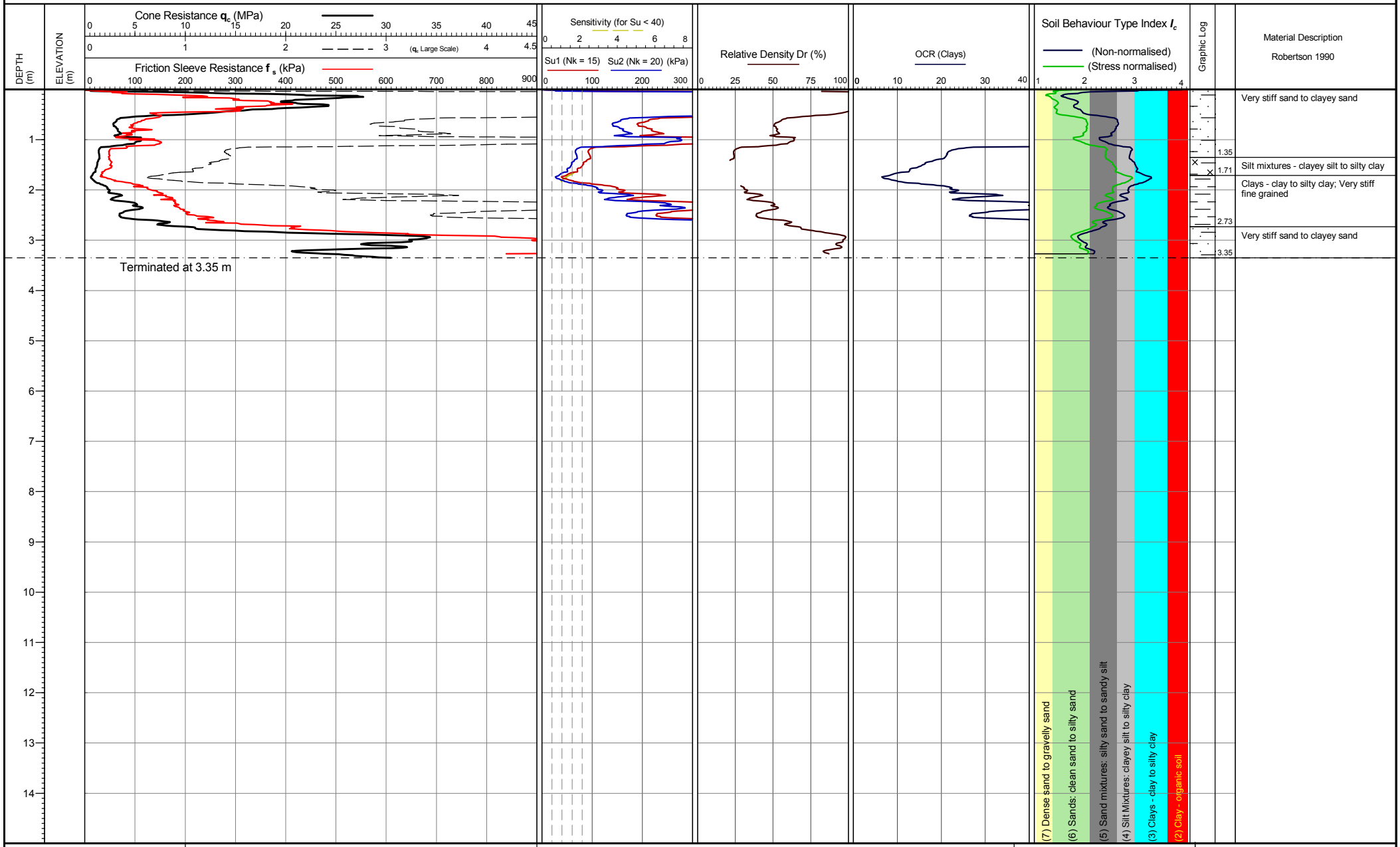
Checked by:
Chris Player

TEST ID: PB219

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 12:35:41

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

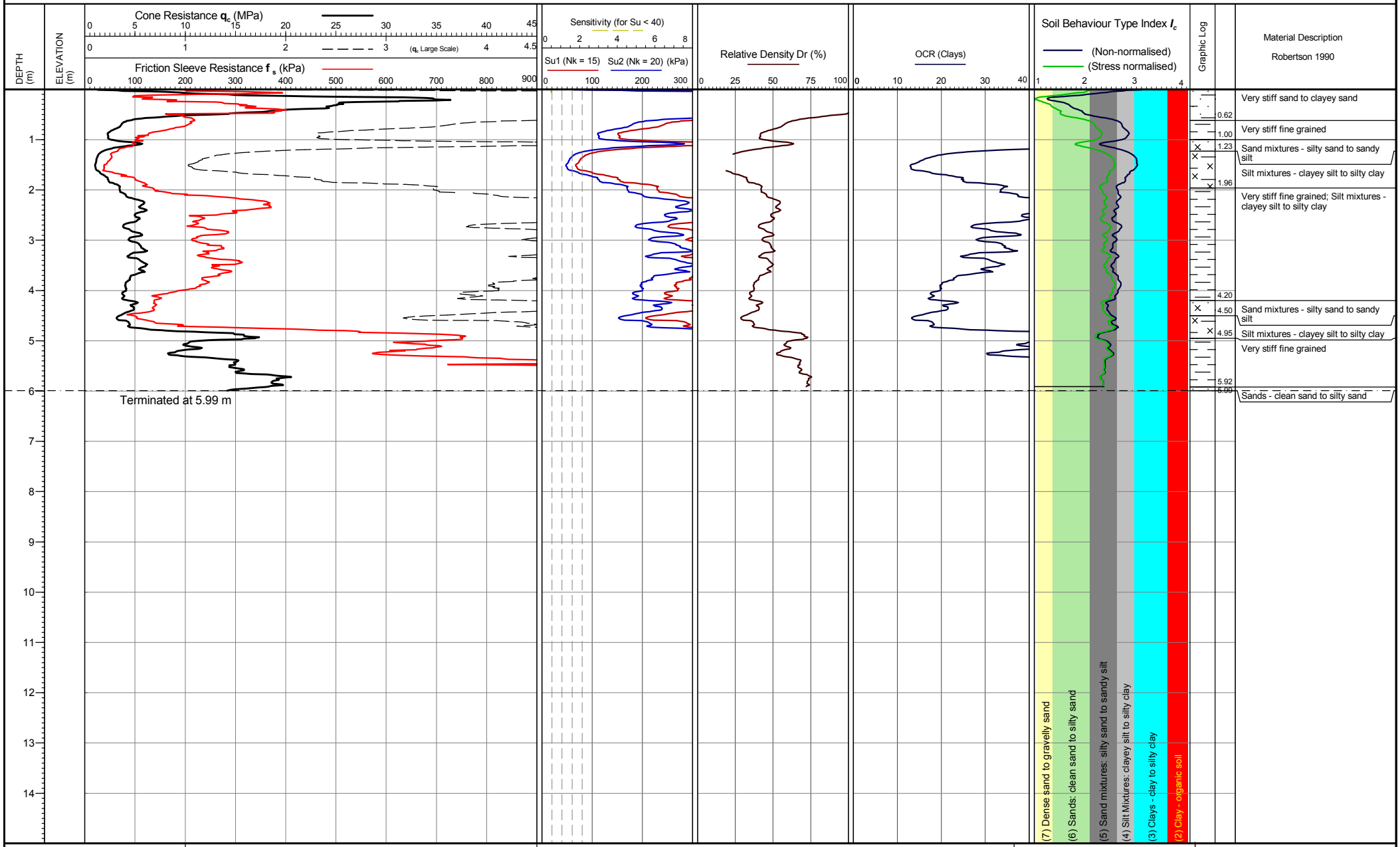
Checked by:
Chris Player

TEST ID: PB220

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 13:18:18

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Total cone load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16
Lankelma Project Ref: P-106347-1

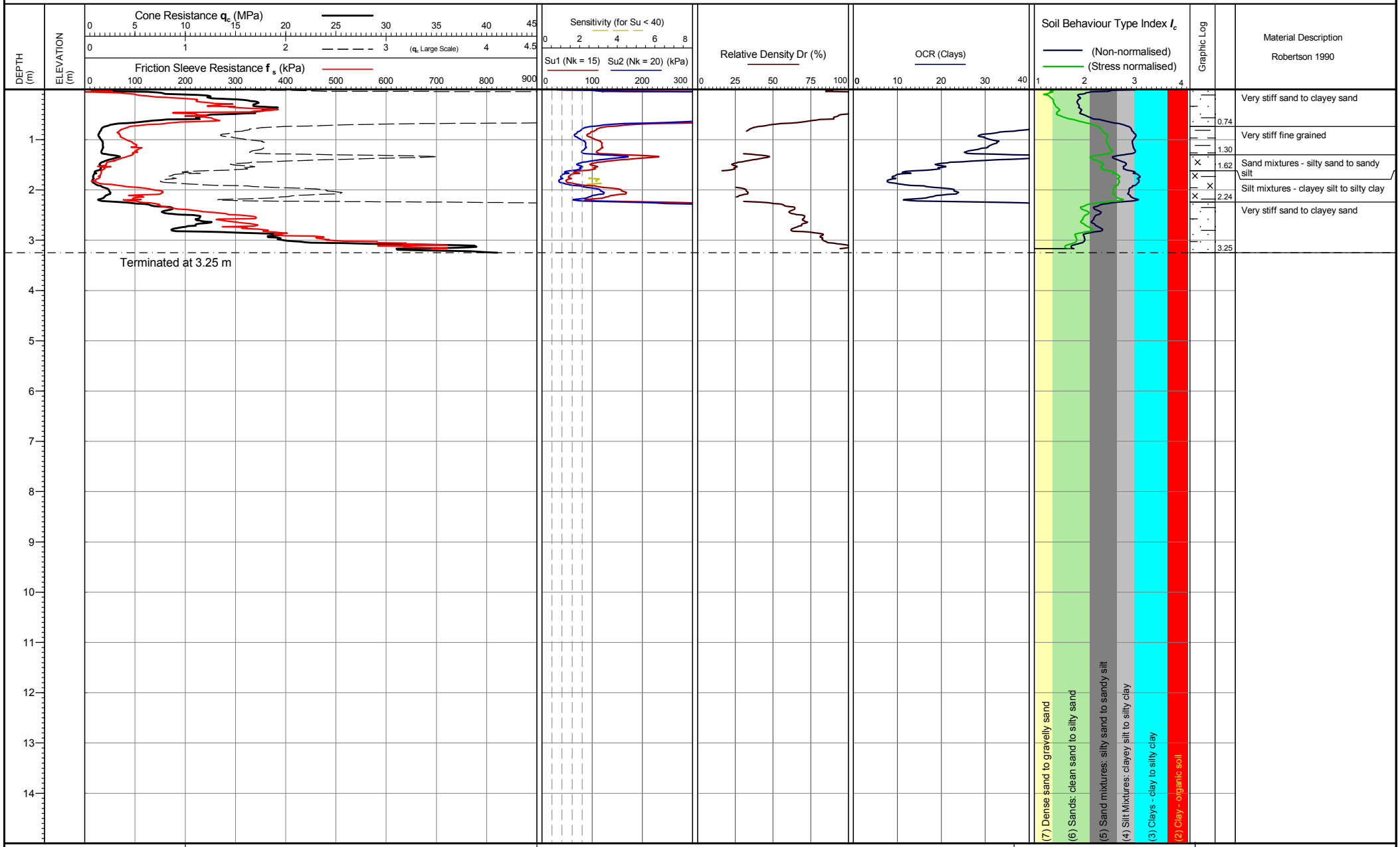
Checked by:
Chris Player

TEST ID: PB221

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1333
Operator: Walter Geddes
Rig Used: UK3
Date of test: 10/03/2016 13:37:14

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks:

Termination Remark:
Tip load

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 10-03-16

Lankelma Project Ref: P-106347-1

Checked by: Chris Player

TEST ID: PB222

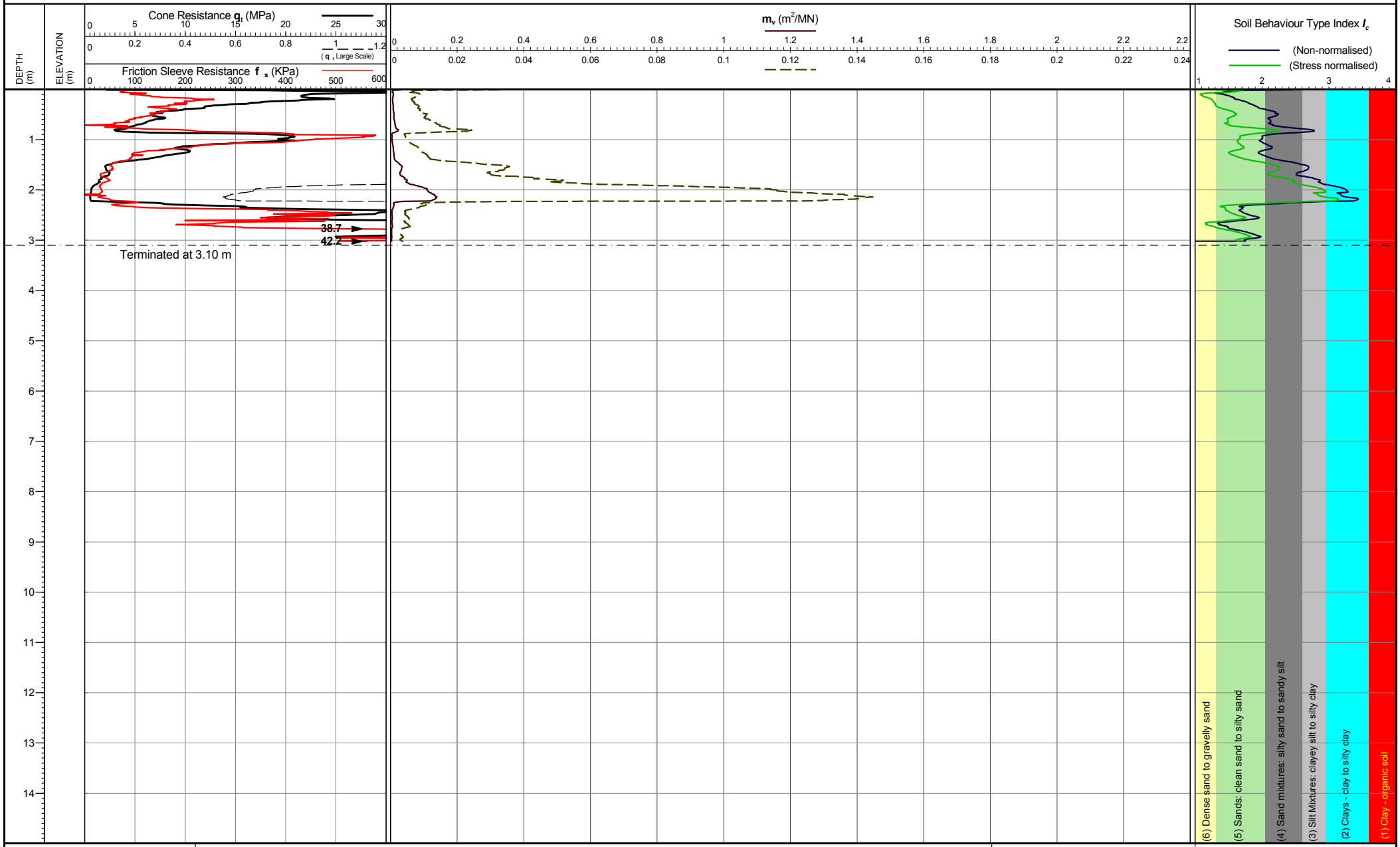
APPENDIX D GEOTECHNICAL PARAMETER RESULTS

COEFFICIENT OF VOLUME CHANGE

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 09:21:12

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

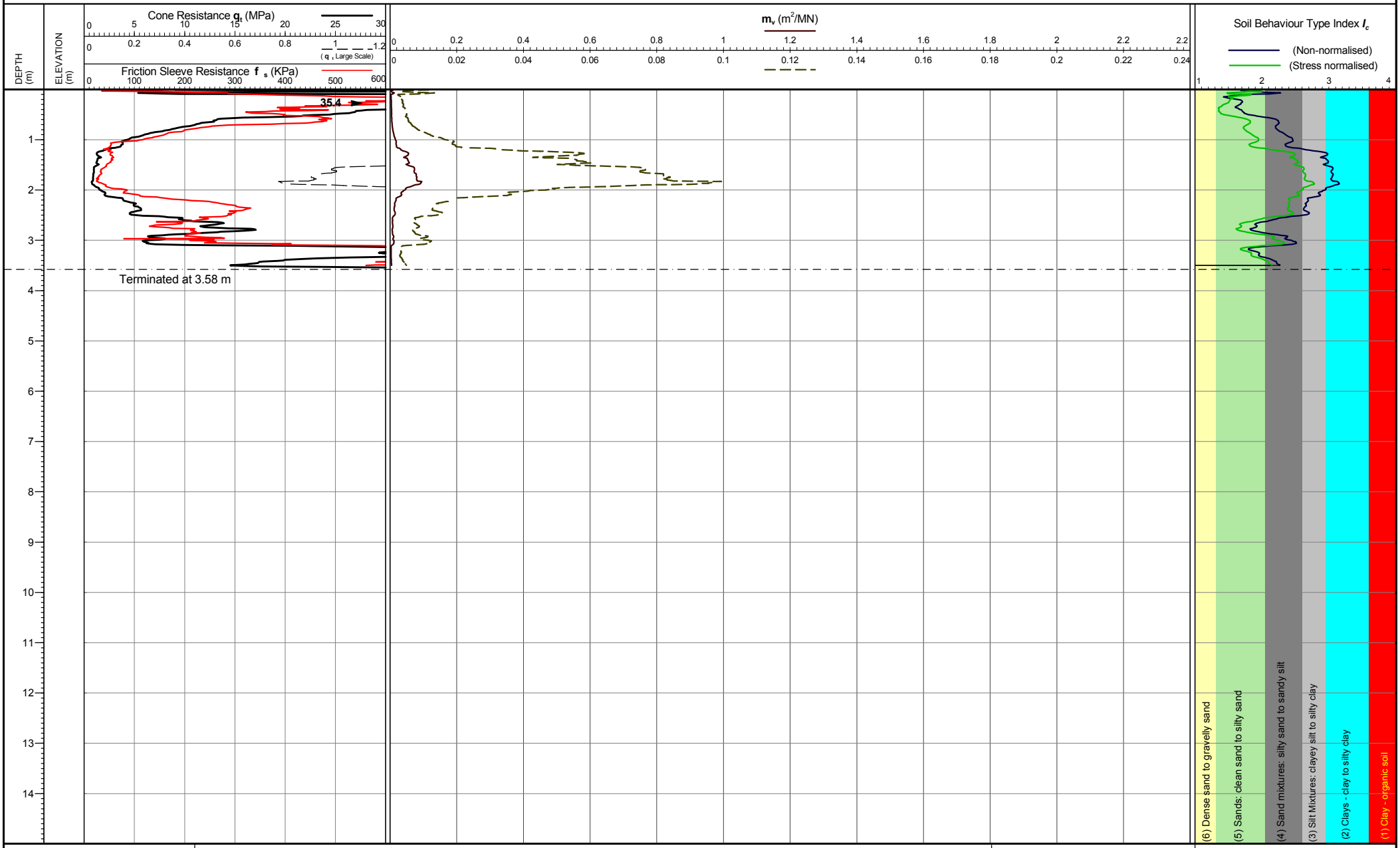
Lankelma Project Ref: P-106347-1

TEST ID: PB101

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 09:39:06

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

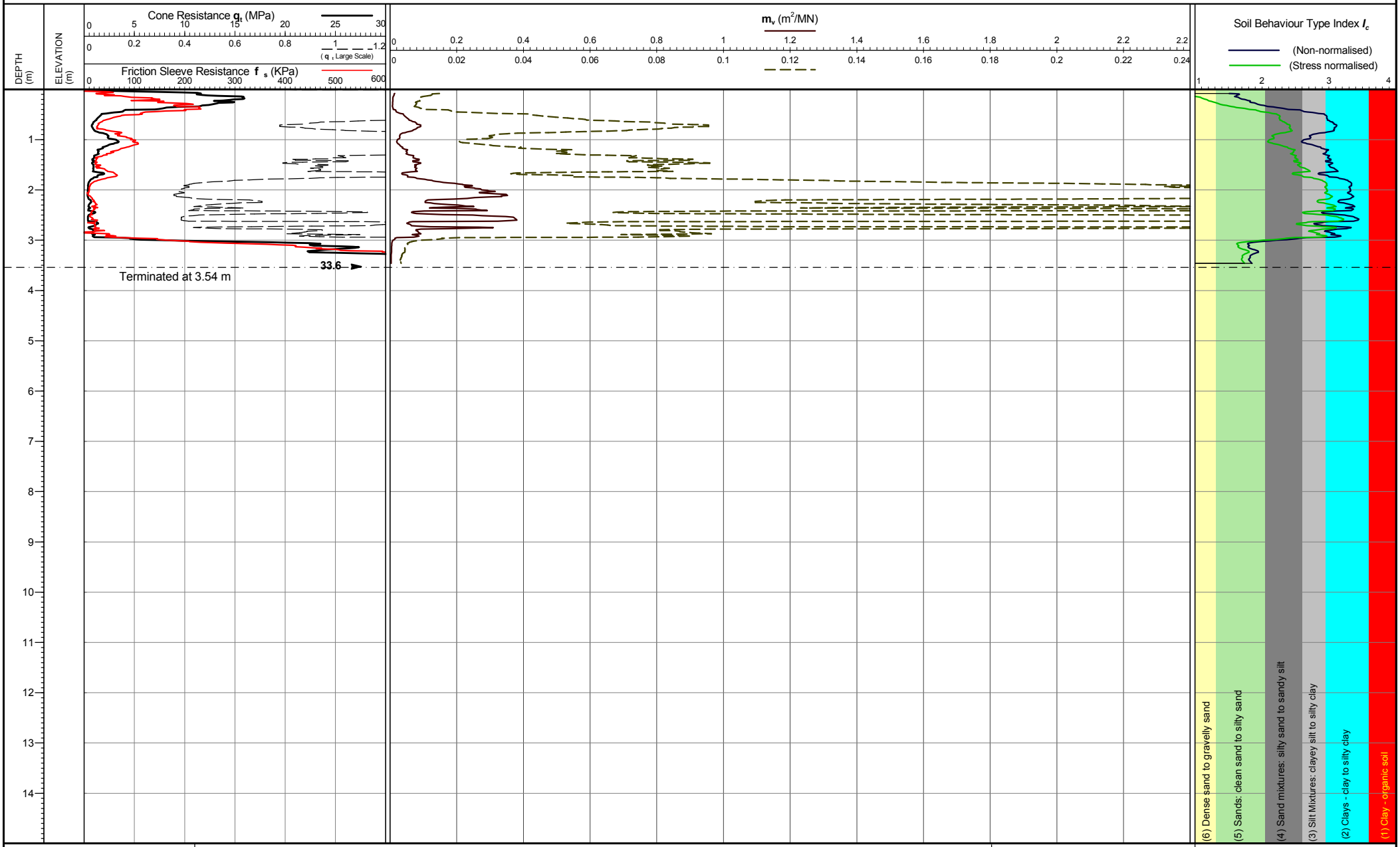
Lankelma Project Ref: P-106347-1

TEST ID: PB102

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 09/03/2016 13:36:39

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

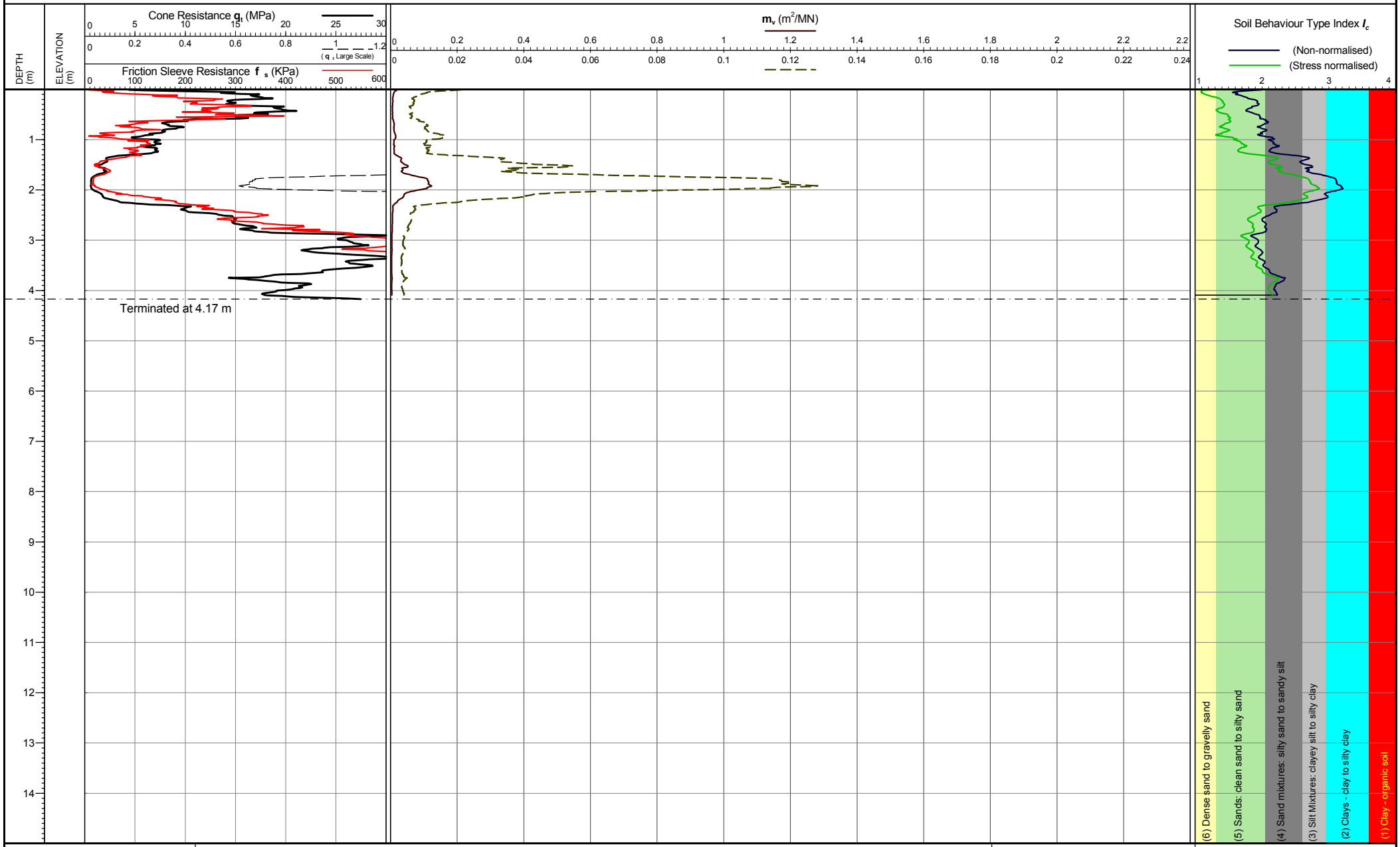
Lankelma Project Ref: P-106347-1

TEST ID: PB103

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 10:57:33

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

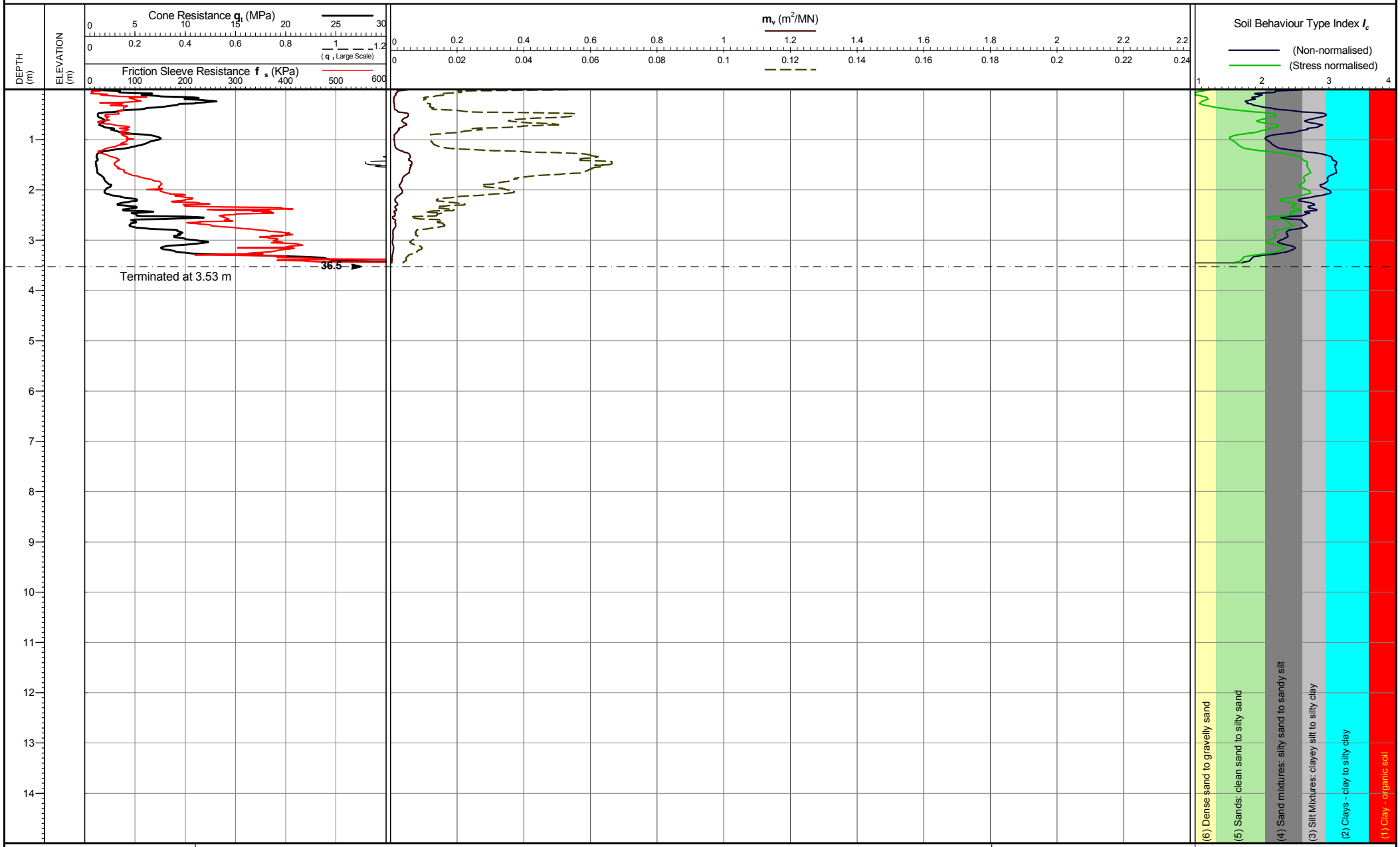
Lankelma Project Ref: P-106347-1

TEST ID: PB104

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 09/03/2016 12:57:48

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

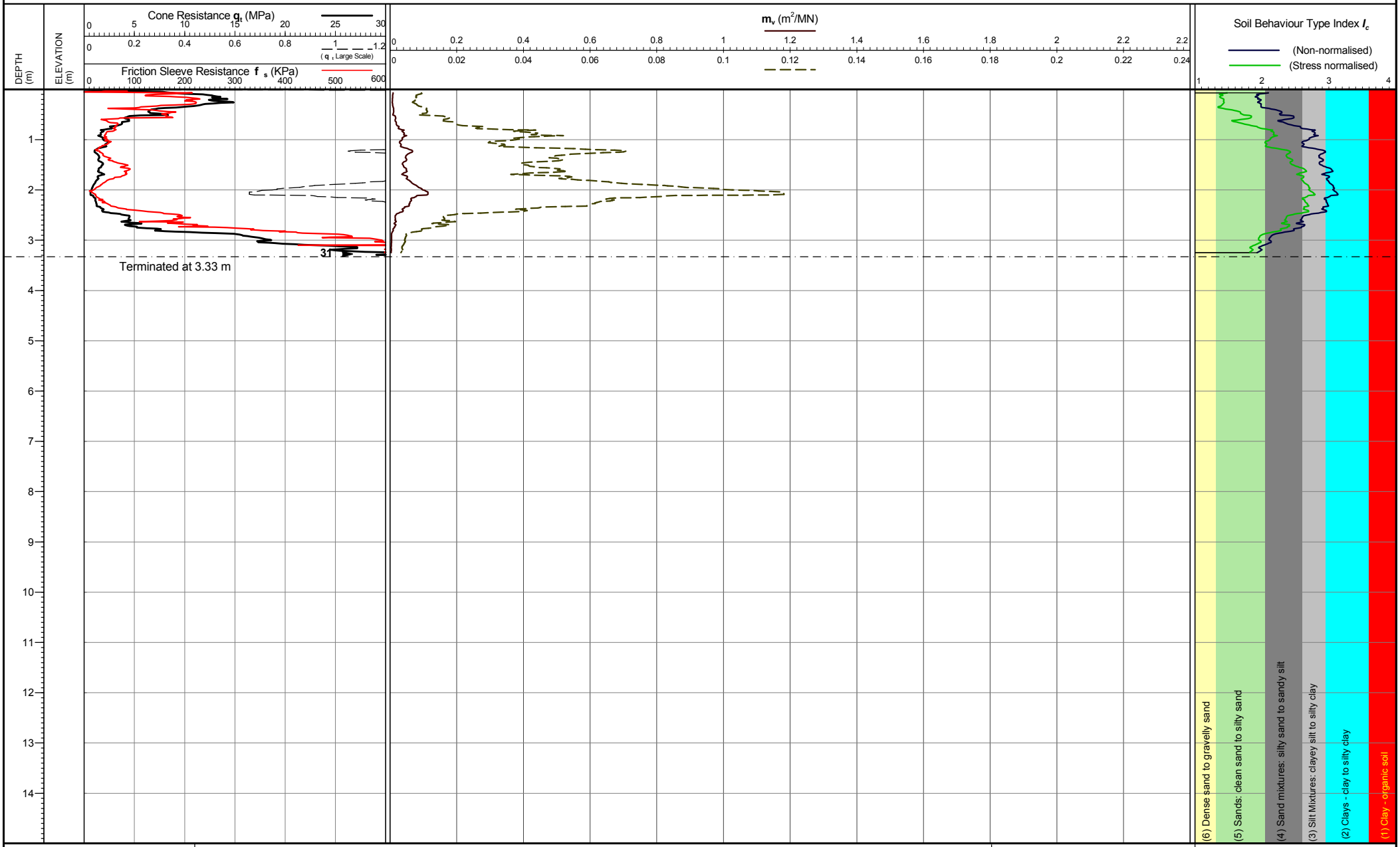
Lankelma Project Ref: P-106347-1

TEST ID: PB105

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 12:12:39

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

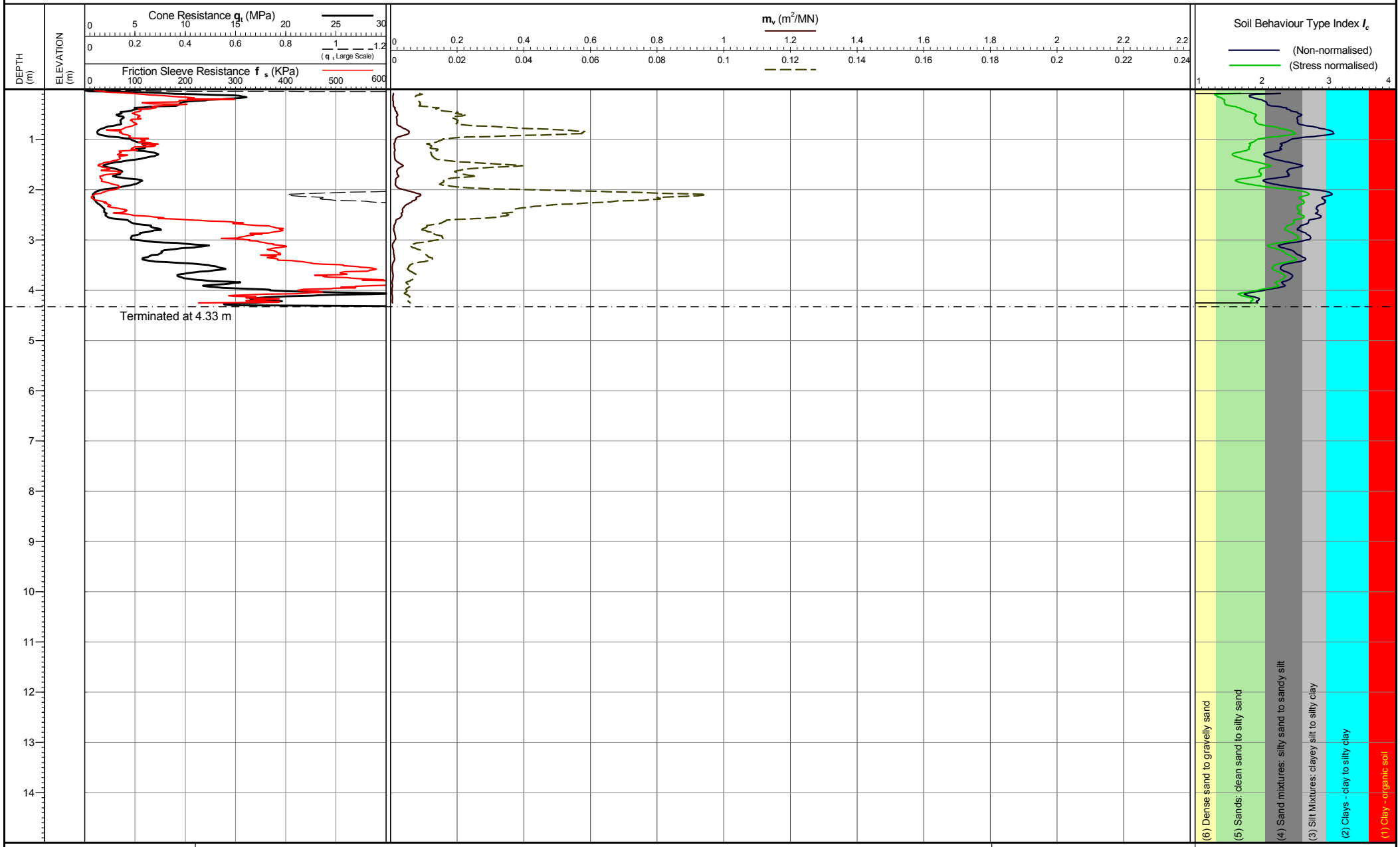
Lankelma Project Ref: P-106347-1

TEST ID: PB106

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 11:25:22

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

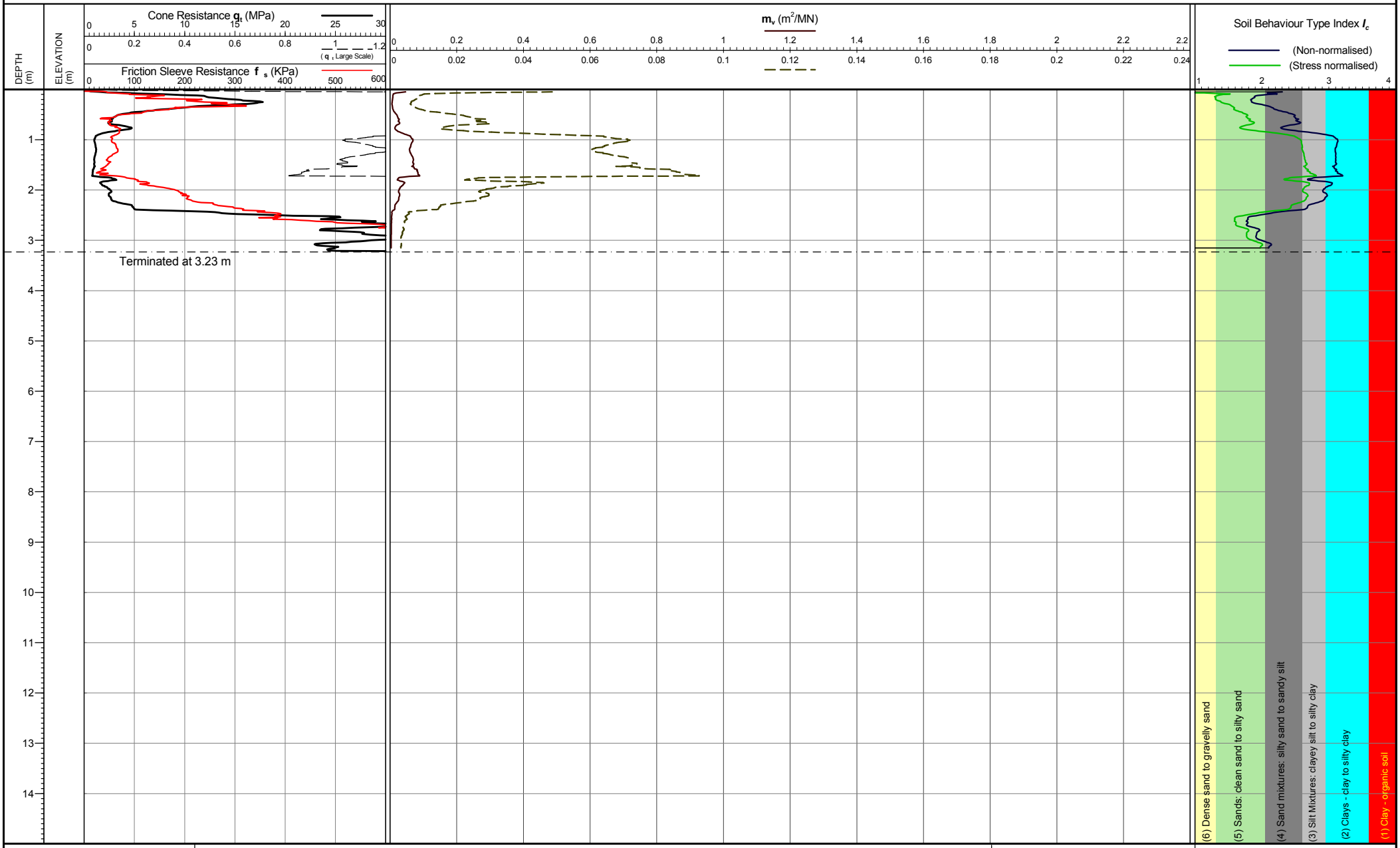
Lankelma Project Ref: P-106347-1

TEST ID: PB107

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 11:44:53

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

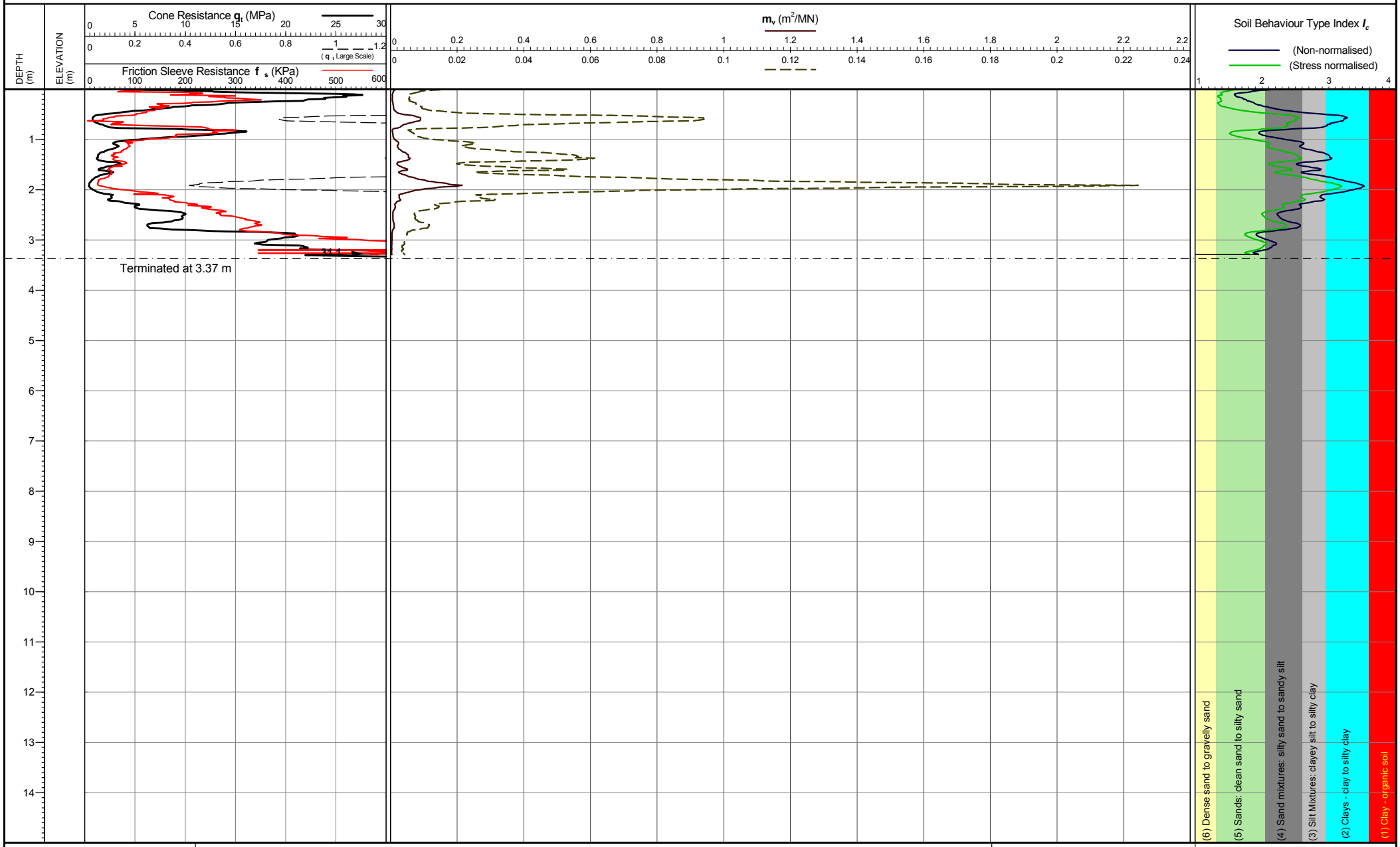
Lankelma Project Ref: P-106347-1

TEST ID: PB108

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 10:37:04

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

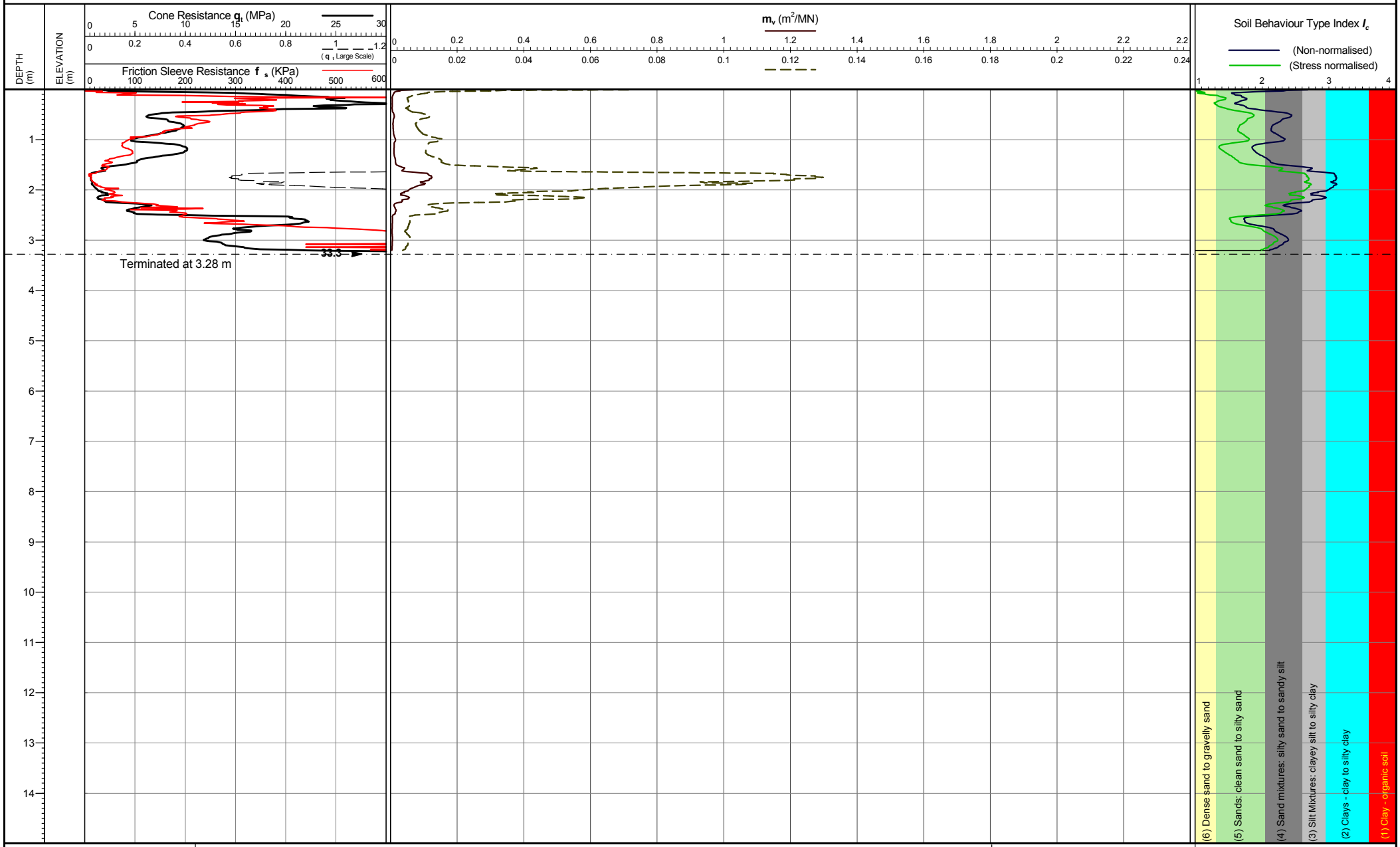
Lankelma Project Ref: P-106347-1

TEST ID: PB109

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 09/03/2016 14:18:26

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

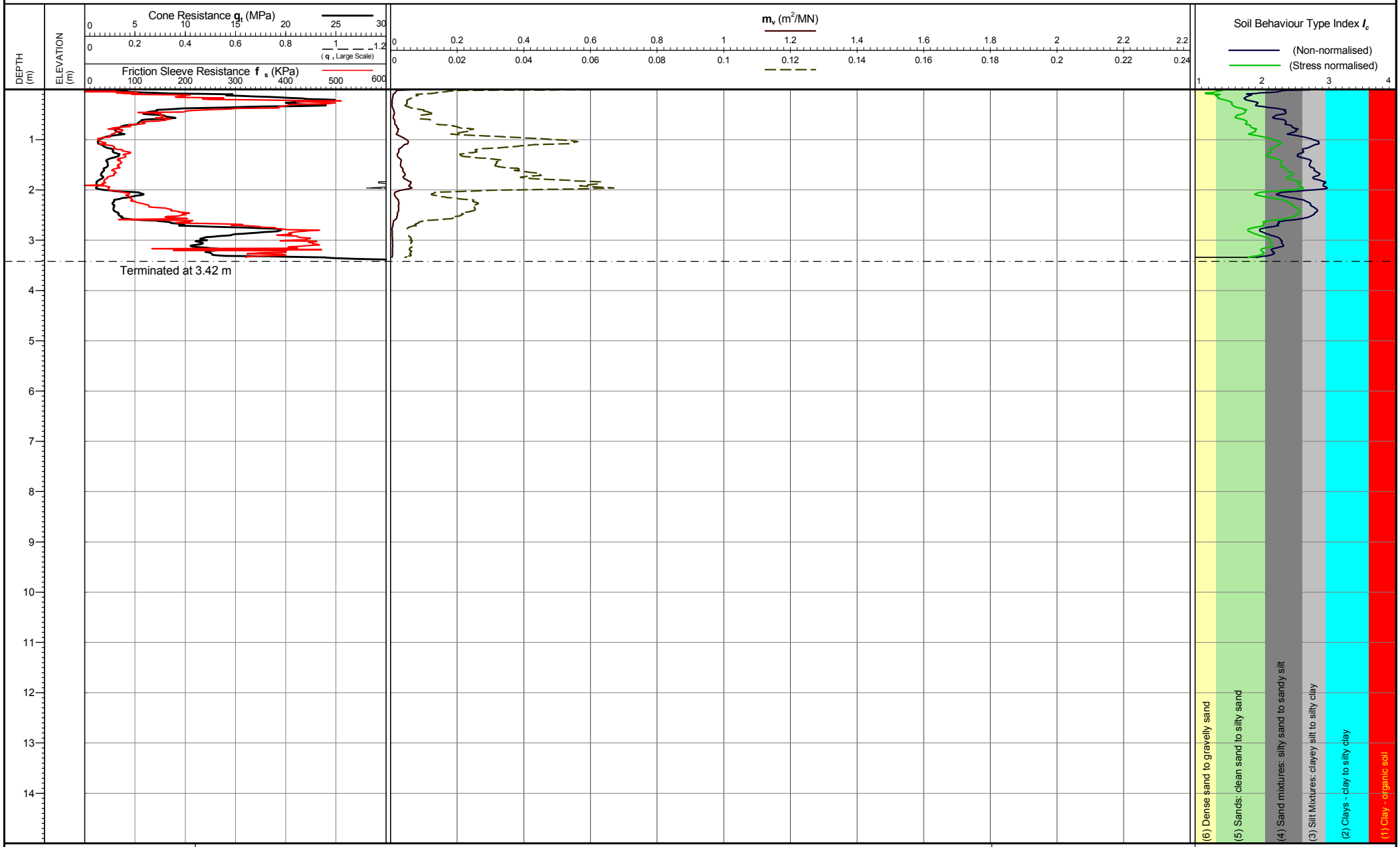
Lankelma Project Ref: P-106347-1

TEST ID: PB110

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 13:57:55

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

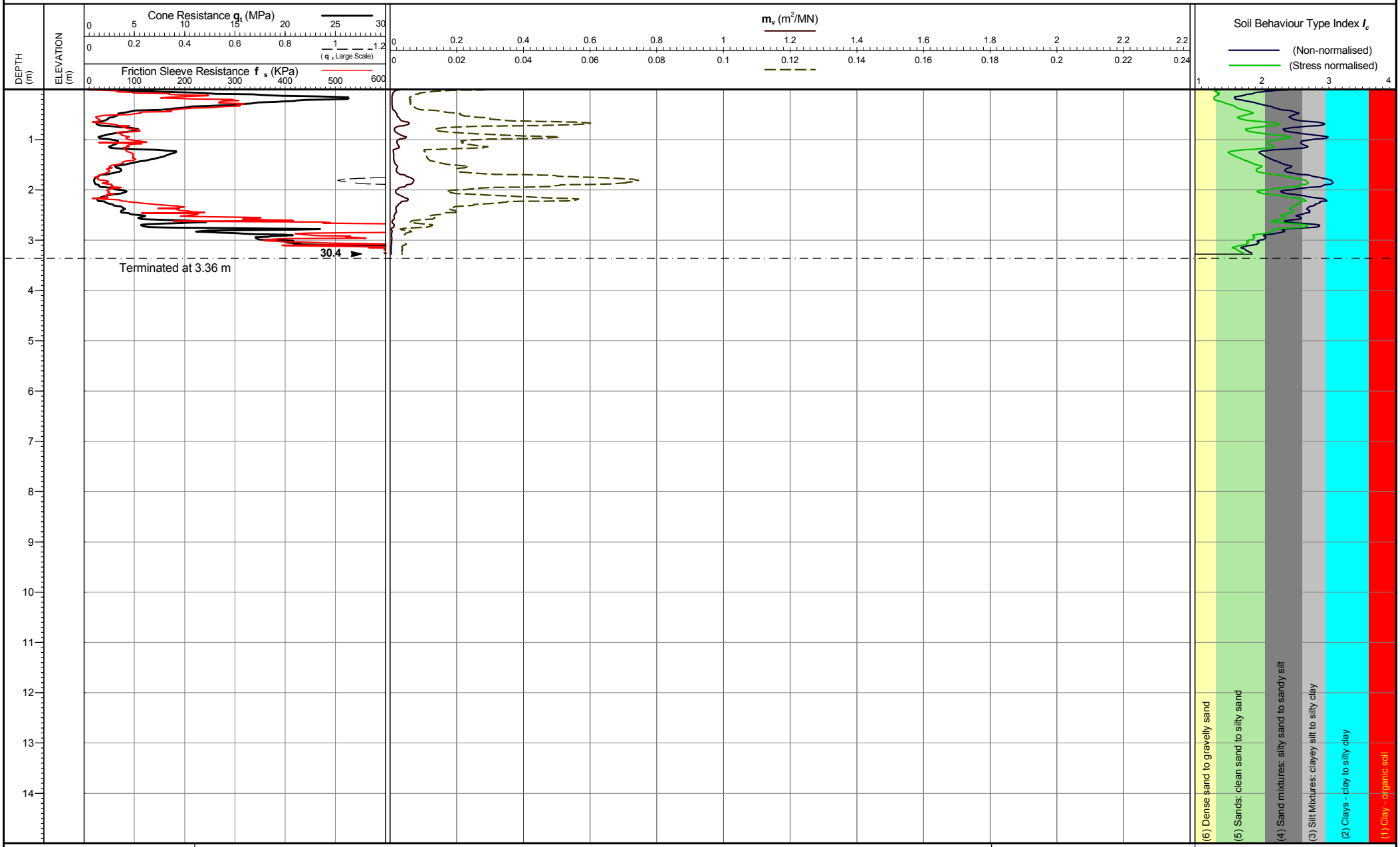
Lankelma Project Ref: P-106347-1

TEST ID: PB111

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 13:12:28

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

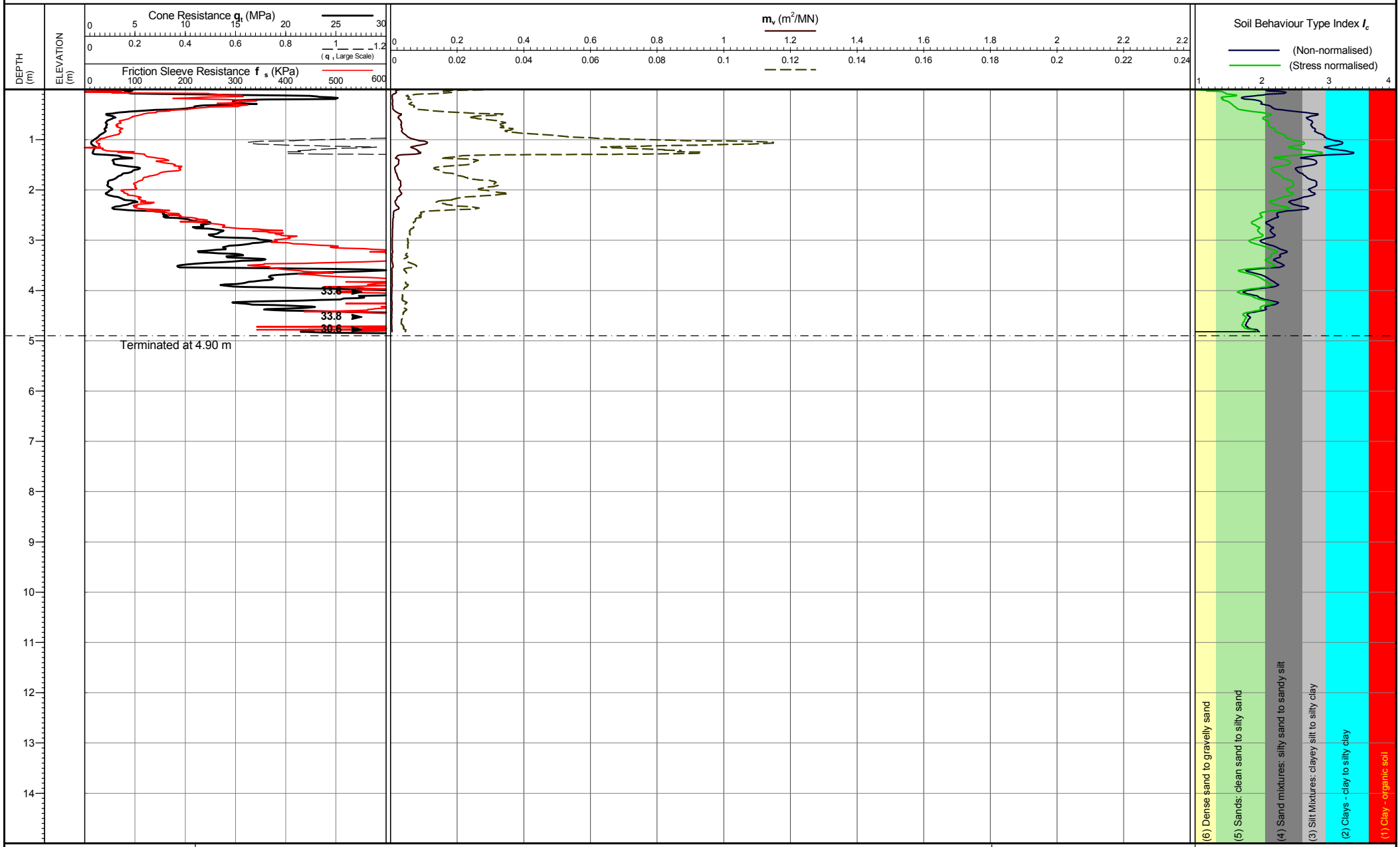
Lankelma Project Ref: P-106347-1

TEST ID: PB112

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 10:09:24

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

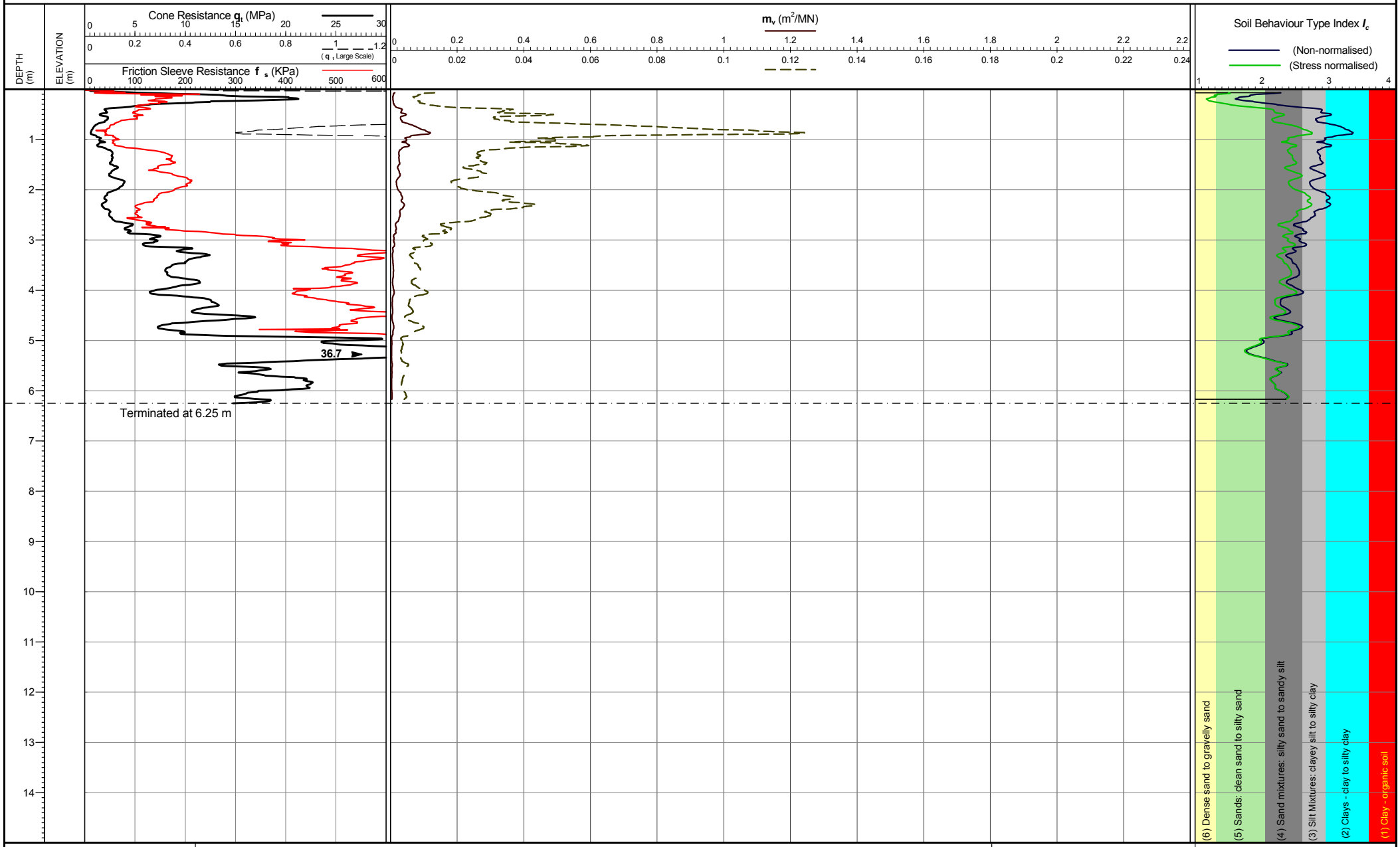
Lankelma Project Ref: P-106347-1

TEST ID: PB113

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 09/03/2016 15:38:41

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

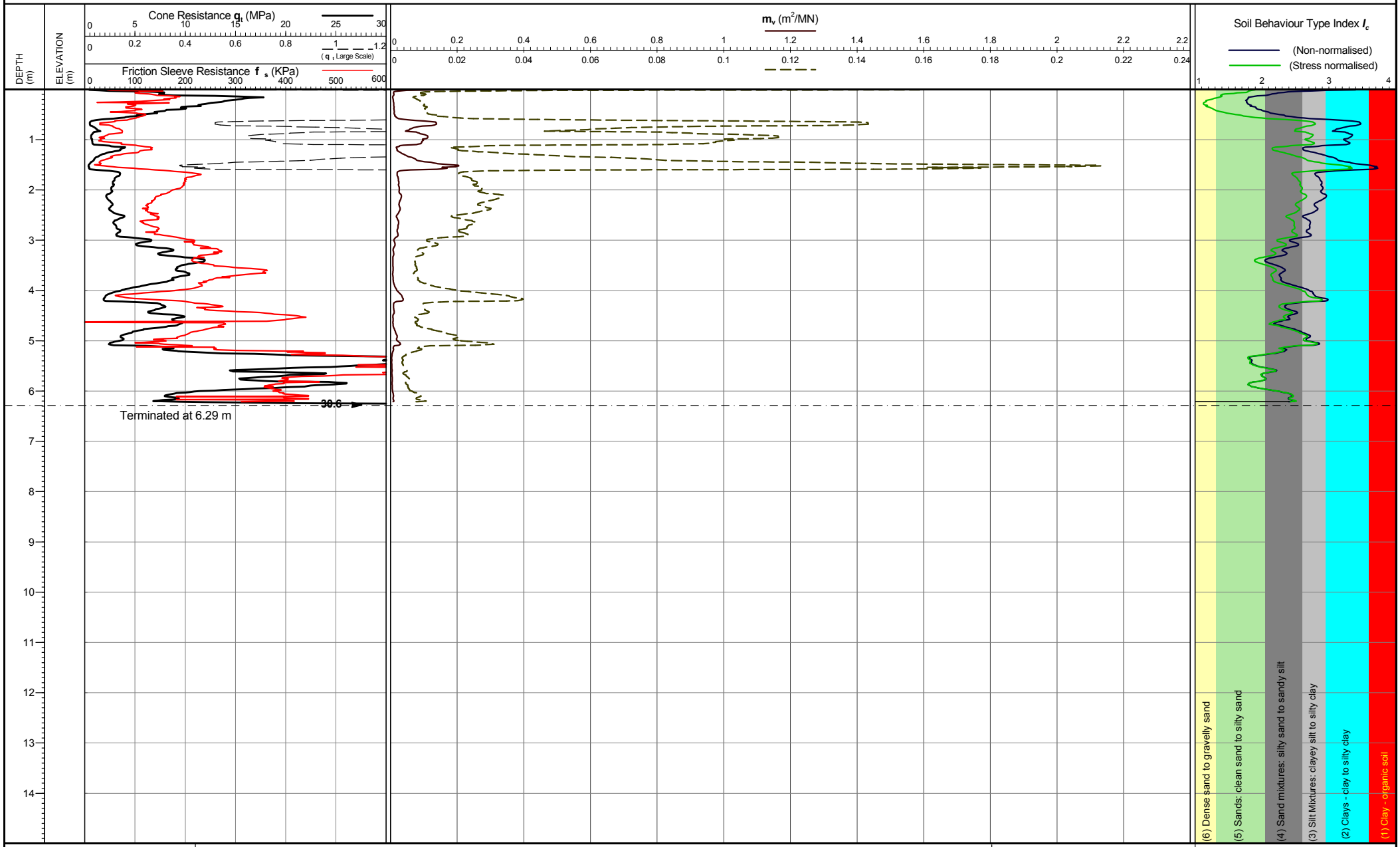
Lankelma Project Ref: P-106347-1

TEST ID: PB201

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 10/03/2016 08:44:44

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

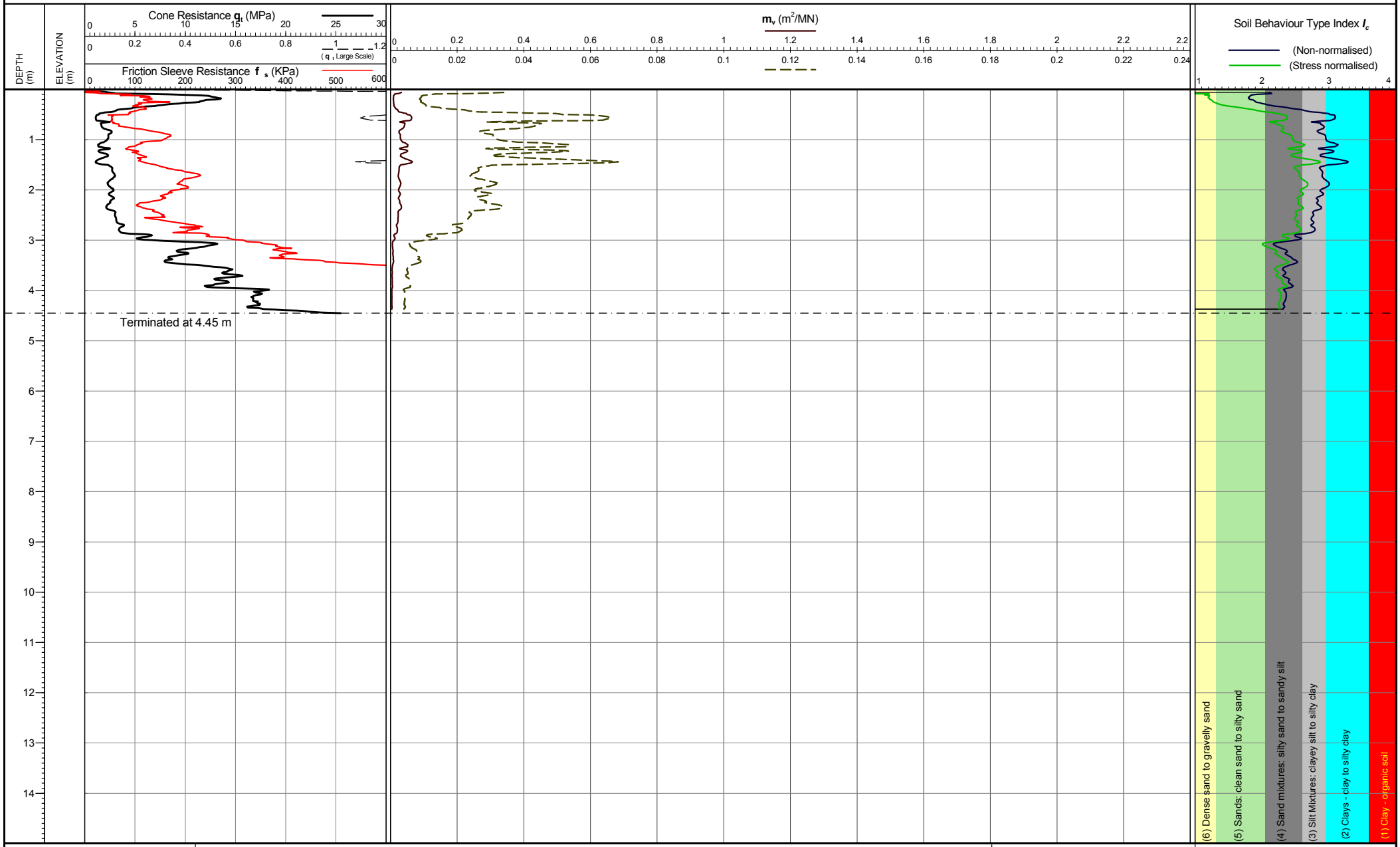
Lankelma Project Ref: P-106347-1

TEST ID: PB202

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 08:24:36

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

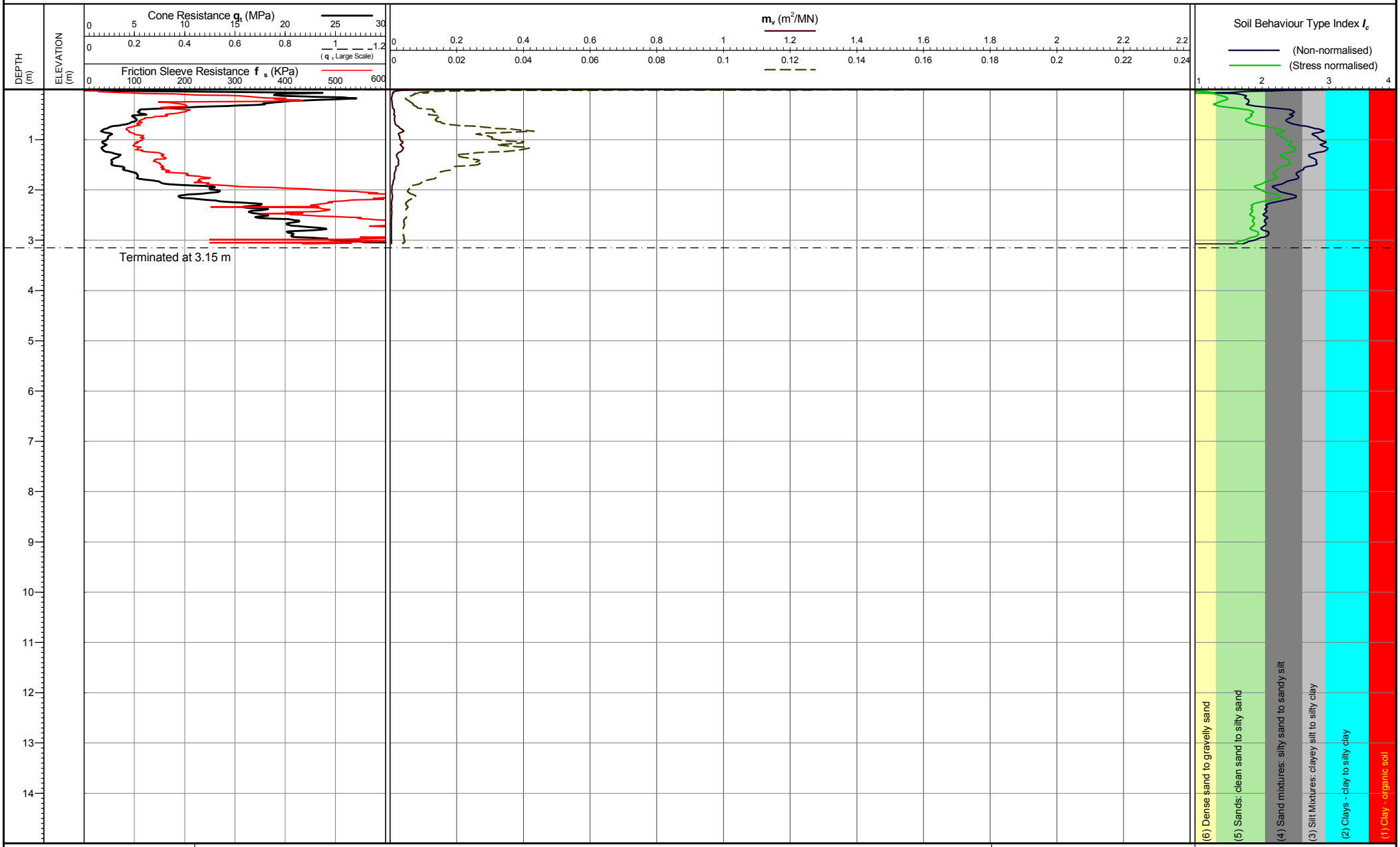
Lankelma Project Ref: P-106347-1

TEST ID: PB203

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 09/03/2016 15:54:14

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

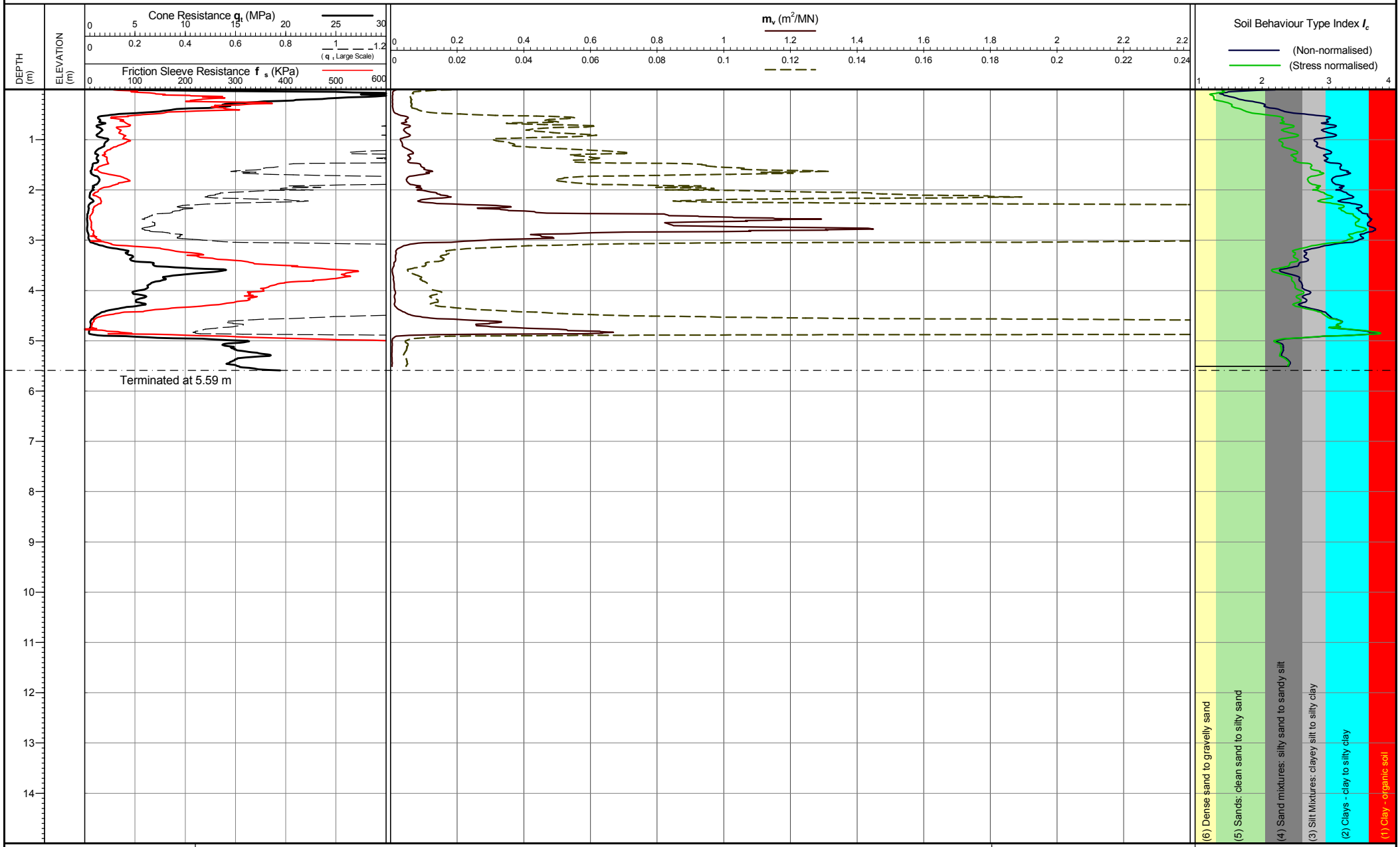
Lankelma Project Ref: P-106347-1

TEST ID: PB204

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 09/03/2016 16:10:46

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

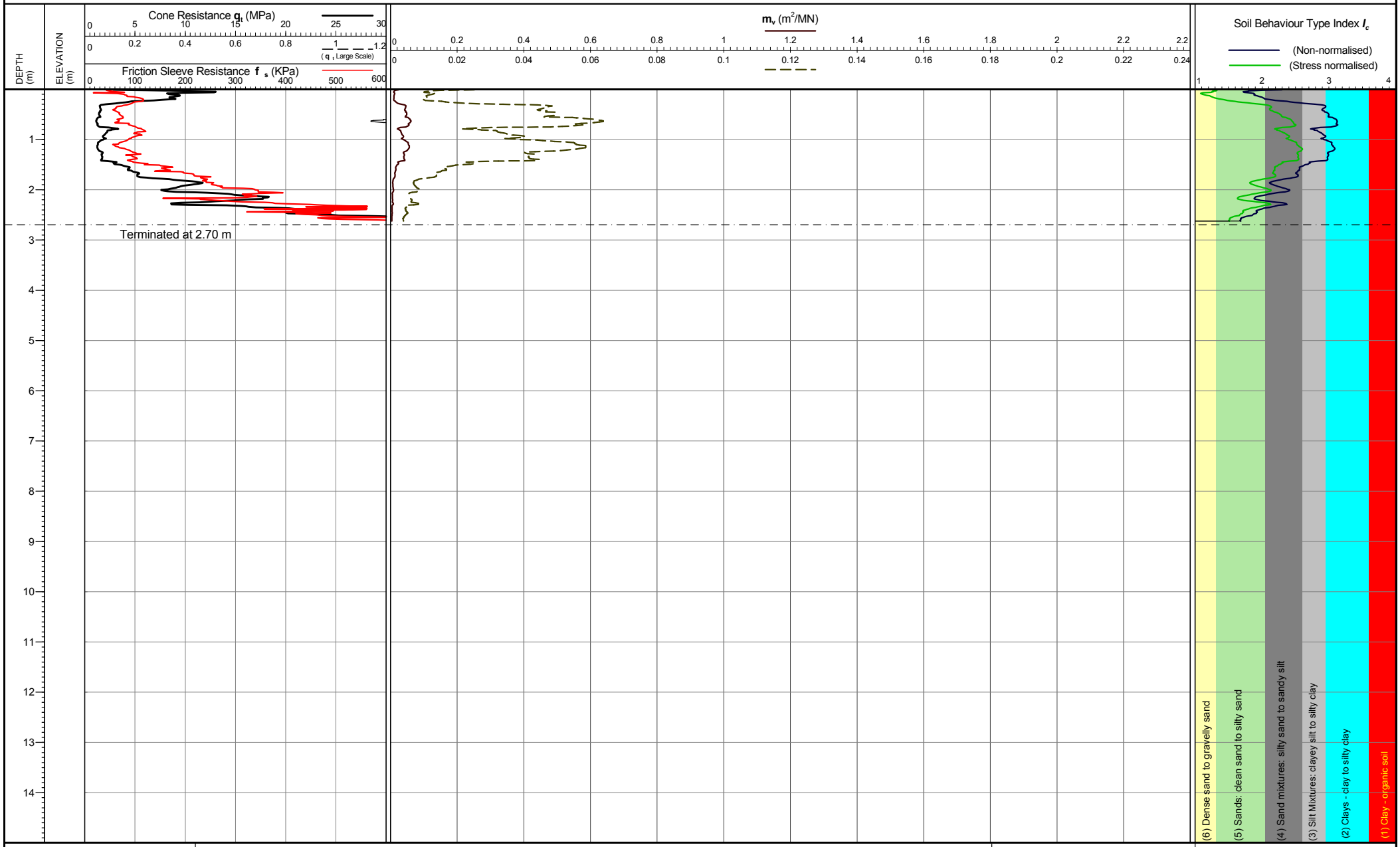
Lankelma Project Ref: P-106347-1

TEST ID: PB205

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 09:03:08

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

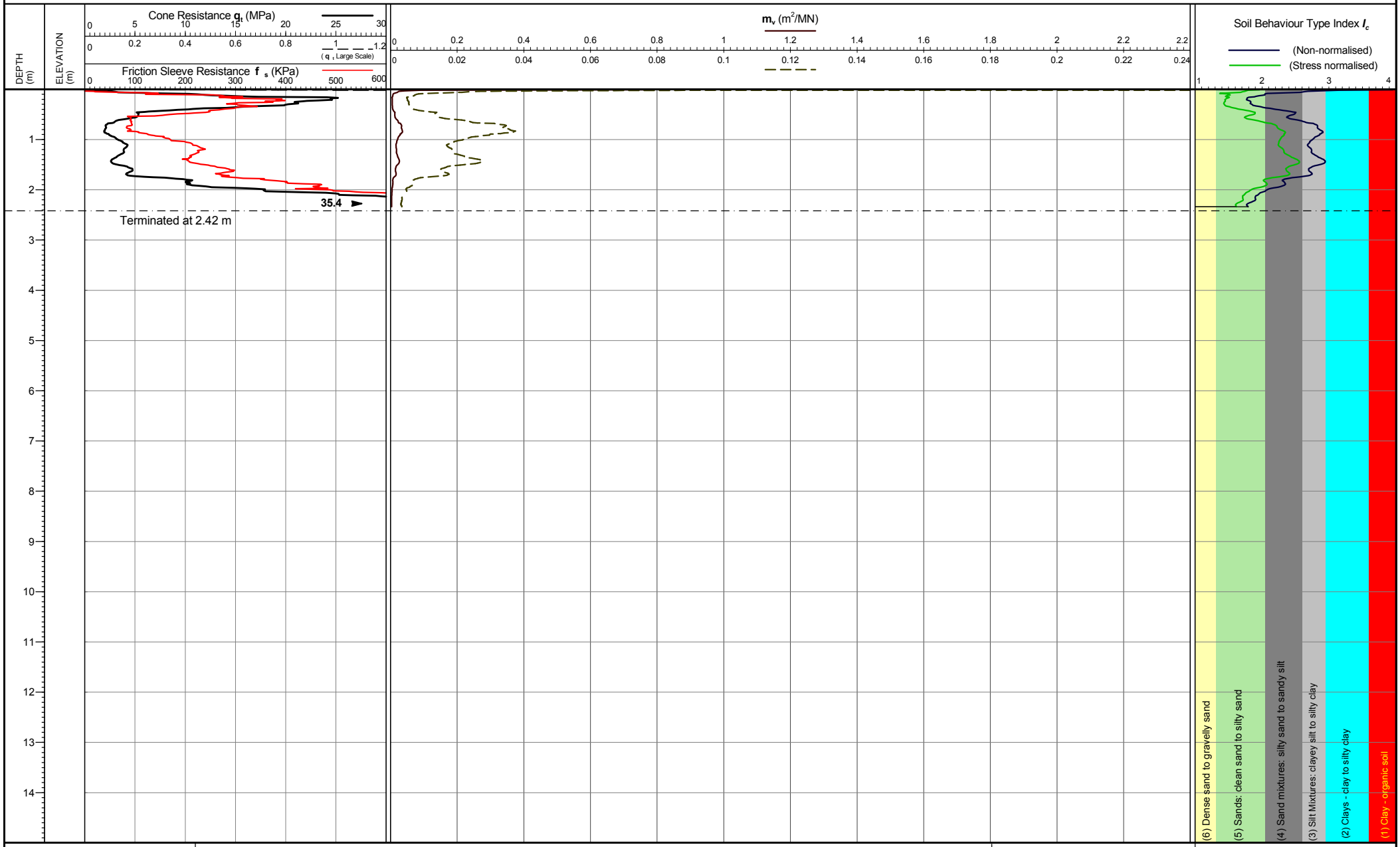
Lankelma Project Ref: P-106347-1

TEST ID: PB206

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 09:39:49

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

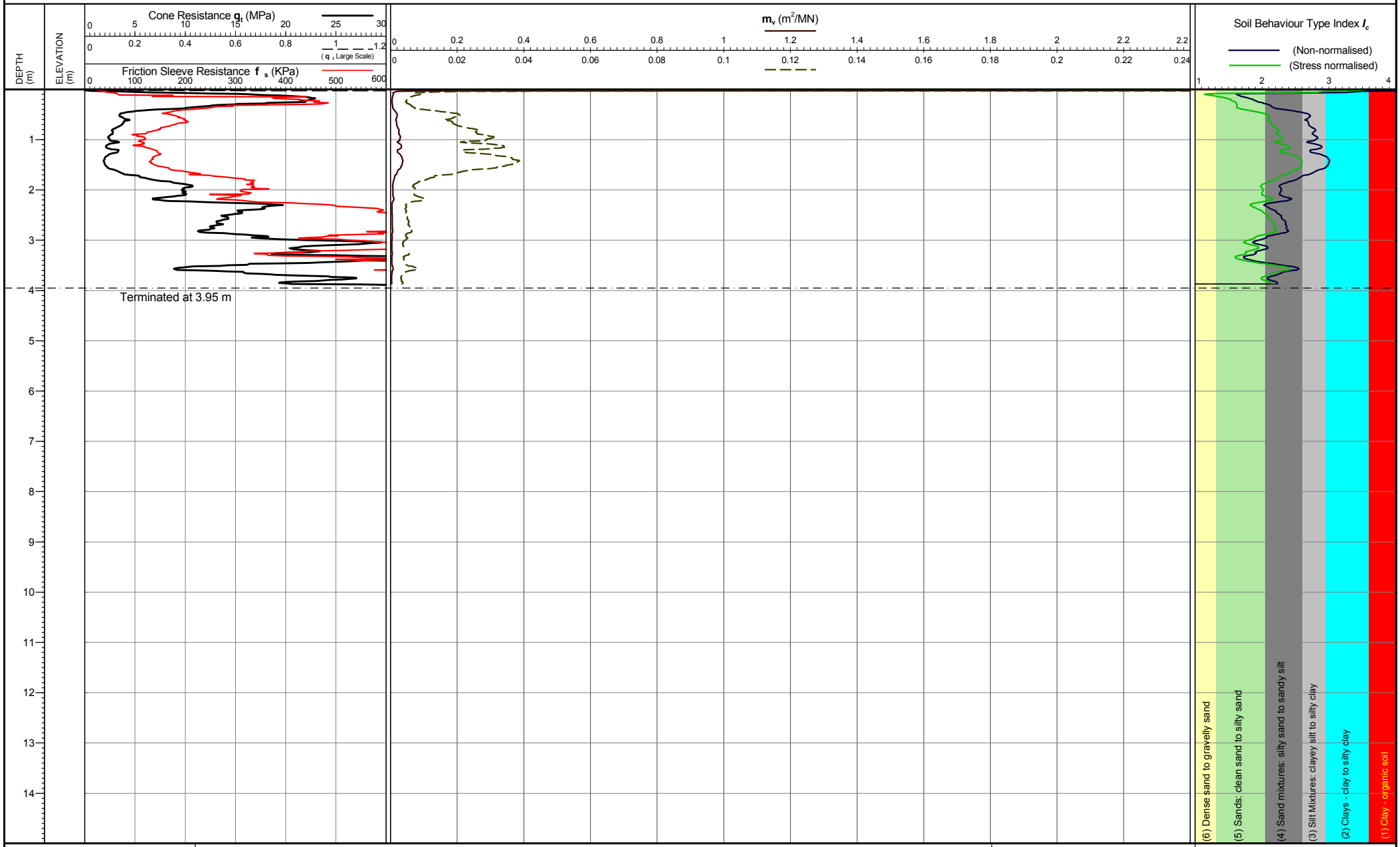
Lankelma Project Ref: P-106347-1

TEST ID: PB207

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 10/03/2016 09:18:12

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

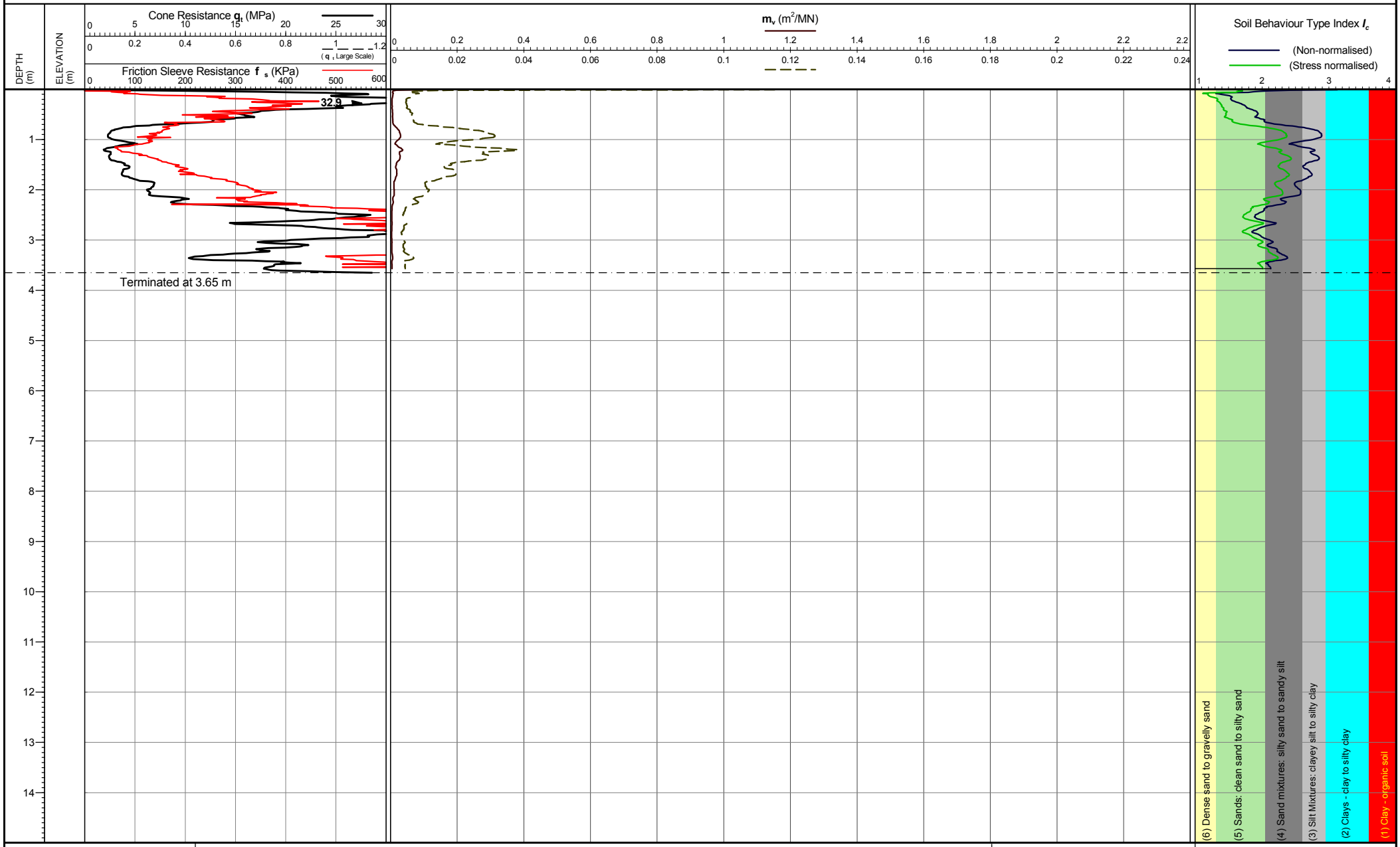
Lankelma Project Ref: P-106347-1

TEST ID: PB208

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 10:03:15

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

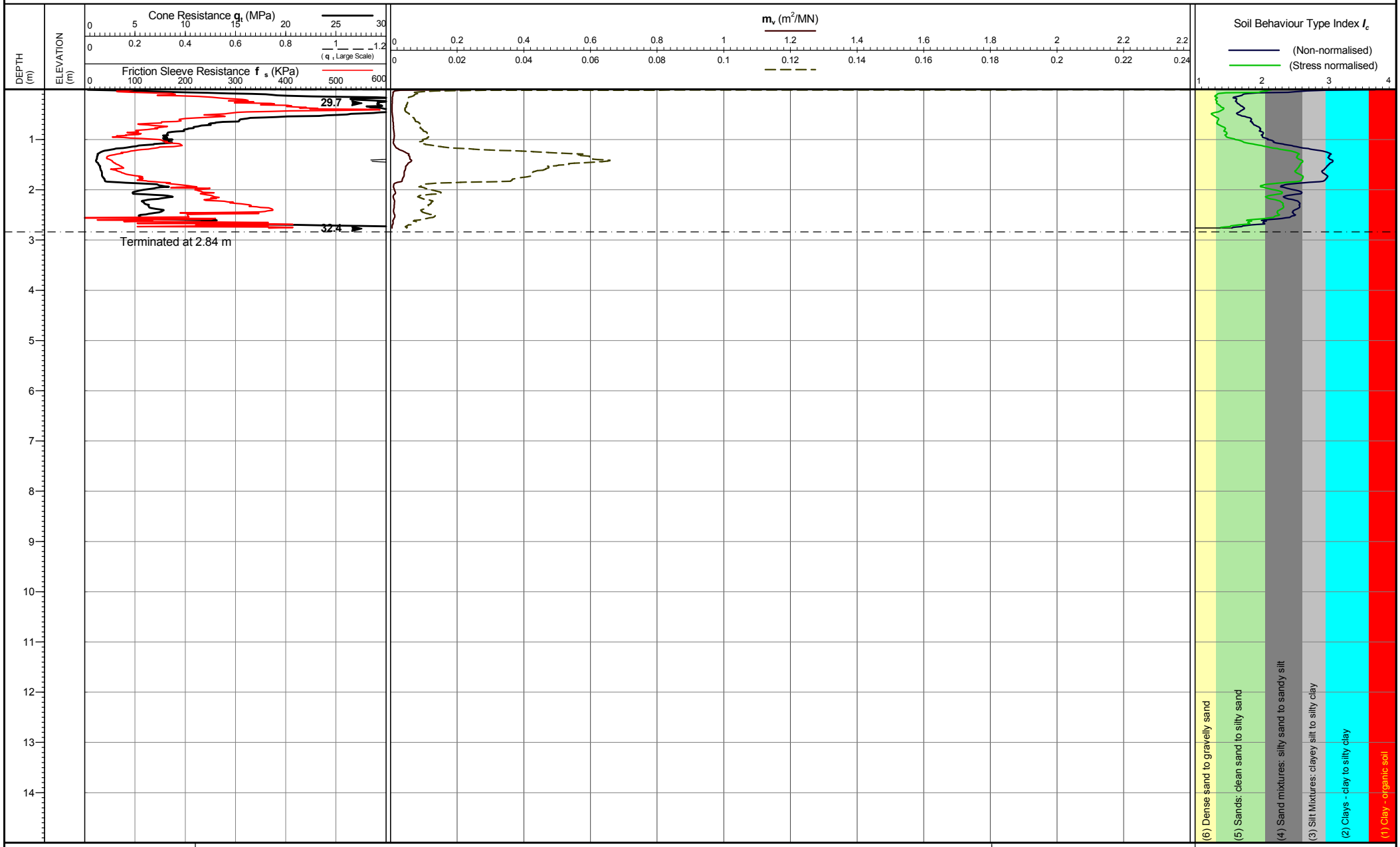
Lankelma Project Ref: P-106347-1

TEST ID: PB209

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 10:51:43

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

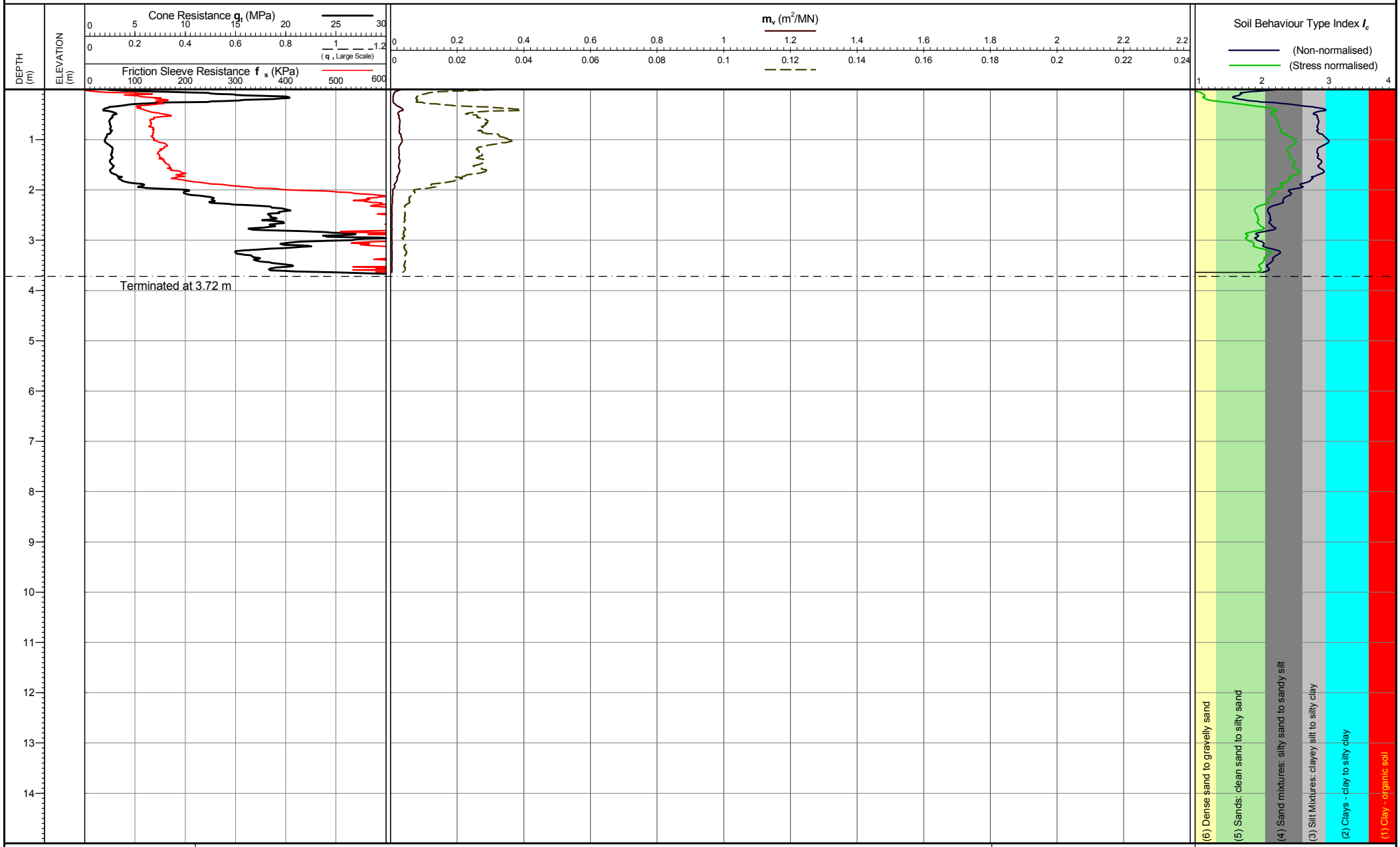
Lankelma Project Ref: P-106347-1

TEST ID: PB210

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 10/03/2016 11:15:23

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

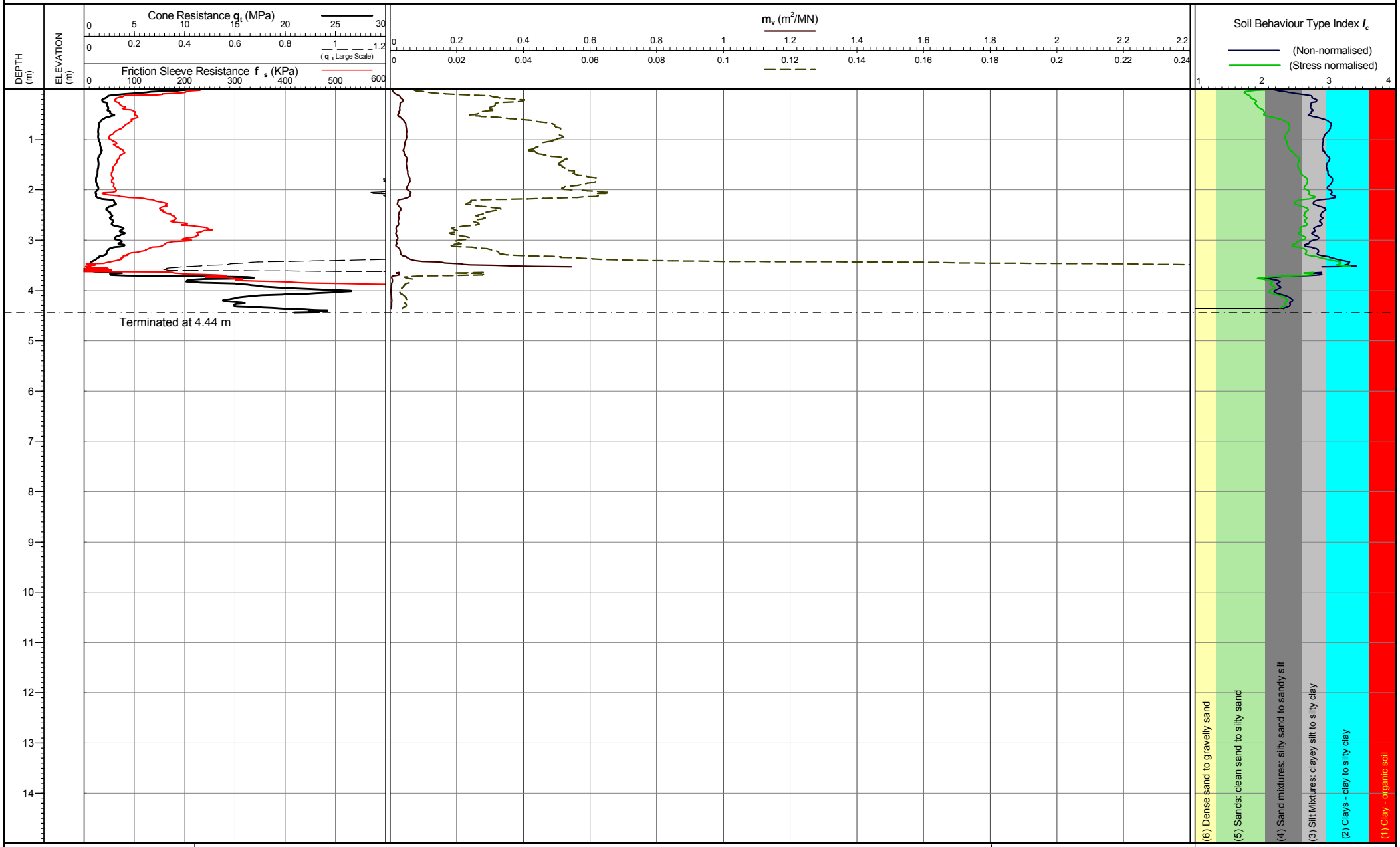
Lankelma Project Ref: P-106347-1

TEST ID: PB211

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 12:52:28

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

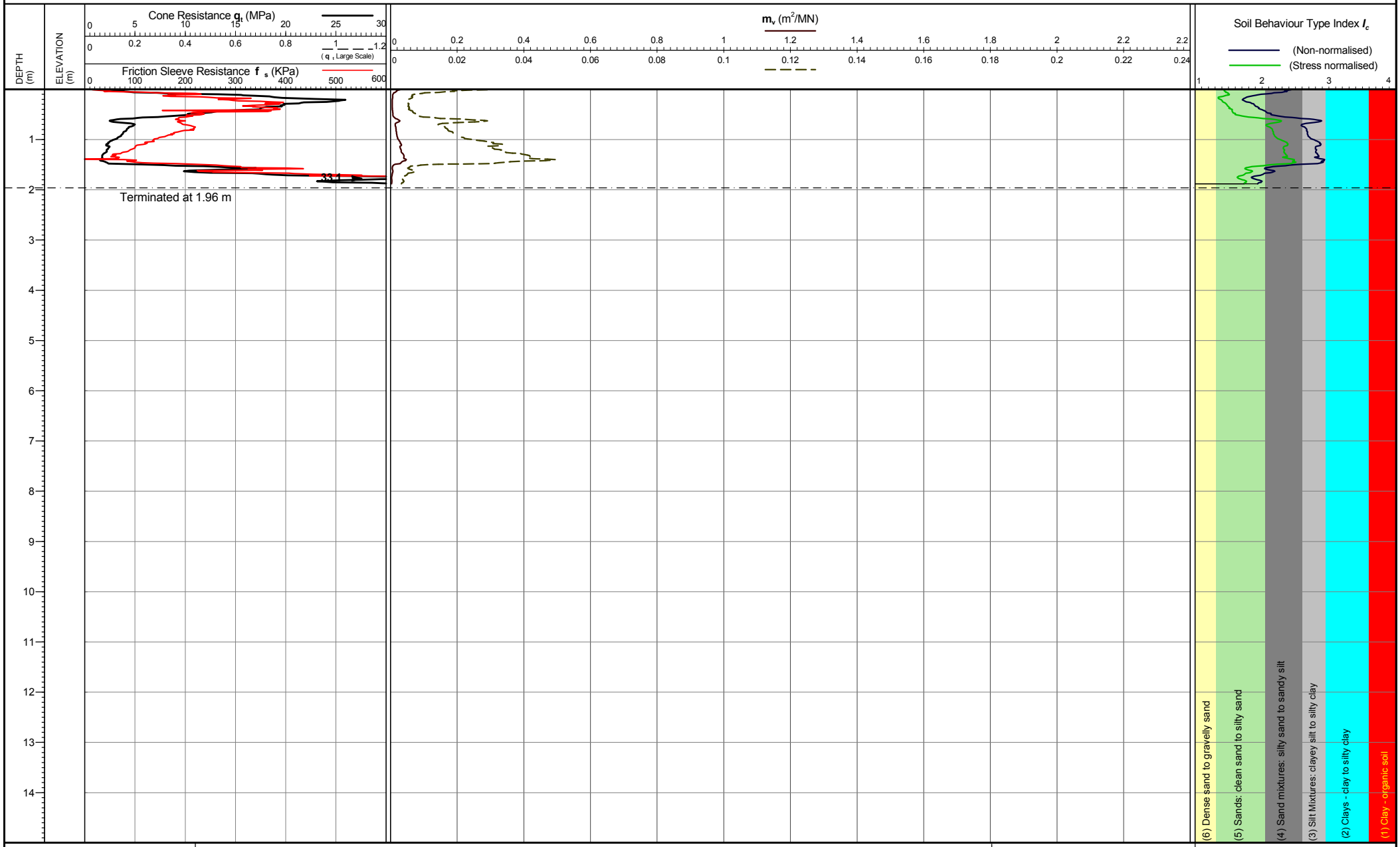
Lankelma Project Ref: P-106347-1

TEST ID: PB212

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 14:18:12

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

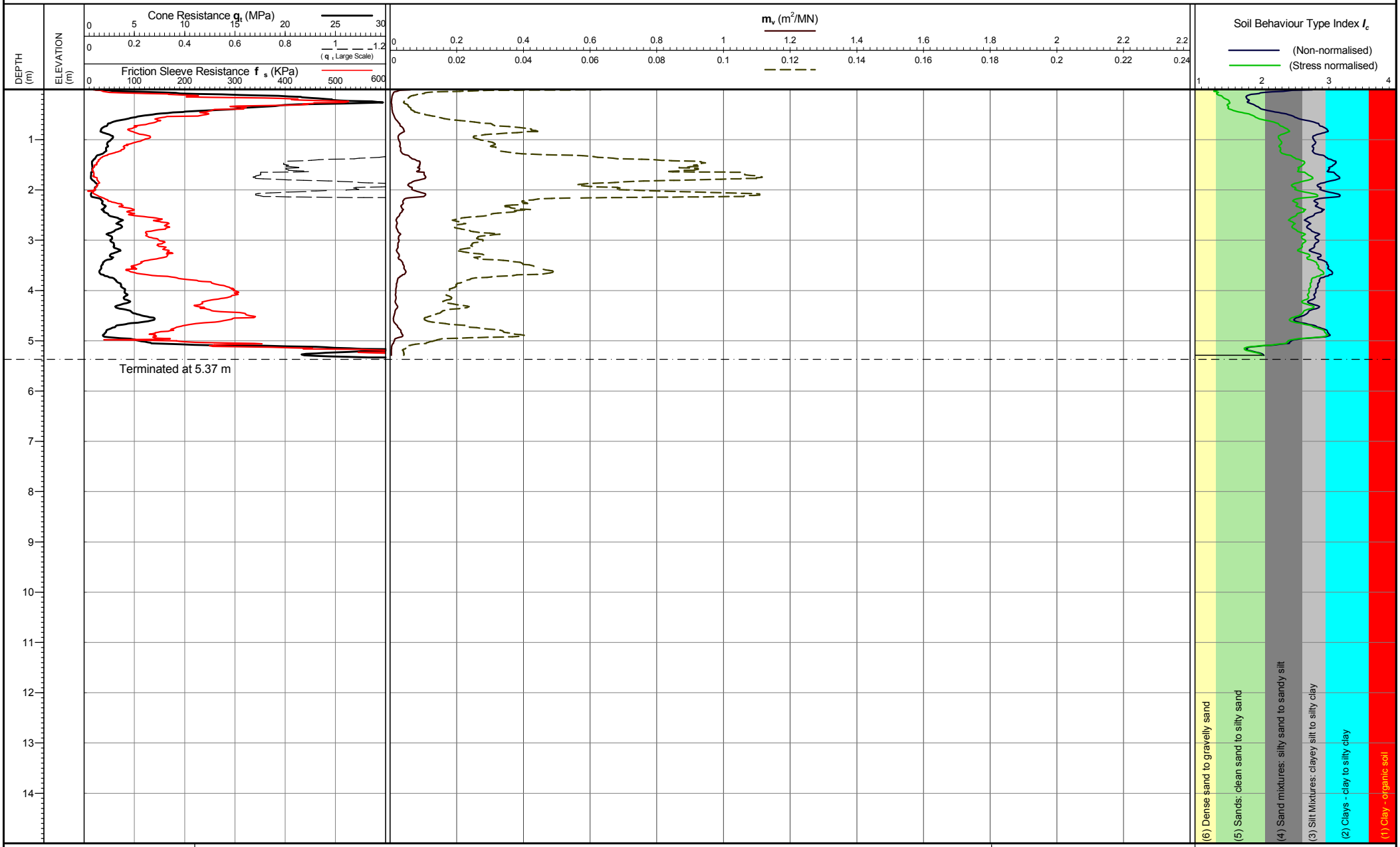
Lankelma Project Ref: P-106347-1

TEST ID: PB213

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 13:51:57

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

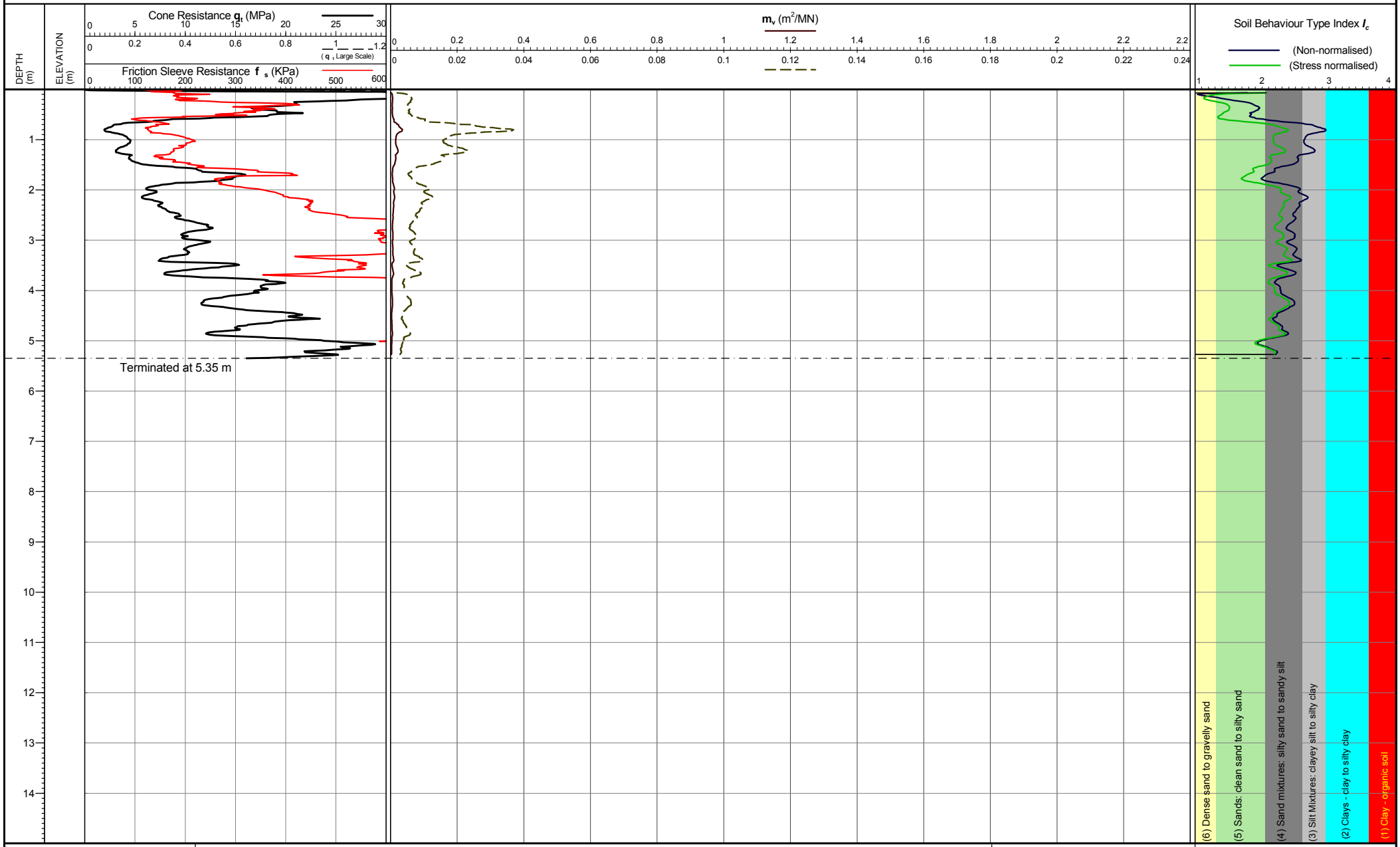
Lankelma Project Ref: P-106347-1

TEST ID: PB214

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 10/03/2016 14:33:06

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

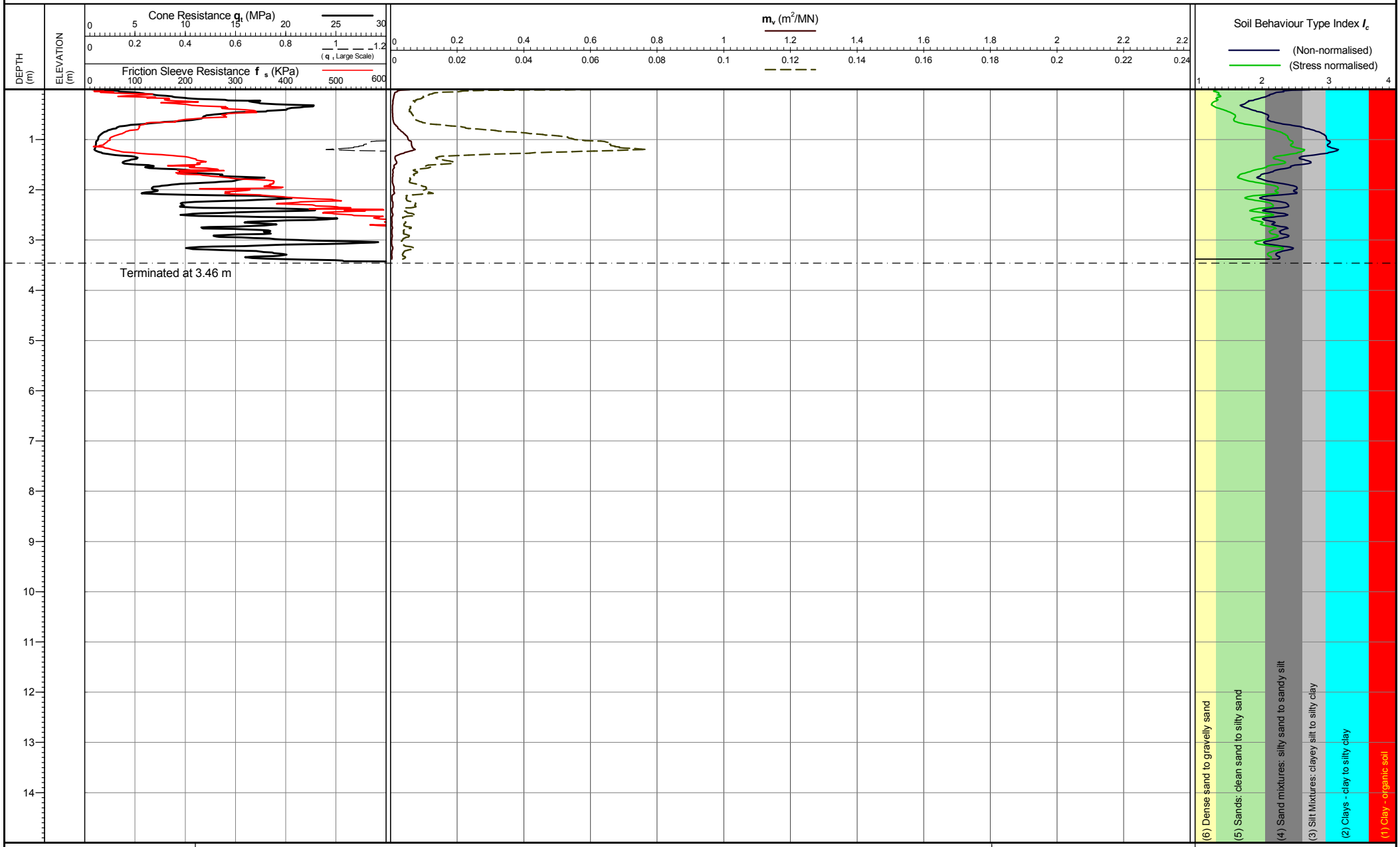
Lankelma Project Ref: P-106347-1

TEST ID: PB215

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 15:00:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

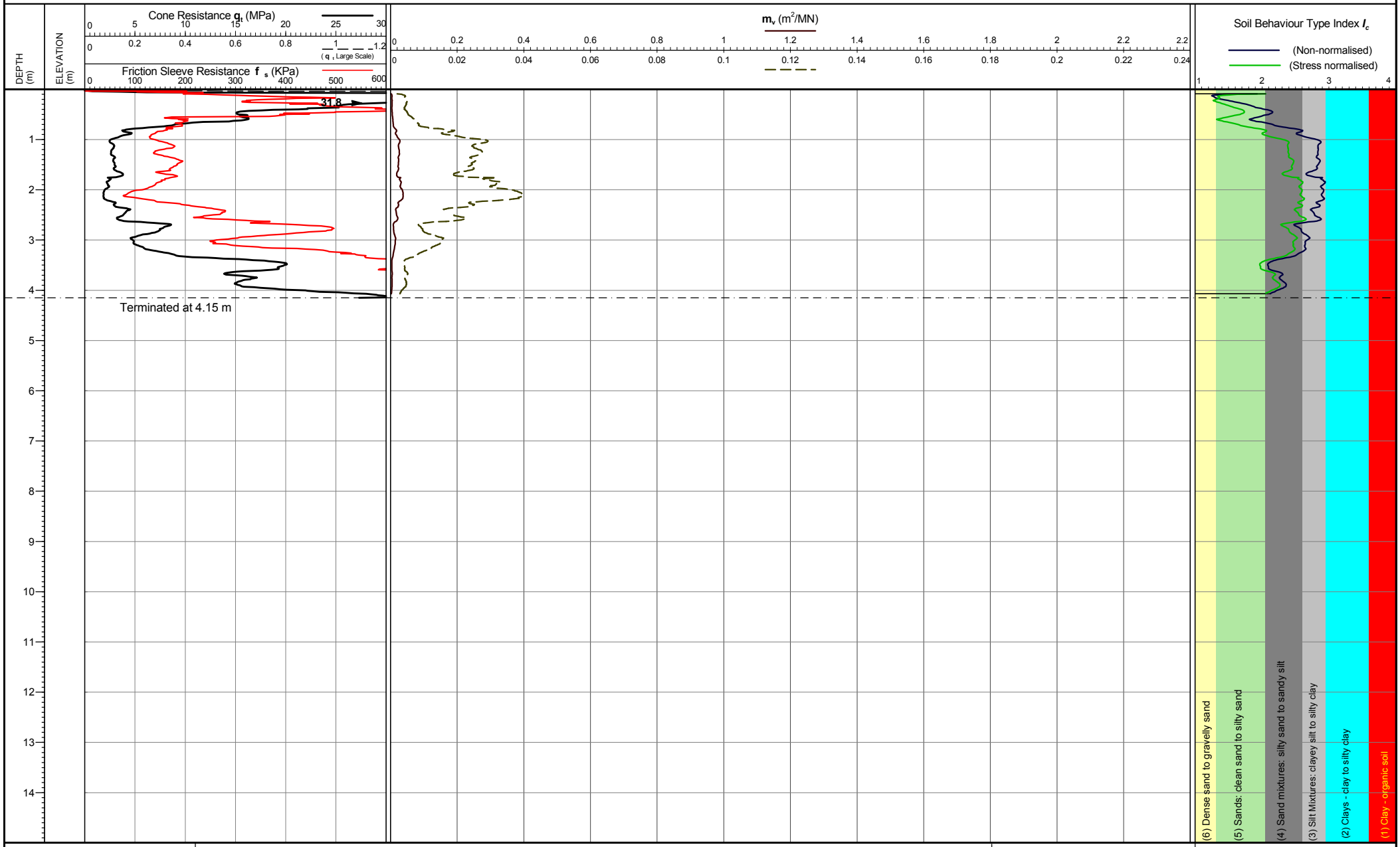
Lankelma Project Ref: P-106347-1

TEST ID: PB216

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 10/03/2016 15:28:53

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

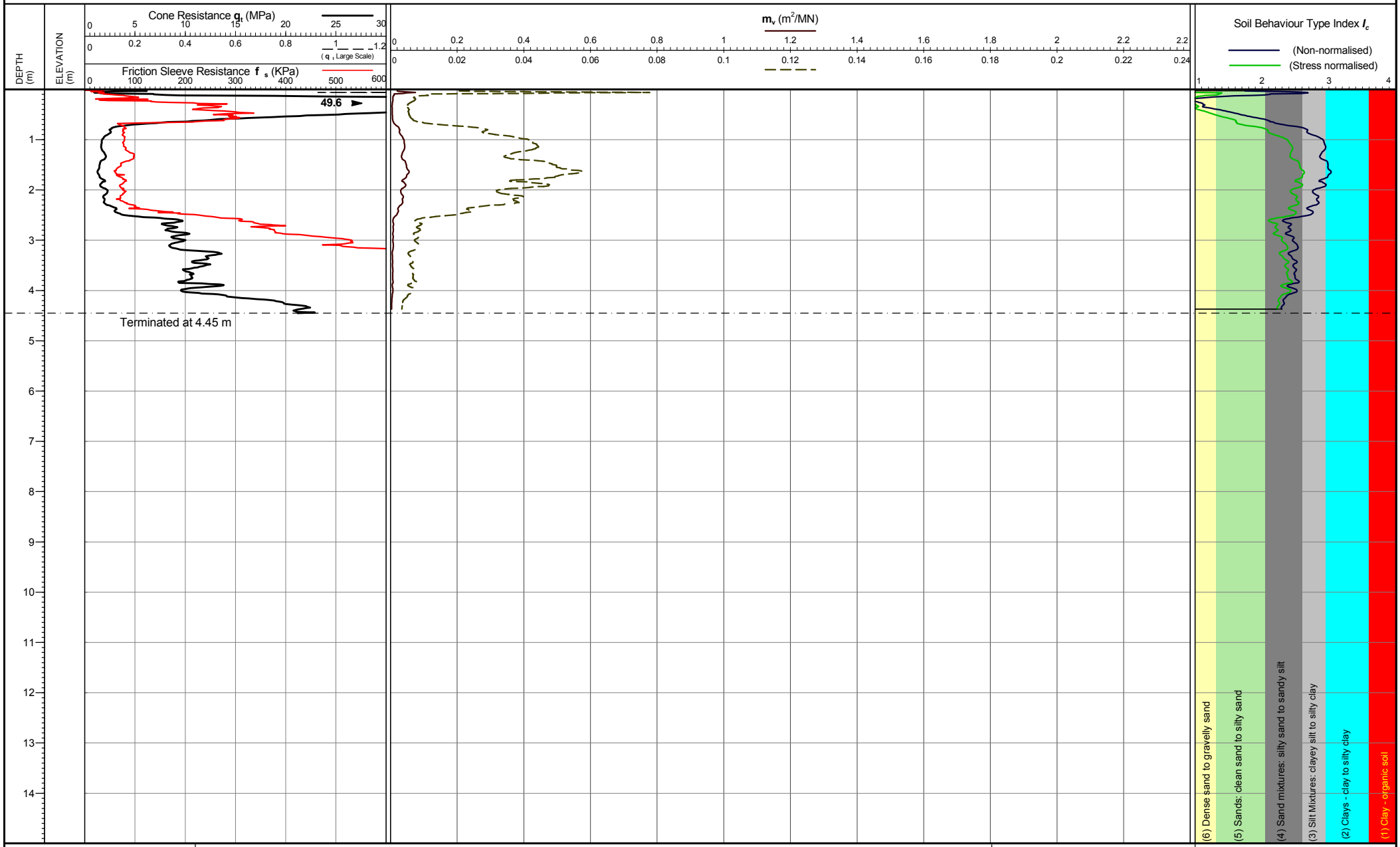
Lankelma Project Ref: P-106347-1

TEST ID: PB217

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 10/03/2016 10:30:39

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

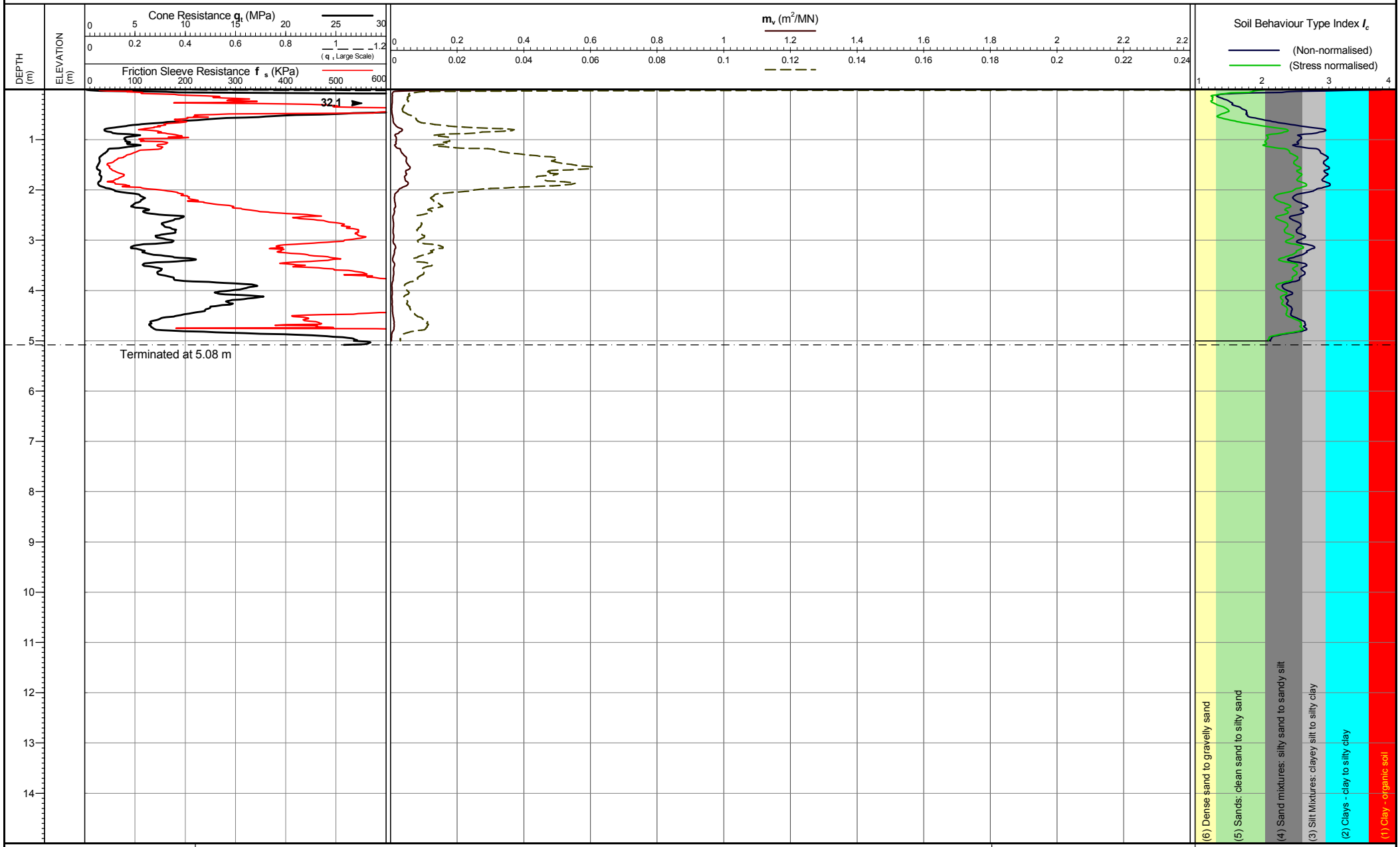
Lankelma Project Ref: P-106347-1

TEST ID: PB218

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Craig Drummond
Date of test: 10/03/2016 12:17:15

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

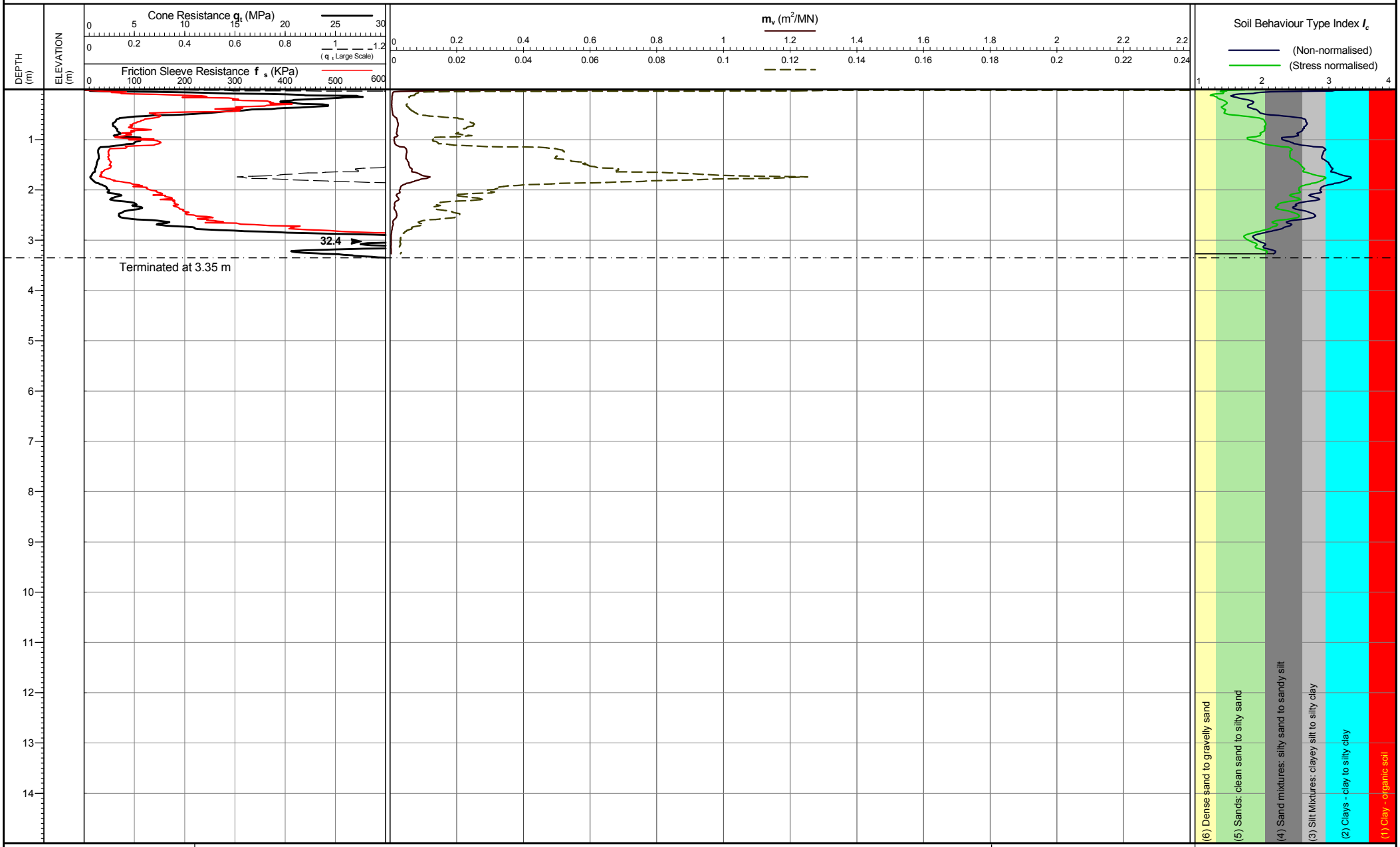
Lankelma Project Ref: P-106347-1

TEST ID: PB219

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 12:35:41

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

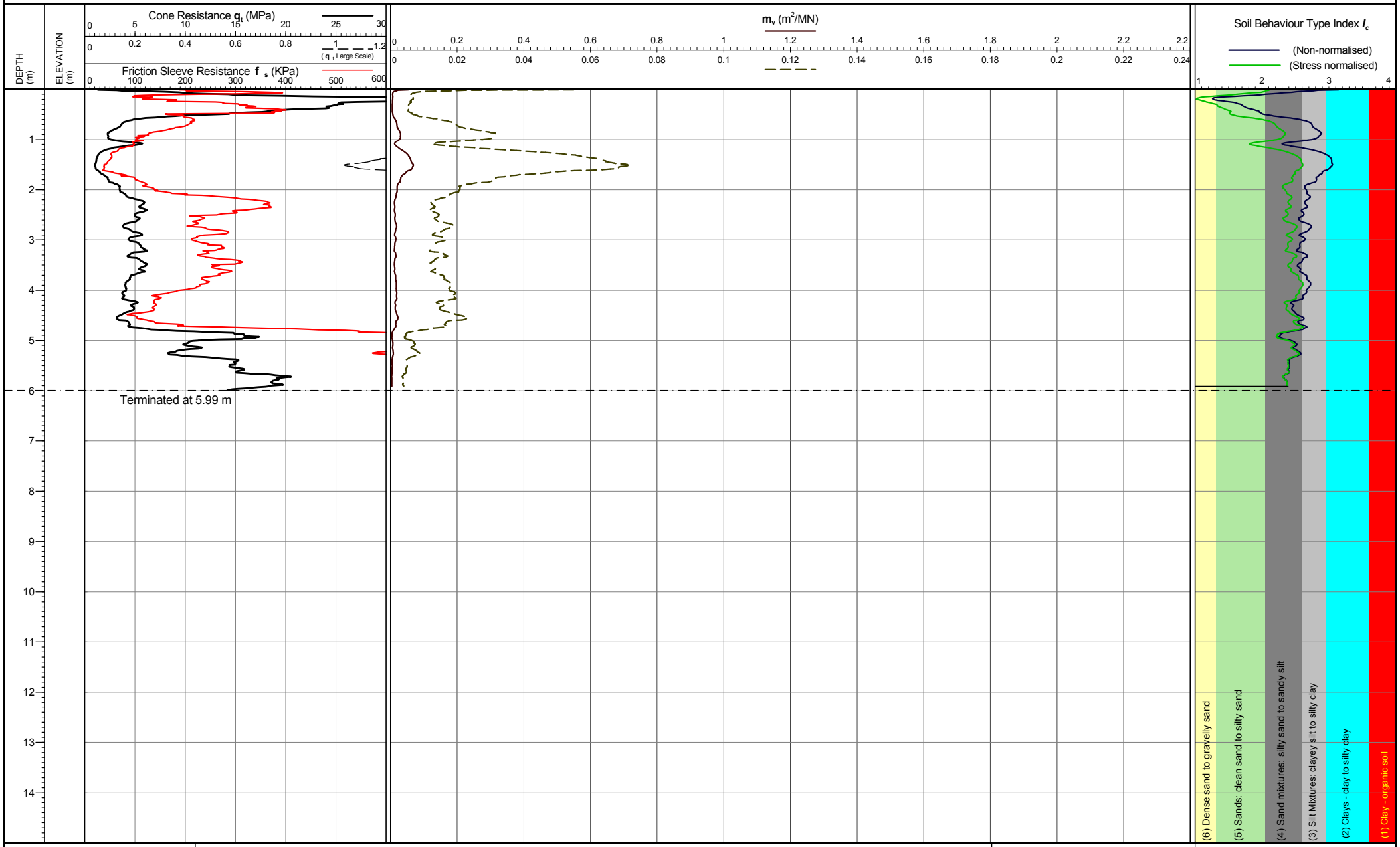
Lankelma Project Ref: P-106347-1

TEST ID: PB220

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 13:18:18

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

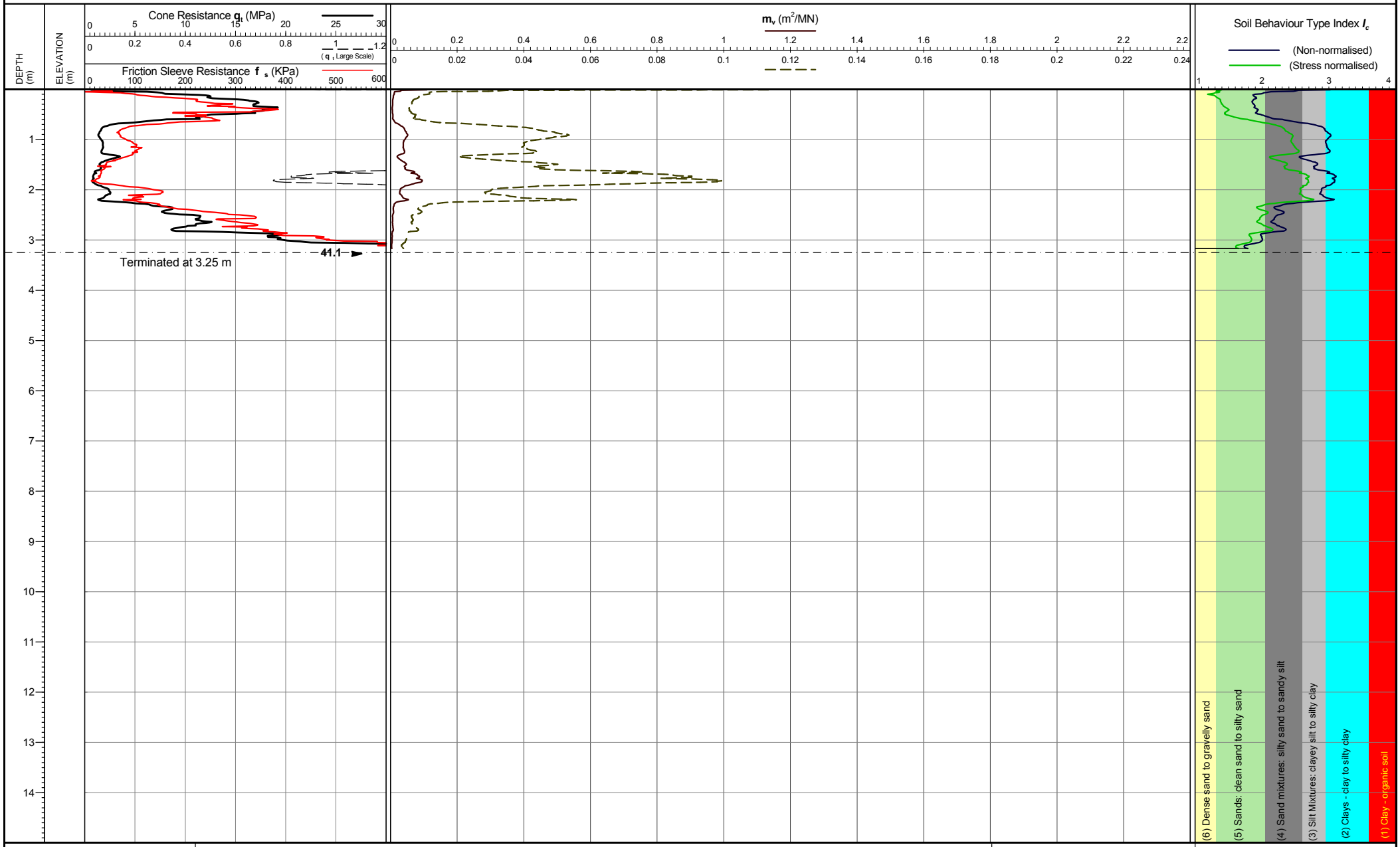
Lankelma Project Ref: P-106347-1

TEST ID: PB221

Client: ROC CONSULTING

Project: AIRPORT CITY NORTH

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.1333
Operator: Walter Geddes
Date of test: 10/03/2016 13:37:14

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Drained and undrained parameters are calculated for mixed soil behaviour types = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for details and discussion.

Please see report body section 'Geotechnical Parameters' for method and discussion of parameter evaluation

Date of plot: 14-03-16

Checked by: Chris Player

Lankelma Project Ref: P-106347-1

TEST ID: PB222

APPENDIX C

CHEMICAL TESTING RESULTS



Supplementary guidance for the selection of water pipes in land potentially affected by contamination

Introduction

In January 2011, UK Water Industry Research (UKWIR) published "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21; the 'UKWIR Guidance'). Its aim is to ensure that the correct materials are selected for water pipes and components to be used below ground in brownfield sites to protect the quality of drinking water whilst taking into account the service life of the water distribution system. It supersedes the Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 "Laying Pipes in Contaminated Land" which has been withdrawn.

The UKWIR Guidance is for use by developers, self-lay organisations, water companies and consultants when planning, designing and constructing water mains and/or services in brownfield sites. It defines brownfield sites as "land or premises that have previously been used or developed. They may also be vacant or derelict. However, they are not necessarily contaminated." The UKWIR Guidance states that it does not apply to greenfield sites; however, we consider this supplementary guidance and the relevant sections of the UKWIR guidance as being equally suitable for application to those greenfield sites considered to be potentially affected by contamination. Where greenfield sites are not affected by contamination a preliminary risk assessment (see below) will suffice.

The UKWIR Guidance also states that there should be no departure from its provisions "*except where formally approved by the Water Company, such departure being technically justifiable or representing advances in knowledge or product development"*.

We have adopted the UKWIR Guidance in principle and produced this company specific supplementary guidance (the 'UUW Guidance') which includes the Risk Assessment for Water Pipes (the 'RA').

This guidance does not cover operative safety, health exposure modelling or accidental pipe damage.

Risk Assessment for Water Pipes in Land Potentially Affected by Contamination

Any application for new water supplies to a development (construction of new properties, or renovation or conversion of existing buildings) in land potentially affected by contamination shall include a completed RA.

As a minimum a desk study (preliminary risk assessment) shall be provided with the RA in accordance with the framework in Environment Agency publication "Model Procedures for the Management of Land Contamination" (ref: CLR11) that sets out whether the land through which the pipes are to be laid may be affected by contamination. The application of the source, pathway, receptor concept will be an integral part of any pipeline risk assessment. For each potential source (the contamination) and each potential receptor (the water pipe), consideration shall be given to whether a potential pathway between source and receptor exists, or may exist in the future, linking the two. There are normally only three pathways by which contamination may come into contact with water pipes. These are direct contact with the soil or backfill, an excessive vapour phase or a contaminated groundwater regime. If none of these conditions exist on site (adopting the source, pathway, receptor concept) then it is likely that extended and/or targeted soil testing will not be required and a simple risk assessment will suffice. For those sites where land may be affected by contamination appropriate testing shall be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. The testing requirements are as described in the following section.

The signatories of the Water Supply Application Form and the RA must ensure that all assessments of land condition have been carried out in accordance with applicable current standards and guidelines by or under the direction of a suitably qualified competent person.

We require the competent person to be a) a chartered member of an appropriate professional body (such as the Institution of Civil Engineers, the Geological Society of London or the Royal Institution of Chartered Surveyors) with relevant experience of investigating contaminated sites or b) a Specialist in Land Condition (SiLC) with appropriate geo-environmental experience.

Testing Requirements

The soil, rock and if appropriate groundwater tests that are required on all sites where the potential for organic contamination has been identified in the desk study and where water pipes are proposed to be laid must be accredited by United Kingdom Accreditation Service (UKAS) as a minimum and where commercially available the Environment Agency's Monitoring Certification Service (MCERTS). These accredited tests should be undertaken for:

Banded hydrocarbons EC5-EC10, EC10-EC16, EC16-EC40 (Total aliphatic and aromatic hydrocarbons for each banding may be summed). Aliphatic/aromatic fractionation and subsequent banding may be required should a more detailed site specific risk assessment be undertaken. The bandings have been amended to take into account readily available laboratory tests. The equivalent carbon number (EC) is used to assess petroleum hydrocarbon mixtures rather than the actual number of carbon atoms in the molecule in line with guidance issued by the Environment Agency (2005).

Volatile organic compounds (VOCs) (method by head space or purge & trap GCMS) with tentative identification of compounds greater than 20µg/kg. The method used should be capable of detecting a wide range of compounds listed in US EPA Method 8260C or similar. The method should include analysis of naphthalene.

BTEX (Benzene, toluene, ethyl benzene and xylenes) plus MTBE (Methyl-tertiary butyl ether) (by head space GCMS)

Semi-Volatile Organic Compounds (SVOCs) (method by GCMS) with tentative identification of compounds greater than 20µg/kg The method used should be capable of detecting the compounds listed in US EPA Method 8270D or similar. The total concentration of SVOCs excludes polycyclic aromatic hydrocarbons, ethers, nitrobenzene, ketones, aldehydes, phenols, cresols and chlorinated phenols. Phenols, cresols and chlorinated phenols which are detected by the SVOC analysis are given their own assessment criteria.

We do not consider Table G1 and Table 3.1 of the UKWIR Guidance to be a definitive guide for assessing total concentrations. Table 1 in the RA below replaces Table 3.1 of the UKWIR Guidance.

Where previous site uses include the use, storage, treatment, disposal or manufacture of any of the following, appropriate testing for these substances will be required:

Ethers, nitrobenzene, ketones, aldehydes and amines. Note that the presence of amines on any site at the proposed pipe depth +/- 1.0m precludes the use of polyethylene. The methods of analysis and method of calculation of total concentrations of these compounds will need to be agreed with UUW.

To comply with the testing requirements, the suites of tests that are required on all brownfield sites where wrapped steel, wrapped ductile iron or copper pipes are to be laid as minimum must include:

pH, Conductivity and redox potential

Sufficiency of Testing

Water pipes are normally laid at between 0.75 and 1.35m from finished ground level to crown of pipe. Samples taken and tested must represent both a) the soil in which the water pipes are to be laid and b) the soil down to at least 500mm below the underside of the proposed pipe. Where the proposed depth of the pipes is unknown at the time of application, soil samples representative of the ground condition between surface level and 1.5m below finished ground level shall be taken as a minimum. Where appropriate (see UKWIR Guidance) groundwater sampling and groundwater monitoring will also be

necessary. Photo-ionisation detection (PID) monitoring along the proposed route of the pipeline may be employed, though this does not provide a definitive guide to the suitability of water pipe materials.

Where required a sufficient number of test results should be obtained from the material in which the pipes are to be laid. CLAIRE/CIEH 2008 "Guidance on comparing soil contamination data with a critical concentration" may be used, where appropriate, to justify the number of soil samples tested; however, this statistical model should not be used on heterogeneous materials or used to average test results from different types of materials.

Further guidance on representative sampling is contained within BS10175:2011 Code of Practice for the Investigation of Potentially Contaminated Sites, the Department of the Environment's Contaminated Land Research Report "Sampling strategies for contaminated land" prepared by The Centre for Research into the Built Environment, Nottingham Trent University (Ref: CLR 4; 1994) and the Environment Agency's "Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination" (ref: R&D Technical Report P5-066/TR; 2000).

Where remediation has been carried out on the site, the test results obtained from validation samples will be used in the assessment. Where a horizontal capping system has been or will be employed using materials spread across a site, sufficient samples will need to be taken to characterise the capping material used and the results presented to UUW. However, the sufficiency of sampling on the horizontal capping system, in which the pipeline will be placed, may be assessed on the basis of the source, quantity and type of materials used.

Detection Limits

Only positive concentrations, ie those above the limit of detection should be used in summation of VOC and SVOC (or other test groups of compounds ie phenols, cresols and chlorinated phenols). Laboratory methods shall provide a minimum limit of detection of 10µg/kg for each individual VOC or SVOC (or other test groups of compounds) quantitatively detected in accordance with the methods described above. For tentatively identified compounds (TICs), only those compounds with a concentration of 20µg/kg or greater shall be used in the summation of VOC and SVOC (or other test groups of compounds).

Protective Measures

Where polyethylene, ductile iron, steel or copper pipes are to be laid on a brownfield site or other land potentially affected by contamination (whether or not it has been remediated) and where the concentrations exceed the generic guideline values set out in Table 1 of the RA, the developer shall provide either:

a) a robust risk assessment to show how any contaminants will not significantly impact on proposed water supplies or buried assets over the lifetime of the assets; or

b) more suitable pipe materials; or

c) an engineering solution to protect the pipe work backed up by an adequate assessment of the risk.

Liquid free phase product (e.g. oil or free solvent layers) shall not remain in the ground or groundwater in the vicinity of water pipes, whether barrier pipe or any other pipe materials are used.

When designing pipe routes on land potentially affected by contamination, new preferential contamination pathways along the route of new water pipes shall not be created. Particular measures may be required to prevent the possible migration of contamination through pipe bedding and into controlled waters.

References

BS10175:2011 “Investigation of Potentially Contaminated Sites Code of Practice”

CLAIRE/CIEH “Guidance on comparing soil contamination data with a critical concentration” 2008

Department of the Environment Contaminated Land Research Report “Sampling strategies for contaminated land” prepared by The Centre for Research into the Built Environment, Nottingham Trent University (Ref: CLR 4) 1994

Environment Agency “Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination” (ref: R&D Technical Report P5-066/TR) 2000

Environment Agency “Model Procedures for the Management of Land Contamination” (ref: CLR11), 2004

Environment Agency P5-080/TR3 “The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils”, 2005

UK Water Industry Research (UKWIR) "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21)” January 2011

Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 “Laying Pipes in Contaminated Land” 2002

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Risk Assessment for Water Pipes (RA)

The risk assessment for water pipes will help you choose appropriate materials for your development. We are happy to deal with a risk assessment for water pipes in advance of any formal application for a new water supply.

If you need any help completing the form please call us on 0845 026 4296.

When completing this form electronically, the larger text boxes will expand in height if required.

Section 1: Development Details	
Development Name *(if it has one)*	Airport City North
Development Address	Outwood Lane, Manchester Airport
OS Grid Reference *(mid point)*	SJ821858
Developers Name	Airport City Partnerships
UUW reference number *(for UU use only)*	

Please provide details below of the current and historical use of the site and adjacent sites.

If your supporting information has details of the current and historical site use, please reference below the relevant sections of your report.

A site investigation report has been carried out on this site by RoC Consulting, extracts from which in addition to chemical testing results have been taken to complete this assessment. The complete version of the report can be made available if required.

The site is located to the north of the main airport complex and is bounded to the north by the Woodhouse Park residential estate; the M56 and main terminal buildings to the south; Aviator Way and commercial office development to the east; and open ground and the M56 to the west. Topography of the site is largely flat although embankments are noted along southern extent with the M56.

Land use across the site is split into two main areas; the central and western extent comprises gravel two car park areas (Jet Parks 1 and 2) that are used by the airport for both long and short term parking. Topography of Both car parks is relatively flat, and are covered by hard standing split between tarmac and gravel material which is in good condition.

The area to the east (Goodman's Land) is predominantly open grass and scrub land with mixed woodland toward the sites boundaries. Topography is uneven, slightly undulating toward the north west of Goodman's Land. There is an area of standing water and drainage ditch to the south of the site and two tributaries of Baguley Brook flowing parallel to each other north-west across the site was noted, bounding the Jet Parks 2 boundary.

Land use on site currently comprises 2 long-stay car parks (Jet Park 1 and 2) assocaited with Manchester Airport and an area of open land (Goodmans Land).

Historically the site has been used as agricultural land, as a nursery and as car parking, with an area of infilled land in the south-east (a former opencast clay pit). Land adjacent to the site was formerly agricultural and woodland and more recently a housing estate to the north and the airport to the south.

On site ground conditions prior to construction comprises a mean depth of topsoil to 0.36mbgl, which was underlain by Stiff Glacial Clay with a mean thickness of 3.19mbgl, and weathered Mudstone bedrock was encountered between 0.8 and 4.50mbgl.

Section 2: Preliminary Risk Assessment	
Has your desk study and site walkover identified any land potentially affected by contamination?	☒ Yes ☐ No

If the site is potentially affected by contamination but you have not completed any intrusive site investigation please provide details below of the rationale behind the intended pipe selection.

If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.

N/A

Section 3: Intrusive Site Investigation	
Have you completed any intrusive site investigation?	☒ Yes ☐ No
Date(s) when the site investigation(s) undertaken	11th and 22nd March 2016
At what level has groundwater been encountered?	6.00 metres below ground level or ☐ Not encountered

Table 1 (Pipeline Selection Risk Assessment Summary (PSRAS)) below classifies testing required where the preliminary risk assessment has identified land potentially affected by contamination. Please provide details below of any test groups which have not been tested and the rationale for not testing.

If your supporting information has details of the rationale behind not testing any particular test groups, please reference below the relevant sections of your report.

A total of 2 samples (BH303 and TP308) were tested for a range of determinands at depths varying between 0.3m and 0.5mbgl across the area of the site known as Goodmans Land.

If the intrusive site investigation has identified concentrations above the PE threshold (see PSRAS) and your intended pipe selection is PE please provide details below of the rationale behind the intended pipe selection.

If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.

1 exceedences above the PE threshold were identified from samples tested during the Site Investigation works;

- Total VOC's (1.2mg/kg Aliphatic Hydrocarbon C27) identified in TP308 at 0.30mbgl.

Section 4: Site Remediation

Please provide details below of any site remediation (which may include a change in site levels) already completed.

If your supporting information has details of the site remediation already completed, please reference below the relevant sections of your report.

No site remediation is proposed

Has the PSRAS (Table 1) been completed using appropriate data after remediation?	☐ Yes ☐ No ☒ N/A

Please provide details below of any proposed site remediation and an analysis of whether this will affect your intended pipe selection. *If your supporting information has details of any proposed site remediation and whether this will affect your intended pipe selection, please reference below the relevant sections of your report.*
No site remediation is proposed

Section 5: Final Use of Site
Please provide details below of any chemicals (including fuel) to be stored on site and any other future contamination risks which may affect your intended pipe selection. *If your supporting information has details of potential contamination risks which may affect your intended pipe selection, please reference below the relevant sections of your report.*
The site is to be redeveloped for commercial-led end uses comprising office space with associated car parking and public realm space.

What water pipe materials are intended to be used on site?	☒ PE ☐ PE Barrier Pipe Type A ☐ PE Barrier Pipe Type B Other (please specify):

Section 6: Additional Information
Please use the section below to provide any additional details to support your intended pipe selection. *If your supporting information has additional information to support your intended pipe selection, please reference below the relevant sections of your report.*
Although a single exceedance of screening criteria has been noted it should also be noted this sample was obtained from the site of a former farmstead and is not representative of site wide conditions. The majority of the site has remained largely un developed the results from testing in this area has failed to identify the need for protective pipe work. It is considered the use of chemically resistant pipe work will be required for development within close proximity to the former farmstead however the remainder of the site is considered unlikely to pose a risk to below ground water supply pipe works. Supplementary testing should be undertaken on a plot by plot basis at such a time as detailed development layout has been realised. Copies of chemical testing results have been provided as an inclusion to this form

Section 7: Risk Assessor	
Name and relevant qualifications of person directing the risk assessment for water pipes	Alex Smiles AIEMA FGS BSc (hons)
Name and address of risk assessor's company	RoC Consulting, 6 Commercial St, Manchester, M15 4PZ

Date risk assessment performed	29/04/2016

Section 8: Declaration			
I confirm I have completed this form and provided supporting information in accordance with 'UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' and UUW's Supplementary Guidance. I also confirm that if any further site investigation is needed and carried out, I will be required to submit an additional Risk Assessment for Water Pipes with the relevant supporting information. I understand that failure to supply any of the required information may delay my application being processed.			
Name	Alex Smiles	Company	RoC Consulting
Phone Number	07790 548596	Date	29/04/2016

Please e-mail the completed form and supporting information to water.connections@uuplc.co.uk. Alternatively you can fax a paper version to 01925 678926 or post to us at United Utilities Water, Metering and Connections, Ullswater House, Lingley Mere, Warrington, WA5 3LP.

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Table 1 - Pipe Selection Risk Assessment Summary (PSRAS)	
1) *Testing must be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. Please use the appropriate testing data to complete Table 1 below.* 2) *If more than one pipe selection is being made, for example, for pipes in different areas of a large site, a completed PSRAS is required for each selection.*	
What materials have been tested to populate Table 1 below?	☒ Existing ground materials ☐ Remediated materials ☐ Imported capping materials

All concentrations in mg/kg								
Test Group	**Testing Required?**	**PE threshold**	**Metal Pipes/ Barrier Pipe**	**Laboratory Detection Limit**	**Testing UKAS accredited Y/N**	**Maximum concentration at proposed pipeline depth** See Note [2]	**Maximum site concentration** See Note [3]	**Locations and depths where concentrations exceed proposed pipeline threshold**
Total VOCs	Where Preliminary Risk Assessment (PRA) has identified land potentially affected by contamination	0.5	Pass	0.1	Y	1.2	N/A	
Total BTEX & MTBE		0.1	Pass	1	Y	<DL	<DL	
Total SVOCs (excluding PAHs and those substances marked with an *)		2	Pass	0.10mg/kg	Y	<DL	<DL	
EC5-EC10 aliphatic and aromatic hydrocarbons		2	Pass	0.010mg/kg	Y	<DL	<DL	
EC10-EC16 aliphatic and aromatic hydrocarbons		10	Pass	1mg/kg	Y	<DL	<DL	
EC16-EC40 aliphatic and aromatic hydrocarbons		500	Pass	1mg/kg	Y	15	<500	
Phenols* (from SVOC analysis)		2	Pass	<1mg/kg	Y	<DL	<DL	
Cresols and chlorinated phenols* (from SVOC analysis)		2	Pass	0.1MG/KG	Y	<DL	<DL	
Ethers*	Only where identified	0.5	Pass					
Nitrobenzene*		0.5	Pass					
Ketones*		0.5	Pass					
Aldehydes*		0.5	Pass					
Amines		Fail	Pass					
Corrosive	Conductivity, Redox and pH	Pass	See Note [1]					

Note [1] Threshold: For wrapped steel, corrosive if pH<7 and conductivity > 400µS/cm. For wrapped ductile iron corrosive if pH<5, Eh not neutral and conductivity > 400µS/cm. For copper, corrosive if pH<5 or >8 and Eh positive.

Note [2] Water pipes are normally laid at 0.75-1.35m below finished ground level.

Note [3] Also state if liquid free product is present in soil or groundwater.

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M16 9FE
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Fax : 0161 874 2468

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Report Number: 556584-1

Date of Report: 06-Apr-2016

Customer: RoC Consulting
Commercial Wharf
6 Commercial Street
Manchester
M15 4PZ

Customer Contact: Mr Jason Bradley

Customer Job Reference: 3407
Customer Purchase Order: 1052
Customer Site Reference: Airport City North
Date Job Received at SAL: 08-Mar-2016
Date Analysis Started: 21-Mar-2016
Date Analysis Completed: 06-Apr-2016

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with Section 25 of the SAL Quality Manual

UKAS TESTING 1549

Report checked and authorised by :
Emma Spear
Project Manager

Issued by :
Emma Spear
Project Manager

Waste Acceptance Criteria

Customer Sample Reference : BH301
SAL Sample Reference : 556584 001
Project Site : Airport City North
Customer Reference : 3407
Bottom Depth : 0.4
Date Sampled : 07-MAR-2016
Top Depth : 0.3
Type : Clay

Soil					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Acid Neutralising Capacity (pH 4)	Titration	2	Mol/kg	N	<2			
Acid Neutralising Capacity (pH 7)	Titration	2	Mol/kg	N	<2			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
Loss on Ignition	Grav	0.1	%	N	**4.4**			10.0
PAH (Sum)	Calc	1.6	mg/kg	N	**2.5**	100.0		
PCB EC7 (Sum)	Calc	0.00035	mg/kg	U	<0.00035	1.0		
pH	Probe			M	**7.9**		> 6.0	
Total Organic Carbon	OX/IR	0.1	%	N	**1.4**	3.0	5.0	6.0
Total Petroleum Hydrocarbons C10-C40 (Sum)	Calc	1	mg/kg	N	(13) **6**	500.0		

Data for BS EN 12457-2 (10:1)					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic	Calc WAC ICP/MS	0.0020	mg/kg	N	**0.024**	0.5	2.0	25.0
Barium	Calc WAC ICP/MS	0.010	mg/kg	N	**0.34**	20.0	100.0	300.0
Cadmium	Calc WAC ICP/MS	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chloride	Calc (W)	10	mg/kg	N	**36**	800.0	15000.0	25000.0
Chromium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper	Calc WAC ICP/MS	0.0050	mg/kg	N	**0.035**	2.0	50.0	100.0
Dissolved Organic Carbon	Calc	10	mg/kg	N	**83**	500.0	800.0	1000.0
Fluoride	Calc (W)	0.50	mg/kg	N	**6.8**	10.0	150.0	500.0
Lead	Calc WAC ICP/MS	0.0030	mg/kg	N	**0.0047**	0.5	10.0	50.0
Mercury	Calc WAC ICP/MS	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum	Calc WAC ICP/MS	0.010	mg/kg	N	**0.029**	0.5	10.0	30.0
Nickel	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols (Total-Mono)	Calc	1.0	mg/kg	N	<1.0	1.0		
Selenium	Calc WAC ICP/MS	0.0050	mg/kg	N	<0.0050	0.1	0.5	7.0
Sulphate	Calc (W)	5	mg/kg	N	**81**	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc WAC ICP/MS	1000	mg/kg	N	**1000**	4000.0	60000.0	100000.0
Zinc	Calc WAC ICP/MS	0.020	mg/kg	N	**0.029**	4.0	50.0	200.0

Following the recommendation from the Environment Agency (England and Wales)*, the leachate preparation in this report has been carried out to BS EN 12457-2 : One Stage batch test at a liquid to solid ratio of 10 l/kg. This is also compliant with Schedule 10 of the Environmental Permitting Regulations 2010.

Note : This is the minimum amount of testing which is required.

Further testing may be required if :

- evidence of immediately leachable parameters becomes available.
- evidence to indicate that the sample could be classified as hazardous under H1-H14 of the Waste(England and Wales) Regulations 2011(as amended) becomes available.

Acceptance of waste at landfill is always at the discretion of the Landfill Operator.

*** Waste Sampling and Testing for Disposal at Landfill, EBPRI 11507B, Environment Agency (England and Wales) March 2013**

Waste Acceptance Criteria

Customer Sample Reference : BH101
SAL Sample Reference : 556584 005
Project Site : Airport City North
Customer Reference : 3407
Bottom Depth : 1.20
Date Sampled : 15-MAR-2016
Type : Clay

Soil					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Acid Neutralising Capacity (pH 4)	Titration	2	Mol/kg	N	<2			
Acid Neutralising Capacity (pH 7)	Titration	2	Mol/kg	N	<2			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
Loss on Ignition	Grav	0.1	%	N	**2.9**			10.0
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
PCB EC7 (Sum)	Calc	0.0035	mg/kg	U	(9) <0.0035	1.0		
pH	Probe			M	**7.9**		> 6.0	
Total Organic Carbon	OX/IR	0.1	%	N	**0.8**	3.0	5.0	6.0
Total Petroleum Hydrocarbons C10-C40 (Sum)	Calc	1	mg/kg	N	(13) **38**	500.0		

Data for BS EN 12457-2 (10:1)					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic	Calc WAC ICP/MS	0.0020	mg/kg	N	**0.0063**	0.5	2.0	25.0
Barium	Calc WAC ICP/MS	0.010	mg/kg	N	**0.045**	20.0	100.0	300.0
Cadmium	Calc WAC ICP/MS	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chloride	Calc (W)	10	mg/kg	N	<10	800.0	15000.0	25000.0
Chromium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper	Calc WAC ICP/MS	0.0050	mg/kg	N	**0.0092**	2.0	50.0	100.0
Dissolved Organic Carbon	Calc	10	mg/kg	N	**68**	500.0	800.0	1000.0
Fluoride	Calc (W)	0.50	mg/kg	N	**1.0**	10.0	150.0	500.0
Lead	Calc WAC ICP/MS	0.0030	mg/kg	N	<0.0030	0.5	10.0	50.0
Mercury	Calc WAC ICP/MS	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	30.0
Nickel	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols (Total-Mono)	Calc	1.0	mg/kg	N	<1.0	1.0		
Selenium	Calc WAC ICP/MS	0.0050	mg/kg	N	<0.0050	0.1	0.5	7.0
Sulphate	Calc (W)	5	mg/kg	N	**21**	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc WAC ICP/MS	1000	mg/kg	N	<1000	4000.0	60000.0	100000.0
Zinc	Calc WAC ICP/MS	0.020	mg/kg	N	**0.031**	4.0	50.0	200.0

Following the recommendation from the Environment Agency (England and Wales)*, the leachate preparation in this report has been carried out to BS EN 12457-2 : One Stage batch test at a liquid to solid ratio of 10 l/kg. This is also compliant with Schedule 10 of the Environmental Permitting Regulations 2010.

Note : This is the minimum amount of testing which is required.

Further testing may be required if :

- evidence of immediately leachable parameters becomes available.
- evidence to indicate that the sample could be classified as hazardous under H1-H14 of the Waste(England and Wales) Regulations 2011(as amended) becomes available.

Acceptance of waste at landfill is always at the discretion of the Landfill Operator.

*** Waste Sampling and Testing for Disposal at Landfill, EBPRI 11507B, Environment Agency (England and Wales) March 2013**

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
BTEX

SAL Reference	**556584 001**	**556584 005**
Customer Sample Reference	**BH301**	**BH101**
Test Sample	**M105**	**M105**
Top Depth	**0.3**	
Bottom Depth	**0.4**	**1.20**
Date Sampled	**07-MAR-2016**	**15-MAR-2016**
Type	**Clay**	**Clay**

Determinand	Method	LOD	Units	Symbol		
Benzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	(13) <10	(13) <10
Toluene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
PCB EC7

SAL Reference	**556584 001**	**556584 005**
Customer Sample Reference	**BH301**	**BH101**
Test Sample	**M105**	**M105**
Top Depth	**0.3**	
Bottom Depth	**0.4**	**1.20**
Date Sampled	**07-MAR-2016**	**15-MAR-2016**
Type	**Clay**	**Clay**

Determinand	Method	LOD	Units	Symbol		
Polychlorinated biphenyl BZ#28	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	<0.05	(9) <0.50
Polychlorinated biphenyl BZ#52	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	<0.05	(9) <0.50
Polychlorinated biphenyl BZ#101	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	<0.05	(9) <0.50
Polychlorinated biphenyl BZ#118	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	<0.05	(9) <0.50
Polychlorinated biphenyl BZ#138	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	<0.05	(9) <0.50
Polychlorinated biphenyl BZ#153	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	<0.05	(9) <0.50
Polychlorinated biphenyl BZ#180	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	<0.05	(9) <0.50

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

				SAL Reference	556584 001	556584 002	556584 003	556584 004	556584 005
				Customer Sample Reference	BH301	BH302	BH303	BH304	BH101
				Test Sample	M105	M105	M105	M105	M105
				Top Depth	0.3		0.45		
				Bottom Depth	0.4	0.55	0.5	0.70	1.20
				Date Sampled	07-MAR-2016	08-MAR-2016	08-MAR-2016	08-MAR-2016	15-MAR-2016
				Type	Clay	Clay	Clay	Clay	Clay
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	**0.3**	<0.1	<0.1
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	<0.1	**0.5**	<0.1	<0.1
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	<0.1	**0.5**	<0.1	<0.1
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.3**	<0.1	**0.2**	<0.1	<0.1
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.2**	<0.1	**0.2**	<0.1	<0.1
Benzo(b/k)Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	<0.1	**0.4**	<0.1	<0.1
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.2**	<0.1	**0.2**	<0.1	<0.1
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.1**	<0.1	**0.1**	<0.1	<0.1
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.1**	<0.1	**0.2**	<0.1	<0.1
Polyaromatic Hydrocarbons (Total)	GC/MS (MCERTS)	0.1	mg/kg	U	**2.5**	<0.1	**2.6**	<0.1	<0.1
Coronene	GC/MS	0.1	mg/kg	N	<0.1	-	-	-	<0.1
Phenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	-	-	-	<0.1

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

				SAL Reference	556584 006	556584 007	556584 008	556584 009	556584 010
				Customer Sample Reference	TP301	TP303	TP304	TP307	TP308
				Test Sample	M105	M105	M105	M105	M105
				Top Depth					
				Bottom Depth	0.25	0.30	0.40	0.60	0.30
				Date Sampled	15-MAR-2016	15-MAR-2016	15-MAR-2016	15-MAR-2016	15-MAR-2016
				Type	Clay	Clay	Clay	Clay	Clay
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	**1.3**	<0.1
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	**1.6**	<0.1
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	**8.2**	<0.1
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	**6.3**	<0.1
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.3**	**0.1**	<0.1	**57**	<0.1
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	**20**	<0.1
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	**0.3**	<0.1	**140**	<0.1
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	**0.3**	<0.1	**120**	<0.1
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.3**	**0.1**	<0.1	**54**	<0.1
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.2**	**0.1**	<0.1	**54**	<0.1
Benzo(b/k)Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.3**	**0.2**	<0.1	**98**	**0.1**
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	**49**	<0.1
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	**25**	<0.1
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	**6.7**	<0.1
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	**28**	<0.1
Polyaromatic Hydrocarbons (Total)	GC/MS (MCERTS)	0.1	mg/kg	U	**2.1**	**1.2**	<0.1	**670**	**0.1**
Coronene	GC/MS	0.1	mg/kg	N	-	-	-	-	-
Phenol	GC/MS (MCERTS)	0.1	mg/kg	M	-	-	-	-	-

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
Total Petroleum Hydrocarbons

				SAL Reference	**556584 001**	**556584 005**
				Customer Sample Reference	**BH301**	**BH101**
				Test Sample	**M105**	**M105**
				Top Depth	**0.3**	
				Bottom Depth	**0.4**	**1.20**
				Date Sampled	**07-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Total Petroleum Hydrocarbons	GC/FID	1	mg/kg	M	(13) **6**	(13) **20**
Total Petroleum Hydrocarbons (C35-C40)	GC/FID	1	mg/kg	N	(13) <1	(13) **17**

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
MCERTS Preparation

				SAL Reference	**556584 001**	**556584 002**	**556584 003**	**556584 004**	**556584 005**
				Customer Sample Reference	**BH301**	**BH302**	**BH303**	**BH304**	**BH101**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Top Depth	**0.3**		**0.45**		
				Bottom Depth	**0.4**	**0.55**	**0.5**	**0.70**	**1.20**
				Date Sampled	**07-MAR-2016**	**08-MAR-2016**	**08-MAR-2016**	**08-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	**19**	**16**	**18**	**16**	**7.4**

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
MCERTS Preparation

				SAL Reference	**556584 006**	**556584 007**	**556584 008**	**556584 009**	**556584 010**
				Customer Sample Reference	**TP301**	**TP303**	**TP304**	**TP307**	**TP308**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Top Depth					
				Bottom Depth	**0.25**	**0.30**	**0.40**	**0.60**	**0.30**
				Date Sampled	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	**48**	**29**	**19**	**17**	**4.0**

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
MCERTS Preparation

				SAL Reference	**556584 001**	**556584 002**	**556584 003**	**556584 004**	**556584 005**
				Customer Sample Reference	**BH301**	**BH302**	**BH303**	**BH304**	**BH101**
				Test Sample	**M40**	**M40**	**M40**	**M40**	**M40**
				Top Depth	**0.3**		**0.45**		
				Bottom Depth	**0.4**	**0.55**	**0.5**	**0.70**	**1.20**
				Date Sampled	**07-MAR-2016**	**08-MAR-2016**	**08-MAR-2016**	**08-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Retained on 10mm sieve	Grav	0.1	%	N	<0.1	<0.1	<0.1	<0.1	<0.1

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
MCERTS Preparation

				SAL Reference	**556584 006**	**556584 007**	**556584 008**	**556584 009**	**556584 010**
				Customer Sample Reference	**TP301**	**TP303**	**TP304**	**TP307**	**TP308**
				Test Sample	**M40**	**M40**	**M40**	**M40**	**M40**
				Top Depth					
				Bottom Depth	**0.25**	**0.30**	**0.40**	**0.60**	**0.30**
				Date Sampled	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Retained on 10mm sieve	Grav	0.1	%	N	<0.1	<0.1	<0.1	<0.1	<0.1

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
RoC Maxi Suite 1

				SAL Reference	**556584 001**	**556584 002**	**556584 003**	**556584 004**	**556584 005**
				Customer Sample Reference	**BH301**	**BH302**	**BH303**	**BH304**	**BH101**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Top Depth	**0.3**		**0.45**		
				Bottom Depth	**0.4**	**0.55**	**0.5**	**0.70**	**1.20**
				Date Sampled	**07-MAR-2016**	**08-MAR-2016**	**08-MAR-2016**	**08-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Boron (water-soluble)	ICP/OES	1	mg/kg	N	<1	<1	<1	<1	<1
Chromium (trivalent)	Calc	2	mg/kg	N	**39**	**26**	**19**	**34**	**22**
Chromium VI	ICP/OES	1	mg/kg	N	<1	<1	<1	<1	<1
pH	Probe			M	**7.9**	**7.2**	**6.8**	**7.0**	**7.9**
Sulphate(2:1)	ICP/OES	100	mg/l	N	<100	<100	<100	<100	<100
Cyanide (Total)	Colorimetry (CF)	1	mg/kg	M	<1	<1	**4**	<1	<1
Cyanide(free)	Colorimetry (CF)	1	mg/kg	M	<1	<1	<1	<1	<1
Phenols (Total-Mono)	Colorimetry (CF)	1	mg/kg	M	<1	<1	<1	<1	<1

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
RoC Maxi Suite 1

				SAL Reference	**556584 006**	**556584 007**	**556584 008**	**556584 009**	**556584 010**
				Customer Sample Reference	**TP301**	**TP303**	**TP304**	**TP307**	**TP308**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Top Depth					
				Bottom Depth	**0.25**	**0.30**	**0.40**	**0.60**	**0.30**
				Date Sampled	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Boron (water-soluble)	ICP/OES	1	mg/kg	N	<1	<1	<1	<1	<1
Chromium (trivalent)	Calc	2	mg/kg	N	**58**	**200**	**36**	**48**	**18**
Chromium VI	ICP/OES	1	mg/kg	N	<1	<1	<1	<1	<1
pH	Probe			M	**7.1**	**6.7**	**7.0**	**6.7**	**7.4**
Sulphate(2:1)	ICP/OES	100	mg/l	N	<100	<100	<100	<100	<100
Cyanide (Total)	Colorimetry (CF)	1	mg/kg	M	<1	**11**	**2**	**6**	<1
Cyanide(free)	Colorimetry (CF)	1	mg/kg	M	<1	<1	<1	<1	<1
Phenols (Total-Mono)	Colorimetry (CF)	1	mg/kg	M	<1	<1	<1	<1	<1

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
RoC Maxi Suite 1

				SAL Reference	**556584 001**	**556584 002**	**556584 003**	**556584 004**	**556584 005**
				Customer Sample Reference	**BH301**	**BH302**	**BH303**	**BH304**	**BH101**
				Test Sample	**M40**	**M40**	**M40**	**M40**	**M40**
				Top Depth	**0.3**		**0.45**		
				Bottom Depth	**0.4**	**0.55**	**0.5**	**0.70**	**1.20**
				Date Sampled	**07-MAR-2016**	**08-MAR-2016**	**08-MAR-2016**	**08-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Antimony	ICP/OES	1	mg/kg	U	<1	<1	<1	<1	<1
Arsenic	ICP/OES	2	mg/kg	M	**12**	**8**	**7**	**19**	**8**
Barium	ICP/OES	1	mg/kg	U	**160**	**67**	**64**	**91**	**70**
Cadmium	ICP/OES	1	mg/kg	M	<1	<1	<1	<1	<1
Copper	ICP/OES	1	mg/kg	M	**39**	**19**	**12**	**22**	**20**
Mercury	ICP/OES	1	mg/kg	M	<1	<1	<1	<1	<1
Molybdenum	ICP/OES	1	mg/kg	M	**3**	**3**	**2**	**5**	**3**
Nickel	ICP/OES	1	mg/kg	M	**18**	**16**	**7**	**34**	**26**
Selenium	ICP/OES	3	mg/kg	M	<3	<3	<3	<3	<3
Vanadium	ICP/OES	1	mg/kg	M	**36**	**37**	**25**	**56**	**30**
Zinc	ICP/OES	1	mg/kg	M	**120**	**34**	**24**	**83**	**78**
Sulphate (Total)	ICP/OES	0.01	%	N	**0.06**	**0.01**	**0.02**	**0.02**	**0.02**
Mass Fraction of organic carbon	Calc TOC/100			N	**0.014**	**0.0028**	**0.0057**	**0.0031**	**0.0083**
Chromium	ICP/OES	1	mg/kg	M	**39**	**26**	**19**	**34**	**22**
Lead	ICP/OES	1	mg/kg	M	**100**	**10**	**30**	**9**	**18**
Beryllium	ICP/OES	2	mg/kg	U	<2	<2	<2	<2	<2

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
RoC Maxi Suite 1

				SAL Reference	**556584 006**	**556584 007**	**556584 008**	**556584 009**	**556584 010**
				Customer Sample Reference	**TP301**	**TP303**	**TP304**	**TP307**	**TP308**
				Test Sample	**M40**	**M40**	**M40**	**M40**	**M40**
				Top Depth					
				Bottom Depth	**0.25**	**0.30**	**0.40**	**0.60**	**0.30**
				Date Sampled	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Antimony	ICP/OES	1	mg/kg	U	<1	**5**	<1	<1	<1
Arsenic	ICP/OES	2	mg/kg	M	**12**	**17**	**7**	**8**	**4**
Barium	ICP/OES	1	mg/kg	U	**140**	**380**	**100**	**110**	**93**
Cadmium	ICP/OES	1	mg/kg	M	<1	<1	<1	<1	<1
Copper	ICP/OES	1	mg/kg	M	**35**	**87**	**28**	**35**	**17**
Mercury	ICP/OES	1	mg/kg	M	<1	**2**	<1	<1	<1
Molybdenum	ICP/OES	1	mg/kg	M	**3**	**4**	**2**	**2**	**2**
Nickel	ICP/OES	1	mg/kg	M	**27**	**22**	**11**	**11**	**5**
Selenium	ICP/OES	3	mg/kg	M	<3	<3	<3	<3	<3
Vanadium	ICP/OES	1	mg/kg	M	**46**	**43**	**24**	**26**	**10**
Zinc	ICP/OES	1	mg/kg	M	**130**	**260**	**63**	**77**	**55**
Sulphate (Total)	ICP/OES	0.01	%	N	**0.08**	**0.08**	**0.04**	**0.03**	**0.04**
Mass Fraction of organic carbon	Calc TOC/100			N	**0.044**	**0.029**	**0.027**	**0.013**	**0.0095**
Chromium	ICP/OES	1	mg/kg	M	**58**	**200**	**36**	**48**	**18**
Lead	ICP/OES	1	mg/kg	M	**130**	**630**	**98**	**130**	**68**
Beryllium	ICP/OES	2	mg/kg	U	<2	<2	<2	<2	<2

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
TPH C5-C40 Ali/Aro

SAL Reference	**556584 003**	**556584 010**
Customer Sample Reference	**BH303**	**TP308**
Test Sample	**AR**	**AR**
Top Depth	**0.45**	
Bottom Depth	**0.5**	**0.30**
Date Sampled	**08-MAR-2016**	**15-MAR-2016**
Type	**Clay**	**Clay**

Determinand	Method	LOD	Units	Symbol		
Benzene	GC/MS (Headspace)	1	µg/kg	U	(13) <1	(13) <1
EthylBenzene	GC/MS (Headspace)	1	µg/kg	U	<1	<1
Meta/Para-Xylene	GC/MS (Headspace)	1	µg/kg	U	<1	<1
Methyl tert-Butyl Ether	GC/MS (Headspace)	1	µg/kg	U	<1	<1
Ortho-Xylene	GC/MS (Headspace)	1	µg/kg	U	<1	<1
Toluene	GC/MS (Headspace)	1	µg/kg	U	<1	<1
Total BTEX & MTBE	Calc	1	µg/kg	U	<1	<1
Total Petroleum Hydrocarbons (C5 - C6 aliphatic)	GC/MS (Headspace)	0.010	mg/kg	N	<0.010	<0.010
Total Petroleum Hydrocarbons (C6-C8 aliphatic)	GC/MS (Headspace)	0.010	mg/kg	N	<0.010	<0.010
Total Petroleum Hydrocarbons (C8-C10 aliphatic)	GC/MS (Headspace)	10	µg/kg	N	<10	<10
Total Petroleum Hydrocarbons (C6 - C7 aromatic)	GC/MS (Headspace)	0.010	mg/kg	N	<0.010	<0.010
Total Petroleum Hydrocarbons (C7-C8 aromatic)	GC/MS (Headspace)	0.010	mg/kg	N	<0.010	<0.010
Total Petroleum Hydrocarbons (C8-C10 aromatic)	GC/MS (Headspace)	0.010	mg/kg	N	<0.010	<0.010
Total Petroleum Hydrocarbons (C5 - C10 aliphatic/aromatic)	Calc	0.010	mg/kg	N	<0.010	<0.010

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
TPH C5-C40 Ali/Aro

SAL Reference	**556584 003**	**556584 010**
Customer Sample Reference	**BH303**	**TP308**
Test Sample	**M105**	**M105**
Top Depth	**0.45**	
Bottom Depth	**0.5**	**0.30**
Date Sampled	**08-MAR-2016**	**15-MAR-2016**
Type	**Clay**	**Clay**

Determinand	Method	LOD	Units	Symbol		
Total Petroleum Hydrocarbons (C10-C12 aliphatic)	GC/FID	1	mg/kg	N	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C12-C16 aliphatic)	GC/FID	1	mg/kg	N	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C16-C21 aliphatic)	GC/FID	1	mg/kg	N	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C21-C35 aliphatic)	GC/FID	1	mg/kg	N	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C35-C40 aliphatic)	GC/FID	1	mg/kg	N	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C10-C12 aromatic)	GC/FID	1	mg/kg	N	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C12-C16 aromatic)	GC/FID	1	mg/kg	N	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C16-C21 aromatic)	GC/FID	1	mg/kg	N	**(13) 4**	**(13) 1**
Total Petroleum Hydrocarbons (C21-C35 aromatic)	GC/FID	1	mg/kg	N	**(13) 11**	**(13) 5**
Total Petroleum Hydrocarbons (C35-C40 aromatic)	GC/FID	1	mg/kg	N	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C10-C16 aliphatic/aromatic)	Calc	1	mg/kg	N	<1	<1
Total Petroleum Hydrocarbons (C16-C40 aliphatic/aromatic)	Calc	1	mg/kg	N	**15**	**6**

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
UU Pipe Selection Risk Assess Sum (UKWIR)

SAL Reference	**556584 003**	**556584 010**
Customer Sample Reference	**BH303**	**TP308**
Test Sample	**M105**	**M105**
Top Depth	**0.45**	
Bottom Depth	**0.5**	**0.30**
Date Sampled	**08-MAR-2016**	**15-MAR-2016**
Type	**Clay**	**Clay**

Determinand	Method	LOD	Units	Symbol		
Semi-Volatile Organic Compounds Screen	GC/MS	0.1	mg/kg	N	<0.1	Unidentified Aliphatic Hydrocarbon circa C19 **0.3** Unidentified Aliphatic Hydrocarbon circa C27 **1.2** Unidentified cyclic hydrocarbon containing O circa C30 **0.2** Lupenone **0.5** No other compounds detected above **-**
Total SVOC (exc PAH & Specific Phenols)	Calc	0.1	mg/kg	U	<0.1	<0.1

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
UU Pipe Selection Risk Assess Sum (UKWIR)

SAL Reference	**556584 003**	**556584 010**
Customer Sample Reference	**BH303**	**TP308**
Test Sample	**AR**	**AR**
Top Depth	**0.45**	
Bottom Depth	**0.5**	**0.30**
Date Sampled	**08-MAR-2016**	**15-MAR-2016**
Type	**Clay**	**Clay**

Determinand	Method	LOD	Units	Symbol		
Cresols and Chlorinated Phenols (Total)	Calc	0.10	mg/kg	N	<0.10	<0.10
Tertiary amyl methyl ether	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Volatile Organic Compounds Screen (Additional Peaks)	GC/MS (Headspace)	100	µg/kg	N	<100	<100

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil
United Utilities Total VOC Suite

SAL Reference	**556584 003**	**556584 010**
Customer Sample Reference	**BH303**	**TP308**
Test Sample	**AR**	**AR**
Top Depth	**0.45**	
Bottom Depth	**0.5**	**0.30**
Date Sampled	**08-MAR-2016**	**15-MAR-2016**
Type	**Clay**	**Clay**

Determinand	Method	LOD	Units	Symbol		
1,1,1,2-Tetrachloroethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,1,1-Trichloroethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,1,2,2-Tetrachloroethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,1,2-Trichloroethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,1,2-Trichloroethylene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,1-Dichloroethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,1-Dichloroethylene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,1-Dichloropropene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,2,3-Trichloropropane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,2,4-Trimethylbenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,2-dibromoethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,2-Dichlorobenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,2-Dichloroethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,2-Dichloropropane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,3,5-Trimethylbenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,3-Dichlorobenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,3-Dichloropropane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
1,4-Dichlorobenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
2,2-Dichloropropane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
2-Chlorotoluene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
4-Chlorotoluene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Bromobenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Bromochloromethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Bromodichloromethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Bromoform	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Bromomethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Carbon tetrachloride	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Chlorobenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Chlorodibromomethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Chloroethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Chloroform	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Chloromethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Cis-1,2-Dichloroethylene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Cis-1,3-Dichloropropene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Dibromomethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Dichlorodifluoromethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Isopropyl benzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Methylene Chloride	GC/MS (Headspace)	10	µg/kg	U	<10	<10
n-Propylbenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Naphthalene	GC/MS (Headspace)	50	µg/kg	U	<50	<50
p-Isopropyltoluene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Sec-Butylbenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Styrene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Tert-Butylbenzene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Tetrachloroethylene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Trans-1,2-Dichloroethylene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Trans-1,3-Dichloropropene	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Trichlorofluoromethane	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Vinyl chloride monomer	GC/MS (Headspace)	5	µg/kg	U	<5	<5
Volatile Organic Compounds (Total)	Calc	5	µg/kg	U	<5	<5

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil

Semi-Volatile Organic Compounds (USEPA 625)

				SAL Reference	**556584 003**	**556584 010**
				Customer Sample Reference	**BH303**	**TP308**
				Test Sample	**M105**	**M105**
				Top Depth	**0.45**	
				Bottom Depth	**0.5**	**0.30**
				Date Sampled	**08-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
1,2,4-Trichlorobenzene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
1,2-Dichlorobenzene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
1,3-Dichlorobenzene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
1,4-Dichlorobenzene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2,4,5-Trichlorophenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2,4,6-Trichlorophenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2,4-Dichlorophenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2,4-Dimethylphenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2,4-Dinitrophenol	GC/MS	0.1	mg/kg	N	(36) <0.5	(36) <0.5
2,4-Dinitrotoluene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2,6-Dinitrotoluene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2-Chloronaphthalene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2-Chlorophenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2-methyl phenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2-Methylnaphthalene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2-Nitroaniline	GC/MS	0.1	mg/kg	U	<0.1	<0.1
2-Nitrophenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
3-Nitroaniline	GC/MS	0.1	mg/kg	U	(36) <0.5	(36) <0.5
3/4-Methylphenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
4-Bromophenyl phenylether	GC/MS	0.1	mg/kg	U	<0.1	<0.1
4-Chloro-3-methylphenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
4-Chloroaniline	GC/MS	0.1	mg/kg	U	(36) <0.5	(36) <0.5
4-Chlorophenyl phenylether	GC/MS	0.1	mg/kg	U	<0.1	<0.1
4-Nitroaniline	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Acenaphthene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Acenaphthylene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Anthracene	GC/MS	0.1	mg/kg	U	**0.1**	<0.1
Azobenzene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Benzo(a)Anthracene	GC/MS	0.1	mg/kg	U	**0.4**	<0.1
Benzo(a)Pyrene	GC/MS	0.1	mg/kg	U	**0.3**	<0.1
Benzo(b/k)Fluoranthene	GC/MS	0.1	mg/kg	U	**0.6**	**0.1**
Benzo(ghi)Perylene	GC/MS	0.1	mg/kg	U	**0.2**	<0.1
Bis (2-chloroethoxy) methane	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Bis (2-chloroethyl) ether	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Bis (2-chloroisopropyl) ether	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Bis (2-ethylhexyl)phthalate	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Butyl benzylphthalate	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Carbazole	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Chrysene	GC/MS	0.1	mg/kg	U	**0.4**	<0.1
Di-n-butylphthalate	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Di-n-octylphthalate	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Dibenzo(ah)Anthracene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Dibenzofuran	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Diethyl phthalate	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Dimethyl phthalate	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Fluoranthene	GC/MS	0.1	mg/kg	U	**0.8**	**0.1**
Fluorene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Hexachlorobenzene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Hexachlorobutadiene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Hexachlorocyclopentadiene	GC/MS	0.1	mg/kg	U	(36) <0.5	(36) <0.5
Hexachloroethane	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Indeno(123-cd)Pyrene	GC/MS	0.1	mg/kg	U	**0.1**	<0.1
Isophorone	GC/MS	0.1	mg/kg	U	(36) <0.5	(36) <0.5
Naphthalene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Nitrobenzene	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Pentachlorophenol	GC/MS	0.1	mg/kg	U	(36) <0.5	(36) <0.5

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Soil Analysed as Soil

Semi-Volatile Organic Compounds (USEPA 625)

				SAL Reference	**556584 003**	**556584 010**
				Customer Sample Reference	**BH303**	**TP308**
				Test Sample	**M105**	**M105**
				Top Depth	**0.45**	
				Bottom Depth	**0.5**	**0.30**
				Date Sampled	**08-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Phenanthrene	GC/MS	0.1	mg/kg	U	**0.7**	<0.1
Phenol	GC/MS	0.1	mg/kg	U	<0.1	<0.1
Pyrene	GC/MS	0.1	mg/kg	U	**0.8**	**0.1**

SAL Reference: 556584
Project Site: Airport City North
Customer Reference: 3407

Leachate to BS EN 12457-2 (10:1) Analysed as Water

Waste Acceptance Criteria

				SAL Reference	**556584 001**	**556584 005**
				Customer Sample Reference	**BH301**	**BH101**
				Test Sample	**10:1**	**10:1**
				Top Depth	**0.3**	
				Bottom Depth	**0.4**	**1.20**
				Date Sampled	**07-MAR-2016**	**15-MAR-2016**
				Type	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Antimony (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1	<1
Arsenic (Dissolved)	ICP/MS (Filtered)	0.2	µg/l	U	**2.4**	**0.6**
Barium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	**34**	**5**
Cadmium (Dissolved)	ICP/MS (Filtered)	0.02	µg/l	U	<0.02	<0.02
Chloride	Discrete Analyser	1	mg/l	U	**4**	<1
Chromium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1	<1
Copper (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	**3.5**	**0.9**
Dissolved Organic Carbon	OX/IR	1	mg/l	N	**8**	**7**
Electrical Conductivity	Probe	10	µS/cm	N	**170**	**110**
Fluoride	Discrete Analyser	0.05	mg/l	U	**0.68**	**0.10**
Lead (Dissolved)	ICP/MS (Filtered)	0.3	µg/l	U	**0.5**	<0.3
Mercury (Dissolved)	ICP/MS (Filtered)	0.05	µg/l	U	<0.05	<0.05
Molybdenum (Dissolved)	ICP/MS (Filtered)	1	µg/l	N	**3**	<1
Nickel (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1	<1
Phenols (Total-Mono)	Colorimetry	0.1	mg/l	U	<0.1	<0.1
Selenium (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	<0.5	<0.5
Sulphate	Discrete Analyser	0.5	mg/l	U	**8.1**	**2.1**
Total Dissolved Solids	Grav	100	mg/l	N	**100**	<100
Zinc (Dissolved)	ICP/MS (Filtered)	2	µg/l	U	**3**	**3**

Index to symbols used in 556584-1

Value	Description
10:1 S	Data for BS EN 12457-2 (10:1)
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
10:1	Leachate to BS EN 12457-2 (10:1)
AR	As Received
9	LOD raised due to dilution of sample
13	Results have been blank corrected.
36	LOD Raised due to low Matrix spike recovery
M	Analysis is MCERTS accredited

U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Samples submitted for GC/MS (Headspace) analysis were submitted in inappropriate containers. It is possible therefore that the results provided may be compromised.

APPENDIX D

GEOTECHNICAL TESTING RESULTS



LABORATORY REPORT

4043

Contract Number: PSL16/1450

Report Date: 21 April 2016

Client's Reference: 3407

Client Name: ROC Consulting
81 Chapel Street
Manchester
M3 5DF

For the attention of: Alex Smiles

Contract Title: Airport City North

Date Received: 1/4/2016
Date Commenced: 1/4/2016
Date Completed: 21/4/2016

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
D Lambe (Senior Technician)	S Royle (Senior Technician)	W Allen (Senior Technician)

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SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		Area	D_e^2	D_e	Failure Load (P)		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	W	D	(mm2)		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
BH101	10.10		A	Par	86	41	1681	4489.44	67.00	-	2.94	0.655	1.141	0.75	Valid	
BH101	20.00		A	Par	86	37	1369	4051.45	63.65	-	0.21	0.052	1.115	0.06	Valid	
BH101	9.20		A	Par	86	29	841	3175.46	56.35	-	0.53	0.167	1.055	0.18	Valid	
BH101	15.50		A	Par	86	38	1444	4160.95	64.51	-	5.22	1.255	1.121	1.41	Valid	
BH101	17.80		A	Par	86	40	1600	4379.94	66.18	-	0.29	0.066	1.134	0.08	Valid	
BH101	10.80		A	Par	86	36	1296	3941.95	62.78	-	0.53	0.134	1.108	0.15	Valid	
BH101	8.30		A	Par	86	33	1089	3613.45	60.11	-	1.44	0.399	1.086	0.43	Valid	
BH102	11.50		A	Par	86	29	841	3175.46	56.35	-	0.39	0.123	1.055	0.13	Valid	
BH102	14.10		A	Par	86	44	1936	4817.94	69.41	-	0.42	0.087	1.159	0.10	Valid	
BH102	10.30		A	Par	86	36	1296	3941.95	62.78	-	0.34	0.086	1.108	0.10	Valid	
BH102	6.30		A	Par	86	33	1089	3613.45	60.11	-	6.14	1.699	1.086	1.85	Valid	
BH102	7.00		A	Par	86	40	1600	4379.94	66.18	-	0.48	0.110	1.134	0.12	Valid	
BH201	11.20		A	Par	86	42	1764	4598.94	67.82	-	0.26	0.057	1.147	0.06	Valid	
BH201	9.00		A	Par	86	39	1521	4270.45	65.35	-	0.52	0.122	1.128	0.14	Valid	
BH201	13.60		A	Par	86	36	1296	3941.95	62.78	-	0.61	0.155	1.108	0.17	Valid	
BH201	14.50		A	Par	86	33	1089	3613.45	60.11	-	0.40	0.111	1.086	0.12	Valid	

Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular

UKAS TESTING 4043

PSL Professional Soils Laboratory

Checked / Approved		Date	21/04/16	Contract No:
Airport City North				PSL16/1450
				Client Ref:
				3407

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D_e^2	D_e	Failure Load		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	L	D		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
BH101	10.10		D	Perp		86	7396	86.00	-	2.22	0.300	1.276	0.38	Valid	
BH101	20.00		D	Perp		86	7396	86.00	-	0.16	0.022	1.276	0.03	Valid	
BH101	9.20		D	Perp		86	7396	86.00	-	0.22	0.030	1.276	0.04	Valid	
BH101	15.50		D	Perp		86	7396	86.00	-	7.86	1.063	1.276	1.36	Valid	
BH101	17.80		D	Perp		86	7396	86.00	-	0.12	0.016	1.276	0.02	Valid	
BH101	10.80		D	Perp		86	7396	86.00	-	0.17	0.023	1.276	0.03	Valid	
BH101	8.30		D	Perp		86	7396	86.00	-	1.37	0.185	1.276	0.24	Valid	
BH102	11.50		D	Perp		86	7396	86.00	-	0.26	0.035	1.276	0.04	Valid	
BH102	14.10		D	Perp		86	7396	86.00	-	0.24	0.032	1.276	0.04	Valid	
BH102	10.30		D	Perp		86	7396	86.00	-	0.29	0.039	1.276	0.05	Valid	
BH102	6.30		D	Perp		86	7396	86.00	-	8.21	1.110	1.276	1.42	Valid	
BH102	7.00		D	Perp		86	7396	86.00	-	0.22	0.030	1.276	0.04	Valid	
BH201	11.20		D	Perp		86	7396	86.00	-	0.14	0.019	1.276	0.02	Valid	
BH201	9.00		D	Perp		86	7396	86.00	-	0.30	0.041	1.276	0.05	Valid	
BH201	13.60		D	Perp		86	7396	86.00	-	0.31	0.042	1.276	0.05	Valid	
BH201	14.50		D	Perp		86	7396	86.00	-	0.26	0.035	1.276	0.04	Valid	

Note All testing carried out on samples at as received water content Par = parallel, Perp = perpendicular

UKAS TESTING 4043	PSL Professional Soils Laboratory	Checked / Approved	Date	21/04/16	Contract No:
		Airport City North			PSL16/1450
					Client Ref:
					3407

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		Area	D_e^2	D_e	Failure Load (P)		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	W	D	(mm2)		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
BH202	6.50		A	Par	86	31	961	3394.46	58.26	-	2.94	0.866	1.071	0.93	Valid	
BH202	7.20		A	Par	86	36	1296	3941.95	62.78	-	3.17	0.804	1.108	0.89	Valid	
BH202	14.60		A	Par	86	38	1444	4160.95	64.51	-	0.68	0.163	1.121	0.18	Valid	
BH202	5.70		I	Par	42	27	729	1443.85	38.00	-	0.36	0.249	0.884	0.22	Valid	
BH202	12.40		A	Par	86	29	841	3175.46	56.35	-	0.52	0.164	1.055	0.17	Valid	
BH202	4.80		A	Par	86	32	1024	3503.96	59.19	-	0.84	0.240	1.079	0.26	Valid	
BH202	8.60		A	Par	86	27	729	2956.46	54.37	-	0.38	0.129	1.038	0.13	Valid	
BH202	10.00		A	Par	86	41	1681	4489.44	67.00	-	0.24	0.053	1.141	0.06	Valid	
BH301	18.50		A	Par	86	42	1764	4598.94	67.82	-	0.74	0.161	1.147	0.18	Valid	
BH301	19.50		A	Par	86	33	1089	3613.45	60.11	-	2.29	0.634	1.086	0.69	Valid	
BH301	20.20		A	Par	86	39	1521	4270.45	65.35	-	0.81	0.190	1.128	0.21	Valid	
BH301	16.50		A	Par	86	40	1600	4379.94	66.18	-	1.44	0.329	1.134	0.37	Valid	
BH301	12.20		A	Par	86	37	1369	4051.45	63.65	-	0.48	0.118	1.115	0.13	Valid	
BH301	10.20		A	Par	86	28	784	3065.96	55.37	-	0.62	0.202	1.047	0.21	Valid	
BH301	8.60		A	Par	86	35	1225	3832.45	61.91	-	0.56	0.146	1.101	0.16	Valid	
BH302	16.00		A	Par	86	32	1024	3503.96	59.19	-	0.54	0.154	1.079	0.17	Valid	
BH302	18.10		A	Par	86	36	1296	3941.95	62.78	-	0.94	0.238	1.108	0.26	Valid	
BH302	12.40		A	Par	86	40	1600	4379.94	66.18	-	0.86	0.196	1.134	0.22	Valid	
BH302	13.90		A	Par	86	42	1764	4598.94	67.82	-	0.49	0.107	1.147	0.12	Valid	
BH302	7.00		A	Par	86	31	961	3394.46	58.26	-	0.24	0.071	1.071	0.08	Valid	
BH302	8.60		A	Par	86	33	1089	3613.45	60.11	-	0.22	0.061	1.086	0.07	Valid	

Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Checked / Approved**	**Date** 21/04/16	**Contract No:** PSL16/1450
		Airport City North		**Client Ref:** 3407

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D_e^2	D_e	Failure Load		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	L	D		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
BH202	6.50		D	Perp		86	7396	86.00	-	0.37	0.050	1.276	0.06	Valid	
BH202	7.20		D	Perp		86	7396	86.00	-	0.52	0.070	1.276	0.09	Valid	
BH202	14.60		D	Perp		86	7396	86.00	-	0.42	0.057	1.276	0.07	Valid	
BH202	12.40		D	Perp		86	7396	86.00	-	0.34	0.046	1.276	0.06	Valid	
BH202	4.80		D	Perp		86	7396	86.00	-	0.25	0.034	1.276	0.04	Valid	
BH202	8.60		D	Perp		86	7396	86.00	-	0.14	0.019	1.276	0.02	Valid	
BH202	10.00		D	Perp		86	7396	86.00	-	0.27	0.037	1.276	0.05	Valid	
BH301	18.50		D	Perp		86	7396	86.00	-	0.57	0.077	1.276	0.10	Valid	
BH301	19.50		D	Perp		86	7396	86.00	-	1.92	0.260	1.276	0.33	Valid	
BH301	20.20		D	Perp		86	7396	86.00	-	0.32	0.043	1.276	0.06	Valid	
BH301	16.50		D	Perp		86	7396	86.00	-	0.69	0.093	1.276	0.12	Valid	
BH301	12.20		D	Perp		86	7396	86.00	-	0.23	0.031	1.276	0.04	Valid	
BH301	10.20		D	Perp		86	7396	86.00	-	0.54	0.073	1.276	0.09	Valid	
BH301	8.60		D	Perp		86	7396	86.00	-	0.40	0.054	1.276	0.07	Valid	
BH302	16.00		D	Perp		86	7396	86.00	-	0.23	0.031	1.276	0.04	Valid	
BH302	18.10		D	Perp		86	7396	86.00	-	0.28	0.038	1.276	0.05	Valid	
BH302	12.40		D	Perp		86	7396	86.00	-	0.38	0.051	1.276	0.07	Valid	
BH302	13.90		D	Perp		86	7396	86.00	-	0.28	0.038	1.276	0.05	Valid	
BH302	7.00		D	Perp		86	7396	86.00	-	0.38	0.051	1.276	0.07	Valid	
BH302	8.60		D	Perp		86	7396	86.00	-	0.12	0.016	1.276	0.02	Valid	

Note All testing carried out on samples at as received water content Par = parallel, Perp = perpendicular

UKAS TESTING 4043

PSL Professional Soils Laboratory

Checked / Approved		Date	21/04/16	Contract No:
Airport City North				PSL16/1450
				Client Ref:
				3407

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		Area	D_e^2	D_e	Failure Load (P)		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	W	D	(mm2)		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
BH303	8.50		A	Par	86	29	841	3175.46	56.35	-	1.34	0.422	1.055	0.45	Valid	
BH303	11.80		A	Par	86	32	1024	3503.96	59.19	-	2.76	0.788	1.079	0.85	Valid	
BH303	12.70		A	Par	86	39	1521	4270.45	65.35	-	0.22	0.052	1.128	0.06	Valid	
BH304	15.50		A	Par	86	29	841	3175.46	56.35	-	0.68	0.214	1.055	0.23	Valid	
BH304	16.60		A	Par	86	32	1024	3503.96	59.19	-	0.42	0.120	1.079	0.13	Valid	
BH304	17.60		A	Par	86	36	1296	3941.95	62.78	-	0.84	0.213	1.108	0.24	Valid	
BH304	14.60		A	Par	86	40	1600	4379.94	66.18	-	3.26	0.744	1.134	0.84	Valid	
BH304	9.40		A	Par	86	32	1024	3503.96	59.19	-	3.14	0.896	1.079	0.97	Valid	
BH304	11.30		A	Par	86	29	841	3175.46	56.35	-	0.48	0.151	1.055	0.16	Valid	
BH304	6.00		A	Par	86	38	1444	4160.95	64.51	-	0.66	0.159	1.121	0.18	Valid	
BH304	8.10		A	Par	86	29	841	3175.46	56.35	-	0.68	0.214	1.055	0.23	Valid	

Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular

UKAS TESTING 4043	PSL Professional Soils Laboratory	Checked / Approved	Date	21/04/16	Contract No:
		Airport City North			PSL16/1450
					Client Ref:
					3407

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D_e^2	D_e	Failure Load		I_s	Corr Fac	I_{s50}	Failure Type	Remarks
				Par / Perp	L	D		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)		
BH303	8.50		D	Perp		86	7396	86.00	-	1.27	0.172	1.276	0.22	Valid	
BH303	11.80		D	Perp		86	7396	86.00	-	0.84	0.114	1.276	0.14	Valid	
BH303	12.70		D	Perp		86	7396	86.00	-	0.35	0.047	1.276	0.06	Valid	
BH304	15.50		D	Perp		86	7396	86.00	-	0.44	0.059	1.276	0.08	Valid	
BH304	16.60		D	Perp		86	7396	86.00	-	0.36	0.049	1.276	0.06	Valid	
BH304	17.60		D	Perp		86	7396	86.00	-	0.46	0.062	1.276	0.08	Valid	
BH304	14.60		D	Perp		86	7396	86.00	-	0.09	0.012	1.276	0.01	Valid	
BH304	9.40		D	Perp		86	7396	86.00	-	2.25	0.304	1.276	0.39	Valid	
BH304	11.30		D	Perp		86	7396	86.00	-	0.12	0.016	1.276	0.02	Valid	
BH304	6.00		D	Perp		86	7396	86.00	-	0.39	0.053	1.276	0.07	Valid	
BH304	8.10		D	Perp		86	7396	86.00	-	0.44	0.059	1.276	0.08	Valid	

Note All testing carried out on samples at as received water content Par = parallel, Perp = perpendicular

UKAS TESTING 4043

PSL Professional Soils Laboratory

Checked / Approved		Date	21/04/16	Contract No:
Airport City North				PSL16/1450
				Client Ref:
				3407

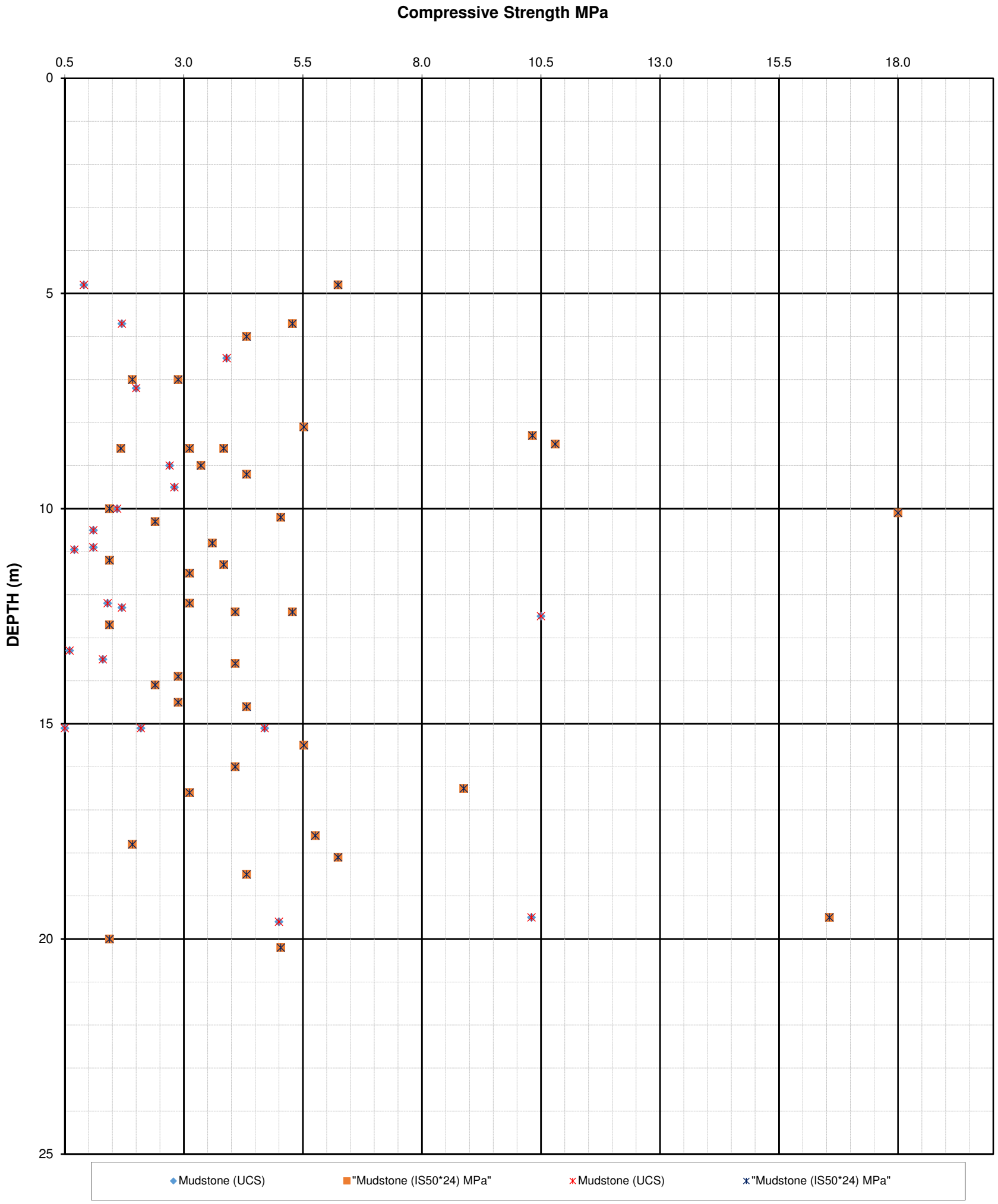
DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH

ISRM Suggested Methods, pp 111 –116, 1981.

Hole Number	Sample Number	Sample Type	Top Depth (m)	Base Depth (m)	Sample Diameter (mm)	Sample Length (mm)	Height Ratio	Initial Mass (g)	Bulk Density (Mg/m)	Moisture Content (%)	Dry Density (Mg/m)	Load Failure	UCS (MPa)	Failure Mode	Date Tested	Remarks
BH101		C	12.50	12.80	86	114	1.3	1623	2.45	9.1	2.25	60.9	10.5	Brittle	20/04/16	
BH102		C	13.50		86	189	2.2	2650	2.41	9.0	2.21	7.4	1.3	Brittle	20/04/16	
BH102		C	15.10	15.30	86	88	1.0	1268	2.48	5.7	2.35	27.1	4.7	Brittle	20/04/16	
BH201		C	10.90	11.90	86	86	1.0	1189	2.38	9.8	2.17	6.3	1.1	Brittle	20/04/16	
BH201		C	15.10	15.40	86	103	1.2	1347	2.25	13.6	1.98	12.1	2.1	Brittle	20/04/16	
BH201		C	13.30	13.50	86	107	1.2	1490	2.40	12.6	2.13	3.3	0.6	Brittle	20/04/16	
BH202		C	6.50	6.75	86	110	1.3	1479	2.31	11.2	2.08	22.9	3.9	Brittle	20/04/16	
BH202		C	7.20	7.45	86	128	1.5	1718	2.31	14.4	2.02	11.8	2.0	Brittle	20/04/16	
BH202		C	5.70	6.00	86	86	1.0	1189	2.38	8.9	2.19	9.8	1.7	Brittle	20/04/16	
BH202		C	4.80	5.00	86	109	1.3	1519	2.40	9.1	2.20	5.2	0.9	Brittle	20/04/16	
BH202		C	10.50	10.60	86	86	1.0	1234	2.47	10.1	2.24	6.2	1.1	Brittle	20/04/16	
BH301		C	19.50	19.70	86	200	2.3	2822	2.43	11.9	2.17	60.1	10.3	Brittle	20/04/16	
BH301		C	15.10	15.40	86	168	2.0	2308	2.37	13.4	2.09	2.7	0.5	Brittle	20/04/16	
BH301		C	9.00	9.10	86	198	2.3	2617	2.27	15.8	1.96	15.5	2.7	Brittle	20/04/16	
BH302		C	9.50	9.65	86	89	1.0	1156	2.24	9.5	2.04	16.4	2.8	Brittle	20/04/16	
BH302		C	10.00	10.15	86	121	1.4	1702	2.42	11.0	2.18	9.3	1.6	Brittle	20/04/16	
BH302		C	10.95	11.10	86	90	1.0	1138	2.18	13.4	1.92	3.8	0.7	Brittle	20/04/16	
BH303		C	12.20	12.40	86	131	1.5	1802	2.37	15.8	2.05	8.0	1.4	Brittle	20/04/16	
BH304		C	19.60	19.80	86	112	1.3	1618	2.49	9.5	2.27	29.1	5.0	Brittle	20/04/16	
BH304		C	12.30	12.50	86	199	2.3	2781	2.41	11.0	2.17	9.7	1.7	Brittle	20/04/16	

UKAS TESTING 4043	PSL Professional Soils Laboratory	Checked / Approved		Date	21/04/16
		Airport City North			Contract No: PSL16/1450
					Client Ref: 3407

UCS ISRM Method v Depth



3407 : Airport City North,

Mudstone UCS MPa	
Maximum	10.5
Average	2.83
Minimum	0.5

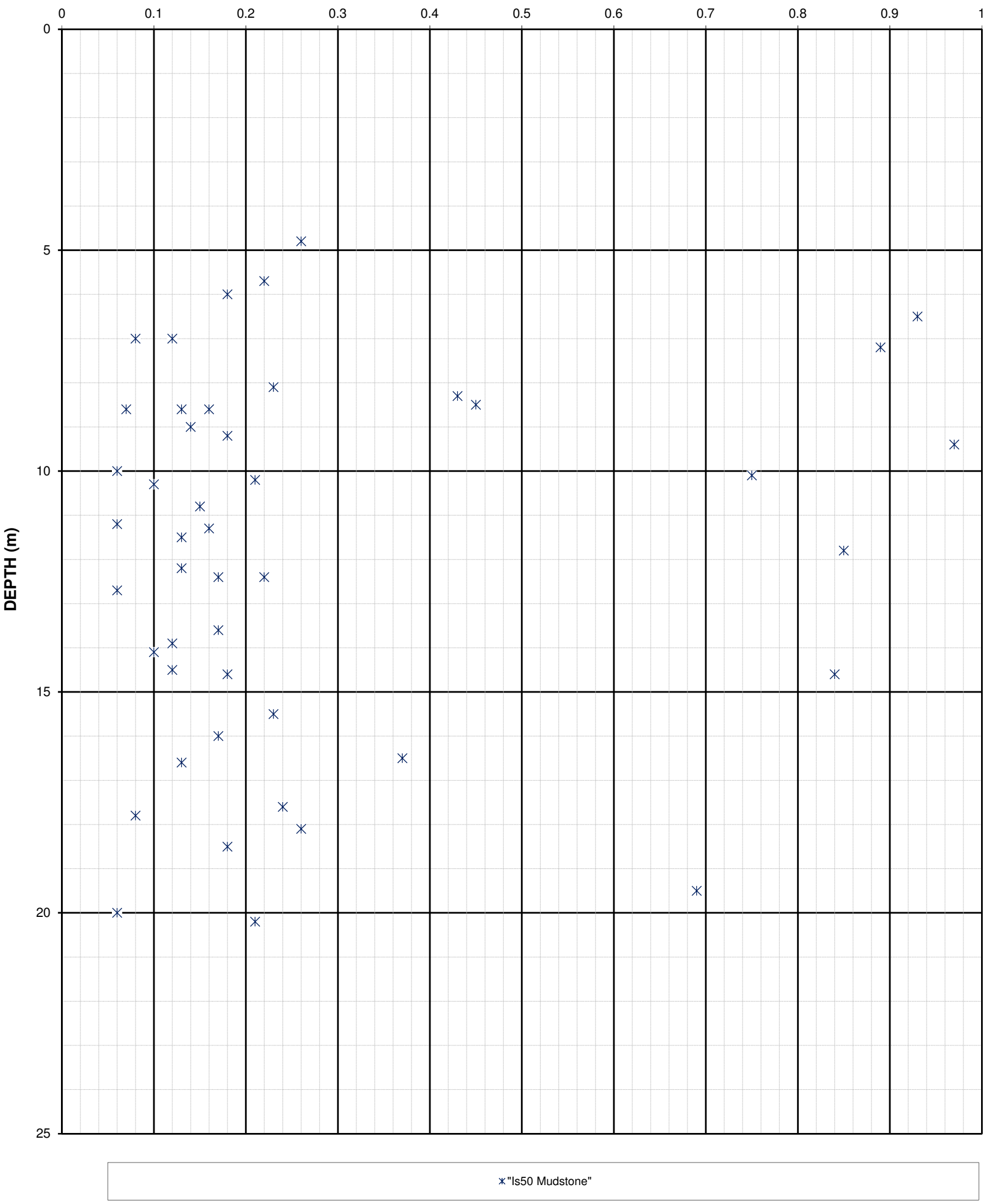
Is50*24 (axial)	
Maximum	44.4
Average	7.95
Minimum	1.4

Extremely weak: less than 1MPa
Very weak : 1 to 5 MPa
Weak: 5 to 25 MPa
Medium strong: 25 to 50MPa
Strong : 50 to 100MPa

UCS(p) = PLT*24

FIGURE 6.1

Point Load Index Test v Depth



3407 : Airport City North,

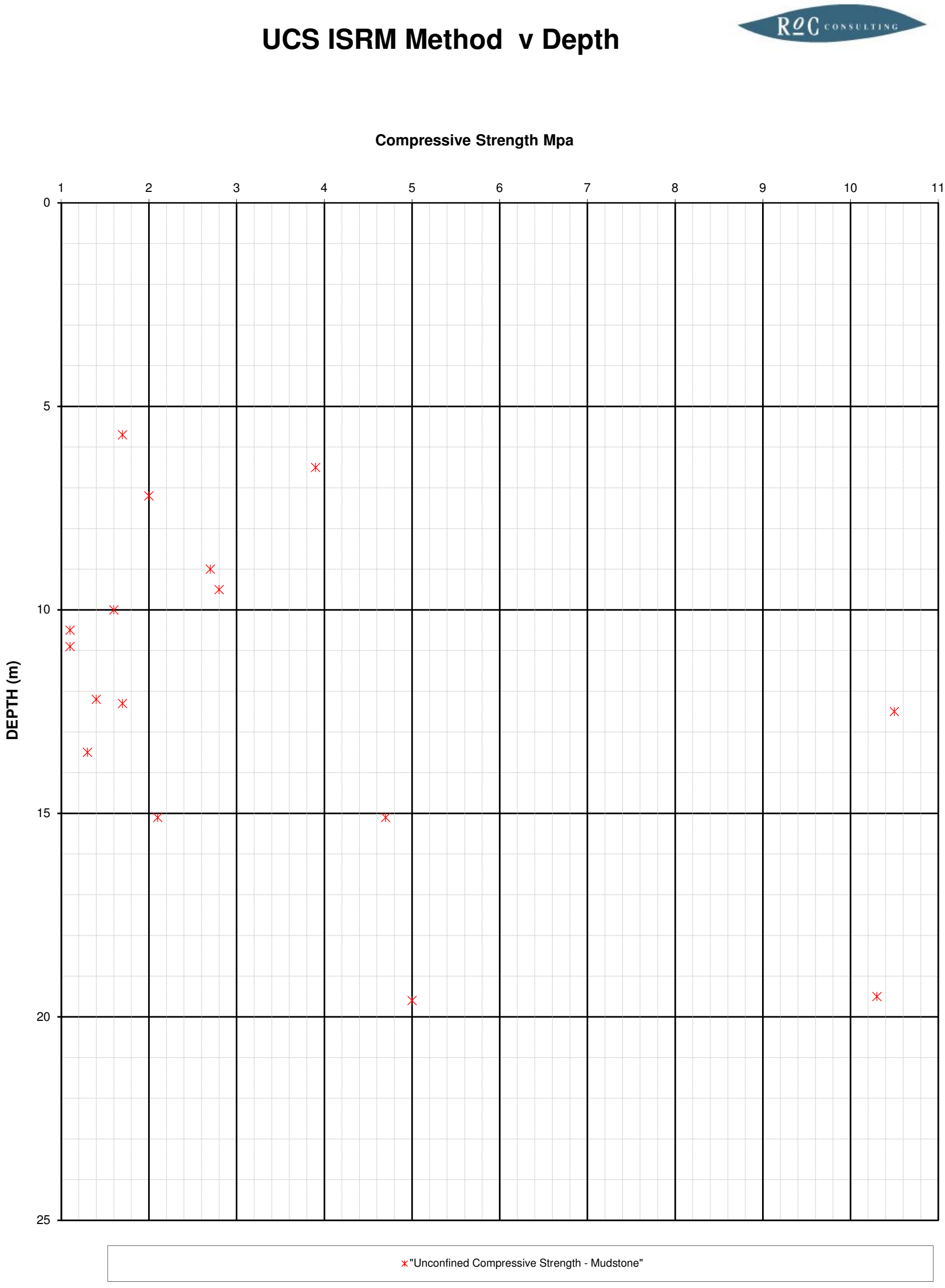
Mudstone Point Load Test Is50

	Axial	Diametral
Maximum	1.85	1.42
Average	0.33	0.13
Minimum	0.06	0.01

	$I_{s(50)}$ MN/m^2	U.C.S. MN/m^2
Very Weak	< 0.05	<1.25
Weak	0.05-0.20	1.25-5
Moderately W	0.20-0.50	5-12.5
Moderately S	0.50 - 2.00	12.5-50

FIGURE 6.2

UCS ISRM Method v Depth



3407 : Airport City North,

Mudstone UCS Mpa	
Maximum	10.5
Average	2.83
Minimum	0.50

Extremely weak: less than 1MPa
Very weak : 1 to 5 MPa
Weak: 5 to 25 MPa
Medium strong: 25 to 50MPa
Strong : 50 to 100MPa

UCS(p) = PLT*24

FIGURE 6.3

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Gravel
Site Name	ACN - Zone 2 Jet Parks 2	Anticpated Ground Conditions	Gravel car park formation overlying clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 201A		Test No.	DPC 201B	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	115	>50%	Top	105	>50%
2	160		2	131	
2	163		2	141	
5	171		5	150	
5	181		5	159	
10	122		5	170	
			10	210	
			10	210	
			10	210	

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Gravel
Site Name	ACN - Zone 2 Jet Parks 2	Anticpated Ground Conditions	Gravel car park formation overlying clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 204		Test No.	DPC 205	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	135		Top	100	
2	184		2	141	
2	241		2	160	31%
5	286	43%	5	182	
10	351		5	213	
10	396		10	306	
10	424		10	392	6%
10	457		10	680	
10	475		5	980	
10	569				
5	656	12%			
5	752				
5	862				
5	981				

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Gravel
Site Name	ACN - Zone 2 Jet Parks 2	Anticpated Ground Conditions	Topsoil overlying Clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 208		Test No.	DPC 209	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	321	5%	Top	115	5%
2	471		2	276	
2	494		2	349	
5	793		5	510	
4	980		5	780	
			5	965	

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Gravel
Site Name	ACN - Zone 2 Jet Parks 2	Anticpated Ground Conditions	Gravel car park formation overlying clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 202		Test No.	DCP 203	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	110		Top	110	
2	159		2	151	
2	180		2	160	
5	209		5	210	
5	230	>50%	5	223	44%
10	270		10	290	
10	310		10	331	
10	325		10	410	
10	350		10	450	
			10	506	
			10	570	
			10	697	16%
			10	891	
			5	982	

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Gravel
Site Name	ACN - Zone 2 Jet Parks 2	Anticpated Ground Conditions	Gravel car park formation overlying clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 206		Test No.	DCP 207	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	130	53%	Top	116	50%
2	161		2	151	
2	175		2	170	
5	210		5	192	
5	233		5	214	
10	272		10	256	
10	299	19%	10	281	
10	330		10	310	
10	408		10	346	
10	563		10	380	22%
10	770		10	419	
10	877		10	470	
10	945		10	610	
			10	690	
			10	770	
			10	951	

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Grass
Site Name	ACN - Zone 3 Goodmans	Anticpated Ground Conditions	Topsoil overlying Clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 301		Test No.	DCP 302	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	125	26%	Top	151	6%
2	162		2	326	
2	191		2	443	
5	250		5	730	
5	270		5	910	
5	345	15%	5	971	
10	550				
10	780				
10	900				
5	950				

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Grass
Site Name	ACN - Zone 3 Goodmans	Anticpated Ground Conditions	Topsoil overlying Clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 305		Test No.	DCP 306	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	143	9%	Top	196	5%
2	312		2	378	
2	365		2	486	
5	460		5	783	
5	635		5	940	
10	920				
5	971				

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Grass
Site Name	ACN - Zone 3 Goodmans	Anticpated Ground Conditions	Topsoil overlying Clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 309		Test No.	DCP 310	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	172	6%	Top	101	5%
2	310		2	221	
2	387		2	325	
5	631		5	610	
5	836		5	830	
5	980		5	980	

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Grass
Site Name	ACN - Zone 3 Goodmans	Anticpated Ground Conditions	Topsoil overlying Clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 303		Test No.	DCP 304	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	160	6%	Top	190	3%
2	250		2	373	
2	321		2	503	
5	680		5	600	20%
5	880		5	675	
5	973		10	843	
			10	930	
			5	962	

TRL - Transport Research Dynamic Cone Penetration CBR

Job No.	3407	Surface Covering	Grass
Site Name	ACN - Zone 3 Goodmans	Anticpated Ground Conditions	Topsoil overlying Clay
Engineer	AS & JB		
Comments	Refer to RoC Consulting drawing ES04 for test locations	Date	26/02/2016

Test No:	DCP 307		Test No.	DCP 308	
Blows	Penetration (mm)	CBR (%)	Blows	Penetration (mm)	CBR (%)
Top	180	7%	Top	141	7%
2	341		2	230	
2	382		2	284	
5	587		5	430	
5	708		5	593	
5	870		5	777	
4	969		5	926	
			1	990	

APPENDIX E

GROUND GAS / WATER MONITORING RESULTS



ROC CONSULTING **Civil, Structural & Environmental Engineers** Commercial Wharf, 6 Commercial St, Manchester	**Job No:**	3407	**Site:**	Airport City North
	Date:	06/04/2016	**Client:**	Manchester Airport Group
	Engineer:	JB	**Equipment:**	GFM 435

Weather Conditions:	Overcast / Mild
Barometric Pressure Trend:	Falling
Surface Ground Conditions:	Hard Standing (101 201 202) Soft Ground (301 302 303 304)

VISIT ONE	**Start**	**Finish**	
Time:	9.20	**Time:**	11.20
Barometric Pressure:	995	**Barometric Pressure:**	995
Background Oxygen:	19.9	**Background Oxygen:**	20.0

Monitoring Point		**Gas Concentration**										**Water**		
		Peak					**Steady**							
BH N°	**Flow Rate (l/h)**	**CH_4 %**	**CO_2 %**	**O_2 %**	**LEL %**	**H2S/CO (ppm)**	**CH_4 %**	**CO_2 %**	**O_2 %**	**LEL %**	**H2S/CO (ppm)**	**Depth to Water**	**Depth to Base**	**Head of water**
101			NO GAS TAP ON RUBBER BUNG									2.20	4.20	
201	1.5	0.00	0.00	20.10	0.00	0/0	0.00	0.00	20.10	0.00	0/0	1.90	3.90	
202			NO GAS TAP OR RUBBER BUNG									3.70	5.80	
301	0	0.00	1.00	7.00	0.00	0/0	0.00	1.00	7.00	0.00	0/0	DRY	4.00	
302	1.2	0.00	0.40	18.60	0.00	0/0	0.00	0.40	18.60	0.00	0/0	4.10	8.00	
303	1.2	0.00	0.00	20.00	0.00	0/0	0.00	0.00	20.00	0.00	0/0	1.80	4.10	
304	1.2	0.00	0.00	20.00	0.00	0/0	0.00	0.00	20.00	0.00	0/0	UNABLE TO REMOVE RUBBER BUNG		

Comments:

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RoC CONSULTING

Phase 2 Site Investigation Report

Airport City Bridge

for

Airport City Limited Partnership

October 2017

Civil
Structural
Earth sciences
Strategic land
Special projects

CONSULTING ENGINEERS

Phase 2 Site Investigation

on

Airport City Bridge

October 2017

DESCRIPTION	DATE	AUTHOR	REVIEWED BY	APPROVED BY
Phase 2 Site Investigation Report FINAL	13/10/2017	Mabel Newby 	Mabel Newby 	Alex Smiles 

REVISION	DESCRIPTION	DATE	AUTHOR	APPROVED BY
R1	Updated to include utility exposure trench information.	04/12/17	Liam Daley 	Alex Smiles 

COMPLEX CHALLENGES ... MADE SIMPLE

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1.0 INTRODUCTION

1.1 Background

1.1.1 RºC Consulting have been appointed by Airport City Limited Partnership to conduct a Phase 2 Site Investigation across land associated with the proposed Airport City Bridge (the site). It is understood that the site is to be developed as a pedestrian and cycle bridge across the M56 motorway spur with associated access ramps / walkways and construction of passenger lift in accordance. The proposed bridge structure will serve as a linkage between the Airport City Central Business District and Northern development portions as indicated on 5 Plus architects drawings (ref: B1_02_2200) provided within Appendix A.

1.1.2 The following assessment has been completed to support design and planning requirements for the sites redevelopment and follows on from Phase 1 Desktop Study relating to the development site, specifically:

1) Phase 1 Desktop Study completed by RoC Consulting dated March 2017 (ref: MN/AS/p2 3590)

1.1.3 In addition to the above works completed within the proposed bridge development, a number of site investigations have been completed by RoC Consulting and others relating to the wider Manchester Airport City development including:

1) Airport City North Phase 2 Site Investigation completed by RoC Consulting dated May 2016 (ref: JB/AS/p2 3407)
2) Airport City CBD Phase 2 Site Investigation completed by RoC Consulting dated July 2015 (ref: JB/AS/p2 3276).
3) Brownfield Solutions Phase 2 Site Investigation (Airport City CBD) dated June 2014 (ref: DMG/C2315/4577).

1.1.4 It is recommended reference be made to the abovementioned report (s) when reviewing the current assessment.

1.1.4 The scope of the report and its assessment has been based around the sites redevelopment proposals as outlined in the aforementioned 5 Plus architects plans. It should be noted that any subsequent revision of the proposed redevelopment or site boundary away from the above mentioned drawing may result in the full or partial re-interpretation of this report and assessment.

1.2 Terms of Reference

1.2.1 The Phase 2 Site Investigation was carried out following receipt of an instruction from Andrew Potter from Faithful + Gould on behalf of Airport City Partnerships.

1.3 Objectives

1.3.1 The scope of works has been tailored to meet both planning and design requirements to assist with the sites redevelopment. These considerations include:

1) Design a programme of site investigation works to establish ground conditions beneath the site to aid foundation design for the proposed bridge structure.

2) Completion of site investigation field works including the formation of x2 Cable Tool boreholes and x2 Rotary Cored boreholes to establish the sites geology.

3) Completion of geo-environmental and geotechnical laboratory analysis of soil / rock samples to determine physical and chemical characteristics.

4) Completion of a detailed geotechnical assessment of site conditions to inform new building foundation and retaining wall design. The scope of this assessment will also include reference to the findings and result of previous site investigation works.

5) Completion of a geo-environmental assessment sufficient in its scope to assist with the construction requirements of the proposed bridge including potential off-site waste disposal requirements and concrete design requirements, with a risk assessment of site soils to construction workers health.

2.0 LIMITATIONS OF STUDY ASSESSMENT

2.0.1 The report has been produced by RºC Consulting for the client solely for the purposes of a review of information for the above mentioned site. It may not be used by any person for any other purpose other than that specified without the express written permission of RºC Consulting. Any liability arising out of its use by a third party for purposes not wholly connected with the above shall be the responsibility of that party who shall indemnify RºC Consulting against all claims, costs, damages and losses arising out of such use.

2.0.2 This report is written in the context of an agreed scope of work and should not be used in a different context. The report should be read in its entirety. Furthermore, new information, improved practices and changes in legislation may require re-interpretation of this report in whole or in part after its original issue. RºC Consulting reserve the right to alter their conclusions and recommendations in the light of further information that may become available.

2.0.3 Ground conditions can change rapidly, especially in areas of made ground, however, it is assumed that the ground conditions observed are typical and representative of the site as a whole. The ground conditions have been determined from a limited number of exploratory holes formed across the property, therefore, only a small percentage of the total area of the property has been investigated. Interpolation between exploratory holes has enabled a general picture of the subsurface conditions to be produced.

2.0.4 Conclusions drawn from the ground investigation should be read in this context. RºC Consulting cannot accept responsibility for any situations resulting from locally unforeseen ground conditions occurring between exploratory holes.

3.0 BACKGROUND INFORMAITON

3.0.1 The overview below outlines the most salient points / considerations and it is recommended reference be made to the complete findings of previous site investigation reports for additional information / clarification.

3.1 Site Description

3.1.1 The site covers an area of approximately 0.11Ha and is located at National Grid Reference 381860, 385620 immediately to the north of the Manchester Airport Ground Transport Interchange. The closest town is Wythenshawe, which is located approximately 970m away.

3.1.2 The area of investigation is of irregular shape and for description purposes can be divided into four portions: southern, central eastern, central western and northern (as shown on Figure 1.0 overleaf). The southern portion is bound to the south by Manchester Airport train station and offices, to the north by a car park, to the east by a car park and roundabout, and to the west by the Voyager building.

3.1.3 The central eastern portion is bound in all directions to a car park and associated road. The red line boundary for the bridge is located in the central western portion of the site.

3.1.4 The central portion is bound to the south by a car park, to the east and west by a car park and M56 motorway and to the north by wooded central reservation. The northern portion of the site is bound to the north by Outwood Lane West, to the east by woodland central reservation and Terminal 1 and 3 Roundabout, to the west by Terminal 2 Roundabout and to the south by M56 motorway.

3.1.5 The northern portion of the site comprises an area of recently cleared woodland with a pond feature to the boundary with the M56 to the south. Levels fall in the area around the Pond from circa 72mAOD at Outwood Lane to the north to 68.0mAOD at the boundary with the M56 to the south. Topography across the remainder of the site to the south is roughly flat at or around 70mAOD.

3.1.6 Land use adjacent to the site predominantly comprises of Manchester Airport activity, such as railway station, terminal buildings, associated roads and offices. A selection of photographs showing the site at the time of inspection have been provided within Appendix A.

3.1.7 With reference to below ground utility records and combined services drawings for the wider Airport City North development (collated by engineers Aecom Ltd) it is noted the site is underlain by a number of service runs including telecommunication ducting (around the site of the proposed northern bridge abutment) and a High Voltage electricity cable) in the area of the southern bridge abutment.

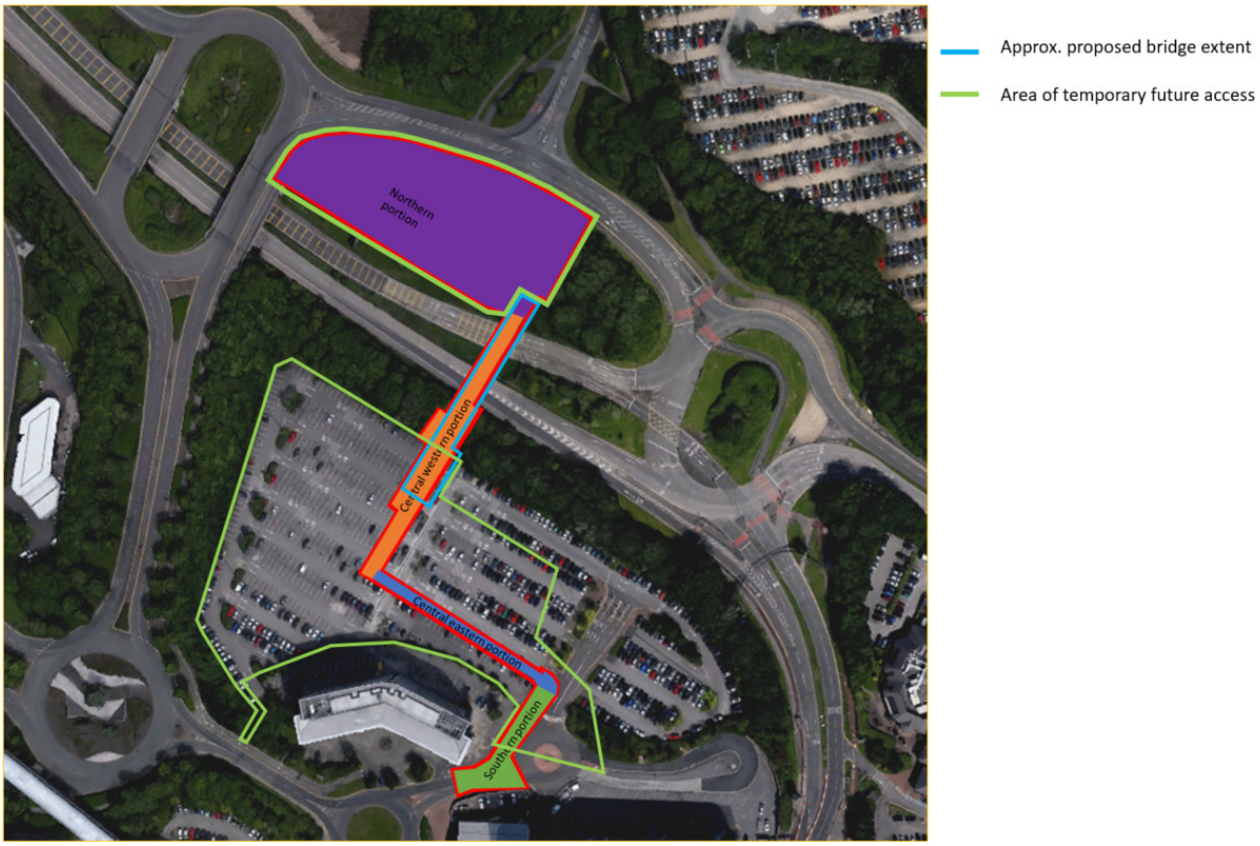


Figure 1.0: Site Subdivision

3.2 Geological Characteristics

3.2.1 Review of publicly available BGS geological map records indicate the site is underlain by the following:

Drift Geology: Till, Devensian - Diamicton

Solid Geology: Bollin Mudstone Member - Mudstone

3.2.2 The Envirocheck report (Appendix C) indicates that the site is not located in an area which may be affected by historic Coal Mining and a Coal Authority report is not required.

3.3 Site History

3.3.1 Historical records indicate that the site remained largely undeveloped as open fields and wooded area, with the exception of a building extending onto the sites north eastern corner (1954 – 1990) and an area of 'Manchester Airport' extending onto the southern portion of the site (from 1987). A cycle track is indicated along the northern boundary from 1995 and the area of 'Manchester Airport' becomes a car park in 1996, which remain at present.

3.3.2 The M56 motorway is indicated on the sites boundary from 1976, however, it is understood that the motorway was constructed in 1972. A pond is also noted on the sites boundary adjacent to the proposed northern bridge abutment from 1987. Both of which remain there at present.

3.3.2 The Envirocheck Groundwater Vulnerability Map indicates the drift geology is classified a Secondary Aquifer Undifferentiated with the underlying Mudstone bedrock classed as a Secondary B Aquifer. The site is not said to be located within any Environment Agency Source Protection Zones or close proximity to any sensitive water abstraction points (e.g. potable water supply well).

3.3.3 The nearest surface water feature is indicated on site in the form of the aforementioned pond.

3.3.4 The nearest active discharge consent is indicated 442m to the east of the site held by Manchester Airport Plc for the release of Trade Effluent Discharge – Site Drainage into River Bollin & Nearby Tributaries.

3.3.5 Two historic pollution incidents have been noted within 500m of the site. The closest pollution incident occurred 292m to the north of the site in December 1996 and comprised a Category 3 – Minor Incident of the release of Oils – Petrol into Sinderland Brook.

3.3.6 The site is not said to be located in an area deemed to be at risk from flooding or extreme flooding events from either land or sea.

4.0 SITE INVESTIGATION DESIGN

General

4.0.1 The RºC intrusive investigation was designed and completed to provide geotechnical information to facilitate the bridge design as well as investigate the chemical composition site soils to inform contaminated land, waste disposal and below ground concrete construction requirements.

4.0.2 As the bridge is to be suspended across the M56, the red line boundary in its entirety was not investigated, and the site investigation works focused on the northern and southern bridge abutments, in contact with the ground, which are located on two separate parcels of land bounding the M56 motorway (refer to RoC drawing ES01 in Appendix A).

4.0.3 The site investigation works comprised the formation of x2 Cable Tool boreholes to depths between 5.32m and 8.31mbgl and x2 Rotary Cored boreholes to depths between 19.5 and 20.0mbgl. In addition the excavation and exposure of a High Voltage Electricity cable was undertaken across the southern abutment site in order to confirm its depth and alignment for proposed bridge foundation construction.

4.0.4 Exploratory hole placement was dictated by proposed development layout; Rotary Cored boreholes were located within the footprint of the northern and southern bridge abutments with the Cable Tool boreholes located within the footprint of the proposed ramp.

4.0.5 Table 4.0 provided below provides location justification for each exploratory hole formed during the site investigation fieldworks.

Table 4.0: Borehole Locations & Justification

BH/WS ID.	Reason for selection
BH201	Located within the footprint of the proposed southern bridge abutment to determine deep ground conditions to facilitate bridge design.
BH202	Located within the footprint of the proposed northern bridge abutment to determine deep ground conditions to facilitate bridge design.
BH203	Located within the footprint of the proposed bridge ramp to determine ground conditions to facilitate bridge design.
BH204	Located within the footprint of the proposed bridge ramp to determine ground conditions to facilitate bridge design.
TT01	Located to confirm the depth and alignment of a below ground electricity cable that runs within proximity to the proposed southern bridge abutment.

4.0.6 Exploratory hole locations are shown on RºC Consulting drawing ES01 provided within Appendix A.

5.0 SITE INVESTIGATION FIELDWORKS

5.0.1 Site investigation fieldworks were completed between the 27th of June and 16th of August 2017 by drilling contractors GSS Ltd. Boreholes were formed using a Dando 150 rig (Cable Tool Boreholes) or a Premier Compact 210 rig (Rotary Boreholes). The exposure of the below ground HV cable was undertaken by sub-contractors of BCEGI Ltd with engineers from RoC Consulting in attendance to record findings. This exercise was repeated in November 2017 to expose the utilities on the north side of the M56. Prior to the commencement of site investigation works, all exploratory hole locations were set out by surveyors of BCEGI Ltd to ensure accuracy.

5.0.2 Information with respect to buried services was obtained from relevant providers prior to commencement of the investigation works. However, as a precautionary measure all exploratory hole locations were scanned with a Cable Avoidance Tool prior to the commencement of works. In addition, hand dug service pits were completed to a depth of 1.2mbgl at all borehole locations deemed to fall in close proximity to the suspected location of possible buried service runs / infrastructure.

5.0.3 To ensure no new sources of contamination were introduced to underlying soils / bedrock during the formation of each borehole, steel casing was used throughout as well as vegetable oil as a lubrication medium for all drilling apparatus. Sampling equipment was also cleaned between sampling to reduce cross-contamination risks.

5.0.4 Soil and rock core samples were collected for subsequent chemical and geotechnical laboratory analysis. Soil samples used for geotechnical analysis were collected in 500g plastic sample tubs and U100 wax sealed sample tubes. Samples collected for chemical testing were collected in 300g glass jars and 500g plastic sample tubs. Samples were obtained from both made ground and natural strata to assess the overall quality of underlying soils. In situ soil strength was investigated using Standard Penetration Tests (SPT) within superficial deposits as well as to confirm rock head had been reached.

5.0.5 The shallow soils encountered during construction of the boreholes were described and logged by a suitably qualified engineer in accordance with BS 5930: Code of Practice for Site Investigations (the log sheets for which have been provided within Appendix B).

5.0.6 A total of x1 groundwater monitoring wells were installed within Cable Tool boreholes. Installation details are provided within Table 5.0 below.

Table 5.0: Monitoring Well Installations

BH ID	Monitoring well depth	Response zone	Response zone strata
BH203	4.0m	1.0 to 4.0m	Made Ground and Natural Strata

6.0 ENCOUNTERED GROUND CONDITIONS

6.0.1 The following ground conditions are summarised from the exploratory holes formed during the R°C Consulting site investigation as well as previous site investigations completed within and around the footprint of the proposed bridge structure. The following represents an overview of encountered ground conditions and it is recommended reference be made to the borehole log sheets provided within Appendix B for a detailed strata description; all depths shown are given in metres below ground level (mbgl) unless otherwise stated.

6.1 Ground Conditions Overview

Southern Bridge Abutment

6.1.1 The following conditions are summarised from x1 Rotary Cored borehole completed within the proposed footprint of the southern bridge abutment by ROC Consulting in 2017 (ROC BH201) and x1 Rotary Cored borehole within the footprint of the bridge to the south of the abutment completed by Brownfield Solutions in 2014 (BS A12). A brief summary of ground conditions in boreholes located within 20m of the proposed bridge footprint has also been included as back ground information, namely Brownfield Solutions 2014 boreholes BS A8, BS C16 and ROC Consulting 2015 boreholes ROC BH103.

Topsoil

6.1.2 Topsoil was encountered in x1 exploratory hole location (ROC BH201) within the proposed footprint of the southern bridge abutment to a depth of 0.1mbgl and comprised a black silty organic sand with numerous roots, rootlets and organic matter.

Made Ground

6.1.3 Made Ground was encountered in x1 exploratory hole location (BS A12) within the proposed footprint of the bridge, located in an area of current car parking operations comprising tarmac over gravel and cobble limestone subbase to a depth of 0.65mbgl.

Clay

6.1.4 Clay was encountered in both exploratory holes located within the proposed footprint of the bridge to depths of 2.7mbgl (ROC BH201) and 3.45mbgl (BS A12) comprising generally a firm brown slightly sandy slightly gravelly formation with occasional sand bands. Gravel is fine to coarse subangular to subrounded of mudstone, siltstone and other lithologies. This strata was reported to be Organic in ROC BH201 between 0.1 and 0.5mbgl, which is likely due to the environment in which the borehole was completed (an area formerly of dense vegetation).

Weathered Mudstone Bedrock

6.1.5 Weathered bedrock was encountered underlying Clay deposits in both exploratory hole locations within the proposed footprint of the bridge and generally comprised highly/completely weathered dark reddish brown silty formation, recovered as Clay and Gravel.

Bollin Mudstone Bedrock

6.1.6 Bollin Mudstone was encountered and cored at both exploratory hole locations within the bridge footprint to depths of 20.0m (ROC BH201) and 18.45mbgl (BS A12). Bollin Mudstone was reported as dark reddish brown / dark grey thinly bedded silty Mudstone with frequent highly / completely weathered zones and occasional gravel / clay filled fractures. The depths to the top of solid bedrock (below the initial weathered fraction) were reported at 5.16mbgl (ROC BH201) and 3.83mbgl (BS A12).

Surrounding Boreholes

6.1.7 Ground conditions in the surrounding area of the southern bridge abutment are largely similar to those within the bridge abutment. ROC BH103 located circa 12.0m to the east encountered Topsoil to a depth of 0.4mbgl, underlain by sandy gravelly Clay with sand bands to a depth of 2.9mbgl. Clay deposits were encountered overlying weathered silty Mudstone recovered as Clay and Gravel to a depth of 3.3mbgl, at which depth silty Mudstone bedrock was encountered.

6.1.8 BS A8 and BS C16 (located within the area of current car parking operations to the south and east reported Made Ground of tarmac and limestone subbase to 0.6mbgl. Sand was encountered underlying the Made Ground in BS C16 to a depth of 0.85mbgl, under which gravelly Clay was encountered to a depth in excess of 3.45mbgl. Sandy gravelly Clay with sand bands was encountered underlying Made Ground deposits in BS A8 to a depth of 3.9mbgl, overlying weathered silty Mudstone recovered as Clay and Gravel to 7.95mbgl, at which depth Mudstone bedrock was encountered.

Northern Bridge Abutment

6.1.9 The following conditions are summarised from x1 Rotary Cored borehole completed within the proposed footprint of the northern bridge abutment (BH202) and x2 Cable Tool boreholes on land to the north in the area of the proposed ramp feature (BH203 and BH204) by ROC Consulting in 2017.

Topsoil

6.1.10 Topsoil was encountered at 2 of 3 exploratory hole locations (ROC BH203 and BH204) to depths of 0.02mbgl as brown slightly gravelly silty sand with numerous roots, rootlets and organic matter. it is noted that site clearance works carried out to allow access to BH202 is likely to have led to the removal of the Topsoil layer at this location.

Made Ground

6.1.11 Made Ground was reported at all exploratory hole locations within the area of the proposed northern bridge abutment underlying Topsoil, or as the uppermost strata (ROC BH202), to depths ranging between 0.6m and 6.0mbgl with thicker Made Ground deposits on the higher level to the north of BH202 (on top of an embankment structure that is believed to relate to the M56 spur construction works).

6.1.12 Made Ground was encountered in BH203 and BH204, located adjacent Outwood Lane West at elevated surface levels, as demolition fill type material comprising brown sandy clayey fine to coarse angular to rounded Gravel of brick, tile, concrete, wood and other mixed lithologies overlying a brown mottled slightly sandy gravelly Clay with gravel fine to medium subangular to subrounded of brick, concrete and other lithologies.

6.1.13 Made Ground was encountered in BH202 located adjacent to the M56 motorway at a lower surface level as reworked brown Clay with roots and rootlets overlying orangish brown mottled slightly sandy Clay.

Glacial Clay

6.1.14 Clay was encountered at all exploratory hole locations to depths ranging between 1.5m and 7.1mbgl and was encountered as generally a brown / reddish brown mottled silty Clay.

Weathered Mudstone Bedrock

6.1.15 Weathered bedrock was encountered underlying Clay deposits in all exploratory hole locations as a highly / completely weathered light grey silty Mudstone recovered as Clay and Gravel.

Bollin Mudstone Bedrock

6.1.16 Bollin Mudstone was encountered at all exploratory hole locations and cored at one position, BH202 to a depth of 19.5mbgl. Bollin Mudstone was reported as dark reddish brown / grey thinly bedded silty Mudstone with frequent highly / completely weathered zones and occasional gravel / clay filled fractures. The depth to the top of solid bedrock (below the initial weathered fraction) was reported at 5.9mbgl.

Geological Cross Sections

6.1.12 Geological cross sections have been collated based on ROC Consulting and Brownfield Solutions data for the site (ROC BH201 – BH204, BS A12) and the surroundings (BS A8 and ROC ACN BH202), see ROC Drawing SEC01 provided within Appendix A.

6.1.13 The depth to weathered bedrock within the proposed footprint of the bridge was noted to gradually decrease from north to south ranging between 68.67mAOD (ROC BH203) and 66.90mAOD (BS A12), although from the three locations cored the depth to the solid bedrock was noted to gradually decrease from south to north ranging between 66.52mAOD (BS A12) and 63.51mAOD (ROC BH202) suggesting that the weathered fraction is much thicker in the northern abutment.

6.1.14 A programme of geotechnical testing was completed on rock samples obtained from site investigation works copies of which are provided within Appendix D.

6.2 Groundwater & Contamination Observations

6.2.1 No visual or olfactory evidence of contamination was reported during the site investigation works.

6.2.2 No groundwater was encountered during the site investigation works and a subsequent groundwater monitoring visit indicates an absence of a groundwater table on site (as revealed from borehole stand pipe).

6.3 Below Ground Obstructions

6.3.1 Made Ground obstructions were encountered in BH203 and BH204 including a section of brick wall in BH204 at 0.5mbgl, whole bricks in BH203 and BH204 at 1.5m and 0.7mbgl respectively and a large concrete boulder in BH203 at 0.4mbgl. Natural strata obstructions were limited to a siltstone boulder was encountered in BH204 at 7.7mbgl.

6.4 HV Utility Exposure Trench – Southern Bridge Abutment

6.4.1 A trench was completed to expose the aforementioned High Voltage electricity cable located in the area of the southern bridge abutment (section 3.1.7). The trench was excavated to 1.6mbgl and spanned approximately 1.3m in length and 0.9m in width. The High Voltage cable was identified running parallel to the M56 (east to west) circa 2.9m south of BH201 at approximately 1.55mbgl (see RoC drawing TT01 in Appendix A).

6.4.2 A second utility exposure trench was initially proposed as part of the current ground investigation works in relation to a series of duct runs that records indicate fall within close proximity to the proposed northern bridge abutment. However, the location of these service runs in close proximity to the live M56 motorway will require access to Highways Agency land and a possible lane closure notice (in order to ensure a safe working area of site operatives completing the excavation works). This was completed in November 2017 and is discussed in section 6.5.

6.4.3 At the time of writing (October 2017) discussions with the wider design team indicate the area of the duct run is likely to fall within wider junction improvement works proposed by BCEGI Ltd and that the exposure and recording of these utility assets will be undertaken as part of this program of works.

6.5 HV Utility Exposure Trench – Northern Bridge Abutment

6.5.1 A trench was completed to expose an electricity cable located in the area of the northern bridge abutment (section 3.1.7). The trench was excavated to 0.7mbgl and spanned approximately 2.8m in length and 0.6m in width. Two orange plastic ducts, measuring 100mm in diameter, were identified at a depth of 0.36m (70.199mAOD), at a distance on 1.8m from the roadside. Live electricity cables were detected, running parallel to the M56 in line with the street lighting (east to west), in both ducts (see RoC drawing TT02 in Appendix A).

6.5.3 At the time of writing discussions with the wider design team indicate the area of the duct run is unlikely to fall within the footprint of the proposed development.

7.0 LABORATORY TESTING

7.0.1 To establish the physical and chemical properties of underlying soils, a programme of laboratory analysis was completed utilising samples obtained during site investigation works. This analysis comprised the testing of soil samples to assist with the estimation of potential costs for off-site waste disposal and the design of below ground concrete.

Chemical Testing

7.0.2 R²C Consulting submitted a total of 3 soil samples to a UKAS accredited testing facility for analysis against a range of determinands synonymous with the site's former industrial activity.

Determinands	No. of Tests
Toxic and phytotoxic metals and metalloids	2
Total & Speciated Polycyclic Aromatic Hydrocarbons (PAH),	2
Other inorganic substances (e.g. Sulphate, Cyanide etc)	2
Water Soluble Sulfate & pH	2
Asbestos ID	3
Waste Acceptance Criteria (WAC) Analysis	1

7.0.3 Copies of chemical testing results have been provided within Appendix C.

Geotechnical Testing

7.0.4 A programme of geotechnical laboratory analysis was completed on an undisturbed soil sample and rock core samples obtained during site investigation works. In order to determine the competency of bedrock and inform of a geotechnical assessment of new building and foundation design the following tests were carried out:

Clay Strength Testing

7.0.5 A total of 1 undisturbed soil sample was tested for the determination of the glacial clays plasticity index and undrained shear strength from a depth of 6.00 – 6.45mbgl located in the area of the proposed ramp structure on the northern portion of the site.

Plasticity Index

7.0.6 The plasticity index was recorded as 22%. These results indicate clays to be of a Low plasticity.

Undrained Shear Strength

7.0.7 Shear strength results were recorded as 116kPa indicating shallow clay strength to be 'Stiff'.

Rock Strength Testing

Point Load Testing

7.0.8 A total of 11 point load tests were completed on rock core samples obtained from BH201 located within the footprint of the southern bridge abutment and a total of 6 point load tests were completed on rock core samples obtained from BH202 located within the footprint of the northern bridge abutment. Point load tests on rock core samples from BH201 ranged in depth between 7.6m and 19.7mbgl and from BH202 ranged in depth between 5.9m and 15.25mbgl. The point load test can be carried out as:

- Axial – the load applied along the core axis, normal to the observed bedding
- Diametral – the load applied across the core, parallel to the observed bedding

7.0.9 For assessment purposes the measure Is_{50} values for Axial Point Load Index results have been corrected using a conversion factor of 24 to establish approximate UCS values. Samples which were deemed irregular were disregarded from calculations. The results are presented in Table 7.1 below.

Table 7.1: Overview to Point Load Testing Results

Borehole ID	Orientation	Is50		Corrected UCS		
		Min (MPa)	Max (MPa)	Min (MPa)	Max (MPa)	Average (MPa)
BH201	Axial	0.15	1.93	3.60	46.32	20.47
BH201	Diametral	0.10	0.32	2.40	7.68	5.04
BH202	Axial	0.30	3.02	7.20	72.48	44.26
BH202	Diametral*	0.38	0.38	9.12	9.12	9.12

*A diameter test was only completed on one core sample from BH202 scheduled for testing due to sample dimensions.

Unconfined Compressive Strength Testing

7.0.10 A total of 6 Unconfined Compressive Strength (UCS) Tests were completed on rock core samples obtained from BH201 at depths ranging between 5.35m and 18.15mbgl and a total of 3 UCS Tests were completed on rock core samples obtained from BH202 at depths ranging between 7.85m and 10.75mbgl. The results are presented in Table 7.2 below.

Table 7.2: Overview to UCS Strength Testing Results

Borehole ID	Min (MPa)	Max (MPa)	Average (MPa)
BH201	3.60	41.80	17.85
BH202	1.70	9.40	6.60

7.0.11 Figures 7.1 and 7.2 (provided overleaf) indicate Unconfined Compressive Strength Test values. These graphs show the variability in the compressive strength of the bedrock with depth in both the proposed northern and southern bridge abutments. The results indicate that the compressive strength of the bedrock in the southern bridge abutment varies between 'Very Weak' to 'Medium Strong', although the average results from Point Load and UCS testing indicate the rock to be within the 'Weak' range. The strength of bedrock in the northern bridge abutment varies between 'Very Weak' and 'Strong' with generally an improvement of rock strength with depth. It must be noted that the calculated UCS and measured UCS in BH202 are highly variable.

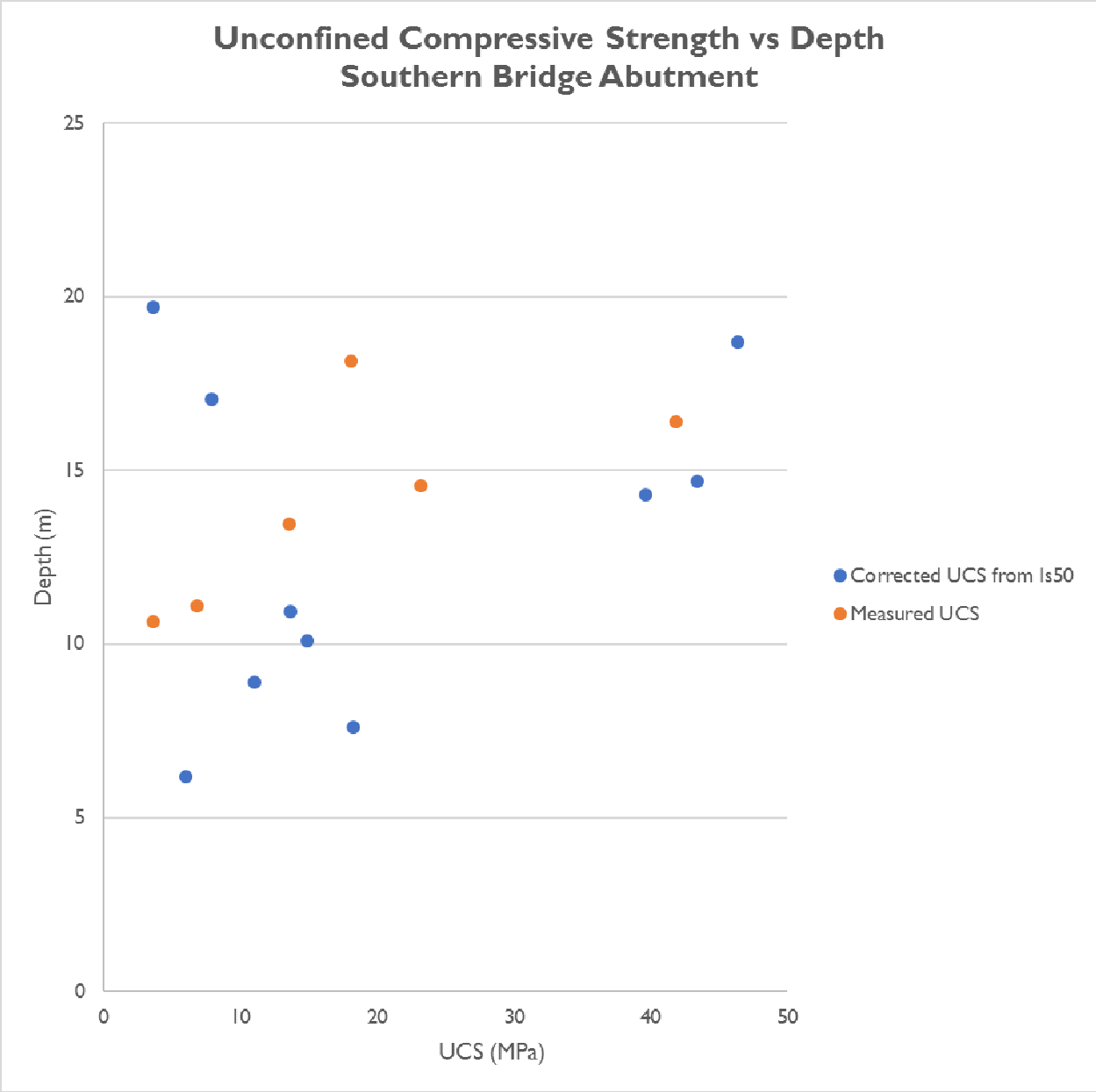


Figure 7.1: Calculated and measured UCS vs Depth in core samples taken from BH201 the area of the southern bridge abutment.

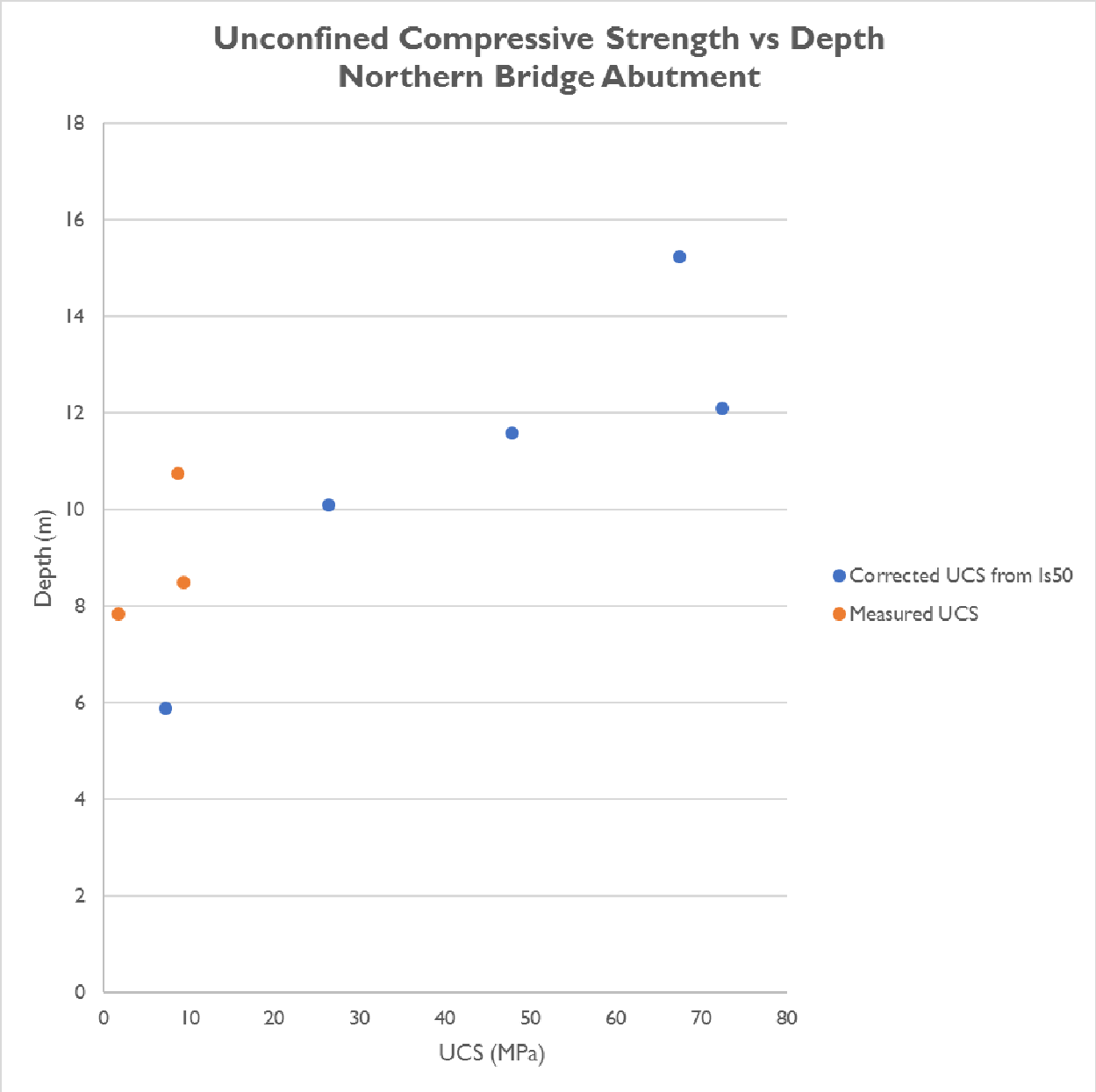


Figure 7.2: Calculated and measured UCS vs Depth in core samples taken from BH202 the area of the northern bridge abutment.

7.0.12 The strength assessments carried out do not take into account the fracture state of the Mudstone which will require detailed consideration when estimating the actual level of settlement that may occur within the foundations that are formed on the bedrock.

7.0.13 Results from geotechnical laboratory testing have been provided within Appendix D.

8.0 PRELIMINARY GEO-ENVIRONMENTAL ASSESSMENT

8.0.1 A preliminary geo-environmental risk assessment has been completed to identify potential specific requirements for off-site waste disposal of surplus soils generated during the construction process. In addition, sulphate concentrations and pH of site soils have been measured to determine any special requirements for below ground concrete construction. Risks posed (if any) to construction workers health from soil contamination have also been preliminarily investigated.

8.0.2 Waste Acceptance Criteria (WAC) analysis is completed to determine the way in which a waste will behave once it is buried in landfill, which is achieved by analysing the leachate derived from the soil sample. The concentration of a range of determinands are screened against derived concentrations classed as 'Inert Waste Landfill', 'Stable non reactive' and 'Hazardous Waste Landfill' to determine whether the soil sample is hazardous waste which required special off-site disposal measures.

8.0.3 In order to determine the design needed for below ground concrete construction to be resistant to attack from commonly found contaminants, sulphate concentrations and pH of site soils are quantified as sulphates and acids in soil and groundwater are the agents most likely to attack concrete, which can result in expansion and softening of the concrete.

8.0.4 In order to estimate the risks posed to human health from soil contamination, a quantitative risk assessment has been completed utilising the latest Environment Agency CLEA methodology. Chemical testing results are compared against Environment Agency Category Four Screening Levels (C4SL) and LQM/CIEH Suitable For Use Values (S4UL) values, under the proposed end use scenario, to determine the sites suitability for use for each determinant with any results reported in exceedance of screening criteria identified and their significance reviewed. In addition to this assessment, an Asbestos Identification test (via the visual inspection method) has been completed on all samples of made ground obtained during the investigation to determine risks posed.

8.0.4 Appropriate assessment have been completed for each of the above utilising the latest statutory and non-statutory guidance documents; for details of risks posed to human health (construction workers) refer to Section 8.1 (soils) and for Waste Acceptance Criteria (WAC) analysis refer to Section 8.2 and risks posed to new structures refer to Section 8.3.

8.1 Assessment of Risk to Construction Workers Health

8.1.1 For the purposes of this assessment we have assumed a "Public Open Space (Park)" end use scenario when reviewing chemical testing data against C4SL / S4UL values; a "worst case" Soil Organic Matter content value of 1% has been assumed for the initial assessment.

Summary and Assessment of Risks Posed by Soil Contamination

8.1.8 Results from chemical testing analysis indicate the following:

1) No exceedances of CLEA SGV or CIEH LQM generic assessment criteria when reviewed under a "Public Open Space (Park)" end use scenario.
2) No evidence of Asbestos containing material was reported in all samples tested.

8.1.9 The findings of the above have been used to update the Refined Conceptual Site Model (provided within Section 9.0) as well as inform the scope of any further investigation or remedial works deemed necessary to support the sites development.

8.2 Waste Acceptance Criteria (WAC) Analysis

8.2.1 A sample of Made Ground was taken from the northern portion of the site (BH204) in order to determine potential waste disposal requirements. Full WAC testing results are provided in Appendix C.

8.3 Below Ground Concrete Construction

8.3.1 Peak potential sulphate concentrations were encountered as <100 mg/l with soil pH values ranging between 7.7 and 7.8. Based on these results, it is considered that well compacted buried concrete should be designed in accordance with Class DS-1 AC-1s requirements as specified in BRE Digest Special Digest 1:2005 *Concrete in aggressive ground: Version 3*.

9.0 GEOTECHNICAL & FOUNDATION DESIGN ASSESSMENT

Background Information

9.0.1 It is understood the site is to be redeveloped to comprise a pedestrian bridge structure spanning the M56 motorway. At the time of writing maximum column loadings associated with this development are unknown, although they are likely to be high given the nature of the development.

9.0.2 Site investigations indicated Made Ground deposits in the area of the northern bridge abutment to depths ranging between 0.6m (69.62mAOD) and 6.0m (68.81mAOD), comprising demolition fill or reworked type material. Made Ground was encountered thickest at higher elevations, adjacent Outwood Lane West. A thin layer of Topsoil was encountered overlying Made Ground deposits (thickness = 0.02m) in 2 of 3 exploratory hole locations, with the third presumed to have been anthropogenically removed during vegetation clearance works. The thickness of made ground in this area is miss leading in so far as the bulk of material encountered relates to excavations associated with the M56 construction (to the south).

9.0.3 Made Ground was also encountered within the area of the southern bridge abutment (to the south of the abutment) to a depth of 69.70mAOD (BS A12), comprising fill relating to current car parking operations (Tarmac and Subbase). Topsoil was encountered to a depth of 0.1mbgl in the footprint of the proposed southern bridge abutment.

9.0.4 Glacial Clay was encountered at all exploratory holes, with sand banding in most, to depths between 68.67mAOD (ROC BH203) and 66.90mAOD (BS A12), at which Weathered Mudstone bedrock was encountered. Bedrock was cored at 3 of 5 exploratory hole locations within the proposed footprint of the bridge, the depth to the top of the solid bedrock (underlying the weathered fraction) was reported at depths between 66.52mAOD (BS A12) and 63.51mAOD (ROC BH202). This suggests that although Mudstone bedrock appears to be dipping to the south, the northern abutment area has a thicker weathered fraction, and the solid fraction is in fact dipping to the north.

9.0.5 Geotechnical laboratory testing results on rock core samples indicate a strength range in the southern bridge abutment between 'Very Weak' and 'Medium Strong', although no obvious increase of rock strength with depth was noted. The strength range in the northern bridge abutment was noted between 'Very Weak' and 'Strong' with generally an increase of rock strength with depth. No below ground obstructions were noted on site, however, the presence of such structures cannot be precluded, furthermore, given the glacial type natural deposits on site, the presence of naturally occurring cobble or boulders cannot be precluded, although the probability of large quantities across this site is considered to be relatively low.

9.0.6 A geological cross section drawing (SEC01) has been collated to illustrate the ground model across the proposed bridge footprint (and wider area) a copy of which is provided within Appendix A.

9.1 Bridge Foundation Design

9.1.1 It is not recommended bridge abutment foundations be constructed on top of made ground deposits, although the supports to the temporary ramp structure will be founded on made ground deposits. The variable composition and in situ strength of these materials is such that unacceptable levels of total and differential settlement will occur as a result.

9.1.2 However, it is noted a number of smaller temporary structures are proposed on the northern abutment site connecting the bridge to wider development across the Airport City North. As previously discussed site investigation results in this area indicate up to 6m of made / reworked ground in this area with associated SPT testing indicating variable strength around the soft range. It is understood these structures will be relatively lightly loaded comprising ramps / staircases etc.

9.1.3 Such structures could be founded within made or reworked ground although ground improvement will be required at each foundation location (given the variable nature of the reworked clays). It is recommended any vegetation, topsoil or other deleterious material is excavated at each foundation location and granular fill placed in layers, with a geogrid at the base. The granular fill should be rolled and compacted in layers to a an appropriate thickness such that a minimum CBR value of 5% is achieved. Using empirical methods ($Cu = 27.15*CBR^{0.586}$) this value would broadly equate to an improvement of clay strength circa to circa 50kPa which in turn equates to an approximate bearing capacity circa 50kN/m^2 (assuming a 1x1m square pad foundation where settlement should not exceed 25mm).

9.1.4 Given the likely loadings associated with the main bridge deck structure it is considered the adoption of a piled foundation would be the most effective solution. Pile selection and length will depend on specific foundation and loading requirements and will require further consideration as the project moves towards a detailed design stage. It is recommended discussions be held with a suitably qualified contractor to establish initial design requirements and loadings. Copies of the current investigation report (along with all appendices) should be provided to piling contractors to assist with the design process.

9.1.5 Smaller more lightly loaded structures such as staircases, lift shafts and access ramps could be constructed using traditional pad foundation solutions formed within the underlying Stiff glacial clay or weathered mudstone bedrock based around an allowable bearing capacity of 150kN/m^2. It will be necessary to inspect the formation of any pad footing in advance of construction and complete Hand Vane shear testing at a number of locations in order to confirm the Shear Strength of Clays is in excess of 75kpa with foundation excavations extended and brought back to required level using mass fill concrete. In addition it would be prudent to blind any exposed clay or mudstone surfaces with concrete to prevent rain or groundwater ingress (and subsequent weakening).

9.1.6 Peak potential sulphate concentrations were encountered as <100 mg/l with soil pH values ranging between 7.7 and 7.8. Based on these results, it is considered that well compacted buried concrete should be designed in accordance with Class DS-1 AC-1s requirements as specified in BRE Digest Special Digest 1:2005 *Concrete in aggressive ground: Version 3*.

9.2 General Comments

9.2.1 No entry should be permitted into excavations exceeding 1.2m depth without appropriate risk assessments, shoring and support. Whilst groundwater was not encountered in significant volumes during site investigation works the presence of a perched water table cannot be precluded. Appropriate provisions should be made to dewater excavations as and when required.

9.2.2 Similarly it is not recommended foundation excavations to underlying clay be left open and exposed to the elements as rainwater ingress will damage and reduce its strength (and subsequent bearing capacity). Similarly, no vehicular movements should be permitted within exposed foundation locations. (*retain / remove depending on ground conditions)*

10.0 CONCLUSIONS AND RECOMMENDATIONS

10.0.1 The site is to be redeveloped as a pedestrian and cycle bridge across the M56 motorway spur with associated access ramps / walkways and construction of passenger lift.

10.0.2 Site investigation works have revealed the following ground conditions:

Northern Bridge Abutment

The northern site generally comprises a Topsoil layer overlying Made Ground comprising demolition fill type material at higher surface levels adjacent Outwood Lane West and reworked Clay at lower surface levels adjacent the M56 motorway. Clay deposits were encountered underlying Made Ground deposits which were in turn underlain by thinly bedded Mudstone bedrock with frequent highly / completely weathered zones. The depth to the solid bedrock (below the initial weathered fraction) was reported at 5.9mbgl within the proposed footprint of the northern bridge abutment.

Southern Bridge Abutment

The southern bridge abutment area was found to comprise a Topsoil or Made Ground layer underlain by Clay deposits, which were in turn underlain by thinly bedded Mudstone bedrock with frequent highly / completely weathered zones. The depth to the solid bedrock (below the initial weathered fraction) was reported at 5.16mbgl.

10.0.3 Geotechnical laboratory testing indicated that the compressive strength of bedrock in the southern bridge abutment varies between 'Very Weak' to 'Medium Strong', with no obvious increase of rock strength with depth. The strength of bedrock in the northern bridge abutment varies between 'Very Weak' and 'Strong' with generally an improvement of rock strength with depth. However, the strength assessments carried out do not take into account the fracture state of the Mudstone which will require detailed consideration when estimating the actual level of settlement that may occur within the foundations that are formed on the bedrock.

10.0.4 Chemical assessment of site soils has failed to reveal any sources of soil contamination when compared against a "Public Open Space (Park)" end use scenario. Due care and attention should be taken at all times when excavating site soils and any suspected sources of contamination identified brought to the immediate attention of RoC Consulting.

10.0.5 The adoption of a a piled foundation solution is considered to be the most effective for the new bridge development, pile selection will depend on specific foundation and loading requirements and it is recommended that discussions be held with piling contractors to establish initial design requirements and loadings.

10.0.6 Smaller lightly loaded structures associated with the bridge, but away from the support of the main bridge deck, can be founded using conventional pad or strip foundations formed within either stiff clay or weathered Mudstone. The proposed temporary link structure to the north will be founded on made / reworked clay and soils will require improvement prior to foundation construction as a result (further details of which are provided in Section 9.1 of the current report).

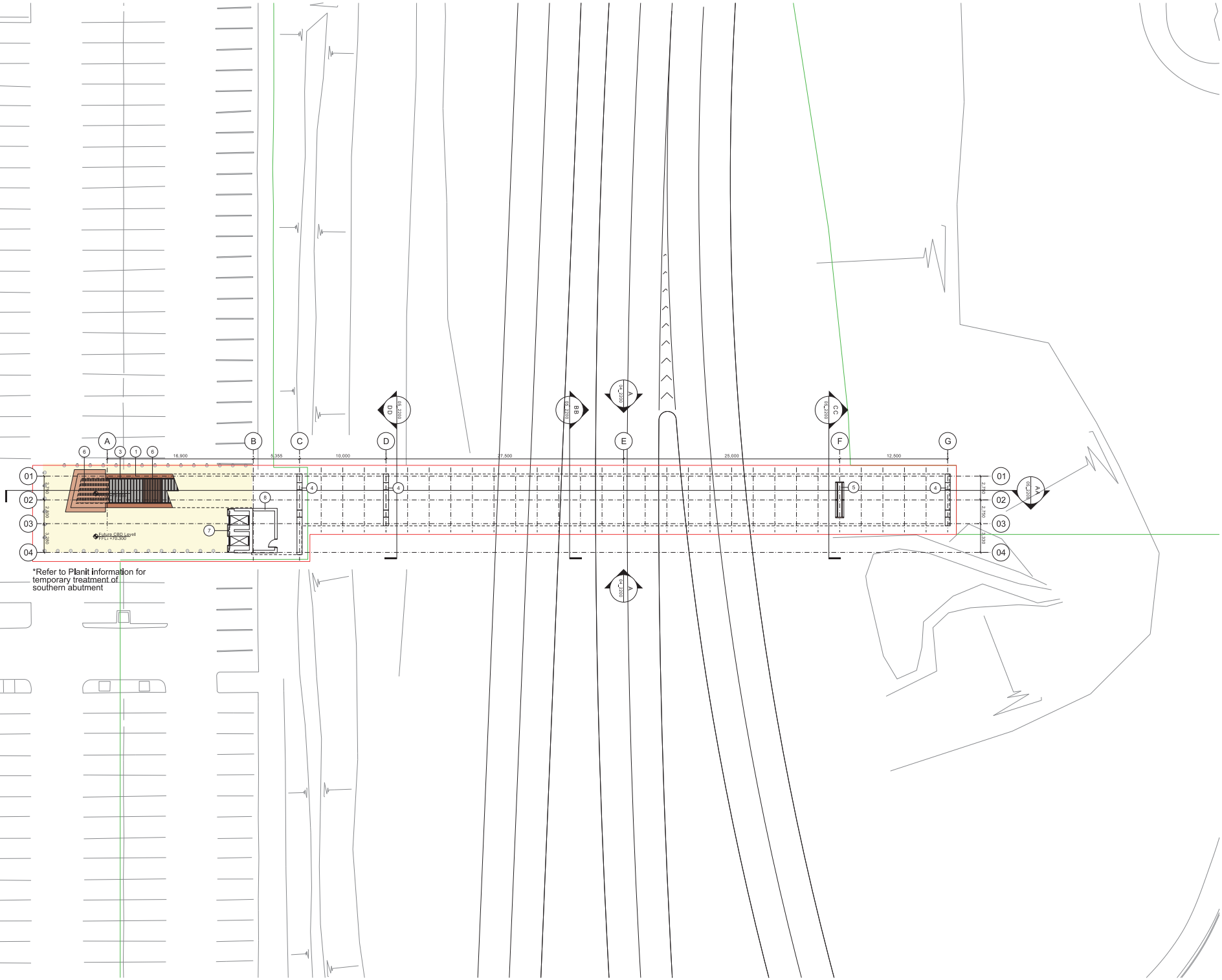
10.0.7 A HV cable was exposed at the southern bridge abutment site and is described in ROC Drawing TT01 within Appendix A. A second utility exposure trench was initially proposed as part of the current ground investigation works in relation to a series of duct runs that records indicate fall within close proximity to the proposed northern bridge abutment. However, the location of these service runs in close proximity to the live M56 motorway will require access to Highways Agency land and a possible lane closure notice (in order to ensure a safe working area of site operatives completing the excavation works). This was completed in November 2017 and identified two 100mm ducts carrying live electrical cables at a depth of 0.36m bgl and at a distance of 1.8m from the roadside on the northern abutment. At the time of writing, discussions with the wider design team indicate the area of the duct run is unlikely to fall within the footprint of the proposed development.

10.0.8 At the time of writing discussions with the wider design team indicate the area of the duct run is likely to fall within wider junction improvement works proposed by BCEGI Ltd and that the exposure and recording of these utility assets will be undertaken as part of this program of works.

10.0.9 As required, any suspected sources of contamination discovered during the site development (outside those discussed in this report) should be brought to the attention of RoC Consulting and their implications assessed. Depending on the extent and severity, the findings and assessment of the current study may require re-interpretation and a remediation strategy proposed to support the sites development.

10.0.10 Copies of the current report, along with the Phase 1 Desktop Study, should be submitted to the local planning authority for consideration and comment. As required, any feedback received from the local authority should be passed back to RoC Consulting for review.

APPENDIX A - SITE DRAWINGS



*Refer to Planit information for temporary treatment of southern abutment

KEY PLANS

Material Legend

1. Weathering Steel
2. Resin Bound Gravel
3. Resin Bound Gravel with Contrasting Stair Nosing
4. Concrete Structural Abutment
5. Weathering Steel Clad Abutment
6. Weathering Steel Anti Slip Grating
7. Lift Shaft Glazing
8. Exposed Concrete

Zone for Future Temporary Access

REVS	DATES	DETAILS

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PROJECT
The Bridge
Airport City Masterplan

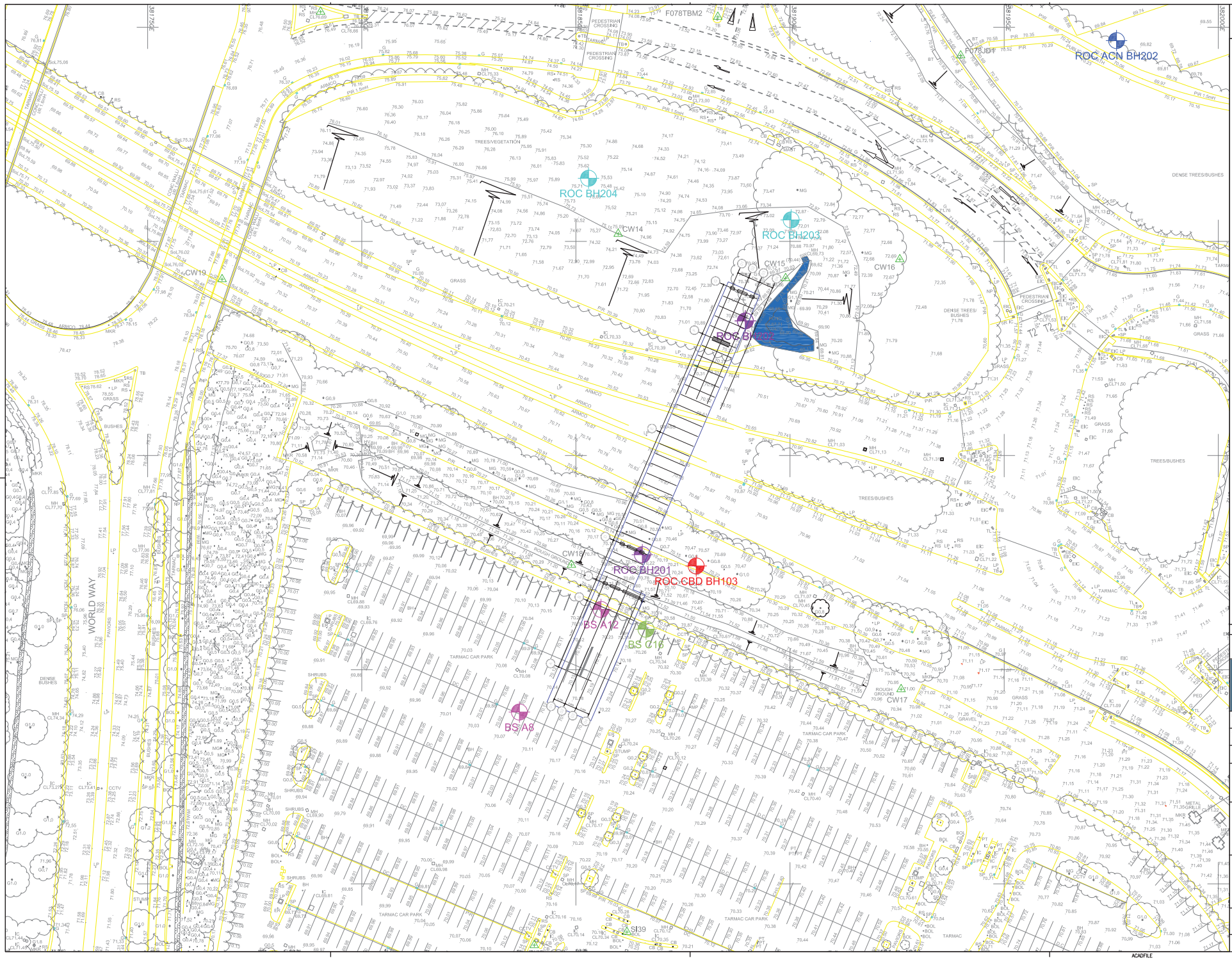
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Proposed Ground Level
General Arrangement Plan

SCALE:	ORIGIN DATE:	DRAWN:	CHECKED:
1:200 @ A1	16.03.2017	HF	JB

STATUS
Planning

PROJECT	DRAWING NO.	REV.
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Architecture | Masterplanning | Interiors | Graphics | Branding



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NOTES

KEY

- ROC BH201 — ROC 2017 ROTARY CORED BOREHOLE
- ROC BH203 — ROC 2017 CABLE TOOL BOREHOLE
- ROC ACN BH202 — ROC 2016 ROTARY CORED BOREHOLE
- ROC CBD BH102 — ROC 2015 CABLE TOOL BOREHOLE
- BS A12 — BROWNFIELD SOLUTIONS 2014 ROTARY CORED BOREHOLE
- BS C16 — BROWNFIELD SOLUTIONS 2014 WINDOW SAMPLER BOREHOLE

NOTES

1) THIS SKETCH SHOWS EXISTING BOREHOLES COMPLETED BY ROC CONSULTING 2017 ON THE PROPOSED AIRPORT CITY BRIDGE SITE, ROC CONSULTING 2016 ON THE AIRPORT CITY NORTH SITE AND ROC CONSULTING 2015 AND BROWNFIELD SOLUTIONS 2014 ON THE CENTRAL BUSINESS DISTRICT SITE.

2) BROWNFIELD SOLUTIONS BOREHOLES ARE CONJECTURED FROM PLANS PROVIDED WITHIN THE REPORT AND SHOULD BE CONSIDERED APPROXIMATE.

3) REFER TO ROC CONSULTING SITE INVESTIGATION REPORT FOR A DETAILED DESCRIPTION OF GROUND CONDITIONS.

4) THE FOLLOWING DRAWING ASSUMES THAT THE DEVELOPMENT WILL FOLLOW PROPOSED MASTERPLAN COMPLETED BY 5 PLUS ARCHITECTS IN 2017.

REV.	DATE	DETAILS	DRN.	CHK.

DRAWING STATUS

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CLIENT

MANCHESTER AIRPORT GROUP

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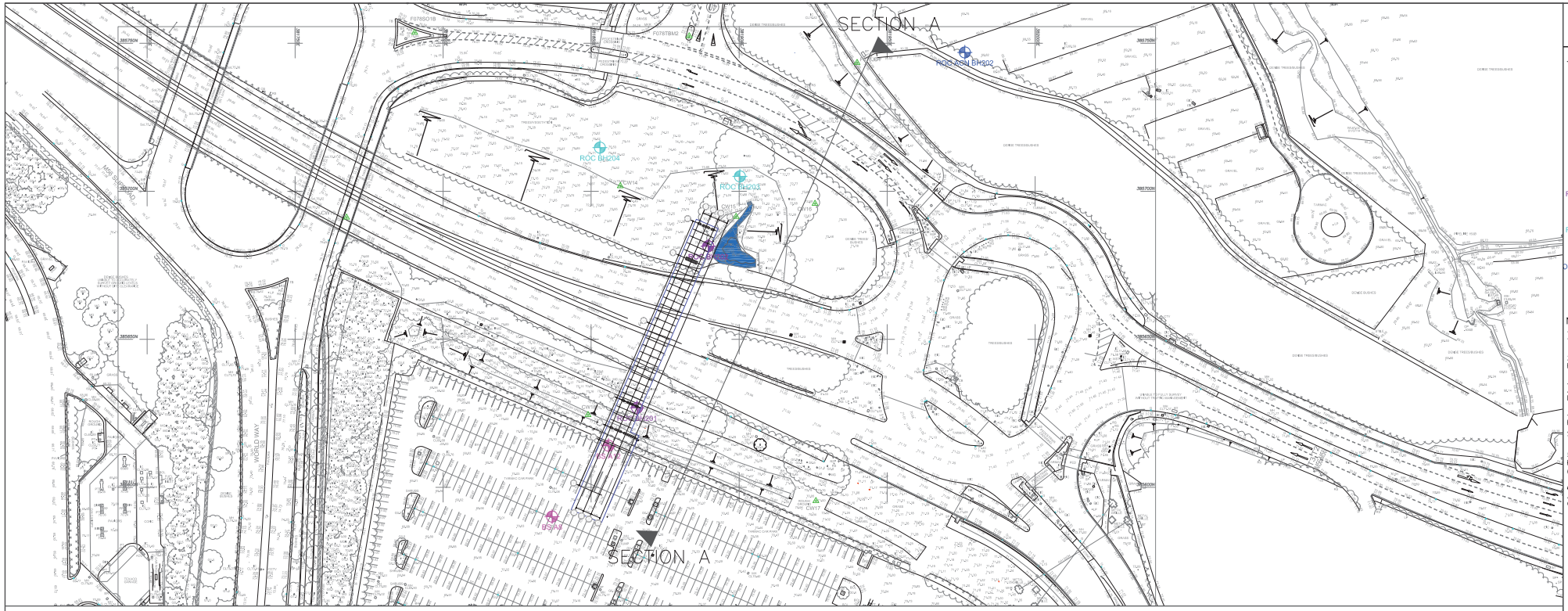
AIRPORT CITY BRIDGE

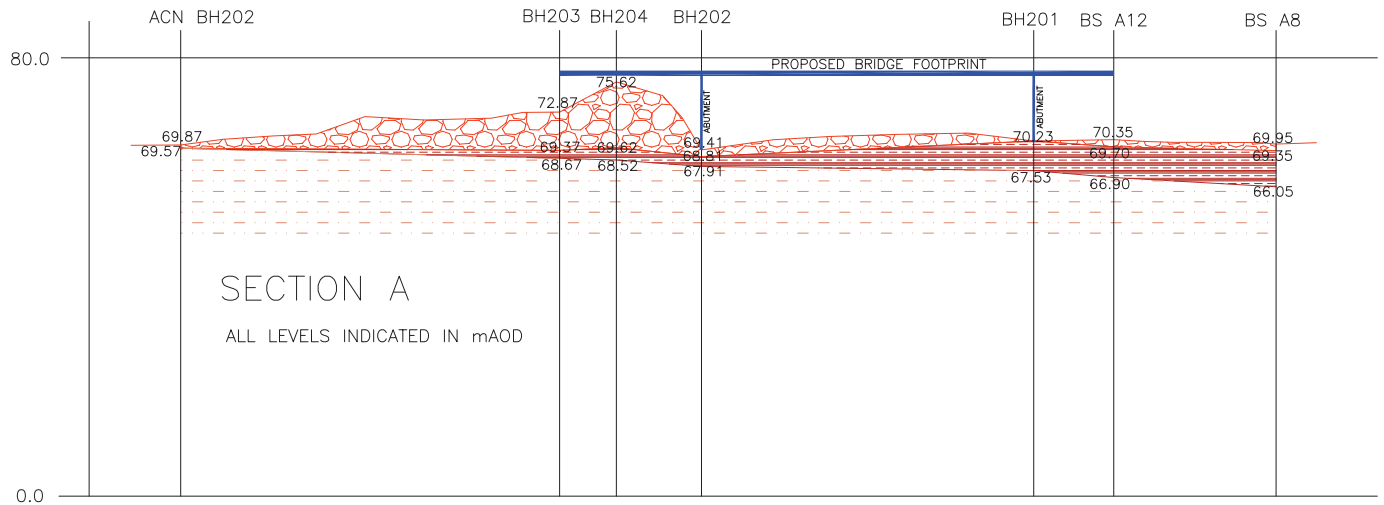
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BOREHOLE LOCATION PLAN PROPOSED BRIDGE DEVELOPMENT

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SECTION A

ALL LEVELS INDICATED IN mAOD

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NOTES

KEY

- MADE GROUND
- GLACIAL CLAY
- WEATHERED & BOLLIN MUDSTONE
- ROC BH201 — ROC 2017 ROTARY CORED BOREHOLE
- ROC BH203 — ROC 2017 CABLE TOOL BOREHOLE
- ROC ACN BH202 — ROC 2016 ROTARY CORED BOREHOLE
- BS A12 — BROWNFIELD SOLUTIONS 2014 ROTARY CORED BOREHOLE

NOTES

1) ROTARY BOREHOLES BH201–BH202 FORMED TO INFORM NEW BRIDGE FOUNDATION DESIGN.

2) CABLE TOOL BOREHOLES BH203–BH204 FORMED TO SUPPORT BRIDGE RAMP DESIGN.

3) BROWNFIELD SOLUTIONS BOREHOLES BS A8 AND BS A12 SHOWN AT APPROXIMATE LOCATIONS.

4) PROPOSED DEVELOPMENT FOOTPRINT TAKEN FROM DRAWINGS PROVIDED BY 5 PLUS ARCHITECTS AND ARE CONSIDERED ACCURATE AT THE TIME OF ISSUE.

5) ALL GEOLOGICAL STRATA LEVELS ARE PROVIDED IN METRES AGAINST ORDNANCE DATUM (mAOD) UNLESS OTHERWISE STATED.

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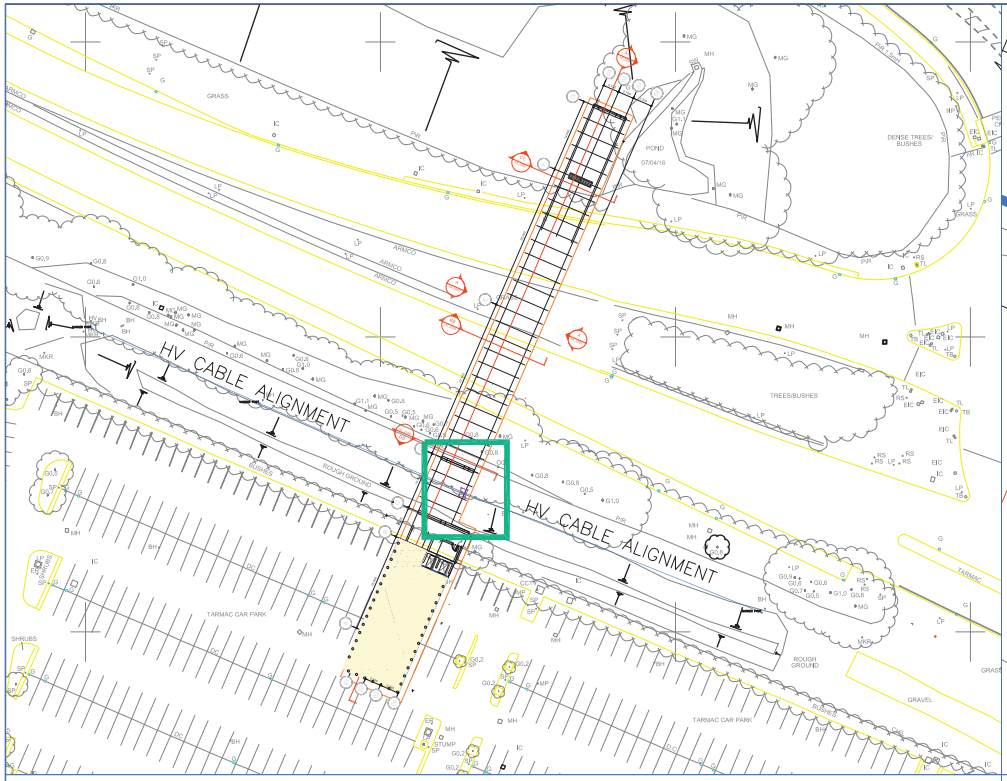
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DRAWING TITLE
CROSS SECTION A

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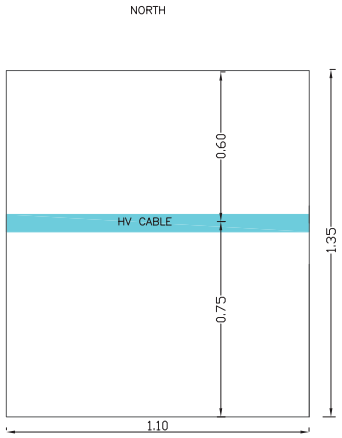
2) THIS DRAWING IS A RECORD OF THE CONTENTS OF THE TRIAL HOLE AS DRAWN ON THE DATE SHOWN.

3) THE CONTINUED ALIGNMENT OF THE HV CABLE IS CONJECTURED FROM PREVIOUS EXPOSURE WORKS.

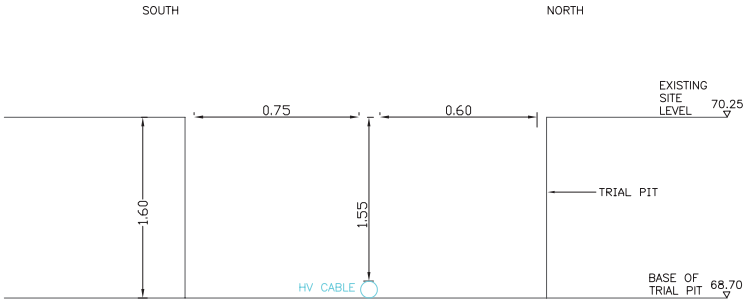
4) NO GUARANTEE IS GIVEN TO THE DEPTH OR POSITIONS OF SERVICES OR ADDITIONAL SERVICES THAT MAY HAVE SUBSEQUENTLY BEEN ALTERED OR INSTALLED BY A THIRD PARTY AFTER THIS DATE.

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PLAN VIEW



CROSS SECTION VIEW



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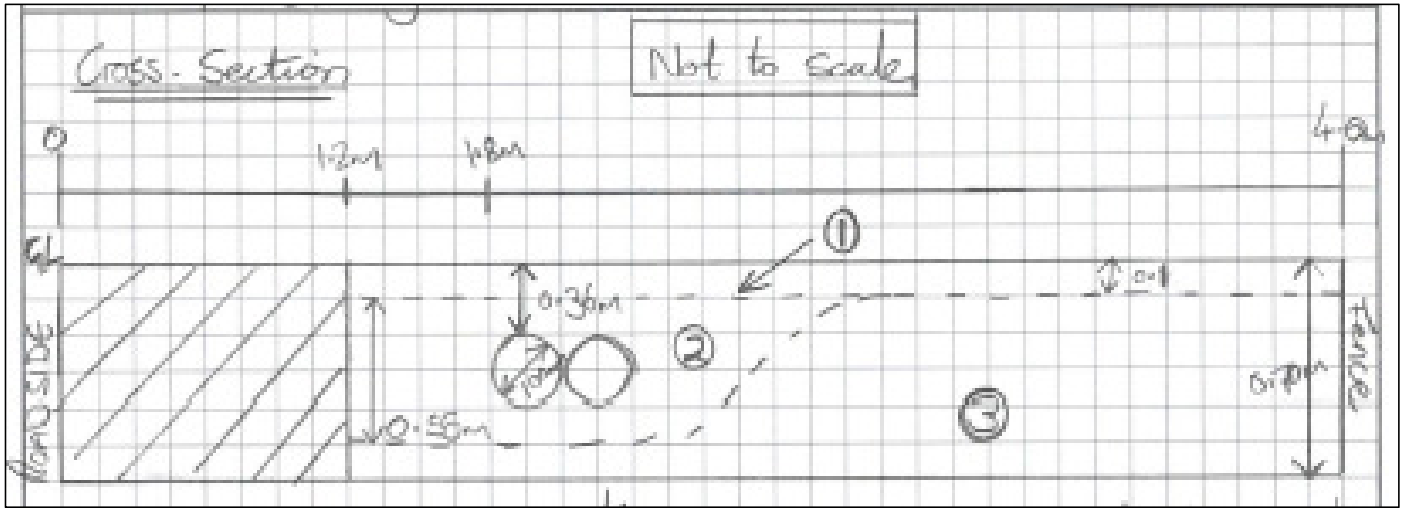
CLIENT
MANCHESTER AIRPORT GROUP

PROJECT TITLE
AIRPORT CITY BRIDGE

DRAWING TITLE
HV CABLE EXPOSURE LOCATION & SECTIONS

PROJECT No.	DRAWING No.	REV.
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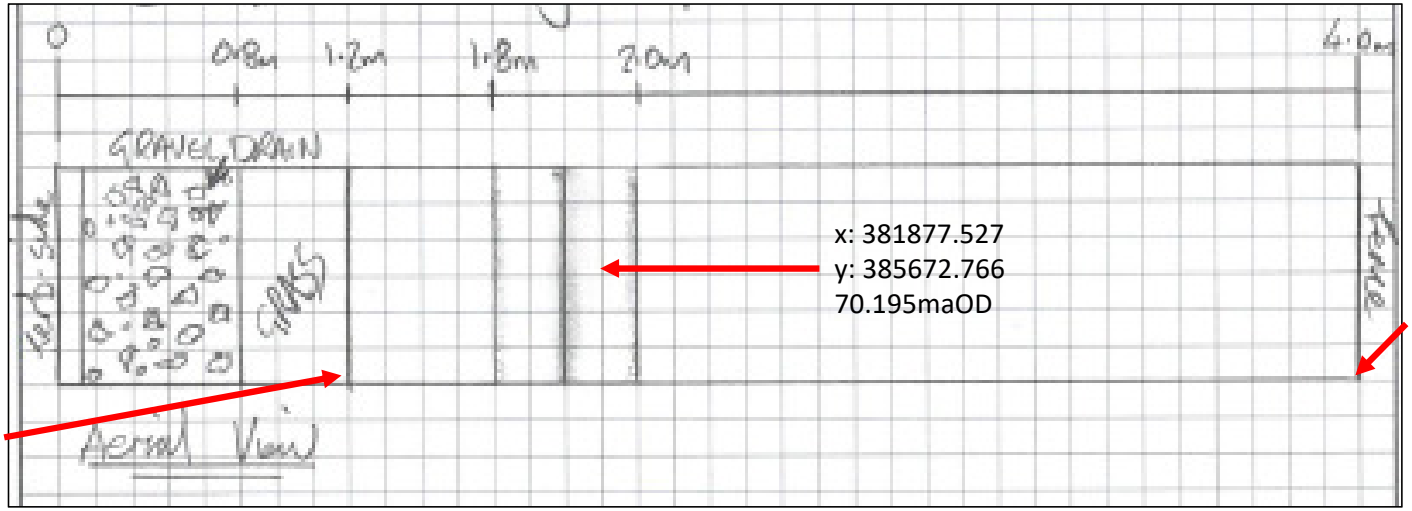
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Geological Description:
1 : Firm brown gravelly sandy CLAY. Gravel is angular to subangular fine to coarse brick, limestone and mudstone.

2 : Orangish brown slightly clayey very gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse limestone

3 : Stiff brown sandy Clay



RoC CONSULTING	JOB NO	3590	SKETCH NO	TT02	DRAWN BY
	PROJECT TITLE	Airport City Green Bridge	SKETCH TITLE	Northern Abutment Utility Trench	L. Daley

APPENDIX B - EXPLORATORY HOLE LOGSHEETS

Rotary Core Log

Borehole No. **BH201**

Sheet 1 of 4

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381865.52 - 385626.86	Hole Type RC
Location: Manchester Airport		Level: 70.23	Scale 1:30
Client: Manchester Airport Partnerships		Dates: 08/08/2017 - 11/08/2017	Logged By MN

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							0.10	70.13		Black silty organic sand with numerous roots, rootlets and organic matter (TOPSOIL)
							0.50	69.73		Dark greyish brown very gravelly sandy organic CLAY with occasional rootlets and organic matter. Gravel is fine to coarse subangular to subrounded of mixed lithologies.
										Orangish brown mottled grey slightly silty sandy CLAY with occasional sand bands
							2.70	67.53		Dark reddish brown completely WEATHERED MUDSTONE. Recovered as silty clay.
							3.40	66.83		Dark reddish brown highly/completely WEATHERED MUDSTONE. Recovered as very clayey silty gravel.
		4.00 - 6.00		81	15	12				
		5.35	C				5.16	65.07		Dark reddish brown MUDSTONE
							5.40	64.83		Light grey, becoming dark reddish brown with depth, highly/completely WEATHERED MUDSTONE. Recovered as slightly clayey gravel with occasional highly fractured intact sections.

Continued on next sheet

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 20.0mbgl

Rotary Core Log

Borehole No. **BH201** Sheet 2 of 4

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381865.52 - 385626.86	Hole Type RC
Location: Manchester Airport		Level: 70.23	Scale 1:30
Client: Manchester Airport Partnerships		Dates: 08/08/2017 - 11/08/2017	Logged By MN

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		6.00 - 7.50		88	36	0	7.37	62.86		
		7.60	C							Dark grey, becoming reddish brown with depth, thinly bedded MUDSTONE
		7.50 - 8.50		100	98	0				
		8.90	C							
		8.50 - 11.50		100	97	45				... 9.46 - 9.65m highly/completely weathered band
		10.10	C							... 9.90 - 10.25m highly/completely weathered band
		10.65	C							
		10.95	C							
		11.10	C							
										... 11.7 - 12.0m highly/completely weathered band
										Continued on next sheet

7 8 9 10 11 12

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 20.0mbgl

Rotary Core Log

Borehole No. **BH201**

Sheet 3 of 4

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381865.52 - 385626.86	Hole Type RC
Location: Manchester Airport		Level: 70.23	Scale 1:30
Client: Manchester Airport Partnerships		Dates: 08/08/2017 - 11/08/2017	Logged By MN

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
										... 12.20 - 12.43m highly/completely weathered band
		12.95	C							
		11.50 - 14.50		93	81	37				
		13.45	C							... 13.4m quartz filled fracture noted
										... 13.62m becoming grey
		14.30	C							
		14.55	C							
		14.70	C							
		15.30	C							
		14.50 - 17.50		90	85	78				
		16.40	C							... 16.37 - 16.44m highly/completely weathered band
		17.05	C							... 17.05m gravel filled fracture

Continued on next sheet

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 20.0mbgl

Rotary Core Log

Borehole No. **BH201**

Sheet 4 of 4

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381865.52 - 385626.86	Hole Type RC
Location: Manchester Airport		Level: 70.23	Scale 1:30
Client: Manchester Airport Partnerships		Dates: 08/08/2017 - 11/08/2017	Logged By MN

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		18.15	C							
		18.70	C							
		17.50 - 20.00		100	93	57	19.10	51.13		Dark reddish brown MUDSTONE
		19.70	C							
							20.00	50.23		End of borehole at 20.00 m

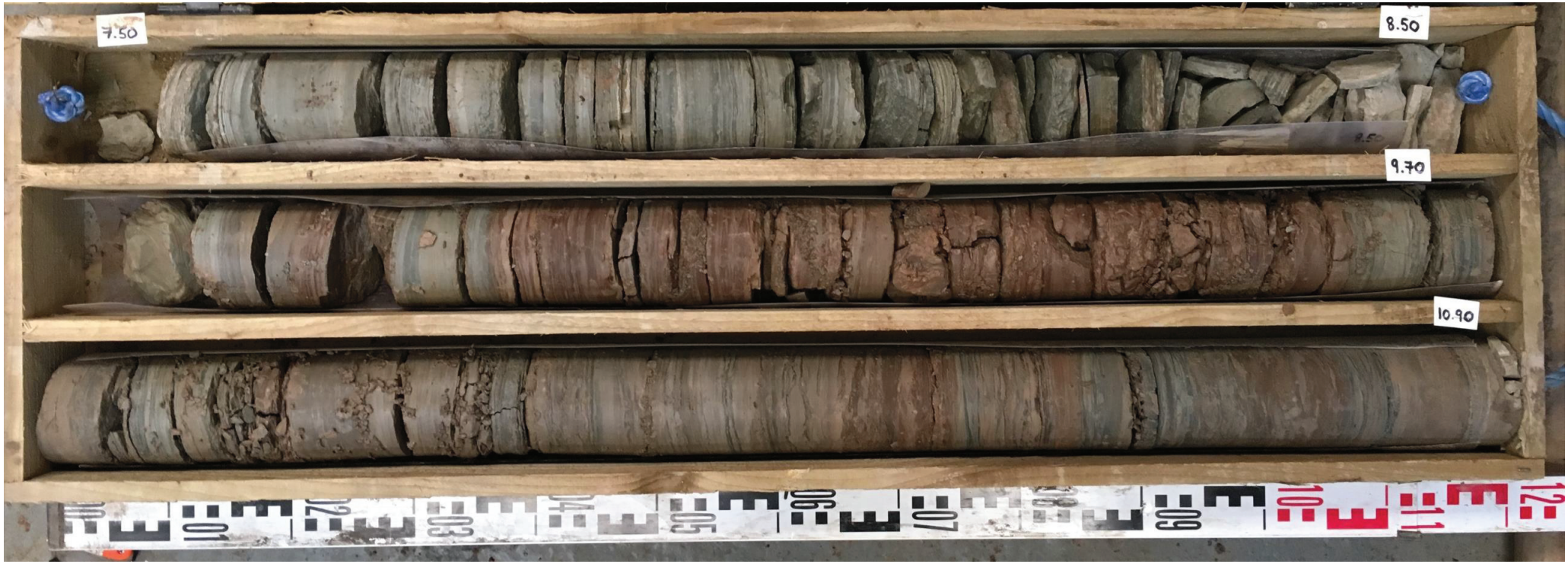
19
20
21
22
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24

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 20.0mbgl



RoC CONSULTING	JOB NO	3590	SKETCH	BH201 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Runs 1 & 2 – 4.0m to 6.0m and 6.0m to 7.5m	MN 21/08/2017



RoC CONSULTING	JOB NO	3590	SKETCH	BH201 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Runs 3 & 4 – 7.5m to 8.5m and 8.5m to 11.5m	MN 21/08/2017

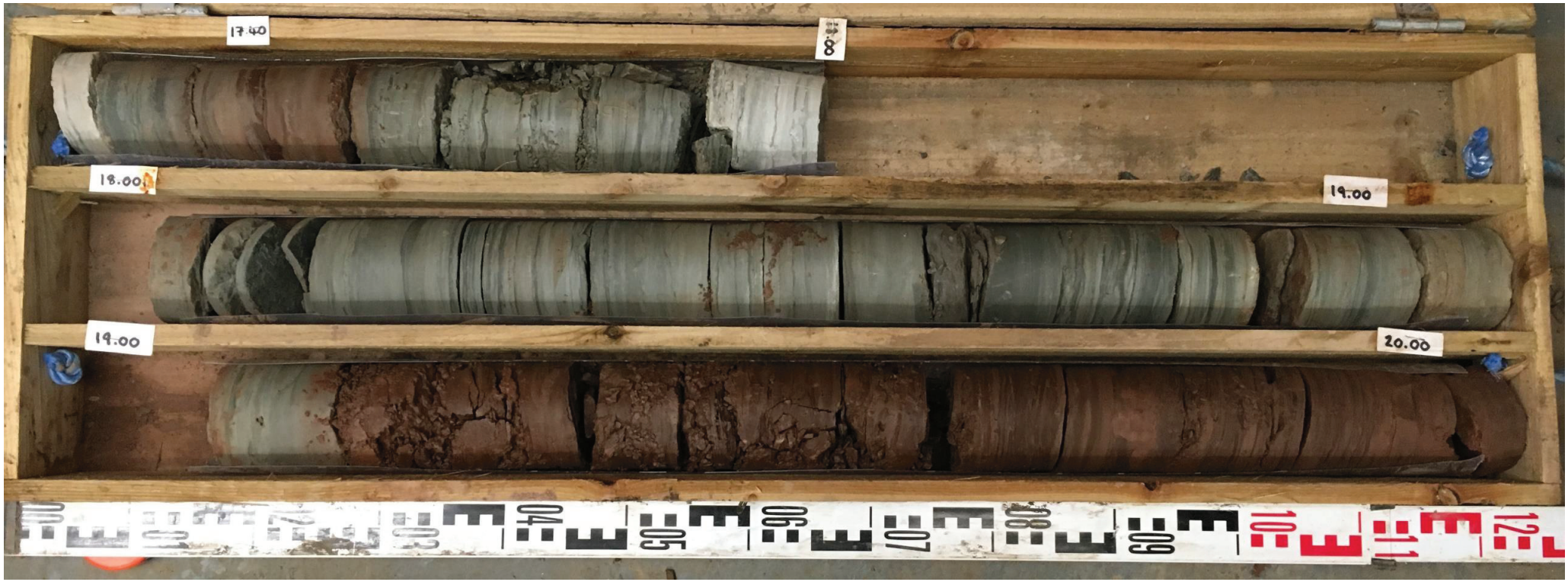


RoC CONSULTING	JOB NO	3590	SKETCH	BH201 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Runs 4 & 5 – 8.5m to 11.5m and 11.5 to 14.5m	MN 21/08/2017

COMPLEX CHALLENGES ... MADE SIMPLE



RoC CONSULTING	JOB NO	3590	SKETCH	BH201 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Run 6 – 14.5m to 17.5m	MN 21/08/2017



RoC CONSULTING	JOB NO	3590	SKETCH	BH201 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Run 7 – 17.5m to 20.0m	MN 21/08/2017

Rotary Core Log

Borehole No. **BH202**

Sheet 1 of 4

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381889.57 - 385681.44	Hole Type RC
Location: Manchester Airport		Level: 69.41	Scale 1:30
Client: Manchester Airport Partnerships		Dates: 14/08/2017 - 16/08/2017	Logged By MN

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							0.02	69.39		Brown reworked CLAY with numerous roots, rootlets and organic matter (MADE GROUND)
										Orangish brown mottled grey, black and reddish brown slightly sandy REWORKED CLAY (MADE GROUND)
							0.60	68.81		Reddish brown occasionally mottled grey silty CLAY
							1.50	67.91		Light grey completely WEATHERED MUDSTONE. Recovered as silty gravelly clay.
							3.00	66.41		Dark reddish brown, becoming grey with depth, highly/completely WEATHERED MUDSTONE. Recovered as very clayey silty gravel.
		3.00 - 6.00		59	8	0				
		5.90	C				5.90	63.51		Dark grey, becoming reddish brown with depth,
										Continued on next sheet

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 19.5mbgl

Rotary Core Log

Borehole No. **BH202**

Sheet 2 of 4

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381889.57 - 385681.44	Hole Type RC
Location: Manchester Airport		Level: 69.41	Scale 1:30
Client: Manchester Airport Partnerships		Dates: 14/08/2017 - 16/08/2017	Logged By MN

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		6.00 - 8.50		73	52	19				thinly bedded MUDSTONE with numerous highly/completely weathered bands noted to 8.5m
		7.85	C							
		8.50	C							
		8.50 - 11.00		95	89	24				... 9.5m becoming grey
		10.10	C							
		10.40	C							
		10.75	C							
		11.60	C							

7 8 9 10 11 12

Continued on next sheet

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 19.5mbgl

Rotary Core Log

Borehole No. **BH202**

Sheet 3 of 4

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381889.57 - 385681.44	Hole Type RC
Location: Manchester Airport		Level: 69.41	Scale 1:30
Client: Manchester Airport Partnerships		Dates: 14/08/2017 - 16/08/2017	Logged By MN

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		12.10	C							
		11.00 - 13.50		70	41	0				
		13.50 - 16.70		73	51	9				
		15.25	C				15.30	54.11		... 14.7 - 14.9m band of dark reddish brown highly/ completely weathered Dark reddish brown highly/completely WEATHERED MUDSTONE. Recovered as clayey gravel with occasional intact sections.

13 14 15 16 17 18

Continued on next sheet

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 19.5mbgl

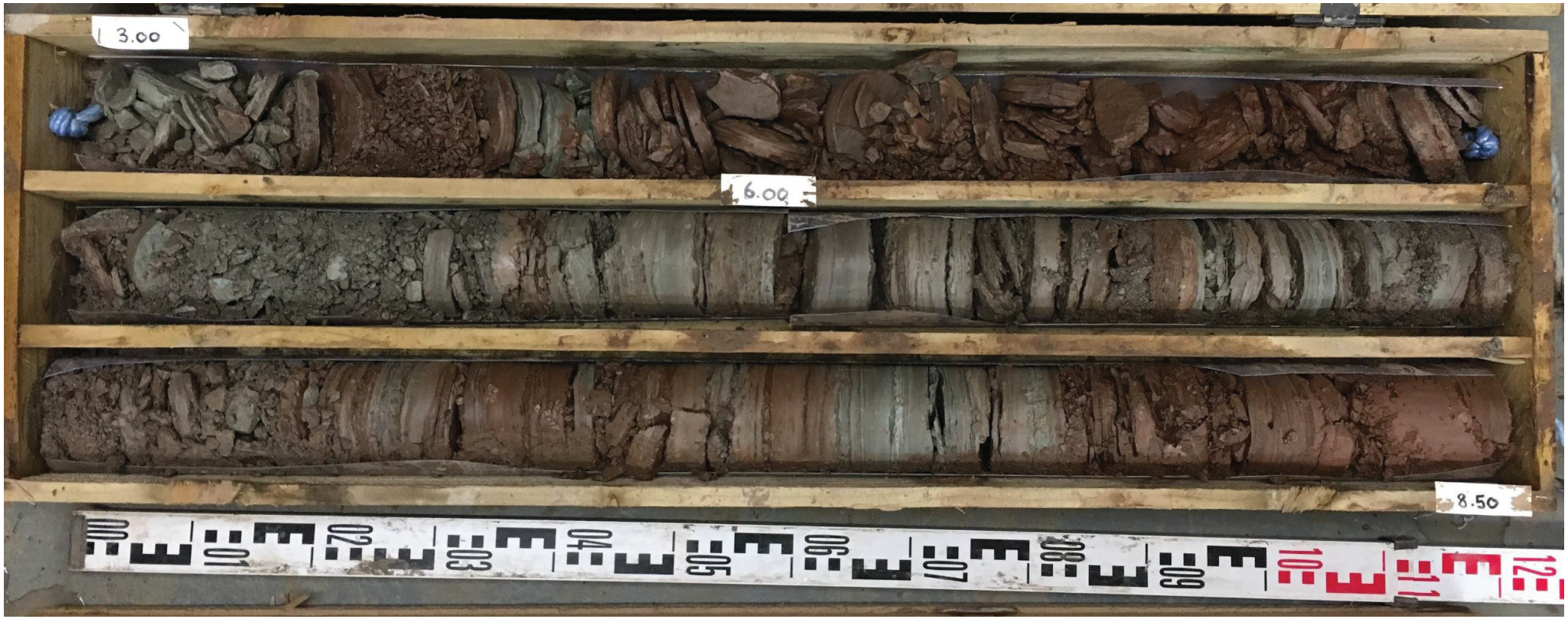
Rotary Core Log

Borehole No.
BH202
Sheet 4 of 4

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381889.57 - 385681.44	Hole Type RC
Location: Manchester Airport		Level: 69.41	Scale 1:30
Client: Manchester Airport Partnerships		Dates: 14/08/2017 - 16/08/2017	Logged By MN

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		16.70 - 19.50		37	18	0	19.50	49.91		End of borehole at 19.50 m

Remarks
1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 19.5mbgl



RoC CONSULTING	JOB NO	3590	SKETCH	BH202 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Runs 1 & 2 – 3.0m to 6.0m and 6.0m to 8.5m	MN 21/08/2017



RoC CONSULTING	JOB NO	3590	SKETCH	BH202 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Run 3 – 8.5m to 11.0m	MN 21/08/2017

COMPLEX CHALLENGES ... MADE SIMPLE



RoC CONSULTING	JOB NO	3590	SKETCH	BH202 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Run 4 – 11.0m to 13.5m	MN 21/08/2017

COMPLEX CHALLENGES ... MADE SIMPLE



RoC CONSULTING	JOB NO	3590	SKETCH	BH202 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Run 5 – 13.5m to 16.7m	MN 21/08/2017



RoC CONSULTING	JOB NO	3590	SKETCH	BH202 Core Photographs	DRAWN BY
	PROJECT TITLE	Airport City Bridge	SKETCH TITLE	Core Run 6 – 16.7m to 19.5m	MN 21/08/2017

Borehole Log

Borehole No. **BH203**

Sheet 1 of 2

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381900.26 - 385705.03	Hole Type CP
Location: Manchester Airport		Level: 72.87	Scale 1:25
Client: Manchester Airport Partnerships		Dates: 28/06/2017 - 28/06/2017	Logged By MN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.02	72.85		Brown slightly gravelly silty sand with numerous roots, rootlets and organic matter (TOPSOIL)
		0.30 - 0.40	ES					Brown mottled grey sandy clayey fine to coarse angular to rounded GRAVEL of brick, tile, concrete and mixed lithologies with rare plastic and wood fragments (MADE GROUND)
								... 0.4m large concrete boulder
		1.20		N=10 (3,4/3,3,2,2)	1.20	71.67		Brown mottled grey and yellowish brown very sandy very gravelly CLAY. Gravel is fine to coarse subangular to subrounded of brick, concrete and other lithologies (MADE GROUND)
								... 1.5m whole brick
		2.00		N=13 (6,3/3,4,3,3)				
		3.00		N=15 (4,3/2,3,6,4)				
					3.50	69.37		Brown mottled grey, black and orange slightly silty CLAY
					3.90	68.97		Reddish brown mottled light grey very silty CLAY with rare fine gravel of mudstone
		4.00		N=33 (4,4/7,9,6,11)				
					4.20	68.67		Light grey silty gravelly CLAY. Gravel is rare, fine, subangular of mudstone (HIGHLY WEATHERED MUDSTONE)
					5.00	67.87		

Continued on next sheet

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 5.32mbgl due to SPT refusal on suspected bedrock

Borehole Log

Borehole No. **BH203**

Sheet 2 of 2

Project Name:	Airport City Bridge	Project No. 3590	Co-ords:	381900.26 - 385705.03	Hole Type CP
Location:	Manchester Airport		Level:	72.87	Scale 1:25
Client:	Manchester Airport Partnerships		Dates:	28/06/2017 - 28/06/2017	Logged By MN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		5.00		58 (4,8/58 for 245mm)				Light grey WEATHERED MUDSTONE with numerous mudstone fragments
					5.32	67.55		End of borehole at 5.32 m

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 5.32mbgl due to SPT refusal on suspected bedrock

Borehole Log

Borehole No. **BH204**

Sheet 1 of 2

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381852.96 - 385714.75	Hole Type CP
Location: Manchester Airport		Level: 75.62	Scale 1:25
Client: Manchester Airport Partnerships		Dates: 27/06/2017 - 27/06/2017	Logged By MN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.02	75.60		Brown slightly gravelly silty sand with numerous roots, rootlets and organic matter (TOPSOIL)	
								Brown mottled grey sandy clayey fine to coarse angular to rounded GRAVEL of brick, tile and mixed lithologies (MADE GROUND)	
		0.60 - 0.70	ES					*... 0.5m section of brick wall*	
		0.70 - 0.80	ES					*... 0.7m whole brick*	
					1.00	74.62		Brown mottled orange, grey and black slightly sandy gravelly CLAY. Gravel is fine to medium subangular to subrounded of brick, concrete and other mixed lithologies (MADE GROUND)	1
		1.20		N=24 (5,3/5,6,7,6)					
		2.00		N=17 (4,4/3,4,5,5)					2
		3.00		N=12 (3,2/2,2,4,4)					3
		4.00		N=12 (2,2/3,3,3,3)				*... 4.0m becoming silty and less gravelly*	4
		5.00		N=15 (2,2/3,4,4,4)				Continued on next sheet	5

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 8.31mbgl due to SPT refusal on suspected bedrock

Borehole Log

Borehole No. **BH204**

Sheet 2 of 2

Project Name: Airport City Bridge	Project No. 3590	Co-ords: 381852.96 - 385714.75	Hole Type CP
Location: Manchester Airport		Level: 75.62	Scale 1:25
Client: Manchester Airport Partnerships		Dates: 27/06/2017 - 27/06/2017	Logged By MN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		6.00 - 6.45	U	Ublow=25	6.00	69.62		Reddish brown mottled bluish grey, yellowish brown and orange very sandy slightly gravelly CLAY
		7.00		N=26 (2,3/4,5,7,10)	7.10	68.52		Light grey mottled brown silty gravelly CLAY. Gravel is fine subangular to angular of mudstone (HIGHLY WEATHERED MUDSTONE)
								... 7.7m siltstone boulder
		8.00		50 (11,13/50 for 230mm)	8.00	67.62		Light grey WEATHERED MUDSTONE with numerous mudstone fragments
					8.31	67.32		End of borehole at 8.31 m

Remarks

1) Hand dug inspection pit completed to 1.2mbgl 2) Groundwater not encountered 3) Borehole terminated at 8.31mbgl due to SPT refusal on suspected bedrock

Airport City Bridge – TT01



PHOTOGRAPH 01 – TT01 Excavation







ROC CONSULTING	JOB NO	3590	SKETCH NO	TT02	DRAWN BY
	PROJECT TITLE	Airport City Green Bridge	SKETCH TITLE	Northern Abutment Utility Trench	L. Daley

APPENDIX C - CHEMICAL TESTING RESULTS

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Scientific Analysis Laboratories registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 666193-1 Interim

Date of Report: 19-Jul-2017

Customer: RoC Consulting
Commercial Wharf
6 Commercial Street
Manchester
M15 4PZ

Customer Contact: Mr Alex Smiles

Customer Job Reference: 3590
Customer Purchase Order: 1219
Customer Site Reference: MAG Green Bridge
Date Job Received at Concept: 05-Jul-2017
Date Analysis Started: 06-Jul-2017
Date Analysis Completed:

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept SOPs

All results have been reviewed in accordance with Section 25 of the Concept, Analytical Quality Quality Manual

UKAS TESTING
1549

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked and authorised by :

Issued by :
Aleksandra Pacula
Project Manager

This document has been printed from a digitally signed master copy

Waste Acceptance Criteria

Customer Sample Reference : BH204 WAC
SAL Sample Reference : 666193 002
Project Site : MAG Green Bridge
Customer Reference : 3590
Top Depth : 0.60
Bottom Depth : 0.70
Date Sampled : 27-JUN-2017
Matrix Class : Sandy Soil

Soil					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Acid Neutralising Capacity (pH 4)	Titration	2	Mol/kg	N	<2			
Acid Neutralising Capacity (pH 7)	Titration	2	Mol/kg	N	<2			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
Loss on Ignition	Grav	0.1	%	N	**4.2**			10.0
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
PCB EC7 (Sum)	Calc	0.070	mg/kg	U	(9, 26) <0.070	1.0		
pH	Probe			M	**7.7**		> 6.0	
Total Organic Carbon	OX/IR	0.1	%	N	<0.1	3.0	5.0	6.0
Total Petroleum Hydrocarbons C10-C40 (Sum)	Calc	1	mg/kg	N	(13) **130**	500.0		

Data for BS EN 12457-2 (10:1)					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic	Calc WAC ICP/MS	0.0020	mg/kg	N	**0.0065**	0.5	2.0	25.0
Barium	Calc WAC ICP/MS	0.010	mg/kg	N	**0.047**	20.0	100.0	300.0
Cadmium	Calc WAC ICP/MS	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chloride	Calc (W)	10	mg/kg	N	<10	800.0	15000.0	25000.0
Chromium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper	Calc WAC ICP/MS	0.0050	mg/kg	N	**0.010**	2.0	50.0	100.0
Dissolved Organic Carbon	Calc	10	mg/kg	N	**60**	500.0	800.0	1000.0
Fluoride	Calc (W)	0.50	mg/kg	N	**2.2**	10.0	150.0	500.0
Lead	Calc WAC ICP/MS	0.0030	mg/kg	N	**0.0095**	0.5	10.0	50.0
Mercury	Calc WAC ICP/MS	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	30.0
Nickel	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols (Total-Mono)	Calc	1.0	mg/kg	N	<1.0	1.0		
Selenium	Calc WAC ICP/MS	0.0050	mg/kg	N	<0.0050	0.1	0.5	7.0
Sulphate	Calc (W)	5	mg/kg	N	**14**	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc WAC ICP/MS	1000	mg/kg	N	<1000	4000.0	60000.0	100000.0
Zinc	Calc WAC ICP/MS	0.020	mg/kg	N	**0.022**	4.0	50.0	200.0

Following the recommendation from the Environment Agency (England and Wales)*, the leachate preparation in this report has been carried out to BS EN 12457-2 : One Stage batch test at a liquid to solid ratio of 10 l/kg. This is also compliant with Schedule 10 of the Environmental Permitting Regulations 2010.

Note : This is the minimum amount of testing which is required.

Further testing may be required if :

- evidence of immediately leachable parameters becomes available.
- evidence to indicate that the sample could be classified as hazardous under H1-H14 of the Waste(England and Wales) Regulations 2011(as amended) becomes available.

Acceptance of waste at landfill is always at the discretion of the Landfill Operator.

*** Waste Sampling and Testing for Disposal at Landfill, EBPRI 11507B, Environment Agency (England and Wales) March 2013**

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

Landfill WAC analysis (specifically leaching test results) should not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	666193 001	666193 002	666193 003
				Customer Sample Reference	BH204 MG	BH204 WAC	BH203 MG
				Test Sample	AR	AR	AR
				Bottom Depth	0.80	0.70	0.40
				Top Depth	0.70	0.60	0.30
				Date Sampled	27-JUN-2017	27-JUN-2017	28-JUN-2017
				Matrix Class	Sandy Soil	Sandy Soil	Sandy Soil
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	13	8.6	10

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	666193 001	666193 002	666193 003
				Customer Sample Reference	BH204 MG	BH204 WAC	BH203 MG
				Test Sample	M40	M40	M40
				Bottom Depth	0.80	0.70	0.40
				Top Depth	0.70	0.60	0.30
				Date Sampled	27-JUN-2017	27-JUN-2017	28-JUN-2017
				Matrix Class	Sandy Soil	Sandy Soil	Sandy Soil
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Retained on 10mm sieve	Grav	0.1	%	N	<0.1	<0.1	<0.1

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
RoC Maxi Suite 1

				Concept Reference	666193 001	666193 003
				Customer Sample Reference	BH204 MG	BH203 MG
				Test Sample	A40	A40
				Bottom Depth	0.80	0.40
				Top Depth	0.70	0.30
				Date Sampled	27-JUN-2017	28-JUN-2017
				Matrix Class	Sandy Soil	Sandy Soil
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Antimony	ICP/OES	1	mg/kg	U	3	3
Barium	ICP/OES	1	mg/kg	U	96	92
Sulphate (Total)	ICP/OES	0.01	%	N	0.02	0.05
Mass Fraction of organic carbon	Calc TOC/100			N	0.0091	0.0000
Beryllium	ICP/OES	2	mg/kg	U	<2	<2

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
RoC Maxi Suite 1

Concept Reference	666193 001	666193 003
Customer Sample Reference	BH204 MG	BH203 MG
Test Sample	AR	AR
Bottom Depth	0.80	0.40
Top Depth	0.70	0.30
Date Sampled	27-JUN-2017	28-JUN-2017
Matrix Class	Sandy Soil	Sandy Soil

Determinand	Method	LOD	Units	Symbol		
Boron (water-soluble)	ICP/OES	1	mg/kg	N	<1	<1
Chromium (trivalent)	Calc	2	mg/kg	N	**27**	**23**
Chromium VI	ICP/OES	1	mg/kg	N	<1	<1
pH	Probe			M	**7.7**	**7.8**
Sulphate(2:1)	ICP/OES	0.1	g/l	N	<0.1	<0.1
Cyanide (Total)	Colorimetry (CF)	1	mg/kg	M	<1	<1
Cyanide(free)	Colorimetry (CF)	1	mg/kg	M	<1	<1
Phenols (Total-Mono)	Colorimetry (CF)	1	mg/kg	M	<1	<1

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
RoC Maxi Suite 1

Concept Reference	666193 001	666193 003
Customer Sample Reference	BH204 MG	BH203 MG
Test Sample	M40	M40
Bottom Depth	0.80	0.40
Top Depth	0.70	0.30
Date Sampled	27-JUN-2017	28-JUN-2017
Matrix Class	Sandy Soil	Sandy Soil

Determinand	Method	LOD	Units	Symbol		
Arsenic	ICP/OES	2	mg/kg	M	**9**	**8**
Cadmium	ICP/OES	1	mg/kg	M	<1	<1
Copper	ICP/OES	1	mg/kg	M	**19**	**22**
Mercury	ICP/OES	1	mg/kg	M	<1	<1
Molybdenum	ICP/OES	1	mg/kg	M	**4**	**3**
Nickel	ICP/OES	1	mg/kg	M	**22**	**22**
Selenium	ICP/OES	3	mg/kg	M	<3	<3
Vanadium	ICP/OES	1	mg/kg	M	**28**	**26**
Zinc	ICP/OES	1	mg/kg	M	**45**	**60**
Chromium	ICP/OES	1	mg/kg	M	**27**	**23**
Lead	ICP/OES	1	mg/kg	M	**34**	**35**

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
BTEX

Concept Reference	666193 002
Customer Sample Reference	BH204 WAC
Test Sample	M105
Bottom Depth	0.70
Top Depth	0.60
Date Sampled	27-JUN-2017
Matrix Class	Sandy Soil

Determinand	Method	LOD	Units	Symbol	
Benzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	(13) <10
Toluene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
PCB EC7

Concept Reference	666193 002
Customer Sample Reference	BH204 WAC
Test Sample	M105
Bottom Depth	0.70
Top Depth	0.60
Date Sampled	27-JUN-2017
Matrix Class	Sandy Soil

Determinand	Method	LOD	Units	Symbol	
Polychlorinated biphenyl BZ#28	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9,26) <10
Polychlorinated biphenyl BZ#52	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9,26) <10
Polychlorinated biphenyl BZ#101	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26,9) <10
Polychlorinated biphenyl BZ#118	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26,9) <10
Polychlorinated biphenyl BZ#153	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9,26) <10
Polychlorinated biphenyl BZ#138	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9,26) <10
Polychlorinated biphenyl BZ#180	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26,9) <10

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

				Concept Reference	666193 001	666193 002	666193 003
				Customer Sample Reference	BH204 MG	BH204 WAC	BH203 MG
				Test Sample	M105	M105	M105
				Bottom Depth	0.80	0.70	0.40
				Top Depth	0.70	0.60	0.30
				Date Sampled	27-JUN-2017	27-JUN-2017	28-JUN-2017
				Matrix Class	Sandy Soil	Sandy Soil	Sandy Soil
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	-	<0.1	-
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	-	<0.1	-
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	-	**0.2**	-
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	-	**0.2**	-
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Benzo(b/k)Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	-	**0.2**	-
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-
Polyaromatic Hydrocarbons (Total)	GC/MS (MCERTS)	0.1	mg/kg	U	-	**0.6**	-
Coronene	GC/MS	0.1	mg/kg	N	-	<0.1	-
Phenol	GC/MS (MCERTS)	0.1	mg/kg	M	-	<0.1	-

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
Total Petroleum Hydrocarbons

				Concept Reference	666193 002
				Customer Sample Reference	BH204 WAC
				Test Sample	M105
				Bottom Depth	0.70
				Top Depth	0.60
				Date Sampled	27-JUN-2017
				Matrix Class	Sandy Soil
Determinand	**Method**	**LOD**	**Units**	**Symbol**	
Total Petroleum Hydrocarbons	GC/FID	1	mg/kg	M	(13) **110**
Total Petroleum Hydrocarbons (C35-C40)	GC/FID	1	mg/kg	N	(13) **26**

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Soil Analysed as Soil
Miscellaneous

				Concept Reference	666193 001	666193 002	666193 003
				Customer Sample Reference	BH204 MG	BH204 WAC	BH203 MG
				Test Sample	AR	AR	AR
				Bottom Depth	0.80	0.70	0.40
				Top Depth	0.70	0.60	0.30
				Date Sampled	27-JUN-2017	27-JUN-2017	28-JUN-2017
				Matrix Class	Sandy Soil	Sandy Soil	Sandy Soil
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Asbestos ID	PLM			SU	N.D.	N.D.	N.D.

Concept Reference: 666193
Project Site: MAG Green Bridge
Customer Reference: 3590

Leachate to BS EN 12457-2 (10:1) Analysed as Water
Waste Acceptance Criteria

Concept Reference	**666193 002**
Customer Sample Reference	**BH204 WAC**
Test Sample	**10:1**
Bottom Depth	**0.70**
Top Depth	**0.60**
Date Sampled	**27-JUN-2017**
Matrix Class	**Sandy Soil**

Determinand	Method	LOD	Units	Symbol	
Arsenic (Dissolved)	ICP/MS (Filtered)	0.2	µg/l	U	**0.6**
Barium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	**5**
Molybdenum (Dissolved)	ICP/MS (Filtered)	1	µg/l	N	<1
Total Dissolved Solids	Grav	100	mg/l	N	<100
Phenols (Total-Mono)	Colorimetry	0.1	mg/l	U	<0.1
Dissolved Organic Carbon	OX/IR	1	mg/l	N	**6**
Electrical Conductivity	Probe	10	µS/cm	N	**43**
Antimony (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1
Cadmium (Dissolved)	ICP/MS (Filtered)	0.02	µg/l	U	<0.02
Chromium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1
Copper (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	**1.0**
Lead (Dissolved)	ICP/MS (Filtered)	0.3	µg/l	U	**0.9**
Mercury (Dissolved)	ICP/MS (Filtered)	0.05	µg/l	U	<0.05
Nickel (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1
Selenium (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	<0.5
Zinc (Dissolved)	ICP/MS (Filtered)	2	µg/l	U	**2**
Chloride	Discrete Analyser	1	mg/l	U	<1
Fluoride	Discrete Analyser	0.05	mg/l	U	**0.22**
Sulphate	Discrete Analyser	0.5	mg/l	U	**1.4**

Index to symbols used in 666193-1 Interim

Value	Description
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
10:1 S	Data for BS EN 12457-2 (10:1)
10:1	Leachate to BS EN 12457-2 (10:1)
AR	As Received
A40	Assisted dried < 40C
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
N.D.	Not Detected
9	LOD raised due to dilution of sample
13	Results have been blank corrected.
26	LOD raised because the analysis was performed by an alternative technique
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos.
These samples have been analysed exceeding recommended holding times for pH. It is possible therefore that the results provided may be compromised.
Please note interim results are considered preliminary and are subject to change.

APPENDIX D - GEOTECHNICAL TESTING RESULTS

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

Client:	ROC Consulting Ltd	Client Reference:	3590
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	30/08/2017
Site Name:	Airport City Bridge	Sampled By:	Mabel Newby
Site Address:	Not Given		

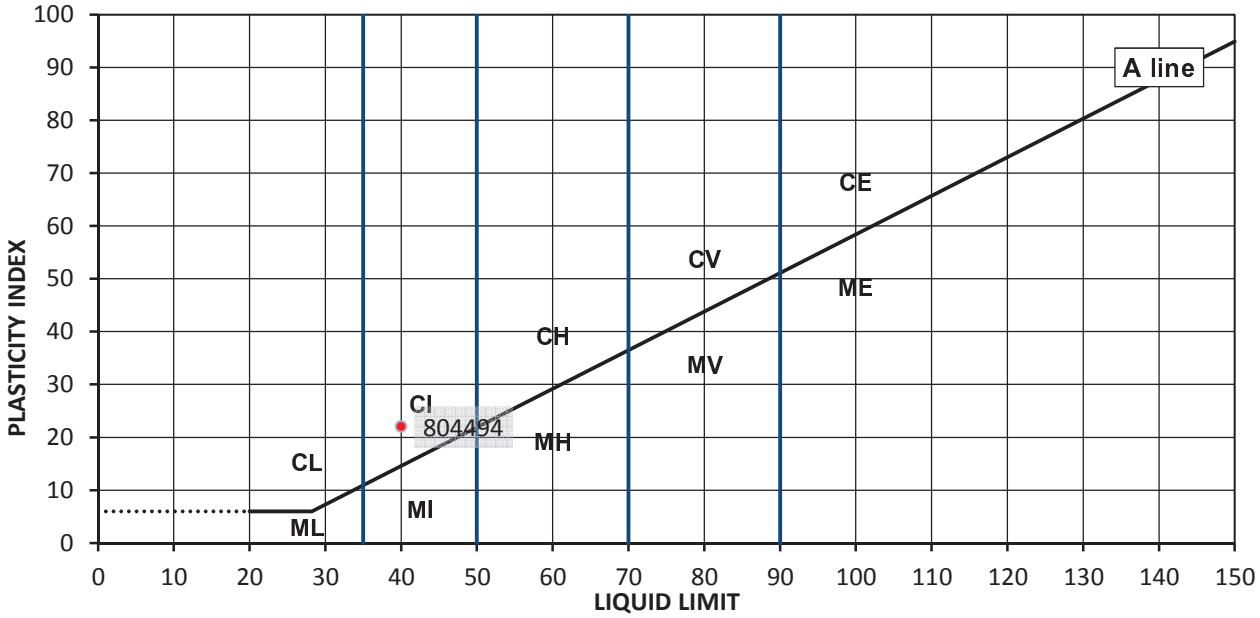
TEST RESULTS

Laboratory Reference: 804494
Sample Reference: Not Given

Description: Mottled brown slightly gravelly sandy CLAY
Location: BH204
Sample Preparation: Tested after washing to remove >425um

Sample Type: U
Depth Top [m]: 6.00
Depth Base [m]: 6.45

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
18	40	18	22	90



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks

Approved:

Dariusz Piotrowski
PL Laboratory Manager Geotechnical Section
Date Reported: 06/09/2017

Signed:

Sushil Sharda
Technical Manager (Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."

GF 105.11

TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

UKAS TESTING 4041

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

Client:	ROC Consulting Ltd	Client Reference:	3590
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	30/08/2017
Site Name:	Airport City Bridge	Sampled By:	Mabel Newby
Site Address:	Not Given		

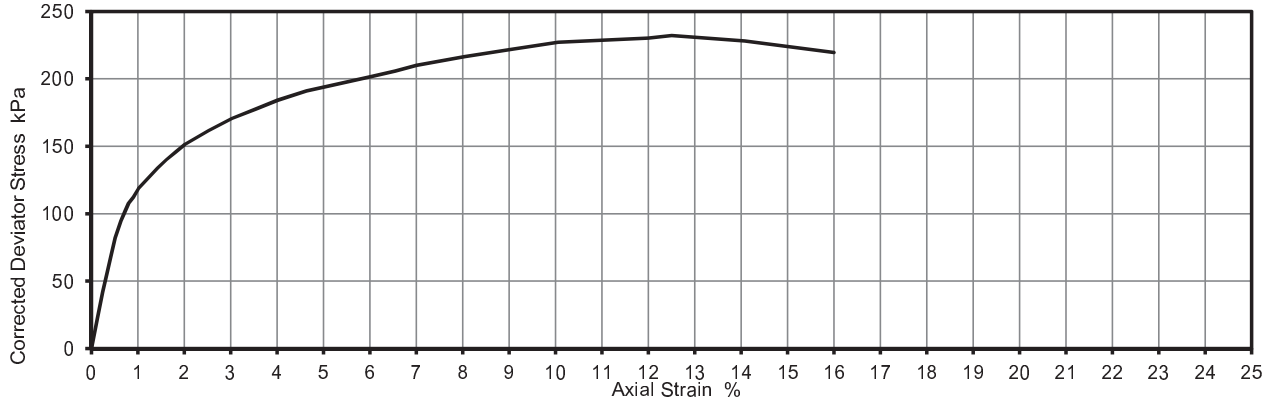
Test Result

Laboratory Reference: 804494
Hole No.: BH204
Sample Reference: Not Given
Sample Description: Mottled brown slightly gravelly sandy CLAY

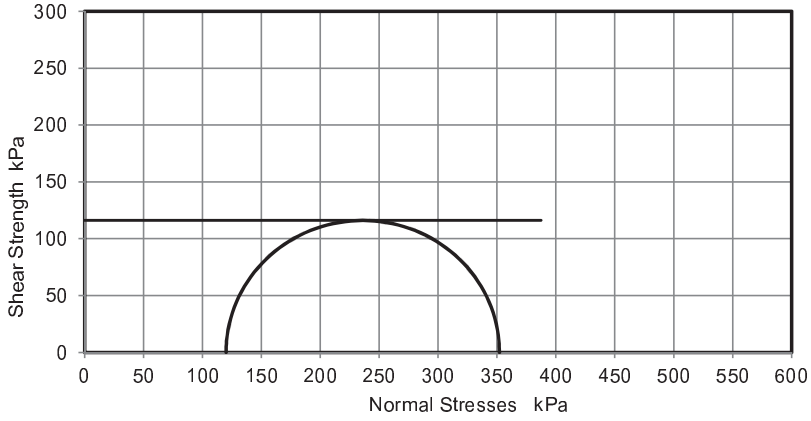
Depth Top [m]: 6.00
Depth Base [m]: 6.45
Sample Type: U

Test Number	1		Rate of Strain	2.00	%/min
Length	99.73	mm	Cell Pressure	120	kPa
Diameter	49.83	mm	Axial Strain at failure	12.5	%
Bulk Density	2.12	Mg/m3	Deviator Stress, (σ1 - σ3)f	232	kPa
Moisture Content	18	%	Undrained Shear Strength, cu	116	kPa ½(σ1 - σ3)f
Dry Density	1.80	Mg/m3	Mode of Failure	Compound	

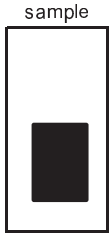
Deviator Stress v Axial Strain



Mohr Circles



Position within sample





Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 05/09/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."

TEST CERTIFICATE

Point Load Strength Index Tests Summary of Results

Tested in Accordance with ISRM : 2007, pages 125-132

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

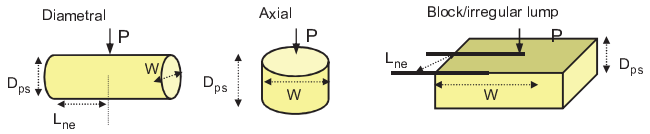
Client: ROC Consulting Ltd
Client Address: Commercial Wharf
6 Commercial Street
Castlefield
Manchester
M15 4PZ
Contact: Mabel Newby
Site Name: Airport City Bridge
Site Address: Not Given

Client Reference: 3590
Job Number: 17-58283
Date Sampled: Not Given
Date Received: 22/08/2017
Date Tested: 04/09/2017
Sampled By: Mabel Newby

Test results

Laboratory Reference	Hole No.	Sample				Specimen		Description	Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
		Reference	Depth Top [m]	Depth Base [m]	Type	Reference	Depth [m]			Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN	mm	Is MPa	Is(50) MPa	
804467	BH201	Not Given	6.20	Not Given	C	Not Given	Not Given	Brown MUDSTONE	MUDSTONE	A	U	YES		83.7	82.0	55.0	1.2	76.6	0.20	0.25	
804468	BH201	Not Given	7.60	Not Given	C	Not Given	Not Given	Grey MUDSTONE	MUDSTONE	A	U	YES		86.6	83.0	65.0	4.3	84.6	0.60	0.76	
804469	BH201	Not Given	8.90	Not Given	C	Not Given	Not Given	Brown MUDSTONE	MUDSTONE	A	U	YES		86.4	63.0	57.0	2.3	79.2	0.37	0.46	Unable to carry out diameter test due to sample dimensions
804470	BH201	Not Given	10.10	Not Given	C	Not Given	Not Given	Brown MUDSTONE	MUDSTONE	A	U	YES		86.6	80.0	45.0	2.6	70.4	0.53	0.62	
804472	BH201	Not Given	10.95	Not Given	C	Not Given	Not Given	Brown to grey MUDSTONE	MUDSTONE	A	U	YES		86.7	67.0	40.0	2.2	66.4	0.50	0.57	
804474	BH201	Not Given	12.95	Not Given	C	Not Given	Not Given	Brown MUDSTONE	MUDSTONE	D	U	YES	44.0	87.1	87.0	84.0	0.6	85.6	0.08	0.10	
804476	BH201	Not Given	14.30	Not Given	C	Not Given	Not Given	Grey MUDSTONE	MUDSTONE	A	U	YES		86.0	73.0	40.0	6.4	66.2	1.46	1.65	
804478	BH201	Not Given	14.70	Not Given	C	Not Given	Not Given	Grey MUDSTONE	MUDSTONE	A	U	YES		86.2	67.0	41.0	7.1	67.1	1.59	1.81	
804479	BH201	Not Given	15.30	Not Given	C	Not Given	Not Given	Brown to grey MUDSTONE	MUDSTONE	D	U	YES	54.4	86.6	86.0	78.0	1.7	82.2	0.26	0.32	
804481	BH201	Not Given	17.05	Not Given	C	Not Given	Not Given	Grey MUDSTONE	MUDSTONE	A	U	YES		87.0	63.0	56.0	1.7	78.8	0.27	0.33	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section
Date Reported: 04/09/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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GF 134.4

TEST CERTIFICATE

Point Load Strength Index Tests Summary of Results

Tested in Accordance with ISRM : 2007, pages 125-132

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

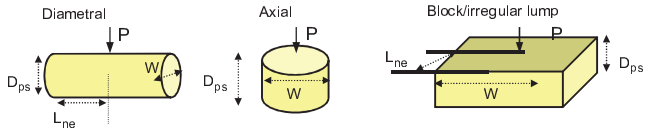
Client: ROC Consulting Ltd
Client Address: Commercial Wharf
6 Commercial Street
Castlefield
Manchester
M15 4PZ
Contact: Mabel Newby
Site Name: Airport City Bridge
Site Address: Not Given

Client Reference: 3590
Job Number: 17-58283
Date Sampled: Not Given
Date Received: 22/08/2017
Date Tested: 04/09/2017
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Specimen		Description	Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
		Reference	Depth Top [m]	Depth Base [m]	Type	Reference	Depth [m]			Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN	mm	Is MPa	Is(50) MPa	
804483	BH201	Not Given	18.70	Not Given	C	Not Given	Not Given	Brown to grey MUDSTONE	MUDSTONE	A	U	YES		86.7	64.0	56.0	9.7	78.6	1.57	1.93	Unable to carry out diameter test due to sample dimensions
804484	BH201	Not Given	19.70	Not Given	C	Not Given	Not Given	Brown MUDSTONE	MUDSTONE	A	U	YES		86.7	57.0	48.0	0.7	72.8	0.12	0.15	
804485	BH202	Not Given	5.90	Not Given	C	Not Given	Not Given	Grey MUDSTONE	MUDSTONE	A	U	YES		86.3	72.0	47.0	1.3	71.9	0.25	0.30	
804488	BH202	Not Given	10.10	Not Given	C	Not Given	Not Given	Brown to grey MUDSTONE	MUDSTONE	A	U	YES		86.7	59.0	35.0	3.8	62.1	0.99	1.10	
804489	BH202	Not Given	10.40	Not Given	C	Not Given	Not Given	Grey MUDSTONE	MUDSTONE	D	U	YES	49.0	86.9	87.0	80.0	2.1	83.4	0.30	0.38	
804491	BH202	Not Given	11.60	Not Given	C	Not Given	Not Given	Grey MUDSTONE	MUDSTONE	A	U	YES		86.0	50.0	39.0	7.5	65.3	1.76	1.99	Unable to carry out diameter test due to sample dimensions
804492	BH202	Not Given	12.10	Not Given	C	Not Given	Not Given	Brown MUDSTONE	MUDSTONE	A	U	YES		85.2	65.0	44.0	12.5	69.1	2.61	3.02	
804493	BH202	Not Given	15.25	Not Given	C	Not Given	Not Given	Brown MUDSTONE	MUDSTONE	A	U	YES		86.9	70.0	50.0	13.0	74.4	2.35	2.81	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section
Date Reported: 04/09/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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GF 134.4

TEST CERTIFICATE

Unconfined Compressive Strength Test

I.S.R.M. Suggested Methods 1981 for Determination of Uniaxial Compressive Strength Part 1

i2 Analytical Ltd
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Croxley Green Business Park
Watford Herts WD18 8YS

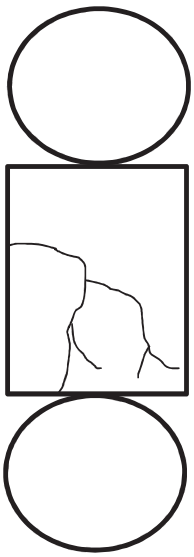
Client:	ROC Consulting Ltd	Client Reference:	3590
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	04/09/2017
Site Name:	Airport City Bridge	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference:	804471	Depth Top [m]:	10.65
Hole No.:	BH201	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	C
Sample Description:	Brown to grey MUDSTONE	Specimen Depth [m]:	Not Given
Specimen Reference:	Not Given	Date and method of sampling:	Not Given
Storage history and environmer	Not Given		

Specimen length	mm	158.4
Specimen diameter	mm	86.3
Test duration	min	0.5
Stress rate	kN/s	1
Machine type		Autocon
U.C.S.	MPa	3.6
Mode of failure		Cleavage
Loading axis relative to anisotropy		
Water content	%	9
Bulk density	Mg/m3	2.30
Dry density	Mg/m3	2.11
Degree of saturation	%	N/A

Failure sketch



Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 05/09/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

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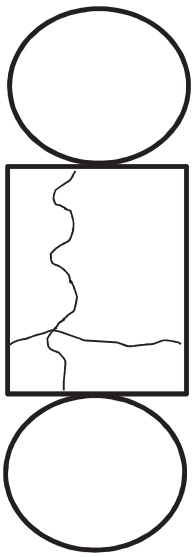
Client:	ROC Consulting Ltd	Client Reference:	3590
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	04/09/2017
Site Name:	Airport City Bridge	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference:	804473	Depth Top [m]:	11.10
Hole No.:	BH201	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	C
Sample Description:	Brown to grey MUDSTONE	Specimen Depth [m]:	Not Given
Specimen Reference:	Not Given	Date and method of sampling:	Not Given
Storage history and environmer	Not Given		

Specimen length	mm	126.3
Specimen diameter	mm	86.4
Test duration	min	1
Stress rate	kN/s	1
Machine type		Autocon
U.C.S.	MPa	6.8
Mode of failure		Cleavage
Loading axis relative to anisotropy		
Water content	%	8.4
Bulk density	Mg/m3	2.39
Dry density	Mg/m3	2.21
Degree of saturation	%	N/A

Failure sketch



Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 05/09/2017

Signed:

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TEST CERTIFICATE

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Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	04/09/2017
Site Name:	Airport City Bridge	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference:	804475	Depth Top [m]:	13.45
Hole No.:	BH201	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	C
Sample Description:	Brown to grey MUDSTONE	Specimen Depth [m]:	Not Given
Specimen Reference:	Not Given	Date and method of sampling:	Not Given
Storage history and environmer	Not Given		

Specimen length	mm	140.5
Specimen diameter	mm	86.4
Test duration	min	1.5
Stress rate	kN/s	1
Machine type		Autocon
U.C.S.	MPa	13.6
Mode of failure		Cleavage
Loading axis relative to anisotropy		
Water content	%	6.1
Bulk density	Mg/m3	2.50
Dry density	Mg/m3	2.36
Degree of saturation	%	N/A

Failure sketch



Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
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Date Reported: 05/09/2017

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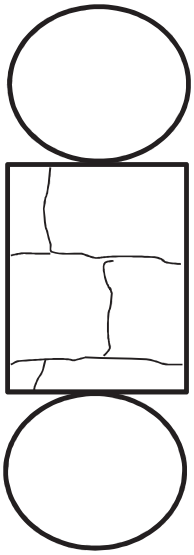
Client:	ROC Consulting Ltd	Client Reference:	3590
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	04/09/2017
Site Name:	Airport City Bridge	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference:	804477	Depth Top [m]:	14.55
Hole No.:	BH201	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	C
Sample Description:	Grey MUDSTONE	Specimen Depth [m]:	Not Given
Specimen Reference:	Not Given	Date and method of sampling:	Not Given
Storage history and environmer	Not Given		

Specimen length	mm	120.2
Specimen diameter	mm	86.6
Test duration	min	2.5
Stress rate	kN/s	1
Machine type		Autocon
U.C.S.	MPa	23.2
Mode of failure		Cleavage
Loading axis relative to anisotropy		
Water content	%	5.1
Bulk density	Mg/m3	2.52
Dry density	Mg/m3	2.40
Degree of saturation	%	N/A

Failure sketch



Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 05/09/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

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TEST CERTIFICATE

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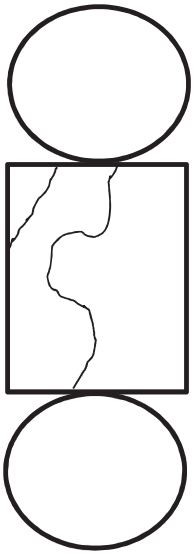
Client:	ROC Consulting Ltd	Client Reference:	3590
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	04/09/2017
Site Name:	Airport City Bridge	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference:	804480	Depth Top [m]:	16.40
Hole No.:	BH201	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	C
Sample Description:	Grey MUDSTONE	Specimen Depth [m]:	Not Given
Specimen Reference:	Not Given	Date and method of sampling:	Not Given
Storage history and environmer	Not Given		

Specimen length	mm	88.2
Specimen diameter	mm	86.4
Test duration	min	4
Stress rate	kN/s	1
Machine type		Autocon
U.C.S.	MPa	41.8
Mode of failure		Cleavage
Loading axis relative to anisotropy		
Water content	%	7.9
Bulk density	Mg/m3	2.42
Dry density	Mg/m3	2.24
Degree of saturation	%	N/A

Failure sketch



Remarks: Sample is to short

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 05/09/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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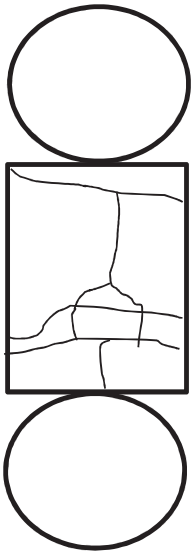
Client:	ROC Consulting Ltd	Client Reference:	3590
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	04/09/2017
Site Name:	Airport City Bridge	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference:	804482	Depth Top [m]:	18.15
Hole No.:	BH201	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	C
Sample Description:	Grey MUDSTONE	Specimen Depth [m]:	Not Given
Specimen Reference:	Not Given	Date and method of sampling:	Not Given
Storage history and environmer	Not Given		

Specimen length	mm	135.1
Specimen diameter	mm	86.5
Test duration	min	2
Stress rate	kN/s	1
Machine type		Autocon
U.C.S.	MPa	18.1
Mode of failure		Cleavage
Loading axis relative to anisotropy		
Water content	%	5.5
Bulk density	Mg/m3	2.54
Dry density	Mg/m3	2.41
Degree of saturation	%	N/A

Failure sketch



Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 05/09/2017

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Unconfined Compressive Strength Test

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Watford Herts WD18 8YS

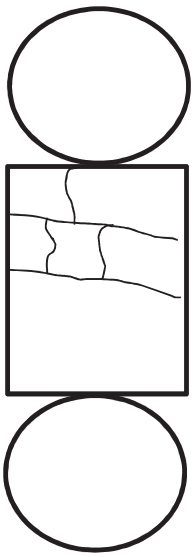
Client:	ROC Consulting Ltd	Client Reference:	3590
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	04/09/2017
Site Name:	Airport City Bridge	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference:	804486	Depth Top [m]:	7.85
Hole No.:	BH202	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	C
Sample Description:	Brown to grey MUDSTONE	Specimen Depth [m]:	Not Given
Specimen Reference:	Not Given	Date and method of sampling:	Not Given
Storage history and environmer	Not Given		

Specimen length	mm	167.7
Specimen diameter	mm	86.6
Test duration	min	2.5
Stress rate	kN/s	1
Machine type		Autocon
U.C.S.	MPa	1.7
Mode of failure		Cleavage
Loading axis relative to anisotropy		
Water content	%	8.6
Bulk density	Mg/m3	2.25
Dry density	Mg/m3	2.07
Degree of saturation	%	N/A

Failure sketch



Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 05/09/2017

Signed:

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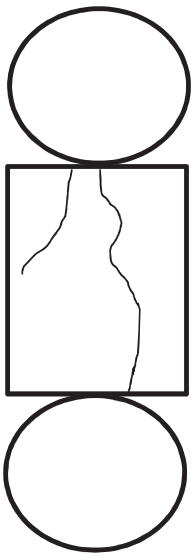
Client:	ROC Consulting Ltd	Client Reference:	3590
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	04/09/2017
Site Name:	Airport City Bridge	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference:	804487	Depth Top [m]:	8.50
Hole No.:	BH202	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	C
Sample Description:	Brown MUDSTONE	Specimen Depth [m]:	Not Given
Specimen Reference:	Not Given	Date and method of sampling:	Not Given
Storage history and environmer	Not Given		

Specimen length	mm	77.2
Specimen diameter	mm	86.4
Test duration	min	1
Stress rate	kN/s	1
Machine type		Autocon
U.C.S.	MPa	9.4
Mode of failure		Cleavage
Loading axis relative to anisotropy		
Water content	%	4.5
Bulk density	Mg/m3	2.37
Dry density	Mg/m3	2.26
Degree of saturation	%	N/A

Failure sketch



Remarks: Sample is to short

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 05/09/2017

Signed:

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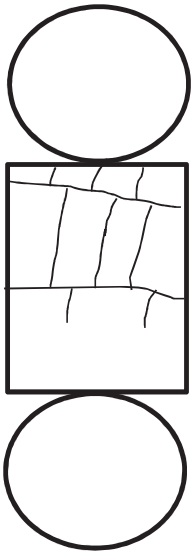
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Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	17-58283
		Date Sampled:	Not Given
		Date Received:	22/08/2017
Contact:	Mabel Newby	Date Tested:	04/09/2017
Site Name:	Airport City Bridge	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference:	804490	Depth Top [m]:	10.75
Hole No.:	BH202	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	C
Sample Description:	Brown to grey MUDSTONE	Specimen Depth [m]:	Not Given
Specimen Reference:	Not Given	Date and method of sampling:	Not Given
Storage history and environmer	Not Given		

Specimen length	mm	80.4
Specimen diameter	mm	86.4
Test duration	min	1
Stress rate	kN/s	1
Machine type		Autocon
U.C.S.	MPa	8.7
Mode of failure		Cleavage
Loading axis relative to anisotropy		
Water content	%	7
Bulk density	Mg/m3	2.28
Dry density	Mg/m3	2.13
Degree of saturation	%	N/A

Failure sketch



Remarks: Sample is to short

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 05/09/2017

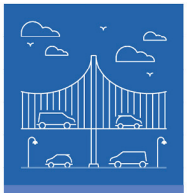
Signed:

Sushil Sharda
Technical Manager
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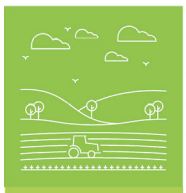
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Structural Engineering



Earth Sciences



Strategic Land



Special Projects

Airport City Bridge

Commercial Wharf
6 Commercial Street
Manchester
M15 4PZ

T 0161 214 5390
W www.rocconsulting.com

British Geological Survey

BGS ID: 914666 : BGS Reference: SJ88NW14
British National Grid (27700) : 381951,386131

(*11932) Wt.30370/0370 10,000 9/39 A.& E.W.Ltd. Gp.685

RECORD OF SHAFT OR BORE

SJ88NW 14

12/98 18SE/12 18SE/2

County Cheshire
Quarter Sheet
1" N.S. Geol. Map
1" O.S. Geol. Map
Whether Confident 14

Name and Number of Shaft or Bore given by Geological Survey:
M/c Corporation Bores No 11.

Name and Number given by owner (if different from above):

Town or Village Kingsway Date of sinking

Exact site 6 yds from NW side Bailey Lane at a point 166 yds NE along lane from NE fence of Moss House. (yds S.W. of boundary fence)

A sketch-map or tracing from a large-scale map is desirable.

Purpose for which made (Information copied from a note by L.H. Tarbs)

Level at which bore commenced relative to O.D. If not down bore, state if horizontal or up

Made by for Messrs.

Information from Date received

Specimens Dip of strata

Geological Classification	Description	Thickness			Depth		
							m
	Soil		1	9		1	0.53
	Brown Clay		2	3		4	0.72
	Unirrigated Clay		22	-		26	0.71.92

Geological Survey and Museum,
South Kensington,
London, S.W.7.

G.S.M. Office File No.	Site marked on 6" Map by	Site marked on 1" Map by

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 914666 : BGS Reference: SJ88NW14
British National Grid (27700) : 381951,386131

SJ 8196 8616

SJ88/22

1956/2

*11932) Wt.30370/0370 10,000 2/39 A.& E.W.Ltd. Gp.685

RECORD OF SHAFT OR BORE FOR MINERALS

County Cheshire
6" Quarter Sheet 18
1" N.S. Geol. Map 98
1" O.S. Geol. Map
Whether Confidential

Name and Number of Shaft or Bore given by Geological Survey: M/C Corporation Bores No. 11.

Name and Number given by owner (if different from above):

Town or Village Ringway Date of sinking

Exact site 6 yds from NW side Bailey Lane at a point 166 yds NE along lane from NE fenced of Moss House: ([redacted] yds S.W. of boundary fence)

A sketch-map or tracing from a large-scale map is desirable.

Purpose for which made

Level at which bore commenced relative to O.D. If not down bore, state if horizontal or up

Made by for Messrs.

Information from Date received

Specimens Dip of strata

Geological Classification	Description	Thickness	Depth
	Soil	1 9	1 9
	Brown Clay	2 3	4 0
	Unirrigated Clay	22 -	26 0

GEOLOGICAL SURVEY AND MUSEUM,
SOUTH KENSINGTON,
LONDON, S.W.7

S.M. Cat. No.	Sheet Map No.	Entered in Index Map by

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 915570 : BGS Reference: SJ88NW889
British National Grid (27700) : 381280,386120

SJ88NW
889

Geotechnical Engineering Limited

BOREHOLE LOG



CLIENT The Department of Transport
SITE M56 Widening, Junctions 4 - 6
DATE 3rd to 4th June 1991

Easting: 5832.5 8097
Northing: 6023.5 8629
Ground Level 65.88m AOD

BOREHOLE CH 3
Sheet 1 of 1
Scale 1 : 50

progress/water levels	casing (m)	SPT/U70	depths (m)	core/sample	TCR (SCR)	RQD	description: Main	description: Detail	tests	depth (m)	level (mOD)	legend
3.6.91			0.00 - 0.20	1B			Brown sandy SILT with many rootlets. (TOPSOIL)			0.20	65.68	
			0.20 - 0.60	2B						(0.40)		
							Firm red brown silty CLAY with much fine to coarse sub angular gravel and occasional rootlets. (DRIFT?)	Gravel includes sandy siltstone.		0.60	65.28	
	0.66	N*= 112	0.60 - 0.85	32	71 (27)	27						
			1.09	27	90 (60)	20	Red brown fresh to slightly weathered highly fractured thinly to thickly laminated silty MUDSTONE weak with very closely spaced laminae of siltstone moderately weak. (Zone I MARL)	Fractures: Generally II 5° and IV 5° Some ripple marks on bedding planes.	SCI	(1.30)		
			1.59							1.90	63.98	
				84	94 (87)	0	Grey-green fresh to slightly weathered highly fractured thinly laminated to thinly bedded highly fractured silty MUDSTONE weak to moderately weak with closely spaced thin laminae to thin beds of grey siltstone moderately weak to moderately strong. (Zone I MARL)	Fractures: Generally V 5-10° and VII 5-10° Bands of moderately weathered mudstone: 4.30m to 4.45m and 4.60m to 4.80m.	H			
			3.09	9W					W			
				75	81 (61)	13	Highly weathered to a clay with lithorelicts: 4.62m to 4.65m. (Zone III MARL)			(3.15)		
			4.59									
	0.66	N*= 250	4.59 - 4.73	32	85 (70)	37						
pm Dry			5.13		88 (88)	77	Red brown fresh to slightly weathered moderately fractured thinly laminated to thinly bedded moderately fractured silty MUDSTONE weak to moderately weak with closely spaced thin laminae and thin beds of grey siltstone moderately weak to moderately strong and with closely spaced brown thin laminae of silty clay. (Zone I MARL)	Fractures: Generally V 5-10° and VII 5-10° Band of moderately weathered mudstone: 5.13m to 5.25m.		5.05	60.83	
4.6.91 am 3.10m			5.64		100 (91)	47				(1.85)		
			6.63		97 (91)	41	Red brown fresh to slightly weathered moderately fractured thinly laminated to thinly bedded silty MUDSTONE moderately weak with closely spaced thin laminae of siltstone moderately weak and silty clay. (Zone I MARL)	Fractures: Generally VII 5-10° Often associated with clay laminae.		6.85	59.03	
										(1.05)		
			8.13							7.90	57.98	
	0.66	N*= 300	8.13 - 8.24		50(0)	0	Grey-green fresh to slightly weathered moderately fractured thinly to thickly laminated silty MUDSTONE moderately weak with very closely spaced laminae of grey sandy siltstone moderately strong. (Zone I MARL)	Fractures: Generally VII 5-10° and VIII 5-10°. Bands of moderately weathered mudstone: 8.30m to 8.50m, 8.95m to 9.00m and 9.50m to 9.60m.				
			8.33		92 (81)	0						
pm 3.80m			9.63							9.63	56.25	
	0.66	N*= 200	9.63 - 9.75				End of Borehole at 9.63m					

Equipment/Methods: Borehole drilled by a Geotechnical Sitemaster rotary rig using a 116mm diameter core barrel with a rigid plastic liner to produce 90mm core from the base of an inspection pit at 0.60m to completion at 9.63m.
Type of flush: Air.
Borehole backfilled with grout on completion.

Remarks

Fracture types: II - smooth stepped; IV - rough undulating; V - smooth undulating; VII - rough planar; VIII - smooth planar.

GEL JOB NO. 2334N

FIGURE 2/3.1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 915571 : BGS Reference: SJ88NW890
British National Grid (27700) : 381350,386040

Geotechnical Engineering Limited

SJ88NW
890

BOREHOLE LOG



CLIENT The Department of Transport
SITE M56 Widening, Junctions 4 - 6
DATE 30th May to 2nd June 1991

Easting: 5924.5 8104
Northing: 5946.0 8639
Ground Level 67.12m AOD

BOREHOLE CH 4
Sheet 1 of 1
Scale 1 : 50

progress/water levels	casing (m)	SPT/U70	depths (m)	core/sample	TCR (SCR)	RQD	piezometer	description: Main	description: Detail	tests	depth (m)	level (mOD)	legend
30.5.91			0.00 - 0.20	1B				Brown silty fine to medium SAND with a little medium angular to sub rounded gravel (TOPSOIL)	Gravel includes quartz and pottery. Many rootlets.		0.20	66.92	
			0.20 - 0.90	2B							(0.70)		
			0.90 - 1.75	3B				Stiff red brown and grey silty CLAY with some angular to sub rounded gravel. (FILL?)	Gravel includes mudstone and quartz.		0.90	66.22	
			1.75 - 1.80	4B							(0.85)		
			1.80					Fine to coarse rounded to sub rounded GRAVEL with much brown medium sand. (FILL)	Gravel includes siltstone, sandstone and quartz.		1.75	75.37	
			2.20	10W							(0.55)		
pmDry	0.00	N*= 100	2.28 - 2.58	7J				Fine to coarse sub angular to sub rounded GRAVEL in a matrix of blue-grey silty clay. (FILL)	Gravel includes siltstone and limestone.	W	2.30	64.82	
31.1.5.91 amDry			2.58		85 (76)	14		Red brown and grey fresh to slightly weathered highly fractured thinly to thickly interlaminated SILTSTONE moderately weak to moderately strong and silty MUDSTONE weak. (Zone I MARL)	Fractures: Generally VIII 5-10° and VII 5-10° Ripplemarks do occur on some bedding fractures e.g. 4.22m and 4.77m.		(3.00)		
Water struck at 5.13m rising to 2.20m in 5 mins pm 2.20m			3.63		95 (87)	30							
			5.13		100 (70)	52							
1.6.91 am 2.20m	2.58	N*= 500	5.13 - 5.20					Grey fresh to slightly weathered highly fractured thinly interlaminated SILTSTONE and silty MUDSTONE weak to moderately weak. (Zone I MARL)	Fractures: Generally VIII 5°		5.30	61.82	
			5.36		75 (71)	0					(2.60)		
			6.65		106 (106)	22							
			8.13					Grey fresh to slightly weathered moderately to highly fractured very thinly to thinly bedded silty fine SANDSTONE moderately strong with closely spaced thin to thick laminae of mudstone and siltstone. (Zone I MARL) Highly weathered to a clay with lithorelicts: 8.56m to 8.60m and 9.01m to 9.03m. (Zone III MARL)	Fractures: Generally VIII 5°. Also: 9.38m to 9.45m VII 85° Bands of moderately to highly weathered mudstone (up to 5mm thick): 8.51m, 8.56m and 9.01m.		7.90	59.22	
	2.58	N*= 500	8.13 - 8.18		97 (91)	60							
pm 3.45m			9.63								9.63	57.49	
	2.58	N*= 750	9.63 - 9.66					End of Borehole at 9.63m					

Equipment/Methods: Borehole drilled by a Geotechnical Sitemaster rotary rig using 128mm casing (Dry-drilling) from the base of an inspection pit at 1.80m to 2.58m and then using a 116mm diameter core barrel with a rigid plastic liner to produce 90mm core to completion at 9.63m. Type of flush: Air/mist.

Remarks: Standpipe piezometer installation: Sand response zone 8.00m to 5.30m; Tip at 7.00m. Water strike at 5.13m; 2.20m at 5 mins, no further rise.

Fracture types: VII - rough planar; VIII - smooth planar.

GEL JOB NO. 2334N

FIGURE 2/4.1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 915572 : BGS Reference: SJ88NW891
British National Grid (27700) : 381340,386150

Geotechnical Engineering Limited

BOREHOLE LOG

SJ88NW 891



CLIENT The Department of Transport
SITE M56 Widening, Junctions 4 - 6
Date 13th June 1991

Easting: 5896.5 8094
Northing: 6055.5 8635
Ground Level 68.24m AOD

BOREHOLE CH 5(BH)
Sheet 1 of 3
Scale 1:50

progress/ water levels	casing (m)	SPT/ U70	depths (m)	core/ sample	description	m (%)	tests	depth (m)	level (mOD)	legend
13.6.91					(TOPSOIL) - Driller's description					
			0.35 - 0.53	1B	Loose to medium dense pale grey and yellow brown			0.35 (0.20)	67.89	
			0.55 - 1.50	2B	Stiff red-brown silty CLAY with a little coarse sand and fine gravel. Gravel includes mudstone and coal. (DRIFT)	L		0.55 (1.95)	67.69	
		N=31	1.50 - 1.95	3J	Thinly to thickly interlaminated hard red-brown silty CLAY, silty MUDSTONE weak and very weak and fine sandy SILTSTONE weak and moderately weak. Recovered as a medium to coarse sub angular to sub rounded platy gravel with much clayey matrix. (Zone II MARL)			1.50 (2.30)	66.74	
			1.95 - 2.50	4B						
	1.68	N*= 122	2.50 - 2.80	5J						
			2.80 - 3.50	6B		Cb				
	1.68	N*= 136	3.50 - 3.71	7J						
			3.85 - 4.50	8B	Thinly to thickly interlaminated silty MUDSTONE weak and SILTSTONE weak and moderately weak. Recovered as a medium to coarse sub angular platy gravel with a little clay matrix. (Zone I MARL)			3.80	64.44	
4.05m	1.68	N*= 214	4.50 - 4.63	9J	Borehole continued by rotary coring, see Fig 2/5.2					

Equipment/Methods: Borehole initially advanced by a light cable percussive rig using 150mm diameter tools from base of an inspection pit at 1.20m to 4.50m, and then extended by a Geotechnical Sitemaster rotary rig using a 116mm diameter core barrel with a rigid plastic liner to produce 90mm diameter core to completion at 12.00m. Water added to assist drilling 2.80m to 4.50m.

Remarks: Borehole backfilled with grout on completion. Casing advanced to 4.59m depth at end of cable percussive boring.

GEL JOB NO. 2334N

FIGURE 2/5.1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 915572 : BGS Reference: SJ88NW891
British National Grid (27700) : 381340,386150

Geotechnical Engineering Limited

BOREHOLE LOG

SJ 38 NW 891

CLIENT The Department of Transport
SITE M56 Widening, Junctions 4 - 6
DATE 13th to 21st June 1991

Easting: 5896.5 8094
Northing: 6055.5 8635
Ground Level 68.24m AOD

BOREHOLE CH 5(BH)
Sheet 2 of 3
Scale 1 : 50

progress/ water levels	casing (m)	SPT/ U70	depths (m)	core/ sample	TCR (SCR)	RQD	description Main	description Detail	tests	depth (m)	level (mOD)	legend
							From 0.00m to 4.50m, borehole advanced by cable percussive drilling, see Fig. 2/5.1.					
21.6.91 am Dry	4.59		4.50		52 (17)	17	Grey highly weathered highly fractured thin laminae to very thin beds of grey SILTSTONE moderately weak with very closely to closely spaced thin laminae of grey-green silty mudstone weak. (Zone II MARL)	Fractures: Generally VIII 10° Firm clay (up to 20mm thick) on some fracture surfaces.		4.50 (1.00)	43.74	
			5.21		98 (75)	25	Grey slightly to moderately weathered highly fractured very thin beds of grey silty SILTSTONE moderately strong with very closely spaced thin laminae of grey-green silty mudstone weak. (Zone II MARL)	Fractures: Generally VII 15° and VIII 15° Clay smearing (less than 1mm thick) on some fracture surfaces.		5.50 (0.90)	62.74	
	4.59	N*= 750	6.47 - 6.55		89 (59)	19	Red brown slightly weathered moderately fractured thin to thick laminae of MUDSTONE weak with very closely spaced laminae of siltstone moderately weak. (Zone I MARL) Highly weathered to a clay with lithorelicts: 6.83m to 6.89m, 7.17m to 7.20m, 7.28m to 7.45m, 8.27m to 8.28m, 8.35m to 8.38m, 8.43m to 8.45m and 9.15m to 9.20m. (Zone III MARL)	Fractures: Generally VII 10° Clay smearing on some fracture surfaces. Occasional solution cavities up to 30mm diameter.		6.40 (3.14)	61.84	
			8.09		96 (71)	23						
			9.59		99 (59)	15	Descripton on Sheet 3			9.54 (10.00)	58.70 (58.24)	
	4.59	N*= 429	9.59 - 9.71				Continued on Sheet 3 in same stratum					

Equipment/Methods See sheet 1.

Remarks Fracture types: VII - rough planar; VIII - smooth planar.

GEL JOB NO. 2334N

FIGURE 2/5.2

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 915572 : BGS Reference: SJ88NW891
British National Grid (27700) : 381340,386150

Geotechnical Engineering Limited

BOREHOLE LOG

SJ88NW 891



CLIENT The Department of Transport
SITE M56 Widening, Junctions 4 - 6
DATE 13th to 21st June 1991

Easting: 5896.5 8094
Northing: 6055.5 8635
Ground Level 68.24m AOD

BOREHOLE CH 5(BH)
Sheet 3 of 3
Scale 1 : 50

progress/ water levels	casing (m)	SPT/ U70	depths (m)	core/ sample	TCR (SCR)	RQD	description Main	description Detail	tests	depth (m)	level (mOD)	legend
21.6.91							Continued from Sheet 2 in same stratum - description as Sheet 2 from 9.54m depth			(10.00)	(58.24)	
							Grey slightly weathered moderately fractured thin laminae to very thin beds of SILTSTONE moderately strong with very closely spaced thin laminae of grey-green silty mudstone moderately weak and grey sandstone moderately strong. (Zone I MARL)	Fractures: Generally VIII 15°				
			11.09									
pm 6.27m					98 (51)	12						
	4.59	N*= 429	12.00 12.00-12.13				Highly weathered to a clay with lithorelicts: 9.20m to 9.72m, 9.82m to 9.88m, 10.40m to 10.55m, 10.85m to 11.40m, 11.60m to 11.63m, 11.68m to 11.70m and 11.81m to 11.90m. (Zone III MARL)			12.00	56.24	
							End of Borehole at 12.00m					

Equipment/Methods See Sheet 1.

Remarks

GEL JOB NO. 2334N

FIGURE 2/5.3

Contact BGS: ngdc@bgs.ac.uk

Geotechnical Engineering Limited

BOREHOLE LOG

SJ 88 NW 909

CLIENT The Department of Transport
SITE M56 Widening, Junctions 4 - 6
DATE 8th to 9th July 1991

Easting: 5999.5 8105
Northing: 5926.0 8646
Ground Level 67.55m AOD

BOREHOLE CH 22
Sheet 1 of 1
Scale 1 : 50

progress/water levels	casing (m)	SPT/U70	depths (m)	core/sample	TCR (SCR)	RQD	description Main	description Detail	tests	depth (m)	level (mOD)	legend
8.7.91							TOPSOIL - Drillers description			0.10		
							FILL of red marl and brick. Drillers description			0.30		
			0.90	15	93 (63)	30	Red brown slightly weathered very highly fractured thinly to thickly interlaminated SILTSTONE moderately weak to moderately strong and silty MUDSTONE very weak to weak. (Zone II MARL)	Fractures: Generally VIII 5-10° Intensely fractured zones: 1.05m to 1.10m 2.68m to 2.68m 3.90m to 4.00m 4.25m to 4.30m				
			1.30	15	73 (0)	0						
			1.60				Highly weathered to a clay with lithorelicts: 1.50m to 1.60m and 2.12m to 2.20m (Zone III MARL)	Bands of moderately weathered mudstone: 2.48m to 2.53m 2.66m to 2.72m 3.15m to 3.28m 3.62m to 3.64m Thin bed of fine sandstone: 1.90m to 1.97m	S			
pm				65	94 (33)	0						
9.7.91 am 1.50m	0.00	N*= 300	2.80 - 2.93	67 45	0 (49)	0				(4.40)		
			3.80	75	96 (60)	0						
							Grey fresh highly fractured thinly to thickly interlaminated silty MUDSTONE weak and SILTSTONE moderately strong. (Zone I MARL)	Fractures: Generally VIII 5-10° Mudstone moderately weathered: 5.56m to 5.66m		4.70		
	0.00	N*= 375	5.30 - 5.40	50	105 (77)	22	Highly weathered to a clay with lithorelicts: 4.79m to 4.81m, 5.22m to 5.23m, 6.26m to 6.30m (Zone III MARL)			(2.20)		
			6.40	50	91 (20)	0	Red brown slightly weathered intensely fractured thinly to thickly interlaminated SILTSTONE moderately weak and MUDSTONE very weak (Zone I MARL)	Core generally non-intact.		6.90		
			7.50	75	103 (73)	50	Grey occasionally red brown slightly weathered highly fractured thinly to thickly interlaminated fine SANDSTONE moderately strong and MUDSTONE very weak. (Zone I MARL)	Fractures: Generally VIII 5-10° Also: 7.90m to 8.00m VII 75° Mudstone laminae often moderately weathered.		(0.70) 7.60		
							Highly weathered to a clay with lithorelicts: 7.88m to 7.90m, 8.14m to 8.18m and 8.60m to 8.62m. (Zone III MARL)			(2.40)		
	0.00	N*= 375	9.00 - 9.08	50	95 (55)	0						
pm 3.50m	0.00	N*= 375	10.00 10.00-10.09				End of Borehole at 10.00m			10.00		

Equipment/Methods: Borehole drilled by a Geotechnical Sitemaster rotary rig using a 116mm diameter core barrel with a rigid plastic liner to produce 90mm core from the base of an inspection pit at 0.90m to completion at 10.00m. Type of flush: Foam. Borehole backfilled with grout on completion.

Remarks: Fracture types: VII - rough planar; VIII - smooth planar.

GEL JOB NO. 2334N

FIGURE 2/22.1

British Geological Survey

BGS ID: 915591 : BGS Reference: SJ88NW910
British National Grid (27700) : 381320,386070

Geotechnical Engineering Limited

BOREHOLE LOG

SJ88NW 910



CLIENT The Department of Transport
SITE M56 Widening, Junctions 4 - 6
DATE 9th to 11th July 1991

Easting: 5890.5 8102
Northing: 5975.5 8635
Ground Level 66.67m AOD

BOREHOLE CH 23
Sheet 1 of 1
Scale 1 : 50

progress/water levels	casing (m)	SPT/ U70	depths (m)	core/ sample	TCR (SCR)	RQD	description Main	description Detail	tests	depth (m)	level (mOD)	legend
9.7.91 pm Dry							TOPSOIL			0.20		
							Red brown CLAY with much medium coarse sub angular gravel. (FILL)	Gravel includes siltstone and glass.		(0.25) 0.45		
10.7.91 am Dry			0.70	20	100 (38)	0	Pale greenish grey slightly weathered very highly fractured thinly to thickly interlaminated silty MUDSTONE very weak and SILTSTONE weak. (Zone II MARL)	Fractures: Generally VIII 5-10° Also: 0.97m to 1.01m, VIII 85° 1.38m to 1.45m VIII 85°		(1.05)		
			1.10	20	89 (55)	0	Highly weathered to a clay with lithorelicts: 0.80m to 0.88m (Zone III MARL)			1.50		
			1.55	65	97 (76)	30	Grey fresh to slightly weathered highly fractured very thinly to thinly bedded fine SAND-STONE strong with closely spaced thin to thick laminae of mudstone.	Fractures: Generally VIII 5° 1.82m to 1.92m VII 85° Intensely fractured zones: 1.90m to 1.95m 3.45m to 3.50m Several of the mudstone laminae have been highly weathered to a stiff clay.		(3.10)		
	0.00	N*= 375	2.95 - 3.03	80	94 (90)	51						
pm 11.7.91 am 3.20m			4.45	20	87 (40)	37	Red brown fresh to slightly weathered highly to very highly fractured thinly to thickly interlaminated SILTSTONE weak to moderately weak and fine SANDSTONE moderately strong with closely spaced of thin laminae of mudstone.	Fractures: Generally VIII 5° Also: 4.95m to 5.10m II 80° with a 5-10mm thick clay fill. Surrounding rock generally moderately weathered.		4.60		
			4.75	70	94 (40)	0						
	0.00	N*= 375	6.25 - 6.35	65	92 (40)	8				(3.15)		
			7.50		89 (56)	9 75	Grey fresh highly fractured thinly to thickly interlaminated silty MUDSTONE very weak to weak and SILTSTONE moderately weak. (Zone I MARL) Highly weathered to a clay with lithorelicts. (Zone III MARL)	Fractures: Generally VIII 5°		7.75		
	0.00	N*= 500	9.00 - 9.07	60	110 (85)	20	Grey fresh to highly fractured very thinly to thinly bedded fine SANDSTONE moderately strong to strong with closely spaced thin laminae of mudstone.	Fractures: Generally VIII 5 ° 9.60m to 10.00m II, 85°		9.50 (0.50) 10.00		
			10.00				End of Borehole at 10.00m					

Equipment/Methods: Borehole drilled by a Geotechnical Sitemaster rotary rig using a 116mm diameter core barrel with a rigid plastic liner to produce 90mm core from the base of an inspection pit at 0.70m to completion at 10.00m. Type of flush: Foam. Borehole backfilled with grout on completion.

Remarks: Fracture types: II - smooth stepped; VII - rough planar; VIII - smooth planar.

GEL JOB NO. 2334N

FIGURE 2/23.1

Contact BGS: ngdc@bgs.ac.uk

Appendix F
PHOTOGRAPHIC RECORD

PHOTOGRAPHIC LOG

Photo no.	**Date:**
1	17/10/2025



Description:

Overview of car park area (northern part of eastern parcel)

Photo No.	**Date:**
2	17/10/2025



Description:

Storage of wall insulation material in eastern parcel of site.

Photo No.	Date:	
3	17/10/2025	
Description: Telecommunications towers and cctv posts in eastern parcel of site.		

Photo No.	Date:	
4	17/10/2025	
Description: Storage container style cabin in eastern parcel of site.		

Photo No.	Date:	
5	17/10/2025	
Description: Overview of southern part of eastern parcel of the site.		

Photo No.	Date:	
6	17/10/2025	
Description: Culverted surface water feature along northern boundary of western parcel of the site.		

Photo No.	Date:
7	17/10/2025



Description:

Entrance to western parcel of the site off Thorley Lane.

Photo No.	Date:
8	17/10/2025



Description:

Electronic barriers and storage container style site cabin.

Photo No.	Date:	
9	17/10/2025	
Description: Overview of car park in western parcel of the site.		

Photo No.	Date:	
10	17/10/2025	
Description: Fenced off grassy soft cover area in western parcel of the site.		

Photo No.	Date:	
11	17/10/2025	
Description: Storage container style cabins		

Photo No.	Date:	
12	17/10/2025	
Description: Road leading to M56 to the south of the site.		

Appendix G
SITE RECONNAISSANCE SURVEY NOTES

Feature observed	Presence Y/N	Description
Physical characteristics		
1. Are there any access constraints?	Y	a) Area in the southern part of the eastern parcel of the site is accessed via a locked herras gate. Some areas within the western part of the site are fenced off. Electronic barriers on entry to western parcel of the site.
	-	-
2. Is the site approximately level?	Y	Both parcels of land are relatively topographically flat.
3. Any evidence of subsidence, landslip or slope erosion?	N	-
4. Any changes in level between the site and adjacent sites?	Y	Retaining wall on adjoining sides of enterprise way due to embankment.
5. Surface cover	-	a) Approx. 60% hard surfacing.
	-	b) Approx. 40% hard surfacing.
	-	c) hardcover tarmacked roadways and footpaths, hardcover aggregate fill beneath parking bays. Some areas of soft landscaping and entire southern area of eastern parcel surfaced with grassy soft cover.
Environmental characteristics		
6. Vegetation on site	Y	Shrubbery, trees on site boundaries and grassy vegetation.
7. Evidence for vegetation stress	N	-
8. Invasive species	N	Based upon the walkover survey obvious evidence of Japanese Knotweed or other invasive species has not been identified on-site. However, it should be noted that a detailed survey of the possible presence or absence of invasive species is outside of the scope of investigation and consideration should be given to commissioning a specialist survey, as necessary.
	N	-
Site visit undertaken in dormancy period?	Y	Site visit in October (dormancy period for invasive species).
9. Surface water features	Y	a) Culverted unnamed water course along northern boundary of the site.

Feature observed	Presence Y/N	Description
	Y	b) Baguley Brook and Fairywell Brook. Unobservable on walkover.
	-	-
10. Site drainage	-	a) Manhole covers spread across site, likely natural drainage or into public sewerage system.
	N	b) Manhole covers across the site
	Y	c) Outfall on northern boundary of the western parcel of the site.
	-	-
Structures and services		
11. Existing buildings on-site	Y	a) The site features multiple storage unit style temporary buildings on both parcels of the site.
	N	-
12. Buried and overhead services present	Y	a) Various manhole covers across the site.
	N	-
13. Underground structures	Y	Large circular drainage infrastructure (storm drains?/access to public drainage systems)
Geotechnical characteristics		
14. Evidence of damage to existing building structures on site?	N	-
15. Remains of building structures present on or adjacent to site?	N	-
16. Retaining walls and adjacent buildings on or close to site boundary?	Y	Alongside Enterprise Way
17. Any abrupt changes in ground level present on or adjacent to site?	Y	Embankment to south of enterprise way
18. Any potentially unstable slopes/exposed ground present on or adjacent to site?	N	-
19. Any mature trees on site?	Y	Along southern boundaries
20. Any visual evidence of infilled basements on site?	N	-

Feature observed	Presence Y/N	Description
Potential evidence for contamination		
21. Underground/above ground storage tanks and pipework	N	-
22. Potentially hazardous materials storage and use	N	-
23. Waste storage	N	-
24. Fly-tipping	Y	Construction insulation wall material in eastern part of the site. Various general waste across site.
25. Electricity sub-stations/transformers	Y	Radio transmitter box on northern boundary of western parcel of the site.
26. Asbestos-containing materials	N	-
27. Fire suppression	N	-
28. Fire history	N	-
29. Is there any visual evidence of potential contamination on site?	N	-
30. Is there any visual evidence of potential contamination on adjacent sites?	N	-

Appendix H
TECHNICAL BACKGROUND

Desk Study

Aquifer designation and Source protection zones (England and Wales)

Principal aquifer: layers of rock or drift deposit that have high intergranular and/or fracture permeability (usually providing a high level of water storage). They may support water supply and/or river base flow on a strategic scale.

Secondary A aquifer: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

Secondary B aquifer: predominantly lower permeability layers that may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Secondary undifferentiated aquifer: it has not been possible to attribute either a category A or B to a rock type. In most cases this means that it was previously designated as both a minor and non-aquifer in different locations owing to the variable characteristics.

Unproductive strata: low permeability with negligible significance for water supply or river base flow.

The EA generally adopts a three-fold classification of source protection zones (SPZ) surround abstractions for public water supply. The Site is situated in an area defined as follows:

- Zone 1 or the 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- Zone 2 or the 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants
- Zone 3 or the 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Future climate change considerations

Several data sources, based on UKCP18 data, are available with which climate change projections can be viewed. These are detailed in the following table. In order to enable a consistent approach in our risk assessment we have based our initial assessment on data available for RCP8.5 data for the far future (2080s) for an initial conservative risk screen.

Climate change induced effect	Source	Notes	Comment
Temperature	https://uk-cri.org	RCP 8.5 average temperature maps for far future (2071-2100), UKCP18 Regional,	Anticipated to be conservative. It has been assumed that a change of +/- 5% is unlikely to have a significant impact

Climate change induced effect	Source	Notes	Comment
		median, 12 x 12 km spatial resolution	
Rainfall/recharge	https://uk-cri.org	RCP 8.5 annual rainfall for far future (2017-2100), UKCP18 Regional, median, 12 x 12 km or Local Authority spatial resolution	Anticipated to be conservative. It is anticipated that a change of +/- 5% is unlikely to have a significant impact for all sites. If a site is located in an urban area away from sensitive dependent receptors then a change of +/- 10% is unlikely to have a significant impact.
Flood risk maps for England/ Wales/Scotland	https://check-long-term-flood-risk.service.gov.uk/risk (England), https://flood-map-for-planning.naturalresources.wales (Wales), **https://map.sepa.org.uk/floodmaps/FloodRisk/FutureFloodMaps** (Scotland)	Future flood maps are only available for England and Scotland.	Identify areas likely to be affected or at an increased risk from future flooding
Coastal erosion	https://www.gov.uk/check-coastal-erosion-management-in-your-area (England), https://naturalresources.wales/flooding/check-your-coastal-erosion-risk-national-coastal-erosion-risk-management-map/?lang=en (Wales), **https://www.dynamiccoast.com/webmaps** (Scotland)		Predicted coastal erosion rates. Includes for potential future scenarios to show how erosion may increase with rising sea levels because of climate change based on UKCP18 projections for a high missions scenario.
Shrink and swell potential	BGS Geoindex layer for GeoClimate UKCP18	GeoClimate UKCP18 (2030 to 2070)	Impossible, possible or probable that foundations will be affected by increased clay-shrink-swell

Preliminary risk assessment methodology

LCRM outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) contaminant linkages (contaminant–pathway–receptor) and is used as the basis for the design of the site investigation. The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the

likelihood and the consequences of an event must be taken into account when assessing risk. RSK has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

- highly likely: the event 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
- likely: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
- low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
- unlikely: circumstances are such that it is improbable the event would occur even in the long term.

RSK also adopt a 'very unlikely' probability to account for where there may be increased certainty over whether an event is probable in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- severe: short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)
- medium: chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem
- mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
- minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the probability of an event occurring and its consequences have been classified, a risk category can be assigned according to the following:

		Consequences			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**Highly likely**	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
	Very Unlikely	Low	Very Low	Negligible	Negligible

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

- very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required
- high: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term
- moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term
- low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild
- very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.

Site Investigation Methodology

Ground gas monitoring

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

Low flow groundwater sampling

Groundwater samples were retrieved using a low-flow purging and sampling methodology

The low-flow method relies on moving groundwater through the well screen at approximately the same rate as it flows through the geological formation. This results in a significant reduction in the volume of water extracted before sampling and significantly reduces the amount of disturbance of the water in the monitoring well during purging and sampling. Drawdown levels in the monitoring well and water quality indicator parameters (pH, temperature, electrical conductivity, redox potential and dissolved oxygen) are monitored during low-flow purging and sampling, with stabilisation indicating that purging is complete and sampling can begin. As the flow rate used for purging, in most cases, is the same or only slightly higher than the flow rate used for sampling, and because

purging and sampling are conducted as one continuous operation in the field, the process is referred to as low-flow purging and sampling.