PHASE 2 DEVELOPMENT
NEW ISLINGTON
MANCHESTER

GEOTECHNICAL REPORT



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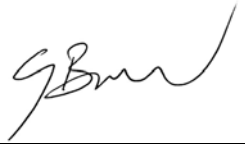
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EXECUTIVE SUMMARY

Site Location:	North and west of Old Mill Street, Ancoats, Manchester. NGR 385263 E, 398522 N.
Site Area:	Approximately 7,300m^2.
Current Land Use:	Open undeveloped ground bordered by a canal and residential buildings/roads.
Proposed Development:	20 three storey houses. 1 six storey building to create 44 self-contained residential apartments. 1 six storey apartment building to create 40 self-contained residential apartments on the first to fifth floors with non-residential uses (commercial / retail) at the ground floor. Associated car parking, landscaping and boundary treatments.
Purpose of Report:	This report is a Geotechnical Assessment. This report reviews previous information, assesses & discusses findings of site and ground investigations and recommends ways to take the project forward in terms of foundations and geotechnics. The scope includes: • Ground and groundwater conditions. • Identification and assessment of potential geohazards. • Site constraints. • Ground conditions adjacent to shooters brook culvert. • Assessment of the complexity of the ground conditions and proposed development. • Management of geotechnical risk.
Previous Information	Site history, geology, desk studies, geotechnical reports and borehole logs.
Findings of Desk Studies	• Site has a 19th Century industrial legacy of former canals, mills, workshops and residential housing. An old canal (backfilled) ran through the site. • The local geology is Glacial till and Manchester Marl (mudstone). Bedrock is envisaged to be at a depth of *circa* 30mbgl.
Geotechnical Complexity	The proposed development, the site and the encountered ground conditions has been assessed as **GC2 (**Geotechnical Category 2).
Made Ground	Extent and Thickness • Made Ground covers entire site. Thickness ranges 1.9m (NE of site) to 8.7m adjacent to the canal basin (SW of site). Suitability for foundations • This material is unsuitable for founding in unless significant ground improvement measures are carried out. Description • Soft to firm to stiff sandy gravelly CLAY with ash, brick, clinker, concrete, coal, tarmac, masonry, plastic & wood. Buried walls, brick and concrete foundations, large lumps of concrete/masonry, and former roads at various depths. SPT N values range from 3 to 22, average of 12.
Drift Deposits	Depth and Thickness • Top of drift ranges in depth from 1.9mbgl to 8.7mbgl, from 45.9mAOD to 40.75mAOD. Base of drift (top of bedrock not encountered during this investigation). Suitability for foundations • Suitable for spread foundations in areas where the Made Ground can be excavated. Will provide excellent bearing capacity for pile and deep foundations. Description: • Stiff to very stiff (occasionally firm) sandy gravelly CLAY (glacial till) with interbeds of dense to very dense gravelly SAND (fluvioglacial deposit). • SPT N values in the drift range from 14 to 50 (average 40) and below the elevation of 40mAOD SPT N ranges 30 to 50 (average 42). SPTs demonstrate increasing shear strength with depth. • Undrained shear strength measured in UU triaxial tests varies from 53 kPa to 415 kPa, average 149 kPa which concurs with previous reports. Interbedded with the stiff to very stiff glacial till are thin beds of less strong clay (possibly to thickness of up to 1.0m) with lower shear strength than surrounding formation,.
Bedrock	Bedrock not encountered during fieldworks. Deepest on-site borehole was sunk to 29.2mAOD (20mbgl) and terminated in drift deposits.
Groundwater	Piezometric Level 1: • *Circa* 45mAOD - Perched water table on top natural ground and within the Made Ground or at the base of the Made Ground. Piezometric Level 2: • *Circa* 33.3mAOD in glacial sand/gravels. Exhibits slight sub artesian pressure.

Geohazards	• Potentially compressible Made Ground - soft and very clayey and of variable thickness. • Obstructions to sinking of piles - Buried relic foundations, floor slabs and walls. • Increased stress on existing adjacent and underlying structures: e.g. stress overlap on existing stressed ground under existing foundations and piles (i.e. Shooters Brook and pile canal wall). • Weaker strata of potentially softer clay within glacial till – to avoid setting pile toe in this softer stratum. • Inflowing groundwater during emplacement of cast in situ bored piles causing hollows and concrete washout. • Downdrag forces from soft clayey Made Ground increasing pile loads and settlement. • Low surface CBR strength of saturated clayey Made Ground for highways, car parking areas, delivery areas and other loaded areas. • Thick layer of relatively weak Made Ground with low lateral stiffness and strength – in relation to 6 storey apartments and horizontal and rotational forces transmitted into the ground. • Potential for contaminated Made Ground and backfill.
Recommended Foundation Solution	• Piled foundations are necessary due to thickness and variable nature of Made Ground. • The appointed specialist piling contractor will optimise pile design such as pile grouping per pile cap, pile diameter & spacing, pile cap settlement, and socket lengths to suit from the SI data.
Potential Hazards to Pile Emplacement	Pile emplacement will require boring techniques that will successfully penetrate buried obstructions such as relic foundations, buried floor slabs and walls, bricks, blocks etc.
Piled Foundations - General Considerations	• Friction Piles set in the glacial till is acceptable. • It is likely that bedrock will be too deep to utilise in pile designs. • Pile designs will require consideration of downdrag forces due to potential time dependent settlement of the Made Ground. • Interbedded with the stiff glacial till are thin beds of less strong clay (possibly to thickness of up to 1.0m) with lower shear strength than surrounding formation, thus it is recommended that this formation is avoided for founding of the pile toe • The piles adjacent to Shooters Brook culvert and retaining walls supporting the canal system will require sleeving to avoid overlapping existing stress zones on these structures and their foundations. These piles adjacent to the existing culvert and canal walls will be founded in the deeper very stiff/very dense glacial till below the culvert and/or piled walls.
Pile Configurations	<u>Anticipated Pile diameters:</u> • 600mm or 450mm diameter for the 6 storeys apartments. • 300mm for the 3 storey houses. <u>Anticipated Pile Lengths for 6 storey blocks</u>: • 16m or 17m may be necessary due to thick deposits of potentially compressible Made Ground and sleeving requirement adjacent to Shooters Brook culvert. • For piles installed away from the stress overlap zones of the canal retaining walls and the culvert it is envisaged that pile lengths will be 13m to 14m. <u>Anticipated pile designs for 3 storey blocks:</u> • Total of 20 No. individual houses. It is envisaged that piles will require approximately 5m of natural ground to mobilise sufficient strength to support the loads. Total pile length will vary according to thickness of Made Ground, i.e. pile lengths will be up to 10m in length. • A special case exists for 3 properties in the far SW of the site because these properties overlie Shooters Brook. Ground beams spanning the culvert with supporting piles to depths below the influence zone. Pile toes will be founded circa 33mAOD which will require a total pile length of up to 16m for these properties. In this case, it may be prudent to re-configure the site layout so that these 3 properties do not overlie the culvert
Floor Slabs	Made Ground is variable with depth and laterally across the site and structures founded on it will have a high risk of settlement and differential settlement, thus ground bearing floor slabs are not recommended.
Site Constraints - Shooters Brook Culvert	<u>Construction Constraint:</u> • Victorian brick lined combined sewer 1.5m in diameter. Invert level 37.07mAOD. The proposed 6 storey block (block 02) overlies this culvert together with 3 ‘low-rise’ properties of block 01. <u>Future Constraint:</u> • Access to this culvert for maintenance and/or repair.
Site Constraints - Existing Canal	The canal basin has a piled retaining wall. The installation of the piles has probably disturbed ground adjacent to Shooters Brook culvert increasing infiltration potential to the culvert. It is recommended not to build over the culvert adjacent to the canal until the culvert is remediated

Pavements	Design CBR: 5% for sub-grade at 450mm below existing ground level (assumes soft spots removed and appropriate moisture contents at time of construction).
Earthworks	The difference in existing ground levels between NE and SW of site is circa 2.75m. Imported granular capping material and selected granular fill will be required to upfill site roads and housing plots to final formation levels.
Mining and Mine Workings	The site is not within a Coal Authority Development High Risk Area or has shafts within 20m of the site boundary.
Temporary Works	• Access restrictions to the site for large construction plant considering the residential nature of the surrounding environs. • Piling platform for the piling operations. Bringing the material on site and either taking it off site on completion or re-using it on site. • Excavations will require support. • Water table is generally low (4mbgl to 5mbgl) but perched water seepages can be expected at relatively shallow depths (0.3mbgl) as observed in TP02. Small scale dewatering may be necessary for near surface excavations.
Concrete Class	Design Sulfate Class for site: DS-2. ACEC Class for site: AC-2
Water Service Supply	Protect against PAH and Phenol using standard water utility guidance.
Soakaway	Initial observations at the site are that the thick deposits of clayey Made Ground underlain by relatively impermeable glacial till will not be suitable for soakaway.
Geotechnical Residual Risk	1. Shooters Brook Culvert (invert 37.07mAOD at manhole no. 30) and compliance to Sewerage Undertaker's requirements for building over or next to main public sewers. Compliance may require 'remedial works' to the existing culvert. 2. Avoidance of disturbance of ground supporting or 'lining' the brick Victorian culvert during installation of piles. 3. Avoidance of imposing increased stress to canal retaining wall system from proposed installation of piles and avoidance of disturbing ground supporting the walls during piling operations. 4. Avoidance of imposing increased stress on the culvert due to the loadings of proposed overlying structures. 5. Access to Shooters Brook culvert for future maintenance and/or repair works. 6. Buried obstructions in the Made Ground during boring of piles (concrete/masonry blocks, relic foundations and walls etc). Glacial boulders in the drift. 7. Risk of inflowing water in the sands & gravels while boring cast in situ piles and risk of hollowing of pile and erosion of concrete during emplacement. 8. Allowance in pile design for downdrag forces in the Made Ground. 9. Deeper SI investigation including rotary drilling may be required if the piling contractor deems it necessary for optimisation of piling design.
Recommendations	• It is not recommended to build over the culvert or disturb the ground immediately in the vicinity of the leaking culvert until the infiltration and culvert is remediated. • The piling methods need to have the ability to bore through obstructions such as blocks, relic walls, bricks and relic foundations. • The location of the 3 storey houses overlying Shooters Brook culvert be moved to another location not affecting the culvert • A full condition report should be carried out of the canal for future reference and potential disputes prior to any works commencing. • All the proposed buildings are to be founded on piles. Accordingly it is recommended that the services of a suitably qualified and experienced piling contractor be sought at the earliest instance. • Allowance in pile design for downdrag forces in Made Ground. • Regarding piled foundations for the 6 storey apartments; an allowance should be made in the designs for lack of lateral stiffness and low shear strength in the thick deposits of relatively weak Made Ground • It is recommended that beds of less strong clay recorded in the borehole logs not be used as founding strata for pile toes. • Ground bearing floor slabs are not recommended due to high risk of settlement and differential settlement in Made Ground. • It is recommended that a new site access is opened and the existing one at the back of Coppersmith Road be permanently closed. • Piling platform for the piling operations will be required. It is recommended that this material is re-used and/or incorporation into permanent works. • It is recommended that the applications for discharge of surface water and sewerage be sought at the earliest instance.

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1 INTRODUCTION

1.1 Background

LK Consult Ltd (LKC) has been commissioned by Urban Splash to carry out a Phase 2 geo-environmental investigation and risk assessment on the Phase 2 Development Site at New Islington, Manchester.

This report considers the geotechnical aspects of the investigation. For the geo-environmental aspects refer to documents LKC 16 1334-01 'Phase 1 Preliminary Risk Assessment' and LKC 16 1334-03 'Geo-environmental investigation and risk assessment' which are issued separately.

The geotechnical investigation is concerned with obtaining ground conditions, identifying potential and actual geohazards, determining the ground model and establishing representative and characteristic ground values for the purpose of geotechnical design. A key objective of the investigations and geotechnical appraisal is to identify geotechnical risk at the site and provide recommendations to effectively manage geotechnical risk during construction and design life of the development.

1.2 Site Detail

A summary of the site details is presented in Table 1-1. The site location and boundary are presented in Figures 1 and 2, and proposed development is presented in Figure 3.

Location	Land south of Winders Drive, New Islington. Nearest postcode M4 6AS. Centred at approximate National Grid Reference 385310E 298530N.
Area	0.73 Ha.
Topography	Approximately 46-50 metres above ordnance datum (AOD). Site is generally flat. However, there is slope down to the northeast corner and a steep bank up to Coppersmith Road.
Current Land Use	Site The site currently comprises disused ground with evidence of earthworks, construction materials and site cabins. Surrounding Area North, Northwest and Northeast: Residential Properties. Southeast: Undeveloped Land. South and Southwest: New Islington Marina and canal.
Proposed Development	Planning Application No. 111587/FO/2016/N1: 20 three storey houses. 1 six storey building to create 44 self-contained residential apartments. 1 six storey apartment building to create 40 self-contained residential apartments on the first to fifth floors with non-residential uses (commercial / retail) at the ground floor. Associated car parking, landscaping and boundary treatments.

Table 1-1. Summary of site details.

2 ACCOMPANYING WORK

Accompanying LKC reports including 'Phase 1 Preliminary Risk Assessment' (Ref LKC 16 1334-01 R1 dated December 2016) and 'Phase 2 Contamination Investigation, Risk Assessment and Remediation Strategy' (LKC 16 1334-03 R0 dated March 2017) include the following information:

- Coal Authority Mine Risk Report (CA CON29M Non-Residential Mining Report# 51001291002002 (22 November 2016) New Islington Manchester Greater Manchester).
- Envirocheck Digital and Background Information (geological, historical, mapping, ordnance survey, mining, flood risk, radon risk, landfill sites etc).
- Review of previous Ground Investigations on or near the site.
- Additional Borehole information taken from British Geological Society.
- Geo-environmental and Contamination Risk Assessment.
- Site photographs.
- Gas monitoring and site monitoring records.
- Gas Risk Assessment.

Selected information relating to the geotechnical appraisal have been utilised in this report and summarised in the following Sections. LKC advise that these reports are read in conjunction with this geotechnical appraisal.

2.1 Site History and Geology

Extracts of significance to the geotechnical appraisal are presented in Tables 2-1 and 2-2 together with pertinent historical maps (Plates 2-1 and 2-2). On site historical features are summarised in Figure 4.

Site Features	Location	Map Dates Present	Comments
Canal / Cannel Street	Centre	1848-1969	- Road running SW-NE through the centre of the site.
Cotton Mills / Engineering Works (1)	W	1851-1969	- Two Cotton Mills, including Perseverance Mill in the far west from 1851 mapping. No longer named from 1908 mapping, however industrial buildings remain. - Named as Engineering Works from 1922 mapping. - Detailed historic building plans from 1928 show name 'Bratby & Hinchliffe Ltd Aerated Water Engineers' and 'Westmacott & Son Chemist & Mineral Water Fac.' Various building shown including warehouses, testing rooms, drugs rooms, paint shop, bottling rooms, store and stables. - Western part of works cleared by 1962 mapping. Part of site may include 'A.L. Starkie Ltd Welding & Constructional Engineers'. - Named as Works / Engineering Works from 1965 mapping.
Canal Street Dye Works (2)	SE	1851-1922	- Including a number of buildings, tanks and chimneys. - Shown as disused on 1908 mapping. - Buildings remain on 1922 mapping but no longer named.
Reservoirs (3)	S	1851 only	- Associated with Canal Street Dye Works. No longer present on 1891 mapping.

Table 2-1: Summary of historical features. See Figure 4 for location of numbers.

Site Features	Location	Map Dates Present	Comments
Glass Works (4)	NE	1891-1969	- Named as Manchester Flint Glass Works from 1891 mapping. Including a number of buildings and chimneys. - Named as 'Molineaux Webb & Co Ltd Glass Works' on 1928 detailed historic building plan. Includes mold stores, sand store, barrel store and ruin. - Named as Kirby Street Glass Works from 1948 mapping. - Named as Warehouse, Works and Depot from 1965 mapping.
Canal branch and Dock (5)	E	1851-1969	- Running SW-NE and terminating approximately at the NE site boundary. - Extension (Dock) towards Canal Street. - By 1891 mapping reduced in size and Dock no longer present.
Dock Yard (6)	SE	1851 only	- Between Dock and Canal Street Dye Works.
Terraced buildings	Centre & N	1851-1969	- Along the E and W of Canal Street.
Church / Play Ground / School Grounds (7)	W	1851-1969	- West side of Canal Street. - Site boundary encroaches the corner of the St Judes Church from 1851 mapping. - Shown as Play Ground from 1891 mapping. - Shown as school grounds from 1948 mapping.
Stables / Garage (6)	E of Centre	1928-1969	- East of Canal Street. Formerly a dock yard. From 1928 mapping includes a number of stables and a straw store. Named as 'James Hancock Carrier'. - 1962 mapping, still shown as 'James Hancock Carrier' but includes garages, workshop and stores. - Shown as Works / Depot by 1965 mapping.
Factory / Works / Yard (2)	SE	1928-1969	- Former location of Dye Works. - Includes a picture frame factory, clothing works, yard, travelling crane, dried fruit warehouse, textile warehouse, cane basket warehouse. - Site cleared by 1974 mapping.
Public House (8)	N	1851-2009	- Named as Colliers Arms from 1851 mapping. At the corner of Canal Street and Kirby Street in the N corner of the site. - Public House still present following 1970s development. Layout different suggesting possible new build from 1978 mapping. - No longer present on 2013 mapping.
1970's Residential Development	Whole Site	1978-2000/2009	- Whole site redeveloped (with the possible exception of the public house in the north) by 1978 for residential use including apartments in the W of the site (William Murray Court), houses in the centre and E with associated roads, car parking and landscaping. - Winder Drive runs through the centre / W of site in a SW-NE direction. - By 2000 (aerial photograph) the apartments in the W have been demolished and land shown as open space (grass). - By 2006 mapping, some of the houses in the W have been demolished. - By 2009 mapping, site cleared with the exception of the N part of Winder Drive and the public house in the N. - Whole site cleared by 2013.

Table 2-1 (cont.): Summary of historical features. See Figure 4 for location of numbers.

Categories			Details
Geology	Artificial		- None recorded on site.
	Superficial		- Till (Diamicton).
	Bedrock		- Manchester Marls Formation (mudstone).
Minerals / Mining	Coal Mining Development High Risk Area (DHRA)		- Not within DHRA.
	Coal Report		- Could be affected by underground mining in 4 seams of coal at 350-1090m depth, last worked in 1961. Any ground movement due to coal mining should have stopped. - No known mine entries within, or within 20m of, the site.
	BGS Recorded Mineral Sites		- None within 500m. Nearest underground is Ardwick Lime Works Pit 772m SE (Great Mine Limestone), ceased. Nearest surface is Alderman Street Brick Works 927m SE (Till, Devensian (clay and shale)), ceased.
	Cheshire Brine Compensation District		- Not within site area.
Hydro-geology	Aquifer Designation	Superficial	- Secondary Undifferentiated (superficial).
		Bedrock	- Secondary B.
	Source Protection Zone (SPZ)		- Site is not within an SPZ.
	Groundwater Abstractions		- None within 500m.
Ground Stability (on-site)			- No hazard: compressible ground, ground dissolution. - Very low hazard: collapsible ground, landslide, running sand, shrinking / swelling clay.
Landfill sites	Known/Registered		- None within 250m.
	Potential		- 9 potentially infilled water features 0-250m (canal arms/basins). Varying dates of infill. - Potentially infilled prior to 1891 a/ reservoirs on site and b/ brickfield adjacent to the west of the site.
Hydrology	Nearest Surface Water		- Adj to SW and NW – New Islington Marina and canal. - Shooters Brook Culvert approximately 11mbgl deep and 1500mm diameter. Brick construction.
	Water Quality Data		- Rochdale Canal 83m NW – River Quality B.
	Flooding		- No risk identified.
	Surface Water Abstractions		- None within 500m.
	Discharge Consent		- 2 within 250m: both consents revoked.
	Pollution Incidents		- 9 within 250m (all minor incidents). Nearest 116m E, unknown pollutant associated with a fire.
Radon			- Probability of <1% of homes above Action Level. No further action required.
Designated Sites			- None within 250m.

Table 2-2. Summary of the Environmental Setting

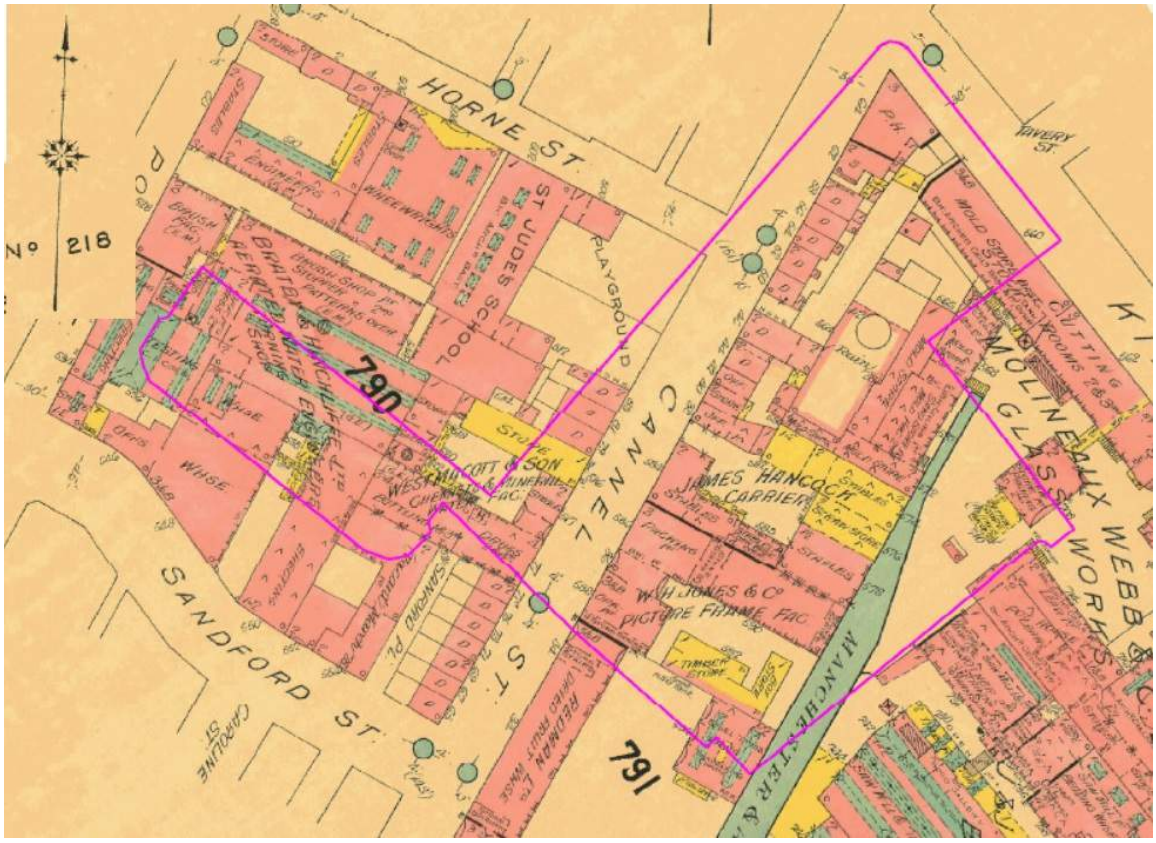


Plate 2-1. Historical Map 1928 Showing Position of Islington Branch Canal.

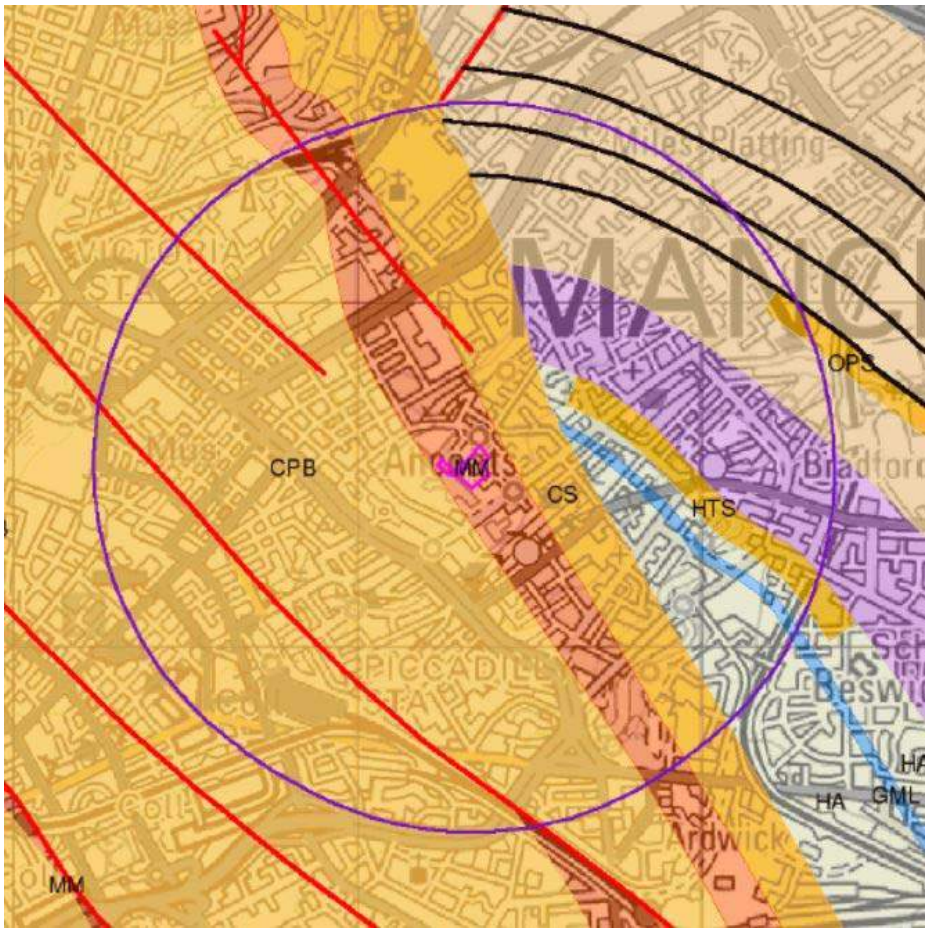


Plate 2-2. Geological Map Showing Site Overlying Manchester Marls.

3 SITE RECONNAISSANCE

A site reconnaissance was carried out on 22nd December 2016. Photographs are provided in the separately issued LKC report, Phase 1 Preliminary Risk Assessment, LKC 16 1334-01, December 2016.

Relevant features identified on site are summarised below:

- Canal basin and canal retaining wall bounds site to SW
- Several manholes on site indicating underground drainage/sewerage
- Canal levels rising from time to time flooding surrounding lower areas (canal spillway gets blocked raising water levels in the canal)
- Boggy wet ground adjacent to canal basin
- Site comprises open land with limited vegetation cover.
- Site is generally flat but elevation is about 2 metres difference between the northern eastern boundary and south eastern part of the site and a steep bank up to Coppersmith Road. Elevation of the ground adjacent to the canal basin is approximately 49.4m AOD.
- New housing present to the southeast, northwest and northeast.
- Access to the site is restricted due to surrounding residential area and narrow roads and canals.
- Surface soils (clayey Made Ground) become soft and turn to mud in wet weather when trafficked. Plant causes deep rutting and mud on the road when leaving site which requires road sweeping.

4 GROUND INVESTIGATION

4.1 Site Investigation Design and Methodology

Fieldworks during the main investigation were carried out between 9th December 2016 and 23rd December 2016 and comprised the following scope of works:

- 7 trial pits (TP101-TP107) excavated by wheeled machine excavator to maximum depth 3.8mbgl. Bulk sampling for geotechnical testing and environmental sampling for contamination testing.
- 7 cable percussion boreholes (CP101-CP107) to depths ranging between 12mbgl and 20mbgl. CP101 to 17m, CP102 to 14m, CP103 to 20m, CP104 to 20m, CP105 to 12m, CP106 to 14m, CP107 to 14m. Undisturbed U100 sampling in fine grained soils for geotechnical testing. Disturbed sampling and split spoon SPT sampling. Dual standpipes for groundwater monitoring were installed in 3 boreholes and designed to specific response zones at deep and shallow depths.
- 3 windowless sample boreholes (WS101-103) to maximum depth 5.45mbgl. Environmental sampling for contamination testing. Standpipes installed in the boreholes to a maximum depth 4.5mbgl for gas monitoring.
- 10 Dynamic Cone Penetrometer (DCP) (DCP1-5 and DCP7-10) probe holes to maximum depth 0.98mbgl

Supplementary Fieldworks carried out between 1st February and 9th February 2017 comprised the following:

- 3 No. cable percussion boreholes (UUCP101-UUCP103) to circa 12mbgl along alignment of Shooters Brook culvert. Single standpipes for groundwater monitoring were installed in 3 No. boreholes and designed to specific response zones at depth. Falling Head tests were carried out in the boreholes.
- 3 No. soakaway tests (S101 to S103) in trial pits.

Cable percussion and window sample borehole logs and trial pitting logs are presented in Appendix A. Borehole and sampling locations are presented in Figure 5 and historical borehole locations in Figure 6.

4.2 Sampling

The following samples were collected from trial pits, window samples and cable percussion boreholes between 9th December 2016 and 23rd December 2016:

- 44 bulk and disturbed bulk samples were collected for soil descriptions and laboratory soil classification testing.
- 23 undisturbed U100s were taken, sealed in wax and sent to the laboratory for Triaxial Testing.

The following samples were collected from cable percussion boreholes during the supplementary fieldworks carried out between 1st February and 9th February 2017:

- 17 bulk and disturbed bulk samples were collected for soil descriptions and laboratory soil classification testing.
- 9 undisturbed U100s were taken, sealed in wax and sent to the laboratory for examination for signs of water erosion and/or UU Triaxial Testing.

- 4 pinhole dispersive tests were also carried out on clay soils recovered from the undisturbed samples at approximately 8m, 9.5m, and 11m below ground level in boreholes UUCP101, UUCP102 and UUCP103.

4.3 In Situ Testing

The following in situ tests were undertaken:

- 84 Standard Penetration Tests (SPT) were carried out down hole at various depths in cable percussion boreholes and 13 SPTs in the windowless boreholes.
- 3 soakaway tests in trial pits (carried out in February 2017)
- 8 falling head tests were carried out in UUCP101 to UUCP103 (carried out in February 2017).
- Hand shear vane tests were undertaken in trial pits and window samples.

4.4 Borehole Installations

All 3 of the window sample boreholes (WS101-WS103) were installed with 50mm monitoring standpipes for gas and groundwater monitoring. 3 of 7 cable percussion boreholes (CP101, CP104 and CP105) were installed with dual standpipes for gas and groundwater monitoring. Supplementary boreholes UUCP101 to UUCP103 were installed with deep standpipes to target ground adjacent to the Shooters Brook culvert. Monitoring wells were installed in accordance with BS5930[1].

Dual wells were installed in cable percussion holes sunk in December 2016 incorporating a shallow well to target made ground and a deep well to target natural ground.

Wells within window sample holes and the shallow wells within cable percussion holes generally comprised approximately 1m plain pipe over a length of slotted pipe surrounded by pea gravel and sealed at the top with bentonite and concrete. The deep wells within cable percussion holes comprised between approximately 4m and 10m of plain pipe over a length of slotted pipe surrounded by pea gravel and sealed at the top with bentonite and concrete. Well installation details are provided in borehole logs in Appendix A.

4.5 Laboratory Testing

Bulk and disturbed samples in trial pits and boreholes, SPT shoe samples and undisturbed samples recovered from cable percussion boreholes were taken to accredited laboratories for geotechnical and environmental testing (Prosoils Ltd and Chemtest Ltd). This includes the U100 samples for quick undrained triaxial testing and water samples recovered from standpipes post field works for sulphate testing.

A summary of the laboratory tests carried out is presented in Table 4.1. The results of the laboratory testing are presented in Appendix B.

4.6 Groundwater Monitoring

Using an electronic dipmeter, 12 No. installations in 9 No. boreholes were dipped to record groundwater levels and base of installations over a period of three months (23/12/2016 to 23/02/2017). The results of the groundwater monitoring are presented in section 5.5.

[1] BS (2015). “Code of Practice for Ground Investigations”. British Standard BS5930:2015.

Laboratory Test	Number of Tests	Laboratory
Moisture Content	74*	Prosoils Ltd
Bulk Density	19	
Atterberg Limits	8	
Soil Grading (PSD)	6	
Unconsolidated Undrained Triaxial Test	28	
BRE SD1 (sulphate) Soil	3	
Sulphate / pH (Soil)	22	Chemtest Ltd
Chloride (Soil)	18	
Sulphate/pH (Water)	3	
Pinhole Dispersion in fine grained soil[2]	4	Prosoils Ltd

Table 4.1 Summary of Laboratory Tests

Notes: *A proportion of these basic soil tests are part of the other testing such as the UU triaxial, bulk density and Atterberg tests.

4.7 Falling Head Tests

LKC undertook falling head tests to assess the permeability of the ground. The tests were carried out in general accordance with guidance given in BS5930[3] and BS22282[4] during fieldworks in cased boreholes with open hole at the base of the hole to Hvorslev's method[5]. Groundwater levels were measured prior to undertaking the tests. Water was added to the well to a known depth and falling water levels were measured over time with a dipmeter.

12 No. falling head tests were carried out during fieldworks to the above methodology in the supplementary boreholes adjacent to Shooters Brook culvert with the objective of determining permeability with depth in the vicinity of the culvert. Test depths were performed at *circa* 5, 7, 8.5 and 10 mbgl in boreholes UUCP101, UUPC102 & UUCP103. The raw data plots are presented in Appendix E.

4.8 Soakaway Testing

The soakaway tests were carried out 1st February 2017 to the following methodology:

- Three trial pits (S101, S102, S103) were machine excavated 1m wide by 2m long to depths of between 2.40 mbgl and 3.00mbgl.
- Logging of arisings in line accordance with BS5930[3].
- As soon as the pit was excavated a temporary slotted standpipe was placed vertically in the pit and one cubic metre of gravel was backfilled into the bottom of the pit to prevent the sides falling in during water influx.
- The pits were filled from a water bowser and the drop in level timed and recorded by dipmeter inside the temporary standpipe.
- The tests were carried out to the British Research Establishment[6] methods.
- Testing locations are shown on Figure 7.
- The testing was carried out within the Made Ground as natural ground was not encountered in the pits. Groundwater was not encountered in the soakaway pits.

[2] BS (1999) 'Methods of test for Soils for civil engineering purposes - Part 5: Compressibility, permeability and durability tests', section 6.2 Pinhole method British Standard BS 1377:1990
[3] BS (2015) "Code of Practice for Ground Investigations". British Standard BS5930:2015.
[4] BS (2012). 'Geotechnical investigation and testing – Geohydraulic testing. Part 2: Water permeability tests in a borehole using open systems'. BS EN ISO 22282-2:2012
[5] BS (1999) 'Code of Practice for Site Investigation', section 25.4.6 Method 1 (after Hvorslev). British Standard BS5930:1999
[6] BRE (2003) 'Soakaway Design' British Research Establishment BRE Digest 365 2003

4.9 DCP (Dynamic Cone Penetrometer) and CBR%

10 DCP tests were carried out in Made Ground along the proposed roads layout to a maximum depth of 978mm. The equivalent CBR percentages have been calculated and are presented in Graph 6-4 and Appendix C.

5 GROUND CONDITIONS

The cable percussion, window sample and trial pitting logs are presented in Appendix A. For falling head tests, DCP results, soakaway results refer to Appendices C and E. Geotechnical laboratory results are presented in Appendix B.

5.1 Geology – Generalised Sequence

The ground conditions beneath the site comprised soft to firm clayey Made Ground underlain by stiff natural sandy gravelly clay which in turn is underlain by very dense sand. Bedrock was not encountered in any the boreholes. Summary profiles of the borehole positions are provided in Plate 5-1, with detailed comments in subsequent sections.

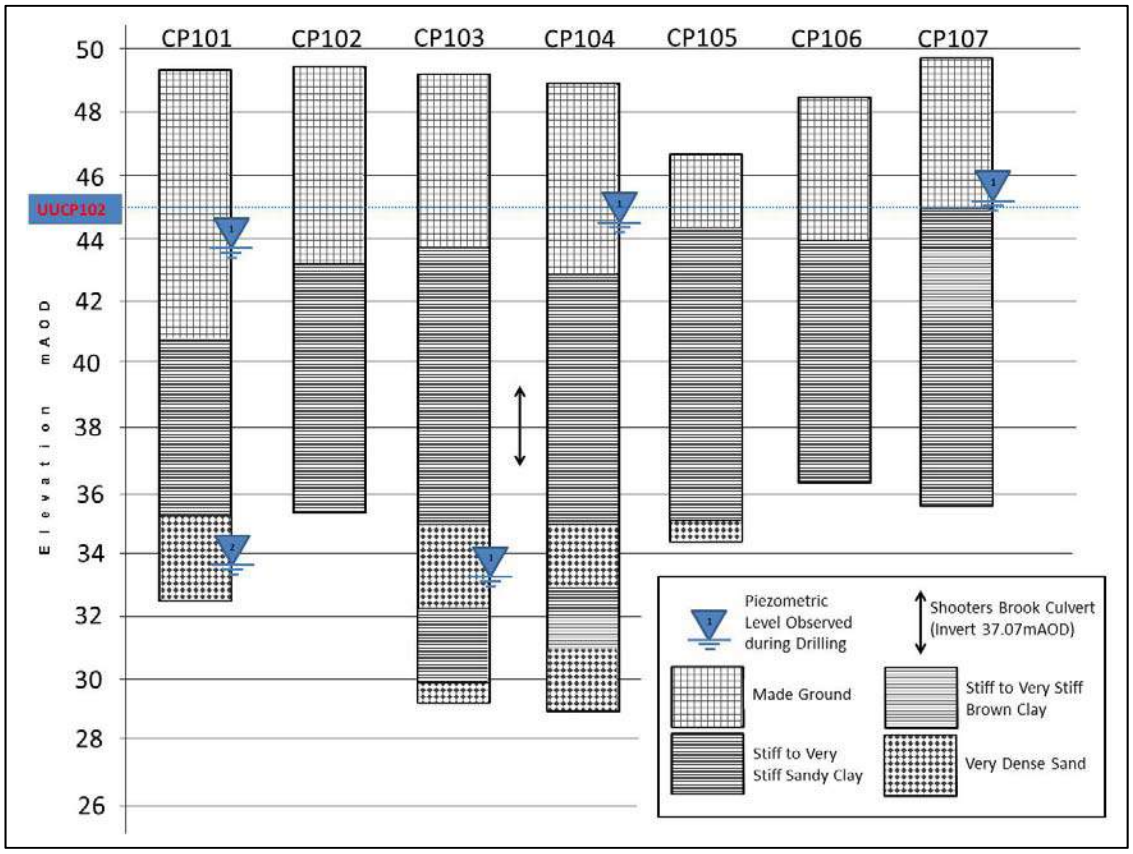


Plate 5-1. Geological Profile and Groundwater Strikes in Cable Percussive Boreholes

5.2 Made Ground

Made Ground was encountered in all intrusive positions; a summary of the trial pit investigations is presented in Table 5-1 and the geological cross section based on the borehole information is presented in Section 6. Thickness of Made Ground ranges 1.9m (NE corner of the site) to 8.7m adjacent to the canal basin (SW of site). Described as soft to firm to stiff sandy gravelly CLAY with ash, brick, clinker, concrete, coal, tarmac, masonry, plastic & wood. Buried walls, brick and concrete foundations, large lumps of concrete/masonry, tarmacadam and former roads at various depths.

TP ID	Termination depth (m)	Groundwater Encountered	Formation Encountered
101	3.4	None	Made Ground
102	3.5	None	Made Ground
103	3.0	None	Made Ground
104	2.9	None	Made Ground
105	2.8	None	Made Ground
106	2.0	None	Made Ground
106A	3.0	None	Made Ground
107	3.1	None	Made Ground

Table 5-1: Summary of Trial Pits.

5.3 Drift Deposits

Maximum proved thickness of 14.7m was observed in CP103 (20m deep borehole). The geological contact at the base of the Made Ground and top of the drift ranges from 45.9mAOD in WS103 to 40.75mAOD in CP101. The contact between the base of the drift deposits and top of the bedrock was not encountered. The deepest proved drift was 29.18mAOD in CP104.

Generally the drift comprises stiff to very stiff (occasionally firm) sandy gravelly CLAY (glacial till) with interbeds of dense to very dense gravelly SAND (fluvioglacial deposit). As the PSD results confirm, the stiff clays may have high silt and sand content, and the fluvio-glacial sands may have relatively high silt and clay fractions.

Notable variations from the above general sequence of glacial till and fluvioglacial sands & gravels have been observed:

- Stiff consistency brown slightly sandy laminated clays are described in CP103 from 13.20mbgl to 14.40mgbl;
- very stiff brown thinly laminated clays in CP104 from 17.20mbgl to 18.00mbgl;
- stiff to very stiff consistency brown mottled grey clay with rare gravel from 6.0mgbl to 8.0mbgl. Interbedded with the stiff to very stiff glacial till are thin beds of less strong clay (possibly to thickness of up to 1.0m) with lower shear strength than surrounding formation.

5.4 Solid Geology

Bedrock was not encountered during fieldworks. Deepest borehole (CP104) was sunk to 29.2mAOD (20mbgl) and terminated in sand and gravel drift deposits.

5.5 Groundwater Encountered During Fieldworks

The trial pits were dry to a maximum depth of 3.5mbgl apart from one slight seepage at 0.3mbgl in TP102. Groundwater observations during field works are shown in Table 5-2.

The elevations of piezometric levels and water strikes for each borehole are presented in Plate 5-1 (geological profiles which shows that two separate piezometric heads exist at the site, one upper phreatic surface correlating to approximately 44mAOD to 45mAOD within the Made Ground, and a second deeper phreatic surface correlating to *circa* 33.3mAOD and within the more permeable coarser grained drift deposits. This information on strikes encountered during fieldworks is supplemented by the standpipe monitoring results carried out post fieldworks (refer below, section 5.6).

Position	Existing Ground Level (mAOD)	Strike Depth (mbgl)	Final Water Level after T mins (mbgl)	Strike Sealed off in borehole (mgbl)	Final Piezometric Level (mAOD)
TP102	49.34	0.3m	Slight Seepage	n/a	Surficial water
CP101	49.45	Fast at 5.8m	No rise (15mins)	9.2m	43.65
CP101	49.45	Slow at 16.3m	15.7m (20 mins)	Not observed	33.75
CP102	49.6	none	n/a	n/a	n/a
CP103	49.21	Fast at 16.5m	16.1 (20 mins)	Not observed	33.5
CP104	49.18	Fast at 6.3m	4.7m (20 mins)	7.5m	44.48
CP105	46.57	none	n/a	n/a	n/a
CP106	48.45	none	n/a	n/a	n/a
CP107	49.79	Fast at 4.9m	4.7m (20 mins)	5.0	45.09
WS101	49.12	none	n/a	n/a	n/a
WS102	49.53	4.0	n/a	n/a	45.53
WS103	47.80	none	n/a	n/a	n/a
UUCP101	49.37	None^{+}	n/a	n/a	n/a
UUCP101	49.35	none^{+}	n/a	n/a	n/a
UUCP101	49.24	none^{+}	n/a	n/a	n/a

Table 5-2: Groundwater observations during fieldworks

Notes: $^{+}$ Falling Head Tests carried out in boreholes which masked potential water strikes

5.6 Groundwater Monitoring Results (Post Fieldworks)

Monitoring was carried out over 3 months from December 2016 to February 2017, commencing with 9 installations installed after the main investigation, and continuing a further 2 more monitoring visits after 3 additional installations were installed during the supplementary investigation. A summary of the groundwater monitoring results is presented in Table 5-3.

Water strikes during fieldworks indicate that a perched water table exists above the stiff boulder clays at approximately 45mAOD which is reinforced by the standpipe readings in UUCP102 which has the same levels. This perched water is to be found within the Made Ground.

Date	23-Dec-16		05-Jan-17		19-Jan-17		02-Feb-17		16-Feb-17		23-Feb-17		Ground Level (mAOD)	Lowest Water Level (mAOD)	Highest Water Level (mAOD)	Variance
Borehole ID	Standing Water Level (mbgl)	Base Dip (mbgl)	Standing Water Level (mbgl)	Base Dip (mbgl)	Standing Water Level (mbgl)	Base Dip (mbgl)	Standing Water Level (mbgl)	Base Dip (mbgl)	Standing Water Level (mbgl)	Base Dip (mbgl)	Standing Water Level (mbgl)	Base Dip (mbgl)				
CP101d	9.72	16.84	9.98	16.70	8.83	15.45	8.45	16.68	8.28	16.68	7.55	16.69	49.45	39.47	41.90	2.43
CP101s	6.92	8.27	7.41	8.70	6.62	8.64	6.73	8.70	6.81	8.61	6.77	8.61	49.45	42.04	42.83	0.79
CP104d	11.21	15.09	13.33	14.58	14.13	14.40	BD	14.71	14.36	14.46	BD	14.50	49.18	34.82	37.97	3.15
CP104s	4.28	6.13	4.60	6.09	4.60	6.05	4.58	6.01	4.57	6.01	4.51	5.95	49.18	44.58	44.90	0.32
CP105d	BD	9.72	BD	9.74	BD	9.68	BD	9.72	BD	9.67	BD	9.72	46.57	46.57	46.57	0.00
CP105s	BD	2.89	BD	2.90	BD	2.90	BD	2.88	BD	2.88	BD	2.88	46.57	46.57	46.57	0.00
UUCP101	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	11.56	11.64	11.56	11.66	49.37	37.81	37.81	0.00
UUCP102	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4.56	9.55	4.23	9.56	49.35	44.79	45.12	0.33
UUCP103	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	BD	9.67	11.36	11.64	49.24	37.88	37.88	0.00
WS101	BD	3.03	BD	3.05	BD	3.05	BD	3.04	BD	3.04	BD	3.04	49.12	49.12	49.12	0.00
WS102	3.74	3.86	3.76	3.86	3.72	3.85	3.71	3.85	3.76	3.86	3.75	3.86	49.53	45.77	45.82	0.05
WS103	BD	4.05	BD	4.06	1.93	4.05	1.88	4.03	2.06	4.06	1.81	4.05	47.80	45.74	45.99	0.25

Table 5-3: Groundwater Monitoring Results

A lower piezometric surface was encountered during fieldworks *circa* 33.3mAOD which exhibited a slight sub artesian pressure, strikes rising less than a metre. This lower piezometric surface was also recorded in standpipes CP101 (deep) and CP104 (deep) but there is no clear or definitive level for a lower phreatic surface to be found when considering all the standpipe data. For instance, the levels in CP101 have risen over the

monitoring period, the final level being *circa* 42mAOD, and the levels in CP104 (deep) stabilized around 35mAOD, which is at the depth limit of the standpipe.

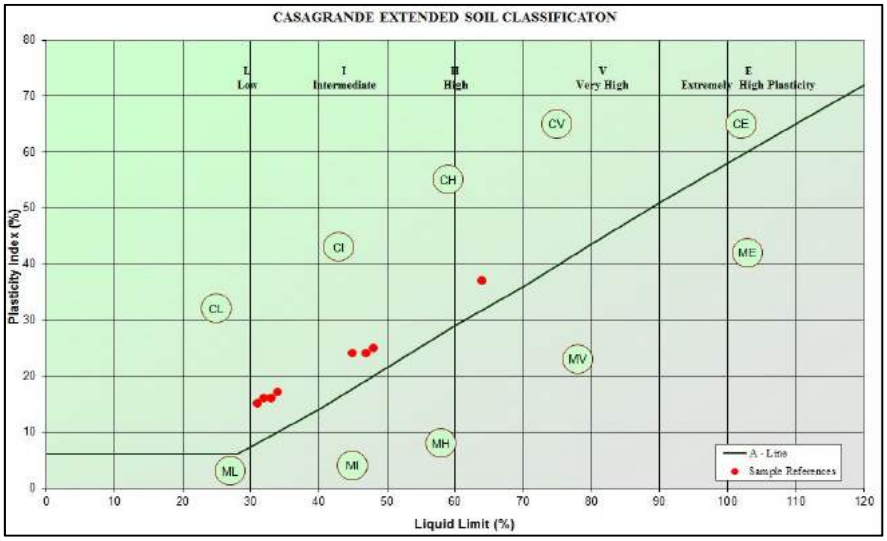
5.7 Pinhole Dispersivity

Dispersivity tests were carried out in U100 samples recovered from UUCP101, UUCP102 and UUCP103. These results will give an indication as to the erodibility of the natural clay formation that is directly adjacent to Shooters Brook culvert. Discussion on this aspect is presented in section 7.

5.8 Plasticity

The results of the Atterberg tests are plotted in Graph 5-1 and the laboratory results are presented in Appendix B.

It can be seen the plasticity is low to intermediate which is typical of glacial till. One test result is classified as high plasticity and appears to be a single outlier. The moisture content is also very high at 28%. This sample was recovered from CP103 at 18.3mbgl (31.3mAOD) which is located below the water table at 33.3mAOD.



Graph 5-1: Plasticity Results

5.9 Undrained Shear Strength and Standard Penetration Test SPT

21 unconsolidated undrained shear strength tests were carried out on undisturbed U100 samples collected in cohesive formation from depths ranging from 31.9mAOD to 49.8mAOD. Plots of undrained shear strength with depth are presented in section 6.4.

SPTs were taken at alternate metre intervals in Cable Percussive and Window Samples wherever possible. SPT N values plotted with depth are presented in section 6.4.

5.10 Moisture Content

The moisture content ranges between 6.4% and 28%, average 17.5%. The plot of moisture content with depth is presented in section 6.5.

5.11 Falling Head Tests and Soakaways

5.11.1 Falling Head Tests

Falling head results are presented in Appendix E. The depths of the tests are presented in Table 5-4. These tests were undertaken to investigate permeability of strata adjacent to Shooters Brook culvert.

Borehole ID	Test Depths (mbgl)	$H/H_0 = 0.37$	Strata
UUCP101	5, 7, 8.5, 10	Not Achieved	Glacial Till
UUCP102	5, 7, 8.5, 10	Not Achieved	Glacial Till
UUCP103	5, 7, 8.5, 10	Not Achieved	Glacial Till

Table 5-4 Falling Head Tests

All of the 12 No. tests failed to reach the criteria[7], i.e. none of the tests carried out in the supplementary boreholes satisfied the valid test condition '$h/h_0 = 0.37$'. This shows that the test water levels did not drop far enough in the given time to establish a valid test condition indicating that the soil tested was of low to very low permeability.

5.11.2 Soakaway Tests

Soakaway tests were carried out in trial pits S101 to S103. These tests were undertaken to ascertain the infiltration in the near surface formation and the suitability of using this formation as a soakaway for site drainage (surface water).

The results of the soakaways are presented in Appendix E and summarised in Table 5-5.

BRE365 indicates that the calculation of the soil infiltration rate is made from the time taken for the water level to fall from 75% to 25% effective storage depth in each pit.

Soil infiltration rate, $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

Where:

V_{p75-25} = the effective storage volume of water in the trial pit between 75% and 25% effective depth.
a_{p50} = the internal surface area of the trial pit up to 50% effective depth including the base area.
t_{p75-25} = the time for the water level to fall from 75% to 25% effective depth.

Due to the slow rate at which water drained only one test was carried out in S101 and S103 while 2 tests were possible within TP102.

TP	Test No.	Strata	Time for outflow between 75% and 25%	Soil infiltration rate (m/s)
S101	1	Made Ground	Outflow not reached	Failed
S102	1	Made Ground	68.3mins	1.15×10^{-5}
	2	Made Ground	152.5mins	5.16×10^{-6}
S103	1	Made Ground	Outflow not reached	Failed

Table 5-5: Summary of Percolation tests and permeability.

[7] BS 'Code of Practice for Site Investigation', section 25.4.6.1 Method 1 (after Hvorslev) British Standard BS 5930:1999

During the percolation tests carried out in S101 and S103, water levels dropped between 10mm and 30mm and the test was considered to have failed. This suggests the ground in this location is unlikely to be suitable for shallow soakaways (within superficial deposits).

The percolation tests carried out in S102 encountered permeabilities with an order of magnitude of 10^{-5}m/s or 10^{-6}m/s. These results are typical of an aquiclude (based on Figure 7.3 of Sarsby[8]) which suggests the ground in this location is unlikely to be suitable for shallow soakaways (within superficial deposits).

5.12 Results of DCP and Calculated CBR

The results of the Dynamic Cone Penetrometer and equivalent CBR are presented below and in Graph 6-4. Raw data is presented in Appendix C. Minimum CBR is 1% and the maximum is in excess of 100%.

DCP ID	Top / Bottom Layer	Average Penetration Rate mm/blow	Equivalent CBR** %	Thickness^^ mm	Depth to base of layer mm
1	Top	22.3	11	760	760
	Bottom	3.3	85	218	978
2	Top	4.9	56	807	807
	Bottom	10.8	24	151	958
3	Top	8.8	30	351	351
	Bottom	27.5	9	604	955
4	Top	2.9	97	300	300
	Bottom	*refusal*			
5	Top	13.1	20	638	638
	Bottom	4.4	64	331	969
7	Top	43.4	6	706	706
	Bottom	18.1	14	254	960
8	Top	5.1	54	296	296
	Bottom	11.1	24	679	975
9	Top	16.5	16	446	446
	Bottom	8.8	30	527	973
10	Top	22	11	736	736
	Bottom	5.2	52	236	972

Note: **Based on CBR TRL relationship: $log_{10}(CBR) = 2.48 - 1.057 \times log_{10}(Strength)$. ^^Equivalent CBR is averaged over thickness as indicated.

5.13 Bulk Density

Bulk density in the Made Ground ranges 1.89Mg/m^3 to 2.12Mg/m^3, average 2.03Mg/m^3. Bulk density in the drift ranges 2.02Mg/m^3 to 2.28Mg/m^3, average 2.17Mg/m^3.

[8] Sarsby (2005). "Environmental Geotechnics".

5.14 Sulphate Levels

Sulphate test results are presented in Appendix B. The sulphate levels from the laboratory test results on 3 water/soil extracts are:

Sample ID	CP101	CP101	CP105
Depth mbgl	9.8	12.8	5.3
pH	8.4	8.5	8.6
SO_4 mg/l	59	100	75

The sulphate test results from the groundwater samples are presented below:

Sample ID	CP101	CP104	WS103
Standing water level mbgl	8.83	4.60	1.93
pH	8.2	8.2	8.1
SO_4 mg/l	36	150	970

The highest sulphate level is in WS103 groundwater sample at 970 mg/l.

Further sulphate testing has been undertaken during the contamination investigation and results are presented in LKC's Contamination Investigation, Risk Assessment and Remediation Strategy Report (LKC 16 1334 03 R0, issued March 2017).

6 GEOTECHNICAL APPRIASAL

6.1 Geotechnical Complexity of Project

The site, adjacent structures, ground conditions encountered, and the proposed development has been assessed as GC2* (Geotechnical Category 2). The geotechnical categories are described as:

- GC1 (relatively straightforward project with prescriptive or non-complex geotechnical design)
- GC2 (some aspect of the project will have some geotechnical challenges requiring bespoke design or specialist methodologies)
- GC3 (geotechnically complex project requiring specialist experience, design and methodologies, usually the project will have higher risks and consequences to be resolved & managed).

Geotechnical Category may change in the light of new information about the site, changes to the proposed development, and/or the level of 'risk and consequence' of the project based on information in Table 2.3 in I.C.E. manual[9].

6.2 Ground Conditions

The borehole profiles shown in the borehole logs and Plate 5-1 demonstrate that the Made Ground is variable in thickness across the site and thickest in the SW adjacent to the canal basin. The thinnest Made Ground is where the elevation is least, i.e. adjacent to Coppersmith Road. A summary of the strata is presented in Table 6-1.

Depth to Top of Strata (mbgl)	Depth to Base of Strata (mbgl)	Thickness of Strata (m)	Generalised Description
Surface Formation	1.9 to 8.7	1.9 to 8.7	**MADE GROUND:** soft to firm to stiff sandy gravelly **CLAY** with ash, brick, clinker, concrete, coal, tarmac, masonry, plastic & wood. Buried walls, brick and concrete foundations, large lumps of concrete/masonry, tarmacadam and former roads at various depths.
1.9 to 8.7	11.4 to 14.1	5.4 to 9.1	**DRIFT:** stiff to very stiff (occasionally firm) sandy gravelly **CLAY.** (Glacial till).
11.4 to 14.1	16.3 to 16.9	2.2 to 2.5	**DRIFT:** Very dense orange brown **SAND** with rare gravel.
16.3 to 16.9	18 to 19.3	1.7 to 2.4	**DRIFT:** Stiff to very stiff consistency reddish brown slightly sandy slightly gravelly **CLAY** overlying very stiff brown thinly laminated **CLAY**. (Glacial Till)
18 to 19.3	Not Proved	>2.0	**DRIFT:** Very dense orange gravelly **SAND**.

Table 6-1. Summary of Strata at Site

The drift deposits are thick across the whole site and with information from historical boreholes it can be anticipated that the drift will be at least 24m to 26m thick across the whole site. The upper drift is glacial till comprising firm to stiff sandy clays that have high silt content that generally become stiffer with depth. Interbedded with the stiff sandy clays are thinner beds of stiff clays with a higher clay fraction, sometimes laminated. With depth the fluvioglacial formation becomes more evident; this coarser grained geology increasing

[9] ICE (2013) 'The Institution of Structural Engineers Manual for the geotechnical design of structures to Eurocode 7', M Puller, J Burland & B Bell et al, Institution of Structural Engineers, London, 2013, pp25.

in thickness and presence and comprising dense and very dense sands and sands & gravelly sands that are evident below 35mAOD.

Based on PRA study information and historical borehole logs in the near vicinity, bedrock is predicted to be at approximately 30mbgl or 20mAOD and may be even deeper. Bedrock is anticipated to be Manchester Marl which was found at circa 17mbgl (pre-existing ground levels) in historic borehole BH122 located 70m to the NW of CP105 which confirms the geological map for Manchester that shows the site to overlie Manchester Marl Formation. Additionally, mudstone was found in historic borehole BH121 approximately 30m to the SE of CP101 which also indicates that the Manchester Marl underlies the site.

6.3 Groundwater

The groundwater encountered during fieldworks indicates that there are two piezometric heads (see Table 5-1 and Graph 6-1) one upper phreatic surface correlating to approximately 44mAOD to 45mAOD and essentially within the Made Ground, and a second deeper phreatic surface correlating to circa 33.3mAOD and within the more permeable coarser grained drift deposits.

The standpipes show a variation of water levels which are related to:

- the two piezometric heads struck during fieldworks, and possibly,
- Shooters Brook culvert, as described in section 7.

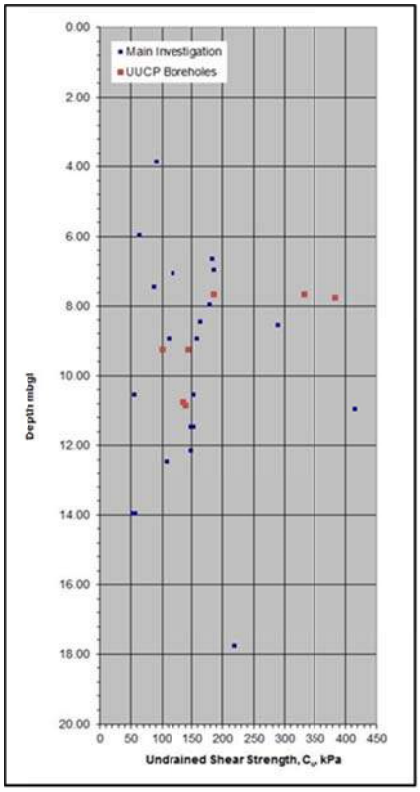
6.4 Shear Strength and Standard Penetration Test (SPT) with Depth

Undrained shear strength, C_u, varies from 53kPa to 415kPa, average 149kPa which concurs with previous geotechnical reports that identified average shear strength in the region of 150kPa. There is not an obvious shear strength increase with depth which is in contrast to SPT data that shows a marked increase in N value with depth. The results of the shear strength vs depth are presented in Graph 6-1.

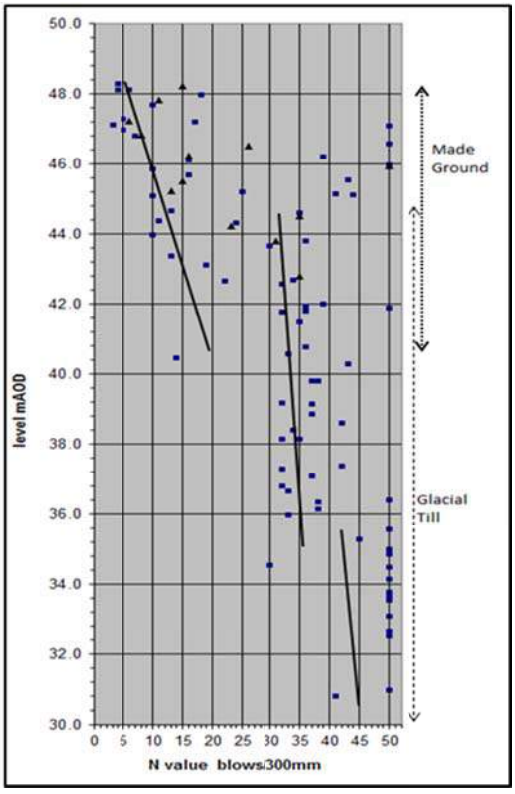
The SPT N value with depth is presented in Graph 6-2. In the Made Ground the SPT N values range from 3 to 22 with the average of 12. SPT N values in the drift range from 14 to 50 (average 40) and below the elevation of 40mAOD SPT N ranges 30 to 50 (average 42). SPTs demonstrate the ground has increasing shear strength and density with depth.

6.4.1 Thin Beds of Clayey Strata Exhibiting Lower Strength than Surrounding Formation

Regarding shear strength with depth, SPT N values generally increase with depth but some clayey interbeds exhibit relatively low shear strength even at depths of 14mbgl; and the SPT and triaxial test results have demonstrated the possibility of interbeds of less strong clay (possibly to thickness of up to 1.0m) with lower shear strength than surrounding stiff to very stiff glacial till strata. Thus, during pile installation it is recommended that these ‘softer’ clayey strata are noted and avoided for founding pile toes.



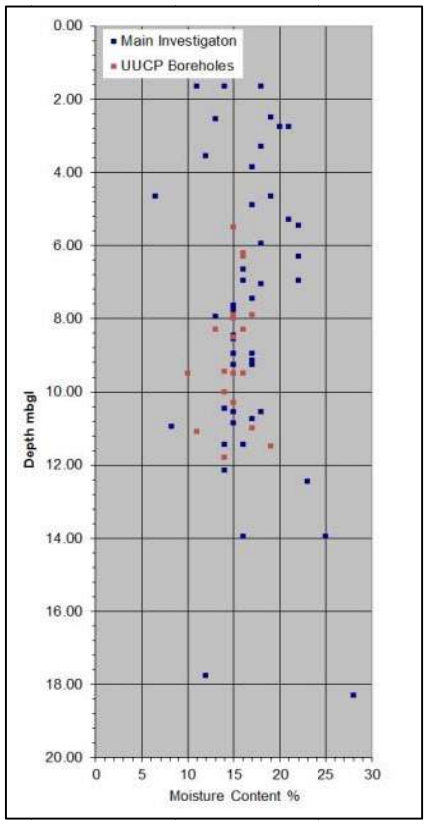
Graph 6-1 Undrained Shear Strength



Graph 6-2 SPT vs Reduced Level

6.5 Moisture Content with Depth

The plot of moisture content with depth is presented in Graph 6-3. The moisture content rises with depth to circa 6m to 7m below existing ground level which correlates with water strikes during drilling. Below circa 7mbgl the moisture content then reduces with depth which implies an increasing relative density and shear strength in the fine grained soils.



Graph 6-3 Moisture Content with Depth

An outlier in the values is observed in CP101 (23%) at 37mAOD (12.45mbgl) and CP102 (25%) at 35.65mAOD (13.95mbgl). The higher moisture contents may be related with a second piezometric head which was encountered during fieldworks around depths of 33.3mAOD but could also be associated with the Shooters Brook culvert that has been shown to have groundwater infiltration in or near this zone of ground. Discussion on the subject of Shooters Brook culvert is presented in section 7.

6.6 Site Geohazards

- Soft clayey and potentially compressible Made Ground of variable thickness.
- Stress overlap on existing stressed ground under existing foundations and piles (i.e. Shooters Brook and pile canal wall). Hazard potentially inducing increased settlements or unfavourable defections on adjacent or underlying structures.
- Obstructions to pile boring. Buried relic foundations and masonry walls in the Made Ground and glacial boulders in the superficial deposits.
- Potentially thin strata in the drift of clay of relatively lower shear strength. This should be noted during pile boring operations and to avoid using as founding strata for the pile toe.
- Sub artesian hydrostatic pressure and inflowing groundwater in gravelly and sandy coarser grained permeable beds in the drift. Groundwater hazards during emplacement of cast in situ bored piles causing hollows and concrete washout.
- Downdrag forces from soft clayey Made Ground increasing pile loads and settlement.
- Low surface CBR strength of saturated clayey Made Ground for highways, car parking areas, delivery areas and other loaded areas.
- Thick layer of relatively weak Made Ground unfavourable to pile lateral support. Low shear strength in the Made Ground and the need for resistance to the lateral, rotational and uplift forces due to wind load on 6 storey apartments.
- Potential for contaminated Made Ground and fill.

6.7 Site Constraints

- Shooters Brook Culvert - Victorian brick lined combined sewer 1.5m in diameter. Invert level 37.07mAOD circa 12mbgl (adjacent to canal in south of the site). Alignment of the culvert is approximately NNE to SSW. The proposed 6 storey block ‘mansion house apartments’ (block 02) overlies this culvert together with 3 individual properties of block 01.
- Piled RC retaining wall supporting existing canal.
- Buried obstructions due to substantial Industrial Legacy and thick layer of Made Ground at this site:
    - Blocks, bricks
    - Relic foundations, relic walls, relic floor slabs
    - Islington Branch canal (wharf stone walls and backfill)
- Restricted site access due to narrow streets, canal and surrounding residential buildings.
- Electrical distribution box on Coppersmith Road (actually within the site boundary).
- Rising ground to existing adjacent properties in vicinity of Coppersmith Road.
- Adjacent empty land that may become developed in the near future. An opportunity may arise for access to Old Mill Road and good relations with impending Contractor to assist with better management of construction traffic for both sites.

6.8 Geotechnical and Characteristic Ground Parameters

Characteristic values based on the findings of this report are presented in Table 6.2:

Parameter	Characteristic value
Bulk Density	Made Ground saturated: 2.03Mg/m^3.
	Drift fine grained saturated: 2.16Mg/m^3.
	Drift coarse grained saturated 2.10Mg/m^3:
Formation Thickness	Made Ground: Varies according to location see nearest boreholes and interpolate if necessary
	Drift (fine and coarse grained): Varies according to location and interbed thickness, see nearest boreholes and interpolate if necessary
Undrained Shear Strength, c_u (based on Graph 5.2)	Made Ground: > 50 kN/m^2 (skin friction not to be relied upon for resistance to pile loadings). Unfavourable downdrag forces to be considered.
	Drift (fine grained): 100 kN/m^2 increasing with depth to maximum of 150 kN/m^2 below 14mbgl (according to depth of formation at location of pile).
Estimated Effective Shear Strength, phi'$_{cv,k}$	A coarse grained stratum generally has a high fines content near or above 25% and according to section 4.3.1.3.11 of BS8004:2015 the angle of shearing resistance (phi'$_k$) should be determined as for a fine grained soil.
Pavement CBR Design Value (Existing condition at surface)	< 2%
Pavement CBR Design Value (> 0.4mbgl)	5%

Table 6-2: Geotechnical and Characteristic Ground Parameters

6.9 Foundation Bearing Capacity

Made Ground covers the whole site up to a thickness of 8.7m. The Made Ground is not suitable for founding in unless ground improvement is carried out.

6.10 Foundation Plan

The current foundation solution for the site is a piled solution to overcome the weak and potentially compressible clayey Made Ground, and to bridge the Shooters Brook culvert with a pile supported load transfer platform (refer to section 6.11). Traditional spread foundations are not recommended unless the ground is improved to increase bearing capacity. It is assumed the project is going forward based on a piled solution

6.11 Pile Foundations

Piled foundations are considered to be necessary. The appointed specialist piling contractor will be able to optimise pile design such as pile grouping per pile cap, pile diameter & pile spacing, installation methodology, pile cap settlement, and socket lengths to suit from the site investigation data.

The piling contractor should be made aware of potential hazards to the sinking of piles in the Made Ground, especially the potential for bricks and blocks and relic walls/floors slabs/foundations in the ground.

Piles mobilising skin friction in the glacial till (stiff to very stiff sandy gravelly clay) and fluvioglacial deposits (dense to very dense sands and gravels) will be acceptable. It is likely that bedrock will too deep utilise. Pile designs will require consideration of downdrag forces due to potential time dependent settlement of the Made Ground. Pile designs will also need to consider any tension or rotational forces in the piles and account for the upper pile section where the pile may be sleeved and relying on lateral stability from the weak Made Ground.

The piles adjacent to Shooters Brook culvert and retaining walls supporting the canal system will require sleeving to avoid overlapping existing stress zones beneath or lateral to these structures and their foundations. These piles adjacent to the existing culvert and canal walls will be founded in the deeper very stiff/very dense glacial till below the culvert and/or piled walls.

6.12 Outline Pile Depths and Diameters

6.12.1 General Considerations

The outline pile configurations set out in the following sub-sections are based on the proposed site layout (refer to Figure 3). It should be noted that the outline pile lengths in this section are based on single piles and it may be the case that the piling contractor's optimised designs may use double piles, triple piles or other pile group configurations which may affect the detail design pile lengths, i.e. as built pile lengths may be shorter than described in this section.

Pile diameters of 600mm or 450mm are anticipated for the 6 storeys apartments and diameters up to 300mm for the 3 storey houses.

6.12.2 Anticipated Pile Lengths for 6 storey block (03)

Assuming downdrag forces are mitigated, lengths of up to 16m or 17m may be necessary due to thick deposits of potentially compressible Made Ground. Assuming an average of 500 kN pile cap loads supported by single piles with total deadload of circa 24MN per block.

6.12.3 Anticipated Pile Lengths for 6 storey block (02)

Sleeving will be required to a depth of approximately 38mAOD for the piles supporting the proposed load platform that will bridge Shooters Brook culvert to avoid imposing stress on the culvert. It is anticipated that the piles supporting the load platform will have lengths of up to 17m with the pile toe founded in very stiff clays at circa 32mAOD as encountered in CP103 and CP104.

For piles installed away from the stress overlap zones of the canal retaining walls and the culvert, it is envisaged that pile lengths will be 13m to 14m assuming downdrag forces in the Made Ground are mitigated.

6.12.4 Anticipated pile designs for 3 storey blocks (01)

The proposal is for a total of 20 individual houses. These will all require piled foundations. Considering single piles in this instance and assuming mitigation of downdrag in the Made Ground, it is envisaged that piles will require approximately 5m of natural ground to mobilise sufficient strength to support the loads (anticipated to be in the order of 100kN per pile). Total pile length will vary according to thickness of Made Ground, i.e. pile lengths will be up to 10m in length.

6.12.5 Special Case

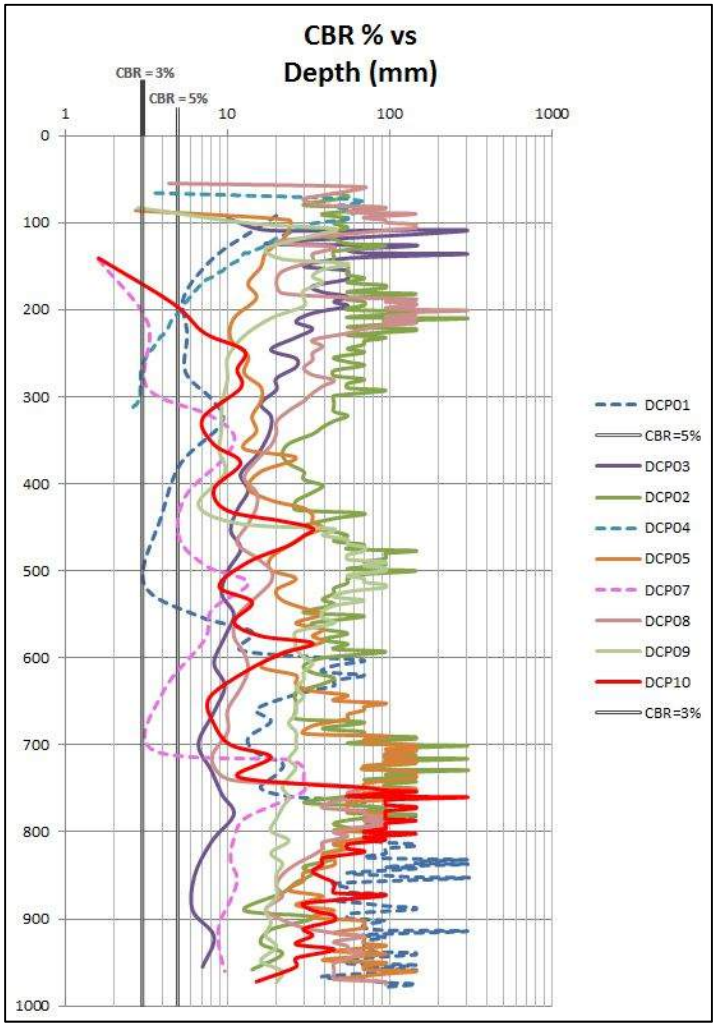
A special case exists for 3 properties in the far SW of the site because these properties overlie Shooters Brook. Ground beams spanning the culvert with supporting piles to depths below the influence zone will be required. Pile toes will be founded circa 33mAOD which will require a total pile length of up to 16m for these properties. In this case, it may be prudent to re-configure the site layout so that these 3 properties do not overlie the culvert.

6.13 Floor Slabs

Made Ground is variable with depth and laterally across the site and structures founded on it will have a high risk of settlement and differential settlement, thus ground bearing floor slabs are not recommended.

6.14 Pavements and Design CBR Value

As seen in the trial pits and borehole logs, the Made Ground comprises of a high proportion of clay which was a 'sea of mud' at ground level during the ground investigations (in winter). Consequently shear strength is very low when this material is saturated at the surface, or near surface, as evidenced by the CBR plot presented in Graph 6-4 below, which is based on DCP test results with depth. The graph demonstrates soft spots to depths of 700mm.



Graph 6-4. CBR% Plotted with Depth

Preliminary CBR Design of 5% is recommended based on the CBR with depth results in Graph 6-4:

- Using the existing ground as 'sub-grade' to the new roads and considering excavating a minimum of 450mm for frost protection, then we can say the weakest sub-grade is 3% (see Graph 6-4) at the in situ moisture content found when tested.
- The majority of CBRs below 450mm are above 5% (apart from DCP07).
- Assuming 5% CBR at time of road construction, one design option would be:

  - 200mm sub-base over 200mm capping.
  - This assumes soft spots in the sub-grade will be removed and/or geogrids installed in the capping or sub-base.
  - Assumes filter geotextile will be employed in the sub-base/capping.
- It is recommended that the sub-grade is protected from weather (and consequent loss of bearing strength with high moisture content) if it is not going to have immediate covering of capping & sub-base.
- In all cases, we recommend that bearing tests be carried out on the exposed sub-grade to inform road design.

Additional measures in areas frequently loaded with cars or delivery trucks may require additional geogrid or other ground strengthening measure to avoid settlement and rutting.

6.15 Earthworks

The difference in existing ground levels between the NE and SW of site is *circa* 2.75m. Imported granular capping material and selected granular fill will be required to upfill site roads and housing plots to final formation levels.

Re-use of Made Ground for 'crusher run' site won material to supplement fill required for site re-profiling may be cost beneficial but this option will yield an unfavourable by-product – i.e. a significant volume of high clay content 'waste soil', and as such this option is unattractive.

6.16 Mining and Mineworkings

The site is not within a Coal Authority Development High Risk Area or has shafts within 20m of the site boundary.

6.17 Temporary Works

- Access restrictions to the site for large construction plant considering the residential nature of the surrounding environs.
- Piling platform for the piling operations. Bringing the material on site and either taking it off site on completion or re-using it on site.
- Excavations will require support.
- Water table is generally low (4m to 5mbgl) but perched water seepages can be expected at relatively shallow depths (0.3mbgl) as observed in TP02. Small scale dewatering may be necessary for near surface excavations.

6.18 Sulphate and Concrete Classification

The sulphate design values are based on water/soil 2:1 extracts and 'worst case' sulphate levels found in WS03 groundwater sample (pH 8.1 & SO_4 970 mg/l). Based on the results the following concrete classification for the site is:

- Design Sulfate Class for site: DS-2.
- ACEC Class[10] for site: AC-2.

[10] BRE Special Digest 1:2005, 'Concrete In Aggressive Ground'.

6.19 Management of Geotechnical Risk

The Geotechnical Risk Register is presented in Appendix D. Regarding the proposed development of the site, geotechnical risks that have been mitigated are:

1. Referring to Coal Authority CON29M Non-Residential Mining Report# 51001291002002 (22 November 2016) New Islington Manchester Greater Manchester, the site is not within a Coal Authority Development High Risk Area or has shafts within 20m of the site boundary.
2. Past underground coal mining of 4 seams of coal at 350m to 1090m depth was last worked in 1961. “Any movement in the ground due to coal mining activity should have stopped.”

Regarding the proposed development of the site, geotechnical risks that require strategies and specific methodologies to mitigate risks are:

1. Shooters Brook Culvert (invert 37.07mAOD at manhole no. 30) and compliance to Sewerage Undertaker’s requirements for building over or next to main public sewers. Compliance may require ‘remedial works’ to the existing culvert.
2. Avoidance of disturbance of ground supporting or ‘lining’ the brick Victorian culvert during installation of piles. This includes disturbing ground that may lead to increasing hydrostatic pressure on the culvert or establishing hydraulic continuity between the perched water and Shooters Brook culvert.
3. Avoidance of imposing increased stress to canal retaining wall system from proposed installation of piles and avoidance of disturbing ground supporting the walls during piling operations.
4. Avoidance of imposing increased stress on the culvert due to the loadings of proposed overlying structures.
5. Access to Shooters Brook culvert for future maintenance and/or repair works.
6. Buried obstructions in the Made Ground during boring of piles (concrete/masonry blocks, relic foundations and walls etc). Glacial boulders in the drift.
7. Risk of inflowing water in the sands & gravels while boring cast in situ piles and risk of hollowing of pile and erosion of concrete during emplacement.
8. Regarding piled foundations for the 6 storey apartments; an allowance should be made for lack of lateral stiffness and low shear strength in the thick deposits of relatively weak Made Ground and the need for resistance to the lateral, rotational and uplift forces due to wind load.
9. Allowance in pile design for downdrag forces in the Made Ground.
10. Deeper SI investigation including rotary drilling may be required if the piling contractor deems it necessary for optimisation of piling design.

7 SHOOTERS BROOK CULVERT - GROUND CONDITIONS

7.1 Background

There are infiltration problems with the old brick lined Victorian culvert, (Shooters Brook) which was the subject of a recent video survey that showed areas of water infiltration in the area immediately north east of the newly constructed canal basin (*circa* 2008), i.e. for a length of approximately 10 to 15 metres inside the boundary of the site.

The supplementary ground investigation (boreholes UUCP101/102/103) was commissioned to investigate the ground conditions in the strata flanking the Shooters Brook culvert. The objective of the supplementary investigation is to provide a ground appraisal in relation to the sewerage undertaker's conditions when building near or over drainage assets.

Other boreholes (as part of the main investigation) are located reasonably close to the culver and the ground conditions encountered in these boreholes will also be included in the ground appraisal (boreholes CP101/102/103/104).

7.2 Drift Deposits Flanking Shooters Brook Culvert

A geological cross section A'-A is presented in Plate 7-1 that displays the strata flanking both sides of the culvert. The line of section A'-A is presented in Figure 7.

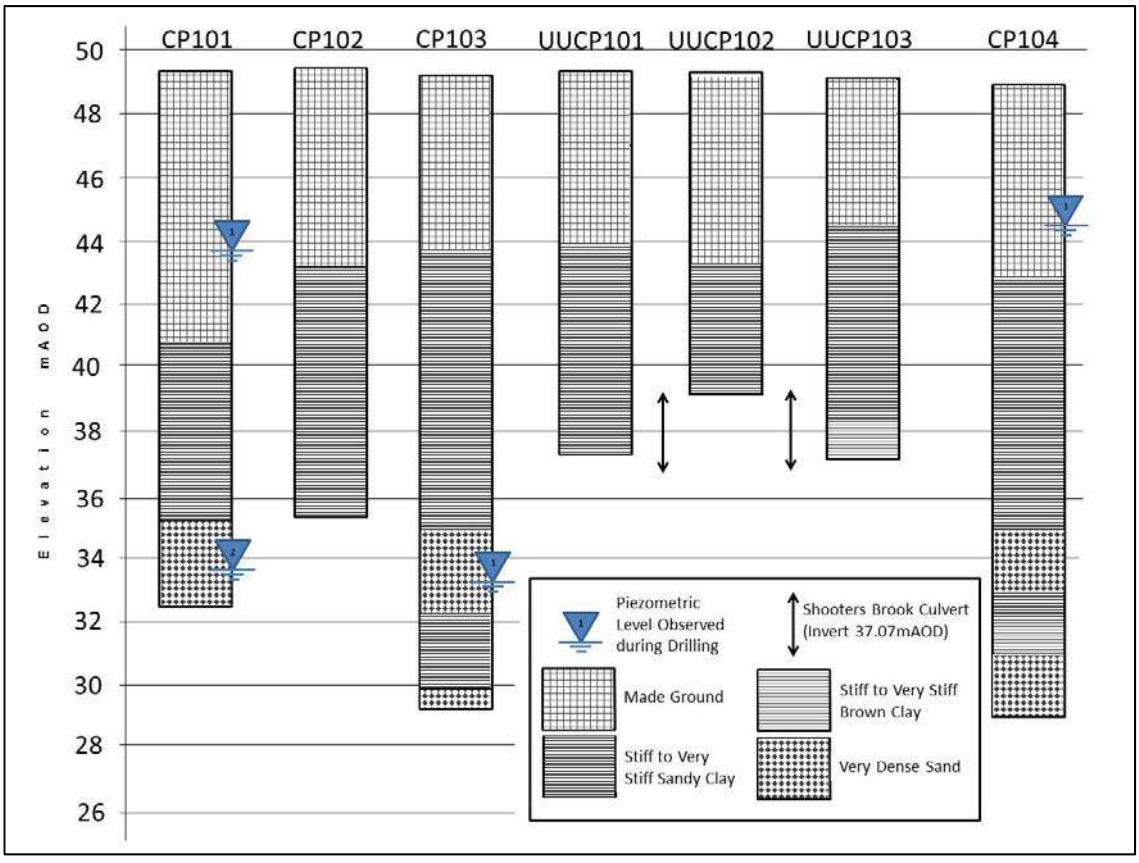


Plate 7-1: Geological Cross Section A'-A and Groundwater Observed During Fieldworks (including supplementary boreholes).

The natural stratum flanking the culvert on both sides is a stiff to very stiff Sandy Clay (glacial till). The culvert is also very likely to be founded on the stiff clay which is present to a depth approximately 2 metres below the invert and 5 metres above the soffit. As a

matter of precaution, none of the boreholes were drilled directly over the culvert, so the nature of the backfill directly above the culvert is unknown, but it is likely to be clayey low permeability material as the culvert does not suffer from water ingress over most of the site wide alignment.

7.3 Permeability of Strata Flanking Shooters Brook Culvert

Falling head tests were carried out in the 3 No. supplementary boreholes at depths of 5mbgl, 7mbgl, 8.5mbgl and 10mbgl. The shallowest tests were carried out at the interface between the Made Ground and natural ground (glacial till) and the tests at 7m and deeper were carried out in the natural glacial till. The deepest tests were carried out in strata to a depth approximately 0.5m lower than the culvert soffit level (invert level *circa* 11mbgl).

None of the tests passed the time lag equivalent to 0.37 head ratio drop which demonstrates that the ground is of very low permeability. This supports the assertion that the ground surrounding the culvert is clayey in nature.

7.4 Shear Strength of Samples Recovered from UUCP Boreholes

7 No. unconsolidated undrained shear strength tests were carried out on samples recovered from the supplementary site investigation boreholes. Graph 6-1 presents the plots of undrained shear strength carried out in both the main and supplementary investigations. There are no outliers or grouping of test results that would indicate softer strata or a weakening of strata in the supplementary holes as compared to the overall number of tests in other areas of the site in the same strata. This would suggest that the natural ground flanking the culvert is the same as the natural ground further away from the culvert and is not suffering from piping or other water erosion / softening mechanisms.

7.5 Examination for Water Erosion in U100 Samples in UUCP Boreholes

'U100' samples recovered during the supplementary GI at depths above and adjacent to the culvert were examined for signs of water erosion at the laboratory. No signs of water erosion were observed in any of the samples.

7.6 Pinhole Dispersivity of Strata Adjacent to Shooters Brook Culvert

4 No pinhole dispersivity tests were carried out on clays recovered from U100 samples. The results of the dispersivity tests are presented in Table 7-1. The dispersive classification is based on information in Table 7-2[++].

Borehole	Depth (mbgl)	Sample Description	Approx. Plastic Limit %	Dispersivity Classification
UUCP101	7.95	Dark Brown Clay	19	ND1
UUCP101	11.05	Dark Brown Clay	15	ND2
UUCP102	9.45	Dark Brown Clay	18	ND2
UUCP103	10.95	Dark Brown Clay	18	ND2

Table 7-1. Results of Pinhole Dispersivity Tests

Note: [++]Classification of Soils from Pinhole Test Results reproduced from British Standard BS1377-5:1990, Section 6.

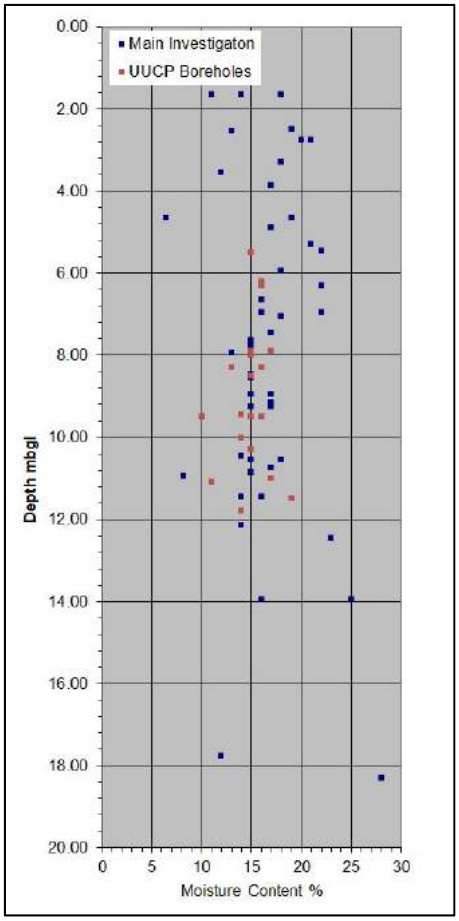
Dispersive classification	Head	Test time for given head	Final flow rate through specimen	Cloudiness of flow at end of test		Hole size after test
				from side	from top	
	mm	min	mL/s			mm
D1	50	5	1.0 to 1.4	dark	very dark	≥ 2.0
D2	50	10	1.0 to 1.4	moderately dark	dark	> 1.5
ND4	50	10	0.8 to 1.0	slightly dark	moderately dark	≤ 1.5
ND3	180	5	1.4 to 2.7	barely visible	slightly dark	≥ 1.5
	380	5	1.8 to 3.2			
ND2	1 020	5	> 3.0	clear	barely visible	< 1.5
ND1	1 020	5	≤ 3.0	perfectly clear	perfectly clear	1.0

Table 7-2. Classification of Pinhole Test Results

The results of the pinhole tests show that the clays are classified as non-dispersive. This demonstrates that the natural strata (boulder clay) flanking the culvert has very low susceptibility to piping and similar water erosion mechanisms.

7.7 Moisture Content of Samples Recovered from UUCP Boreholes

The moisture content plot with depth is presented in Graph 7-1. The moisture content of the glacial till averages approximately 15% around the depth of the culvert. The variance in the moisture content values in the supplementary boreholes increases around the depth of the culvert. This may support a notion that there is a hydraulic connectivity between the leaking culvert and the surrounding ground, but there is no clear outlier or grouping of test results seen in the graph that would suggest the ground adjacent to the culvert has a significantly higher moisture content than other similar strata at this depth in other parts of the site.



Graph 7-1. Moisture Content with Depth

7.8 Groundwater Levels Adjacent to Shooters Brook Culvert

Plate 7-3 shows a plot of phreatic surfaces (minimum and maximum levels) that were monitored and recorded in each standpipe. The plot is laid out so that the wells showing the shallowest water table are to the left and the wells showing the deepest water table are to the right. The aim for plotting the wells in this way is to investigate the potential relationship between the water levels recorded in the standpipes and the level of the culvert.

The water levels in standpipes CP104 (deep), UUCP101 and UUCP103 are between 37.8mAOD and 38mAOD, which is approximately one metre above the invert of the culvert (invert 37.07mAOD). The UUCP boreholes are close to Shooters Brook culvert and CP104 is about 28m east of the culvert. The plot demonstrates that there is a potential linkage (hydraulic connectivity) between the culvert and the water levels at the site.

Given the water level data, it is reasonable to assume that the leaking culvert is controlling the perched water groundwater table (*circa* 44mAOD) in this locality, draining water from the strata and depressing the water table in the ground close to the culvert.

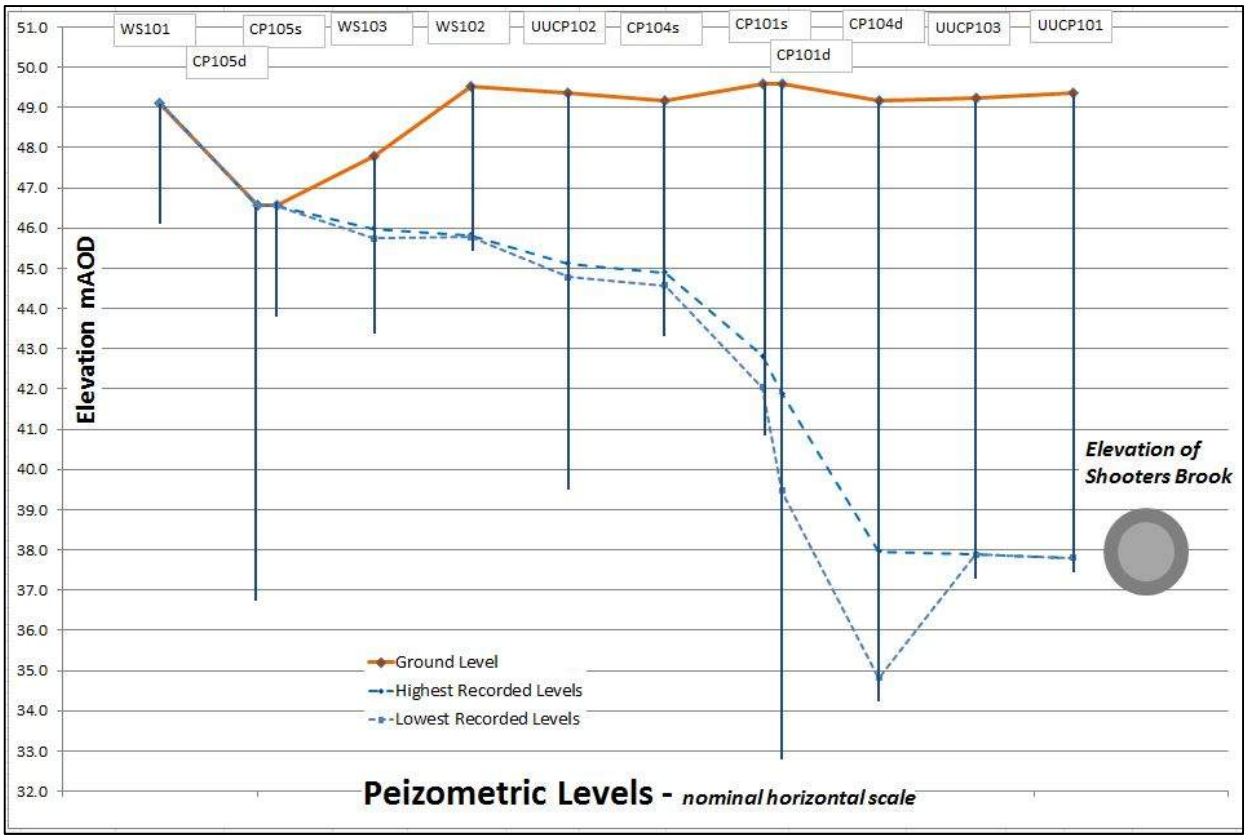


Plate 7-3. Monitoring Results - Water Levels in Standpipes

7.9 Discussion on Culvert Infiltration

The logs of UUCP101 through UUCP103 show the natural ground adjacent to the culvert is glacial till and the falling heads confirm the low permeability of this strata. The culvert has existed since the mid-19th century and the culvert exhibits no infiltration under most of the site, which would reinforce the assumption that the natural ground acts as a barrier preventing infiltration of water into the culvert.

Assuming that the backfill above the culvert is also of low permeability we can also assume that the perched water table is cut off from the culvert by low permeability soil.

The lower water table at circa 33.3mAOD is below the culvert and therefore cannot be responsible for the infiltrating water. The standpipes show that there is a localised water table in the vicinity of the culvert. The assumption is that the water infiltrating the culvert is of such volume that it cannot be coming from the low permeability clay and must be coming from the perched water table which lies perched above the clay. The perched water table is in hydraulic continuity with the culvert.

The pinhole test results indicate that the clay surrounding the culvert is not naturally prone to piping and water erosion.

The location of the infiltration is below the newly installed canal and piled canal wall. It may be the case that the pathway for the hydraulic connectivity between the perched water and the culvert is through ground disturbed during the installation of the piles.

The disturbed ground would then allow the perched water table to flow downwards and enter the culvert, supplying the infiltration water.

8 CONCLUSIONS

8.1 Site Specific

The site is to be redeveloped with two medium rise apartment blocks (6 storey) and twenty individual houses (3 storey) in three separate blocks. The south western site boundary has an existing canal basin which is formed by a piled RC retaining wall.

The whole site is covered by a thick deposit of relatively soft clayey Made Ground which also comprises significant amounts of brick/concrete and other demotion materials, and has relic buried foundations, relic floor slabs, relic walls and roadways.

The recommended foundation solution is a piled solution. It is important to ensure that the Piling Contractor understands his scope with respect to potential obstructions in the ground due to blocks, bricks and relic structures in the Made Ground due to the industrial legacy at the site.

The underlying drift is glacial till, mostly comprised of stiff to very stiff sandy clays sometimes interbedded with less sandy clayey strata. With increasing depth the glacial till becomes interbedded with coarser material in the form of dense to very dense sands and gravelly sands.

Groundwater encountered during drilling is found at two main levels, the upper piezometric level of 43.7mAOD to 45mAOD in Made Ground or base of Made Ground and top of drift. The second or lower piezometric level is circa 33.5mAOD in glacial sand/gravels. Water table is generally low (4m to 5mbgl) but perched water seepages can be expected at relatively shallow depths (0.3mbgl) as observed in TP02. Small scale dewatering may be necessary for near surface excavations.

Traditional foundations for the 3 storey buildings may be employed if significant ground improvements are carried out.

Pile diameters of 600mm or 450mm diameter are anticipated for the 6 storeys apartments and diameters up to 300mm for the 3 storey houses.

Anticipated pile lengths for 6 storey block ‘03’ is up to 16m or 17m.

Anticipated pile lengths for 6 storey block ‘02’ bridging over Shooter Bridge Culvert is up to 17m (including sleeving to a depth of approximately 38mAOD). For piles installed away from the stress overlap zones, pile lengths will be in the order 13m to 14m

Anticipated pile lengths for 3 storey blocks ‘01’ will be up to 10m in length. A special case exists for 3 properties overlying Shooters Brook - pile toes will be founded circa 33mAOD requiring a total pile length of up to 16m.

The surface soils are very clayey in content and become very soft when saturated. The CBR Design Value is 5% assuming at least 400mm is excavated. Pavements and vehicle loaded areas will require capping and consideration of ground strengthening materials such as geogrid to prevent rutting.

The design of the piles to resist lateral and rotational forces will need to take into account the thick deposits of weak and potentially compressible Made Ground.

The difference in existing ground levels between NE and SW of site is circa 2.75m. Imported granular capping material and selected granular fill will be required to upfill site roads and housing plots to final formation levels.

The site is not within a Coal Authority Development High Risk Area or has shafts within 20m of the site boundary. The Coal Authority stated that all surface movements due to deep coal mining in the past should have stopped.

There may be access restrictions to the site for large construction plant considering the residential nature of the surrounding environs.

Piling platform for the piling operations will be required.

Excavations will require support.

Design Sulphate Class for site is DS-2. ACEC Class for site is AC-2.

Falling head test and soakaway test results at the site indicate that the thick deposits of clayey Made Ground will not be suitable for soakaway.

Shooters Brook culvert invert is at 37.07mAOD (i.e. approximately 12mbgl) and has internal diameter 1.5m and is aligned underneath parts of the site that are earmarked for the construction of a 6 storey apartment block and 3 individual houses of 3 storeys height.

The proposed piles adjacent to Shooters Brook culvert and piles adjacent to the retaining walls supporting the canal system will require sleeving to avoid overlapping existing stress zones on these structures and their foundations. These piles will be founded in the deeper very stiff/very dense glacial till below the culvert and/or piled walls. This includes piles to accommodate the three 3 storey houses.

Deeper site investigation including rotary drilling may be required if the piling contractor deems it necessary for optimisation of piling design.

8.2 Source of Shooters Brook Culvert Infiltration

The sewerage undertaker has restrictions to the construction of new buildings over or near the culvert. Discussions about this are on-going. A supplementary ground investigation of 3 boreholes obtained more information about the ground conditions adjacent and near the culvert.

The natural ground adjacent to the culvert is boulder clay of low permeability. There are two main water tables (approximately 45mAOD and 33.3mAOD) with a ‘third water table’ in the vicinity of Shooter Brook culvert where the water table is depressed to a level of approximately 38mAOD. This localised water level is likely to be the result of the perched water table leaking downwards and infiltrating Shooters Brook culvert through previously disturbed ground in the vicinity of the existing piled canal wall.

The conclusion of the supplementary ground investigation is that the infiltration water entering the culvert is most likely coming from the perched water table through the pathway of disturbed and/or piled ground associated with installation of the canal.

Compliance to the United Utilities’ requirements concerning building over or near their assets may require expensive ‘remedial works’ to the existing culvert. Future access to Shooters Brook culvert for on-going maintenance and/or repair works will be required.

9 RECOMMENDATIONS

The following recommendations are made:

- The piling methods need to have the ability to bore through obstructions such as blocks, relic walls, bricks and relic foundations.
- The location of the 3 storey houses overlying Shooters Brook culvert be moved to another location not affecting the culvert.
- All the proposed buildings are to be founded on piles. Accordingly it is recommended that the services of a suitably qualified and experienced piling contractor be sought at the earliest instance.
- A full condition report should be carried out of the canal for future reference and potential disputes prior to any works commencing.
- Allowance in pile design for downdrag forces in Made Ground.
- Regarding piled foundations for the 6 storey apartments; an allowance should be made for lack of lateral stiffness and low shear strength in the thick deposits of relatively weak Made Ground and the need for resistance in the piles to the lateral, rotational and uplift forces due to, for example, wind load.
- A design CBR value of 5% is recommended conditional on surface soil conditions during excavation of sub-grade. Importation of suitable granular material or modification of existing soils is recommended.
- It is recommended that beds of less strong clay recorded in the borehole logs be avoided as founding strata for pile toes.
- Ground bearing floor slabs are not recommended due to high risk of settlement and differential settlement in Made Ground.
- It is recommended that a new site access is opened and the existing one at the back of Coppersmith Road be permanently closed.
- Piling platform for the piling operations will be required. It is recommended that this material is re-used and/or incorporation into permanent works.
- It is recommended that the applications for discharge of surface water and sewerage be sought at the earliest instance.

It is recommended that in the area of Shooters Brook and the canal system that the piling design takes account of the following:

- Avoidance of disturbing ground close to the Shooters Brook culvert such that the perched water table has the opportunity to migrate downwards and enter the culvert as infiltration water.
- Avoidance of disturbance of ground supporting or ‘lining’ the brick Victorian culvert during installation of piles.
- Avoidance of imposing increased stress to canal retaining wall system from proposed installation of piles and avoidance of disturbing ground supporting the walls during piling operations.
- Avoidance of imposing increased stress on the culvert due to the loadings of proposed overlying structures.

Recommendations concerning Shooters Brook infiltration:

- It is not recommended to build over the culvert or disturb the ground immediately in the vicinity of the leaking culvert until the infiltration and culvert is remediated.

FIGURES

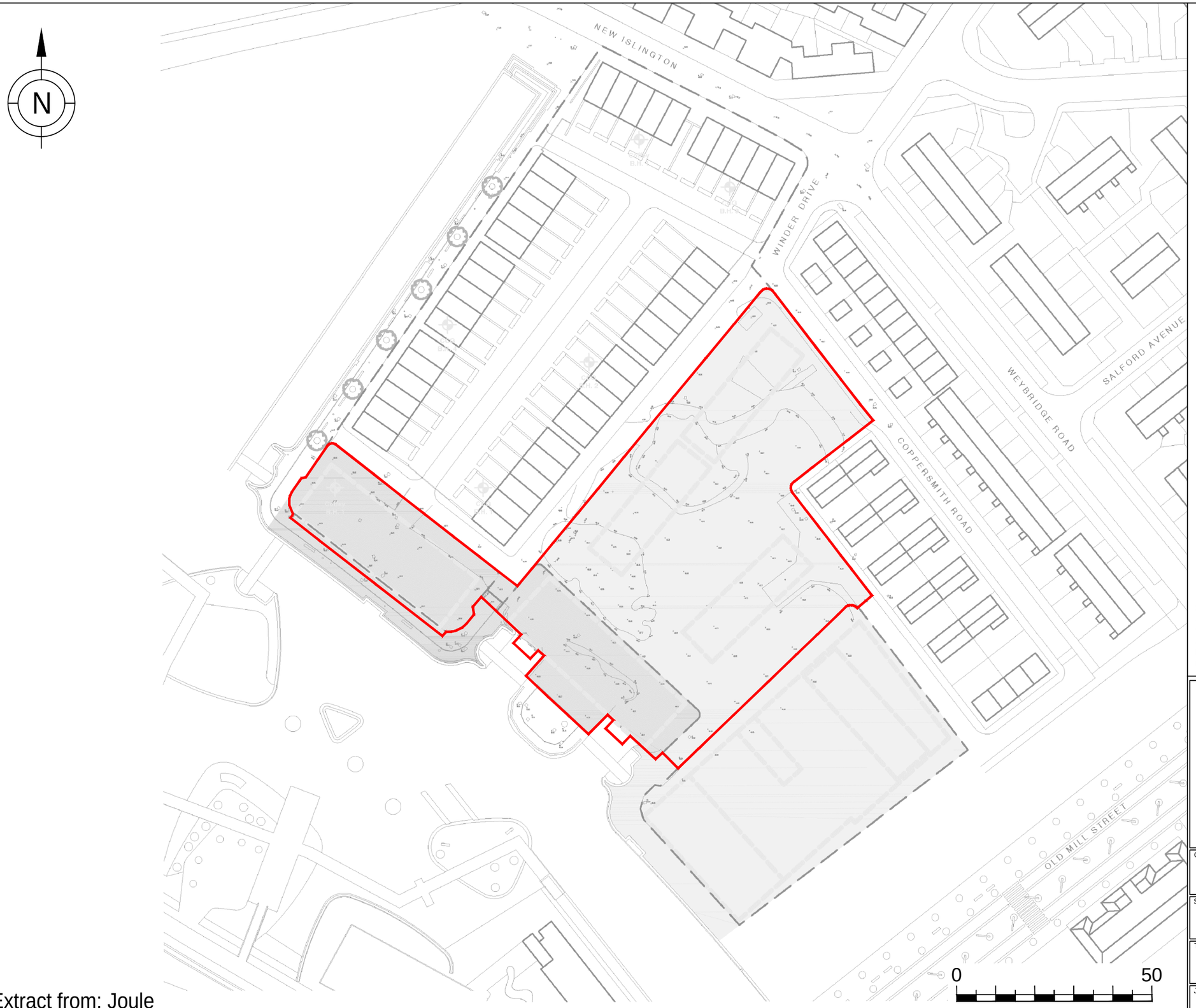


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Figure 1: Site Location Plan, Phase 2 Development, New Islington, Manchester

Drawn: December 2016 Scale: 1:25,000 @ A4 (see scale bar)

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KEY

Site Boundary

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

LK CONSULT LIMITED

Client: Urban Splash

Site: Phase 2 Development, New Islington, Manchester

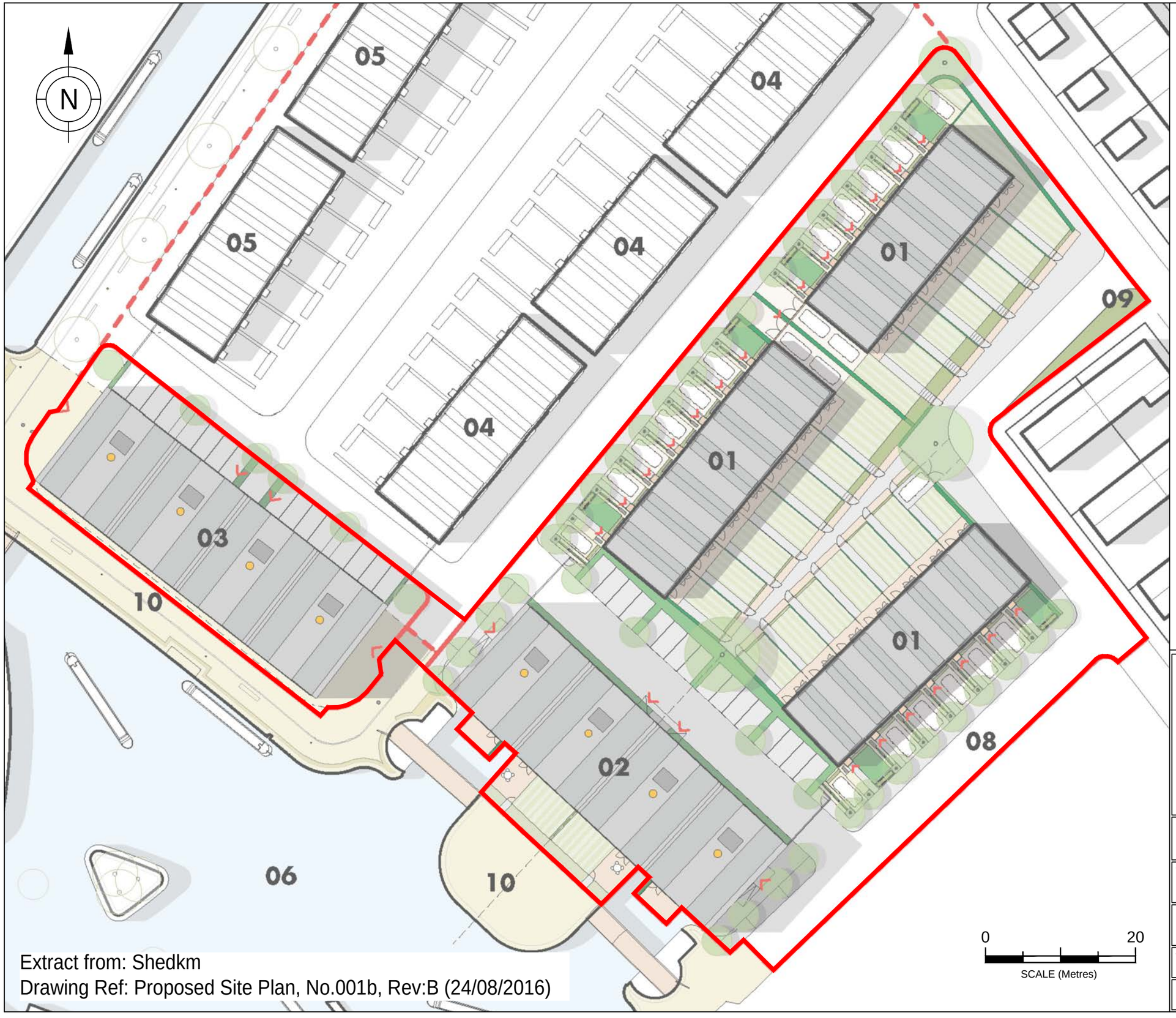
Title: Site Boundary Plan

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 16 1334	1:1000 @ A3	2	

Drawn By:	Checked By:	Drawn:
AC	RC	Dec 2016

Extract from: Joule
Drawing Ref: Existing Site Plan, No.SI 20 (August 2016)

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Extract from: Shedkm
Drawing Ref: Proposed Site Plan, No.001b, Rev:B (24/08/2016)

KEY

Site Boundary

proposed three stroey terraced houses	01
mansion house apartments (ground floor commerical)	02
mansion house apartments (ground floor residentail)	03
two storey terraced houses NI Phase 01	04
three storey terraced houses NI Phase 01	05
New Islington mairna	06
vacant land for development	07
proposed access road	08
landscape top suit existing falls	09
completed public realm to New Islington marina	10
residential entrances	^
commerical entrances	^

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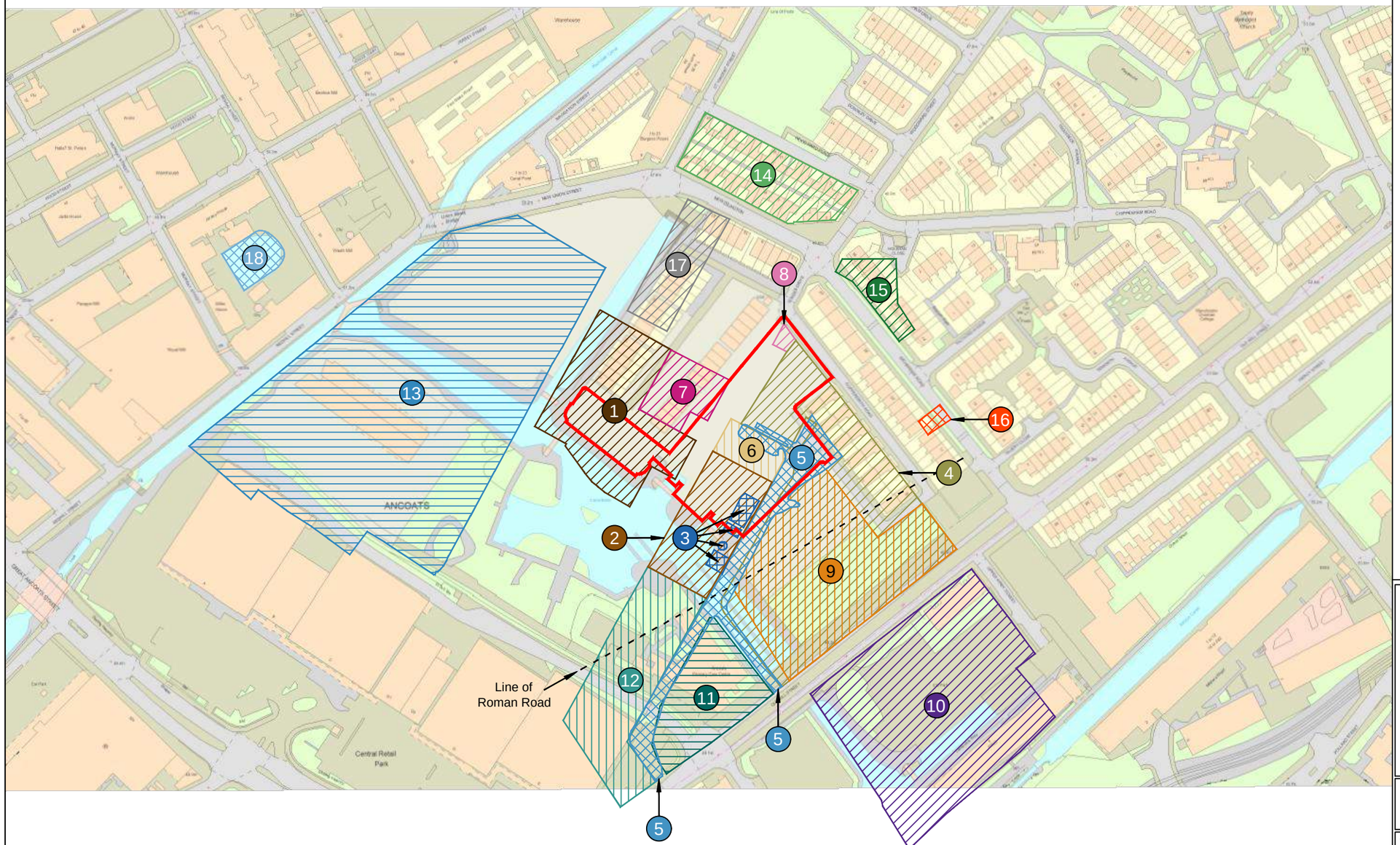
Client: Urban Splash

Site: Phase 2 Development, New Islington, Manchester

Title: Proposed Site Use

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 16 1334	1:500 @ A3	3	

Drawn By:	Checked By:	Drawn:
AC	RC	Dec 2016



Extract from: Envirocheck
Drawing Ref: Existing Site Plan (December 2016)

0 50 100
SCALE (Metres)

KEY

- Site Boundary
- 1 Cotton Mills/Engineering Works/ Other Works
- 2 Canal Street Dye Works
- 3 Reservoirs
- 4 Glass Works/ Other Works
- 5 Canal Branch & Dock
- 6 Dock Yard/Stables/Garage
- 7 Church/School/Play Ground
- 8 Public House
- 9 Brick Field
- 10 Hospital
- 11 Wharfs/Works
- 12 Wharfs/Works
- 13 Canals/Wharfs/Works
- 14 Mill/Works
- 15 Foundry
- 16 Timber Yard
- 17 Foundry
- 18 Basin/Reservoir

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

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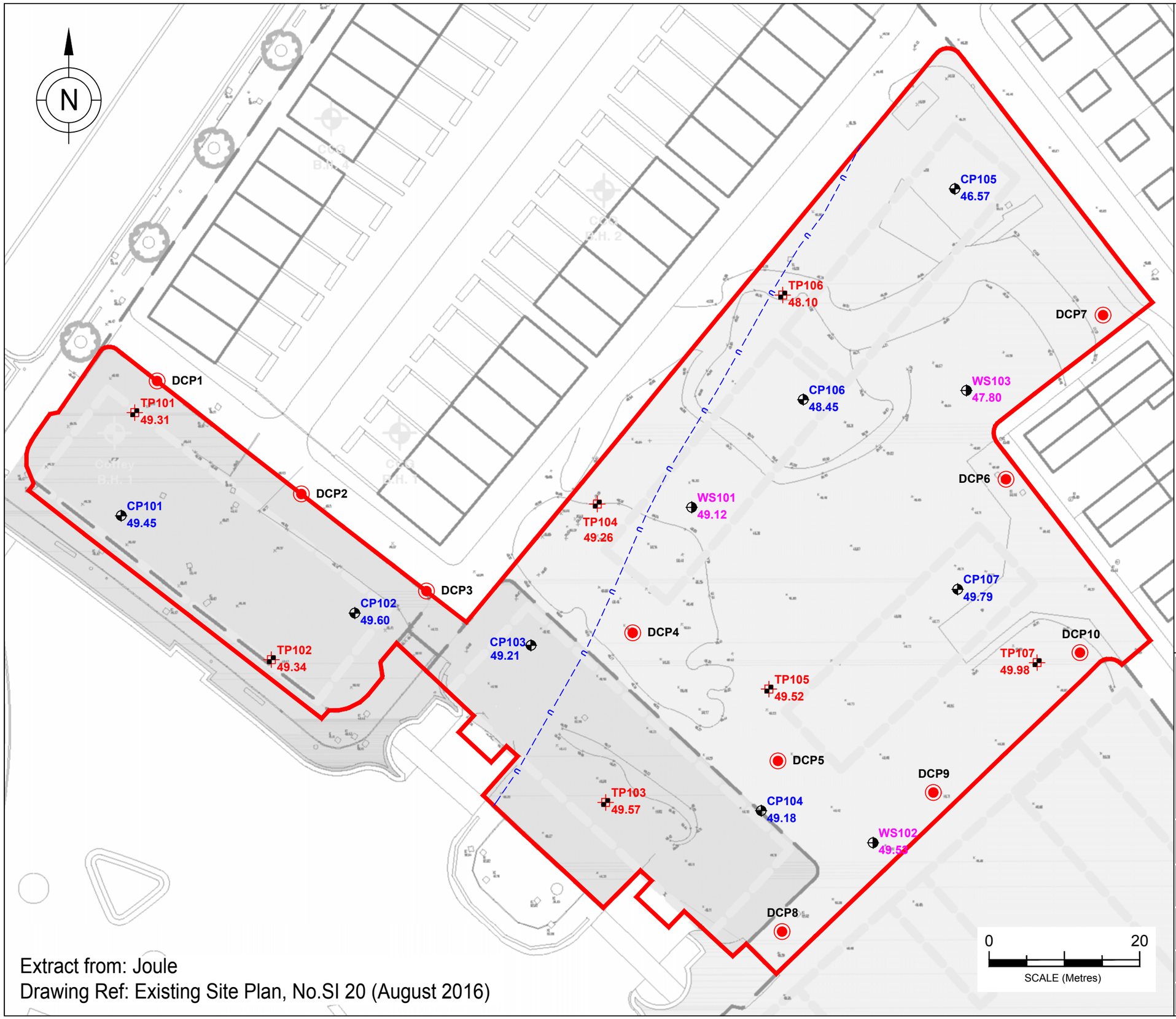
Client: Urban Splash

Site: Phase 2 Development, New Islington, Manchester

Title: Historical Features

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 16 1334	1:2500 @ A3	4	

Drawn By:	Checked By:	Drawn:
AC	CB	Dec 2016



Extract from: Joule
Drawing Ref: Existing Site Plan, No.SI 20 (August 2016)

KEY

- Site Boundary
- Window Sample Borehole (WS)
- Trial Pit (TP)
- Cable Percussive Borehole (CP)
- Dynamic Cone Penetrometer Hole (DCP)
- Line of Culvert

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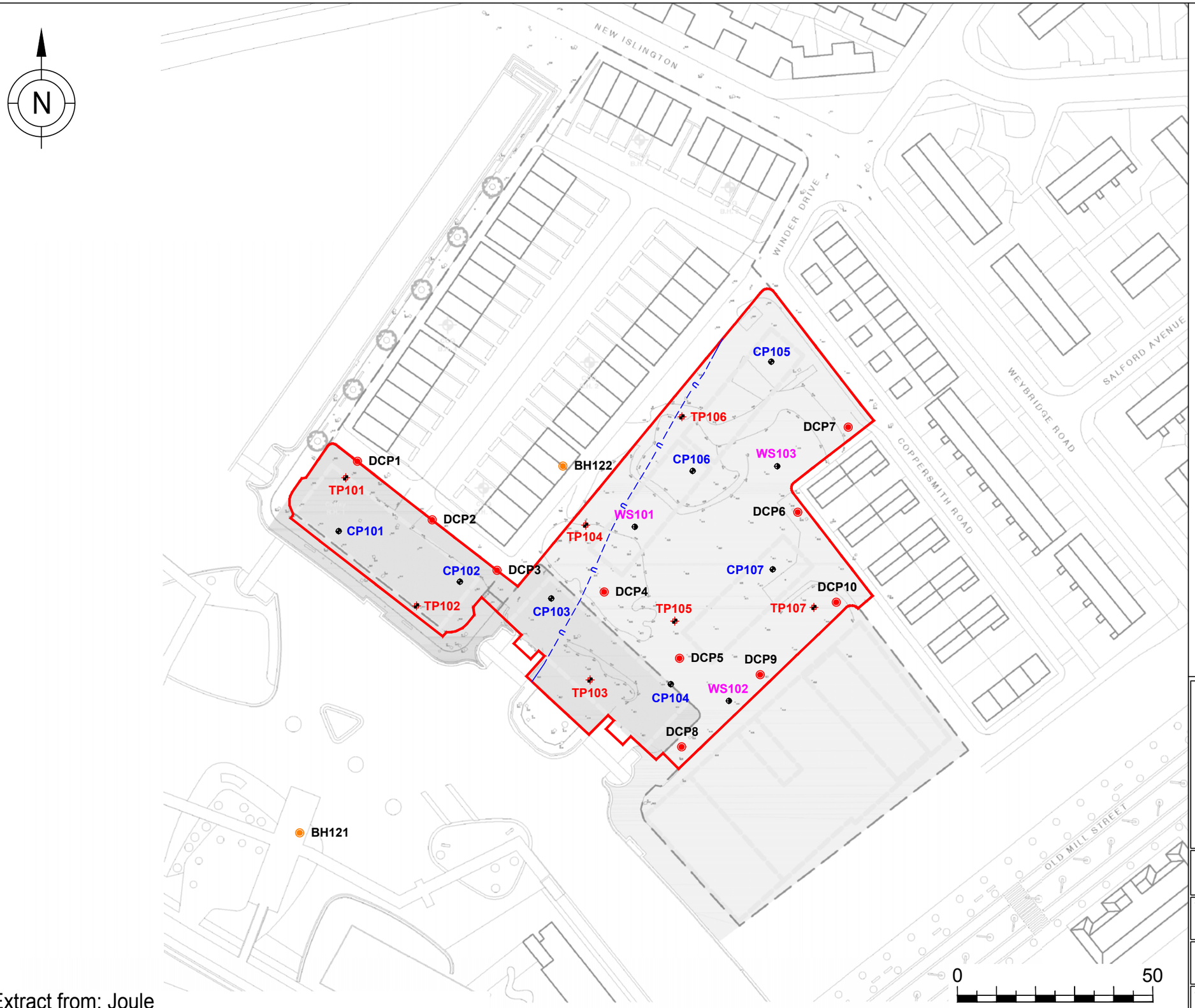
Client: Urban Splash

Site: Phase 2 Development, New Islington, Manchester

Title: Site Investigation Location Plan

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 16 1334	1:500 @ A3	5	

Drawn By:	Checked By:	Drawn:
AC	RC	Feb 2017



KEY

- Site Boundary
- Window Sample Borehole (WS)
- Trial Pit (TP)
- Cable Percussive Borehole (CP)
- Dynamic Cone Penetrometer Hole (DCP)
- Historical Borehole (BH)
- Line of Culvert

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Client: Urban Splash

Site: Phase 2 Development, New Islington, Manchester

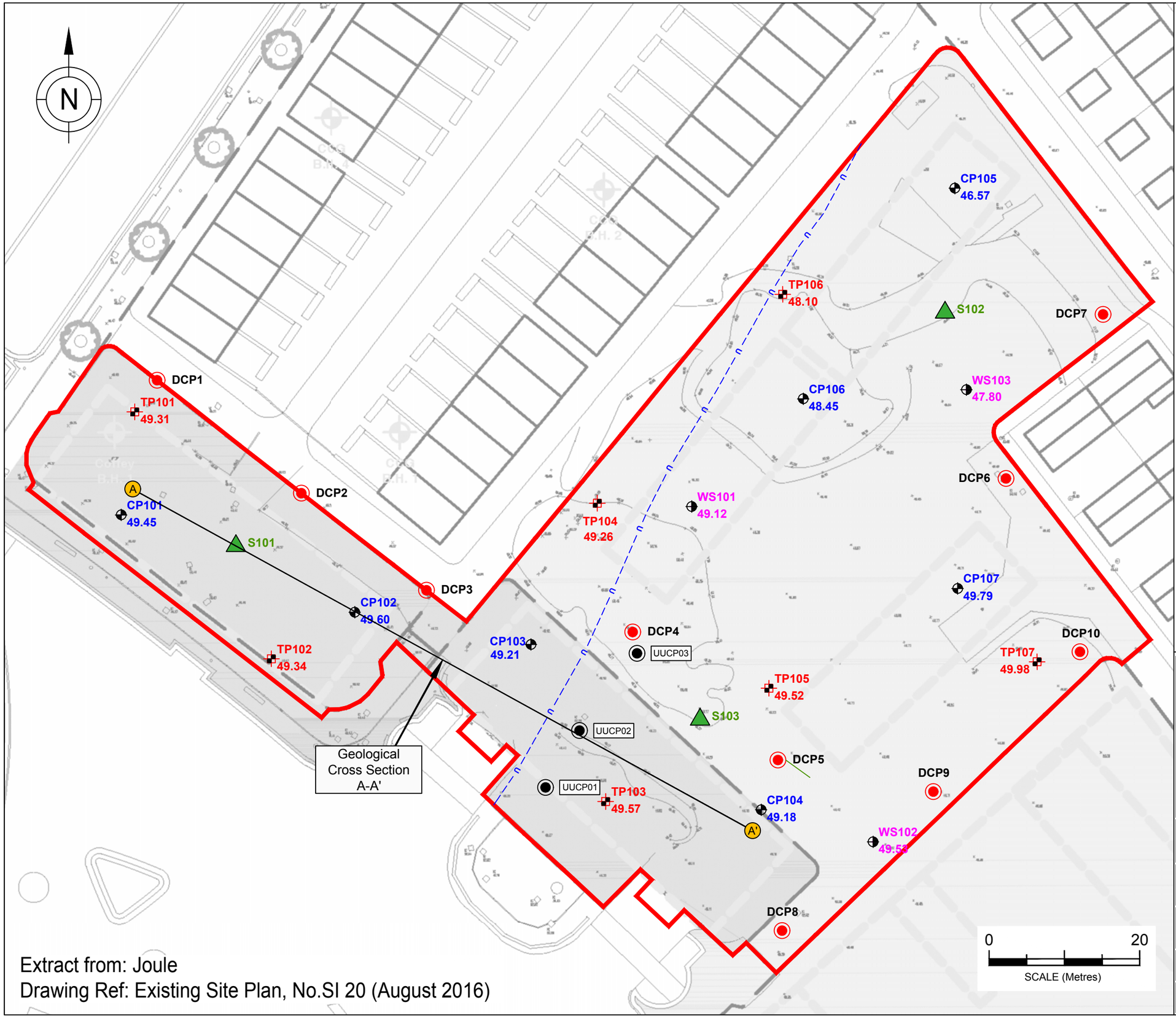
Title: Historical Boreholes

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 16 1334	1:1000 @ A3	6	

Drawn By:	Checked By:	Drawn:
AC	RC	Feb 2017

Extract from: Joule
Drawing Ref: Existing Site Plan, No.SI 20 (August 2016)

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Extract from: Joule
Drawing Ref: Existing Site Plan, No.SI 20 (August 2016)

KEY

- Site Boundary
- Window Sample Borehole (WS)
- Trial Pit (TP)
- Cable Percussive Borehole (CP)
- Dynamic Cone Penetrometer Hole (DCP)
- Line of Culvert
- UU Cable Percussive Borehole (UUCP)
- Soakaway Location (S)

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LK CONSULT LIMITED

Client: Urban Splash

Site: Phase 2 Development, New Islington, Manchester

Title: Geological Cross Section A-A' Including Supplementary Boreholes

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 16 1334	1:500 @ A3	7	

Drawn By:	Checked By:	Drawn:
AC	GB	Mar 2017

APPENDIX A

PROFILE LOGS

LK CONSULT LTD

Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Borehole Number
New Islington, Manchester	CP101

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.45	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385243.979 E 398522.811 N	14-12-2016	LKC	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	D1						MADE GROUND: Brown very sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, coal, concrete, limestone, ash and clinker.			
1.20-1.65	SPT N=18			2,3/5,5,4,4						
2.10-2.51	SPT 50/255			1,3/6,8,18,18		(4.80)				
3.20-3.63	SPT 50/275			6,6/6,10,18,18,16						
4.00-4.45	SPT N=41			6,7/8,8,10,15						
4.80-4.89	SPT 25*/50 50/40			25/50	44.65	4.80	NO RECOVERY			
				Fast(1) at 5.80m, no rise after 15 mins, sealed at 9.20m.		(1.70)			▼1	
6.50-6.95	SPT N=22			3,4/4,5,6,7	42.95	6.50	MADE GROUND: Soft brown very sandy slightly gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, clinker, limestone, coal and concrete.			
						(0.70)				
7.40-7.59	SPT 50/40			9,14/50	42.25	7.20	MADE GROUND: Reddish brown very sandy gravel. Sand is fine to coarse. Gravel is fine to medium, angular to sub-angular, of brick.			
						(1.50)				
8.70-9.15	SPT N=14			2,2/2,3,4,5	40.75	8.70	Soft consistency brown slightly sandy CLAY with occasional gravel. Sand is fine to coarse. Gravel is fine to medium, sub-rounded, of sandstone.			
					40.55	(0.20) 8.90	Firm to stiff consistency brown slightly sandy CLAY with occasional gravel. Sand is fine to coarse. Gravel is fine to medium, sub-rounded, of sandstone.			
9.50-9.80	B1									

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BH101

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Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Borehole Number
New Islington, Manchester	CP101

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.45	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385243.979 E 398522.811 N	14-12-2016	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(2.10)				
10.10-10.55	U100									
10.60	D2									
11.00-11.45	SPT N=35			4,5/7,8,10,10	38.45	11.00	Stiff to very stiff consistency brown slightly sandy slightly gravelly CLAY with sand lenses. Sand is fine to coarse. Gravel is fine, angular to sub-rounded, of sandstone, coal and mudstone.			
12.00-12.45	U100									
12.50	D3					(3.10)				
12.50-12.80	B2									
12.80-13.25	SPT N=38			6,7/8,10,10,10						
13.50-13.95	U100									
14.10-14.40	B3				35.35	14.10	Very dense orange brown slightly silty SAND with occasional gravel. Sand is fine to coarse. Gravel is fine to medium, sub-angular to sub-rounded, of sandstone.			
14.20-14.52	SPT 50/170			9,14/17,25,8						
						(1.90)			▼2	
15.10-15.37	SPT 50/115			10,13/24,26						
15.70-15.92	SPT 50/70			9,15/50						
					33.45	16.00	Very dense brown slightly clayey SAND. Sand is medium to coarse.		▽2	
				Slow(2) at 16.30m, rose to 15.70m in 20 mins.		(1.00)				
16.70-17.00	SPT 50/145			10,15/21,29						
					32.45	17.00	Complete at 17.00m			

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BH101

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Site	Borehole Number
New Islington, Manchester	CP102

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.60	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385275 E 398509.899 N	08-12-2016	LKC	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	D1						MADE GROUND: Dark brown gravelly sandy clay with occasional cobble of concrete. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, ash, and clinker.		
1.20-1.65	SPT N=4			1,2/2,1,0,1					
2.10-2.55	SPT N=17			6,5/3,3,6,5					
						(6.30)			
3.20-3.65	SPT N=16			3,4/3,3,4,6					
4.10-4.55	SPT N=25			10,8/6,5,8,6					
5.00-5.45	SPT N=24			4,4/7,7,6,4					
6.20-6.65	SPT N=19			1,4/4,4,4,7	43.30	6.30	Stiff consistency brown mottled grey gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is fine, angular, to sub-rounded, of coal and sandstone.		
						(0.70)			
7.00-7.45	U100				42.60	7.00	Firm to very stiff consistency brown mottled grey gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is fine, angular, to sub-rounded, of coal and sandstone.		
7.50-7.95	SPT N=36			5,5/7,8,10,11					
7.50	D2								
8.00-8.30	B1								
8.50-8.95	U100								
9.00	D3								
9.50-9.95	SPT N=38			4,5/6,7,11,14					

Remarks
Excavating from 1.00m.

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BH102

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LK CONSULT LTD
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Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Borehole Number
New Islington, Manchester	CP102

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.60	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385275 E 398509.899 N	08-12-2016	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.10-10.55	U100					(6.50)			
10.60	D4								
10.90-11.35	SPT N=34			4,6/7,7,9,11					
11.50-11.80	B2								
12.20-12.65	SPT N=37			5,7/8,9,10,10					
13.50-13.95	U100				36.10	13.50	Stiff consistency brown sandy laminated CLAY. Sand is fine to medium.		
						(0.50)			
14.00	D5				35.60	14.00	Complete at 14.00m		

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BH102

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Site	Borehole Number
New Islington, Manchester	CP103

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.21	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385298.404 E 398505.611 N	15-12-2016-16-12-2016	LKC	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	D1						MADE GROUND: Grey brown very sandy gravelly clay with rare tile. Sand is fine to medium. Gravel is fine to coarse, sub-angular to angular, of birck, coal, ash, and clinker.		
1.20-1.65	SPT N=6			1,2/2,1,1,2					
2.20-2.65	SPT N=3			1,0/1,0,1,1					
						(5.30)			
3.10-3.55	SPT N=39			4,5/7,9,10,13					
4.20-4.65	SPT N=44			7,8/10,10,11,13					
					43.91	5.30			
5.50-5.95	SPT N=36			4,5/6,10,10,10			Firm to very stiff consistency brown mottled grey slightly gravelly CLAY. Gravel is fine, angular to sub-angular, of coal and sandstone.		
6.00-6.30	B1								
6.50-6.95	U100								
						(2.80)			
7.00	D2								
7.30-7.75	SPT N=39			4,5/8,9,10,12					
					41.11	8.10			
8.10-8.55	U100						Very stiff consitency brown slightly gravelly CLAY with occasional coal fragments. Gravel is fine, sub-rounded to rounded, of sandstone.		
8.60	D3								
8.70-9.00	B2								
9.00-9.45	SPT N=43			4,6/9,10,11,13					

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BH103

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Site	Borehole Number
New Islington, Manchester	CP103

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.21	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385298.404 E 398505.611 N	15-12-2016-16-12-2016	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00-10.45	U100								
10.50	D4					(5.10)			
10.70-11.15	SPT N=42			5,7/9,10,10,13					
11.70-12.15	U100								
12.20	D5								
12.50-12.95	SPT N=32			5,6/7,8,8,9					
					36.01	13.20	Stiff consistency brown slightly sandy laminated CLAY. Sand is fine to medium.		
13.20-13.50	B3								
13.50-13.95	U100					(1.20)			
14.00	D6								
					34.81	14.40	Very dense orange brown very gravelly SAND. Sand is fine to medium. Gravel is fine to medium, angular to rounded, of coal and sandstone.		
14.50-14.80	SPT 50/145			10,14/21,29					
15.60-15.89	SPT 50/135			10,13/20,30		(2.50)			
16.30-16.57	SPT 50/115			11,13/24,26					▼1
				Fast(1) at 16.50m, rose to 16.10m in 20 mins.					▽1
					32.31	16.90	Stiff to very stiff consistency sandy CLAY with occasional gravel of coal and sandstone.		
17.30-17.75	U100								
17.80	D7								
18.00-18.30	B4					(2.40)			
18.50-18.95	SPT N=41			6,9/11,10,10,10					
					29.91	19.30	Very dense orange gravelly SAND. Sand is fine to medium. Gravel is fine to medium, sub-rounded to rounded, of sandstone.		
19.60-20.04	SPT 50/285			6,8/10,12,13,15		(0.70)			
					29.21	20.00			

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BH103

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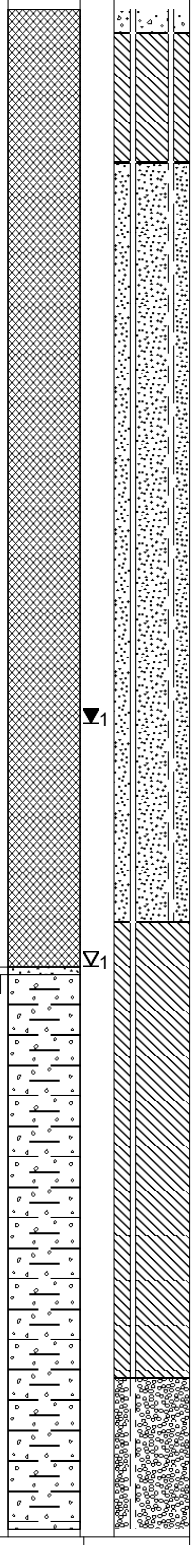
LK CONSULT LTD
Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Borehole Number
New Islington, Manchester	CP104

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.18	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385328.983 E 398483.662 N	20-12-2016-21-12-2016	LKC	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
0.00-1.00	D1						MADE GROUND: Brown slightly sandy slightly gravelly clay with rare clinker gravel. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, sandstone, and coal.
1.20-1.65	SPT N=10			2,2/3,3,2,2			
2.10-2.55	SPT N=7			2,2/2,1,2,2			
						(6.30)	
3.20-3.65	SPT N=16			3,4/4,4,4,4			
4.50-4.95	SPT N=11			1,2/3,3,3,2			
5.50-5.95	SPT N=13			2,3/3,2,4,4			
				Fast(1) at 6.30m, rose to 4.70m in 20 mins, sealed at 7.50m.	42.88	6.30	
					42.83	6.35	Orangish brown fine to medium SAND.
6.30-6.75	SPT N=32			4,4/6,7,8,11			Soft to very stiff consistency dark brown slightly gravelly thinly laminated CLAY. Gravel is fine to medium, sub-angular to sub-rounded, of coal and sandstone.
7.00-7.30	B1						
7.50-7.95	U100						
8.00	D2						
8.30-8.75	SPT N=33			4,5/6,6,9,12			
						(4.15)	
9.10-9.55	U100						
9.60	D3						
9.70-10.15	SPT N=32			5,5/7,7,8,10			



Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BH104

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Site	Borehole Number
New Islington, Manchester	CP104

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.18	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385328.983 E 398483.662 N	20-12-2016-21-12-2016	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.00-10.30	B2									
10.50-10.95	U100				38.68	10.50	Very stiff consistency dark brown slightly sandy slightly gravelly CLAY with lenses of brown very sandy silt and orange sand. Sand is fine to medium. Gravel is fine to medium, sub-angular to sub-rounded, of coal and sandstone.			
11.00	D4									
11.20-11.50	B3									
11.50-11.95	SPT N=42			5,9/10,10,11,11		(3.60)				
12.50-12.89	SPT 50/235			7,11/14,14,15,7						
13.60-14.05	SPT N=45			7,10/10,12,12,11						
14.10-14.38	SPT 50/125			9,15/23,27	35.08	14.10	Very dense orange brown SAND with rare gravel. Sand is fine to medium. Gravel is fine, sub-rounded of coal and sandstone.			
14.50-14.80	B4									
15.30-15.62	SPT 50/170			9,12/18,22,10		(2.20)				
16.30-16.59	SPT 50/135			7,10/22,28	32.88	16.30	Stiff to very stiff consistency reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine, sub-angular to sub-rounded of coal and sandstone.			
16.60-16.90	B5					(0.90)				
17.20-17.50	B6				31.98	17.20	Very stiff brown thinly laminated CLAY.			
17.40-17.85	U100					(0.80)				
18.00-18.27	SPT 50/115			7,14/23,27	31.18	18.00	Very dense orange brown slightly gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-angular to sub-rounded, of coal and sandstone.			
18.50-18.80	B7									
19.10-19.37	SPT 50/115			10,14/25,25		(2.00)				
19.80-20.11	SPT 50/160			9,12/18,22,10	29.18	20.00				

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BH104

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Site	Borehole Number
New Islington, Manchester	CP105

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		46.57	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385354.7 E 398566.182 N	12-12-2016	LKC	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	D1						MADE GROUND: Brown sandy very gravelly clay with rare plastic and occasional clinker gravel. Sand is medium to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, limestone, sandstone, and coal.			
0.00-1.00	PID <0.1ppm									
						(2.30)				
1.20-1.65	SPT N=10			2,3/2,3,3,2						
					44.27	2.30				
2.30-2.75	SPT N=10			1,2/1,2,2,5			Stiff consistency brown mottled grey sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine, angular to sub-angular, of coal and sandstone.			
						(1.10)				
3.00-3.30	B1									
					43.17	3.40				
3.90	U100						Stiff consistency brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine, angular to sub-angular, of coal and sandstone.			
4.50-4.95	SPT N=32			4,7/8,8,8,8						
5.00-5.30	B2									
5.50-5.95	SPT N=36			5,7/8,9,9,10						
						(5.10)				
6.60-7.05	U100									
7.10	D2									
7.40-7.85	SPT N=37			4,8/9,9,9,10						

Remarks

Scale (approx)	Logged By
1:40	NS

Figure No. LKC 16 1334.BH105

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Site	Borehole Number
New Islington, Manchester	CP105

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		46.57	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385354.7 E 398566.182 N	12-12-2016	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
8.50-8.95	U100				38.07	8.50	Very stiff consistency brown sandy slightly gravelly CLAY with sand lenses. Sand is fine to coarse. Gravel is fine, angular to sub-angular, of coal and sandstone.			
9.00	D3									
9.60-10.05	SPT N=33			5,7/7,8,8,10						
10.00-10.30	B3					(2.90)				
10.70-11.13	SPT 50/275			5,9/10,12,12,16						
11.00-11.30	B4									
11.50-11.77	SPT 50/115			7,15/21,29	35.17	11.40	Very dense reddish brown slightly clayey SAND with occasional sandstone gravel. Sand is fine to coarse.			
11.90-12.12	SPT 50/70			10,14/50		(0.72)				
					34.45	12.12	Complete at 12.12m			

Remarks

Scale (approx)	Logged By
1:40	NS

Figure No.
LKC 16 1334.BH105

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Site	Borehole Number
New Islington, Manchester	CP106

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		48.45	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385334.572 E 398538.219 N	09-12-2016	LKC	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	D1						MADE GROUND: Brown slightly gravelly clay with frequent crushed brick and rare clinker gravel. Gravel is fine to medium, angular to sub-angular, of brick and coal.		
1.20-1.65	SPT N=5			1,2/1,1,1,2					
2.30-2.75	SPT N=10			2,2/2,2,3,3		(4.50)			
3.50-3.95	SPT N=13			2,3/3,3,4,3					
4.50-4.95	SPT N=30			3,4/6,6,8,10	43.95	4.50	Very stiff consistency brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium, sub-angular to sub-rounded, of coal and sandstone.		
5.00-5.30	B1								
5.50-5.95	U100								
6.00	D2								
6.20-6.65	SPT N=36			5,7/8,9,9,10					
7.00-7.30	B2								
8.00-8.45	U100					(6.50)			
8.50	D3								
9.00-9.45	SPT N=37			6,6/8,8,10,11					
10.00-10.45	SPT N=32			5,6/7,8,8,9					

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No. LKC 16 1334.BH106

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Site	Borehole Number
New Islington, Manchester	CP106

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		48.45	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385334.572 E 398538.219 N	09-12-2016	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
11.00-11.45	U100				37.45	11.00	Very stiff consistency slightly sandy CLAY with sand lenses and occasional gravel. Sand is fine to coarse. Gravel is fine to medium, sub-angular to sub-rounded, of coal and sandstone.		
11.50	D4								
12.00-12.45	SPT N=38			6,7/9,10,10,9					
						(3.05)			
12.70-13.15	D5								
12.70-13.15	U100								
13.00-13.30	B3								
13.60-14.05	SPT N=30			5,6/7,7,8,8					
					34.40	14.05	Complete at 14.05m		

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No. LKC 16 1334.BH106

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Site	Borehole Number
New Islington, Manchester	CP107

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.79	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385355.068 E 398513.052 N	20-12-2016-21-12-2016	LKC	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							MADE GROUND: Brown very sandy gravelly CLAY with rare clinker gravel. Sand is medium to coarse. Gravel is fine to medium, angular to sub-angular, of brick, concrete, sandstone, and coal.		
1.20-1.65	SPT N=4			1,0/2,0,1,1					
2.20-2.65	SPT N=5			1,2/2,1,1,1		(4.90)			
3.00-3.31	SPT 50/160			9,10/19,21,10					
4.00-4.33	SPT 43/180			6,10/11,11,21					▼1
				Fast(1) at 4.90m, rose to 4.70m in 20 mins, sealed at 5.00m.	44.89	4.90			▽1
4.90-5.35 5.50-5.80	SPT N=35 B1			4,5/7,7,10,11		(1.10)	Very stiff consistency brown mottled grey slightly sandy slightly gravelly thinly laminated CLAY. Sand is fine to medium. Gravel is fine, angular to sub-rounded, of coal and sandstone.		
6.50-6.65	U100				43.79	6.00			
6.70 6.80-7.25	D1 SPT N=34			5,7/8,8,9,9		(2.00)	Stiff to very stiff consistency brown mottled grey CLAY with rare gravel. Gravel is fine to medium, angular to sub-rounded, of coal and sandstone.		
7.50-7.95	U100								
8.00-8.45 8.00	SPT N=35 D2			6,7/8,9,9,9	41.79	8.00	Stiff to very stiff consistency brown mottled grey slightly gravelly CLAY. Gravel is fine to medium, angular to sub-rounded, of coal and sandstone.		
9.00-9.45	U100								
9.50	D3								
9.70-10.15	SPT N=37			6,8/9,9,10,9					

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BH107

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Site	Borehole Number
New Islington, Manchester	CP107

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.79	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385355.068 E 398513.052 N	20-12-2016-21-12-2016	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.20-10.50	B2								
11.00-11.45	U100					(5.95)			
11.50	D4								
11.50-11.80	B3								
12.20-12.65	SPT N=32			5,5/7,7,8,10					
13.50-13.95	SPT N=33			4,5/7,8,9,9					
					35.84	13.95	Complete at 13.95m		

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No. LKC 16 1334.BH107

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Site	Trial Pit Number
New Islington, Manchester	TP101

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX	0.50m x 2.00m		Urban Splash	LKC 16 1334
	Location	**Dates** 08-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.70 0.00-0.70	D1 PID <0.1ppm				(0.70)	MADE GROUND: Greyish brown cobbley gravelly sandy clay with occasional wood, fabric, rope and areas of organic dense rootlets. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded, of brick, concrete, taramac, and tile.		
0.70-1.80 0.70-1.80	D2 PID <0.1ppm				0.70 (1.10)	MADE GROUND: Dark brown cobbley sandy slightly clayey gravel with occasional wood, fabric, metal and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, and masonry.		
1.80-3.40 1.80-3.40	D3 PID <0.1ppm				1.80 (1.60)	MADE GROUND: Greyish brown cobbley gravelly sandy clay with occasional wood, fabric, rope, and brick and concrete boulders. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded, of brick, concrete, coal, taramac, tile, and occasional ash and clinker. Rare black staining identified between 1.90 and 3.40mbgl.		
					3.40	Complete at 3.40m		



Remarks

No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.TP101

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Site	Trial Pit Number
New Islington, Manchester	TP102

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX	0.50m x 2.00m		Urban Splash	LKC 16 1334
	Location	**Dates** 08-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00 0.00-1.00	D1 PID <0.1ppm		Water strike(1) at 0.30m.			MADE GROUND: Dark brown cobbley gravelly very sandy clay with occasional wood, metal and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded, of brick, concrete, taramac, paving, and occasional ash and clinker. Rare black staining identified.		▽1
1.00-2.00 1.00-2.00	D2 PID <0.1ppm				(3.50)			
2.00-3.50 2.00-3.50	D3 PID <0.1ppm				3.50	Complete at 3.50m		



Remarks

Slight groundwater seepage at 0.3m.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.TP101

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Site	Trial Pit Number
New Islington, Manchester	TP103

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX	0.50m x 2.00m		Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
	08-12-2016	LKC	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60 0.00-0.60	D1 PID <0.1ppm				(0.60) 0.60	MADE GROUND: Orange / yellow clayey cobbley sandy gravel with wood, plastic and metal.		
0.60-2.00 0.60-2.00	D2 PID <0.1ppm				(2.40)	MADE GROUND: Dark brown cobbley sandy very gravelly clay with occasional wood, metal and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, coal, masonry, and occasional ash and clinker.		
2.00-3.00 2.00-3.00	D3 PID <0.1ppm				3.00	Complete at 3.00m		



Remarks

No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.TP101

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Site	Trial Pit Number
New Islington, Manchester	TP104

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX	0.50m x 2.00m		Urban Splash	LKC 16 1334
	Location	**Dates** 08-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00 0.00-1.00	D1 PID 0.4ppm					MADE GROUND: Dark brown cobbley very sandy gravelly clay with occasional wood, metal and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, coal, masonry, and occasional ash and clinker. Rare boulder of concrete, and siltstone.		
1.00-2.00 1.00-2.00	D2 PID <0.1ppm				(2.90)			
2.00-2.90 2.00-2.90	D3 PID <0.1ppm					Large quantity of plastic tarpaulin encountered between 2.20m and 2.60mbgl.		
					2.90	Complete at 2.90m		



Remarks

No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.TP101

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Site	Trial Pit Number
New Islington, Manchester	TP105

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX	0.50m x 2.00m		Urban Splash	LKC 16 1334
	Location	**Dates** 08-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00 0.00-1.00	D1 PID <0.1ppm					MADE GROUND: Dark brown cobbley sandy very gravelly clay with occasional wood, metal and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, masonry, and rare ash and clinker.		
1.00-2.00 1.00-2.00	D2 PID <0.1ppm				(2.30)	Rare black staining identified between 2.30m to 2.79mbgl.		
2.30-2.60 2.30-2.60	D3 PID 0.3ppm				2.30 (0.49) 2.79	MADE GROUND: Black gravelly sandy clay with wood. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, ash and clinker.		
					2.80	MADE GROUND: Brick flooring. Complete at 2.80m		



Remarks

No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.TP101

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Site	Trial Pit Number
New Islington, Manchester	TP106

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX	0.50m x 2.00m		Urban Splash	LKC 16 1334
	Location	**Dates** 08-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00 0.00-1.00	D1 PID <0.1ppm				(0.10) 0.10	MADE GROUND: Dark brown cobbley sandy very gravelly clay with occasional wood, metal and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, masonry, and rare ash and clinker.		
						FILL: Soft to firm brown slightly sandy gravelly clay with plastic, metal, and wood. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, ash and clinker.		
1.00-2.00 1.00-2.00 1.10	D2 PID <0.1ppm SV 27.67kPa		29, 28, 26/Av. 27.67		(1.89)			
					1.99 2.00	MADE GROUND: Tarmacadam. Complete at 2.00m		



Remarks

No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.TP101

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Site	Trial Pit Number
New Islington, Manchester	TP106A

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX	0.50m x 2.00m		Urban Splash	LKC 16 1334
	Location	**Dates** 08-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.80 0.00-1.80	D1 PID <0.1ppm				(1.80)	MADE GROUND: Dark brown cobbley sandy very gravelly clay with occasional wood, metal, geomembrane rolls and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, masonry, and rare ash and clinker.		
					1.80 (0.10) 1.90	MADE GROUND: Brick cobble structure - possible former road.		
1.90-3.00 1.90-3.00	D2 PID <0.1ppm				(1.10)	MADE GROUND: Black cobbley very sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of ash, clinker, brick, concrete and coal.		
					3.00	Complete at 3.00m		



Remarks

No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.TP101

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Site	Trial Pit Number
New Islington, Manchester	TP107

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX	0.50m x 2.00m		Urban Splash	LKC 16 1334
	Location	**Dates** 08-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00 0.00-1.00	D1 PID <0.1ppm					MADE GROUND: Dark brown cobbley sandy very gravelly clay with occasional wood, metal, and plastic, with occasional concrete boulders. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, concrete, masonry, and sandstone.		
1.00 1.00-2.00 1.00-2.00	SV 38.33kPa D2 PID <0.1ppm		40,30,45/Av. 38.33		(3.10)			
2.00 2.00-3.00 2.00-3.00	SV 27.33kPa D3 PID <0.1ppm		26,27,29/Av. 27.33					
					3.10	Complete at 3.10m		



Remarks

No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.TP101

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Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Number
New Islington, Manchester	WS101

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Urban Splash	LKC 16 1334
	Location	**Dates** 13-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00 0.00-1.00	D1 PID <0.1ppm					MADE GROUND: Firm consistency dark brown sandy very gravelly clay with occasional cobbles of brick and sandstone, and with plastic, metal and rubber. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of brick, sandstone, tile, coal, clinker, and glass.			
1.00-1.45 1.00-2.00 1.00-2.00	SPT N=11 D2 PID <0.1ppm		3,3/3,3,3,2		(3.26)				
2.00-2.45 2.00-3.00 2.00-3.00	SPT N=8 D3 PID <0.1ppm		2,2/3,2,2,1						
3.00-3.23	SPT 50/75		7,5/5,45		3.26	Complete at 3.26m			

Remarks
No groundwater encountered.

Scale (approx)	Logged By
1:40	NS

Figure No. LKC 16 1334.WS101

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Site	Number
New Islington, Manchester	**WS102**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Urban Splash	LKC 16 1334
	Location	**Dates** 13-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00 0.00-1.00	D1 PID <0.1ppm					MADE GROUND: Firm to stiff consistency dark brown sandy gravelly clay with rare plastic. Sand is fine to coarse. Gravel is fine to medium, angular to sub-rounded, of brick, coal, sandstone, limestone and clinker.			
1.00-1.45 1.00-2.00 1.00-2.00	SPT N=15 D2 PID <0.1ppm		3,3/4,3,4,4		(2.90)				
2.00-2.45 2.00-2.90 2.00-2.90	SPT N=6 D3 PID <0.1ppm		1,1/2,1,1,2						
3.00-3.45	SPT N=16		3,3/3,3,5,5		2.90 (1.50)	MADE GROUND: White / brown sandy clayey gravel. Sand is fine to coarse. Gravel is fine to medium, angular to sub-angular, of limestone (MOT).		▽1	
4.00-4.45	SPT N=13		Water strike(1) at 4.00m. 2,3/3,3,3,4						
4.50-5.00 4.50-5.00	D4 PID <0.1ppm				4.40 (0.60)	Firm consistency brown very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine, angular to sub-angular, of coal and sandstone.			
5.00-5.45	SPT N=23		3,3/4,5,6,8		5.00 (0.45) 5.45	Stiff conssitency brown slightly silty CLAY. Complete at 5.45m			

Remarks

Scale (approx)	Logged By
1:40	NS

Figure No. LKC 16 1334.WS102

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Site	Number
New Islington, Manchester	WS103

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Urban Splash	LKC 16 1334
	Location	**Dates** 13-12-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00 0.00-1.00	D1 PID <0.1ppm				(0.90)	MADE GROUND: Firm consistency sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular, of brick, coal and limestone.			
					0.90				
1.00-1.45 1.00-1.90 1.00-1.90	SPT N=26 D2 PID <0.1ppm		10,9/9,6,6,5		(0.50)	MADE GROUND: White / orange very sandy gravel. Sand is medium to coarse. Gravel is fine to medium, angular to sub-angular, of limestone (MOT).			
					1.40				
					(0.50)	MADE GROUND: Firm consistency sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular, of brick, coal, clinker and limestone.			
					1.90				
2.00-2.45 2.00-3.00 2.00-3.00 2.00-3.00	SPT N=15 B1 D3 PID <0.1ppm		3,3/3,4,4,4			Firm consistency brown mottled grey and orange sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium, angular to sub-rounded, of coal and sandstone.			
3.00-3.45	SPT N=35		6,7/7,9,9,10						
					(3.25)				
3.70-4.15	SPT N=31		4,5/5,7,9,10						
4.70-5.15	SPT N=35		6,7/7,9,9,10						
					5.15	Complete at 5.15m			

Remarks
No groundwater encountered.

Scale (approx)	Logged By
1:40	NS

Figure No.
LKC 16 1334.WS103

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Site	Borehole Number
New Islington, Manchester	UUCP101

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.37	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385298.489 E 398484.024 N	09-02-2017	LKC	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(4.80)	MADE GROUND: Grey brown very sandy gravelly clay with rare tile. Sand is fine to medium. Gravel is fine to coarse, sub-angular to angular, of brick, concrete, coal, ash and clinker.			
					44.57	4.80				
						(0.70)	MADE GROUND: Brown slightrly sandy clay with rare brick content. Sand is fine to coarse.			
					43.87	5.50				
5.90-6.20	B1						Very stiff consistency brown mottled grey slightly gravelly CLAY. Gravel is fine, angular to sub-angular, of coal and sandstone.			
7.50-7.95	U100									
8.00	D1									
8.20-8.50	B2					(5.50)				
9.00-9.45	U100									
9.50	D2									
9.70-10.00	B3									

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BHUU03

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Site	Borehole Number
New Islington, Manchester	UUCP101

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.37	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385298.489 E 398484.024 N	09-02-2017	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.60-11.05	U100									
11.10	D3				38.37	11.00	Very stiff consistency brown sandy CLAY. Sand is fine to medium.			
11.50-11.80	B4					(1.00)				
					37.37	12.00	Complete at 12.00m			

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BHUU03

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Site	Borehole Number
New Islington, Manchester	UUCP102

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.35	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385302.575 E 398495.351 N	03-02-2017	LKC	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(5.60)	MADE GROUND: Grey brown very sandy gravelly clay with rare tile. Sand is fine to medium. Gravel is fine to coarse, sub-angular to angular, of brick, coal, ash and clinker.			
					43.75	5.60				
6.00-6.30	B1						Very stiff consistency brown mottled grey slightly gravelly CLAY. Gravel is fine, angular to sub-angular, of coal and sandstone.			
7.40-7.85	U100									
7.90	D1					(4.55)				
8.00-8.30	B2									
9.00-9.45	U100									
9.50	D2									

Remarks
Borehole refused on a boulder at 10.15mbgl.

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BHUU03

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Site	Borehole Number
New Islington, Manchester	UUCP102

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.35	Urban Splash	LKC 16 1334

Location	Dates	Engineer	Sheet
385302.575 E 398495.351 N	03-02-2017	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.10-10.15	SPT 0*/50 50/0			/50	39.20	10.15	Boulder encountered at 10.10mbgl. Complete at 10.15m			

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BHUU03

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	**Site** New Islington, Manchester		**Borehole Number** **UUCP103**
Boring Method Cable Percussion	**Casing Diameter**	**Ground Level (mOD)** 49.24	**Client** Urban Splash	**Job Number** LKC 16 1334
	Location 385308.101 E 398506.305 N	**Dates** 09-02-2017	**Engineer** LKC	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(4.80)	MADE GROUND: Grey brown very sandy gravelly clay with rare tile. Sand is fine to medium. Gravel is fine to coarse, sub-angular to angular, of brick, concrete, coal, ash and clinker.			
					44.44	4.80				
5.20-5.50	B1						Very stiff consistency brown mottled grey slightly gravelly CLAY. Gravel is fine, angular to sub-angular, of coal and sandstone.			
7.40-7.85	U100									
7.90	D1					(6.20)				
8.00-8.30	B2									
9.00-9.45	U100									
9.50	D2									

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BHUU03

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Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Borehole Number
New Islington, Manchester	UUCP103

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion		49.24	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385308.101 E 398506.305 N	09-02-2017	LKC	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.00-10.30	B3									
10.50-10.95	U100									
11.00	D3				38.24	11.00	Very stiff consistency brown silty CLAY.			
11.20-11.50	B4					(1.00)				
					37.24	12.00	Complete at 12.00m			

Remarks

Scale (approx)	Logged By
1:50	NS

Figure No.
LKC 16 1334.BHUU03

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Site New Islington, Manchester			**Trial Pit Number** S101
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.2m x 0.6m x 2.6m	**Ground Level (mOD)**	**Client** Urban Splash **Job Number** LKC 16 1334
	Location	**Dates** 01-02-2017	**Engineer** LKC **Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-2.00	D1				(2.60)	MADE GROUND: Dark brown / black sandy gravelly cobbley clay with occasional ash and clinker, metal, wood, plastic and glass. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rouded, of brick, slate, concrete and coal. Cobbles are sub-angular of brick and concrete.		
					2.60	Complete at 2.60m		



Remarks
Excavating from 2.00m.
No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.S101

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Site New Islington, Manchester			**Trial Pit Number** S102
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 1.7m x 0.6m x 2.0m	**Ground Level (mOD)**	**Client** Urban Splash	**Job Number** LKC 16 1334
	Location	**Dates** 01-02-2017	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-2.00	D1				(1.90)	MADE GROUND: Dark brown / black sandy gravelly cobbley clay with occasional ash and clinker, metal, wood, wire, plastic and glass. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rouded, of brick, slate, tarmacadam, concrete and coal. Cobbles are sub-angular of brick and concrete.		
					1.90 (0.10) 2.00	MADE GROUND: Yellow brown cobbley sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular, of sandstone and brick. Cobbles are angular to sub-angular of sandstone and brick. Complete at 2.00m		



Remarks
Excavating from 2.00m.
No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.S101

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com		**Site** New Islington, Manchester	**Trial Pit Number** **S103**
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 1.8m x 0.6m x 2.1m **Location**	**Ground Level (mOD)** **Dates** 01-02-2017	**Client** Urban Splash **Engineer** LKC	**Job Number** LKC 16 1334 **Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-2.00	D1				(1.90)	MADE GROUND: Dark brown / black sandy gravelly cobbley clay with occasional ash and clinker, metal, wood, wire, plastic and glass. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rouded, of brick, slate, tarmacadam, concrete and coal. Cobbles are sub-angular of brick and concrete.		
					1.90	Complete at 2.10m		



Remarks
Excavating from 2.00m.
No groundwater encountered.

Scale (approx)	Logged By	Figure No.
1:25	NS	LKC 16 1334.S101

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APPENDIX B

GEOTECHNICAL LABORATORY RESULTS

LABORATORY REPORT

4043

Contract Number: PSL17/0104

Report Date: 06 February 2017

Client's Reference:

Client Name: The LK Group
Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

For the attention of: Rosie Cummings

Contract Title: New Islington Manchester

Date Received: 10/1/2017
Date Commenced: 10/1/2017
Date Completed: 6/2/2017

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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
L Knight (Senior Technician)	S Royle (Senior Technician)	A Fry (Senior Technician)

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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
101	X2		1.65		MADE GROUND brown very gravelly sandy clay.
101	X3		2.50		MADE GROUND brown very gravelly sandy clay.
101	X5		4.65		MADE GROUND brown very gravelly sand.
101	X6		4.90		MADE GROUND brown very sandy silty gravel.
101	X7		6.95		MADE GROUND brown gravelly sandy clay.
101	X9		9.15		Brown sandy CLAY.
101	U11		10.55		Firm brown slightly gravelly very sandy CLAY.
101	U14		12.45		Stiff brown sandy CLAY.
101	B16		12.80		Brown slightly gravelly sandy CLAY.
101	U18		13.95		Brown slightly gravelly very sandy CLAY.
101	B21		14.50		Brown slightly gravelly clayey very silty SAND.
102	X2		2.55		MADE GROUND dark brown very sandy very clayey gravel.
102	X5		5.45		MADE GROUND brown very gravelly sandy clay.
102	U7		7.45		Stiff brown slightly gravelly very sandy CLAY.
102	U11		8.95		Stiff brown slightly gravelly very sandy CLAY.
102	U14		10.55		Stiff brown slightly gravelly very sandy CLAY.
102	U19		13.95		Firm brown slightly sandy CLAY.
103	X2		1.65		MADE GROUND brown very sandy slightly clayey gravel.
103	X4		3.55		MADE GROUND brown clayey sand & gravel.

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
103	X5		4.65		MADE GROUND brown very clayey sand & gravel.
103	B7		6.30		MADE GROUND brown gravelly sandy clay.
103	U8		6.95		Very stiff brown slightly gravelly sandy CLAY.
103	U11		8.55		Very stiff brown slightly gravelly sandy CLAY.
103	U15		10.45		Brown slightly gravelly very sandy CLAY.
103	U18		12.15		Stiff brown slightly gravelly very sandy CLAY.
103	B21		13.50		Brown sandy CLAY.
103	U22		13.95		Firm brown sandy CLAY.
103	U28		17.75		Very stiff brown slightly gravelly very sandy CLAY.
103	B30		18.30		Brown slightly sandy CLAY.
104	U9		7.95		Very stiff brown slightly gravelly very sandy CLAY.
104	U16		10.95		Hard brown slightly gravelly very sandy CLAY.
105	X1		1.65		MADE GROUND brown very clayey sand & gravel.
105	X2		2.75		Brown slightly gravelly sandy CLAY.
105	B30		3.30		Brown slightly gravelly sandy CLAY.
105	U4		3.85		Stiff brown slightly gravelly sandy CLAY.
105	B7		5.30		Brown slightly gravelly sandy CLAY.
105	U9		7.05		Stiff brown slightly gravelly sandy CLAY.
105	U12		8.95		Very stiff brown slightly gravelly very sandy CLAY.

UKAS TESTING 4043	PSL Professional Soils Laboratory	New Islington Manchester	Contract No: PSL17/0104 Client Ref:

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
106	X3		2.75		MADE GROUND brown gravelly sandy clay.
106	U7		5.95		Firm brown very sandy CLAY.
106	U11		8.45		Stiff brown slightly gravelly very sandy CLAY.
106	U15		11.45		Stiff brown slightly gravelly very sandy CLAY.
107	U7		6.65		Very stiff brown slightly gravelly sandy CLAY.
107	U17		11.45		Very stiff brown sandy CLAY.

UKAS TESTING
4043

PSL
Professional Soils Laboratory

New Islington Manchester

Contract No:
PSL17/0104
Client Ref:

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
101	X3		2.50		19			48	23	25	73	Intermediate plasticity CI.
101	X5		4.65		6.4							
101	X7		6.95		22							
101	X9		9.15		17							
101	U11		10.55		18			34	17	17	94	Low plasticity CL.
101	U14		12.45		23			47	23	24	100	Intermediate plasticity CI.
101	U18		13.95		16			32	16	16	97	Low plasticity CL.
103	X4		3.55		12							
103	U15		10.45		14			33	17	16	97	Low plasticity CL.
103	B30		18.30		28			64	27	37	100	High plasticity CH.
105	X2		2.75		21							
105	U4		3.85		17			45	21	24	93	Intermediate plasticity CI.
105	B7		5.30		21							
105	U12		8.95		15			31	16	15	94	Low plasticity CL.

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

New Islington Manchester

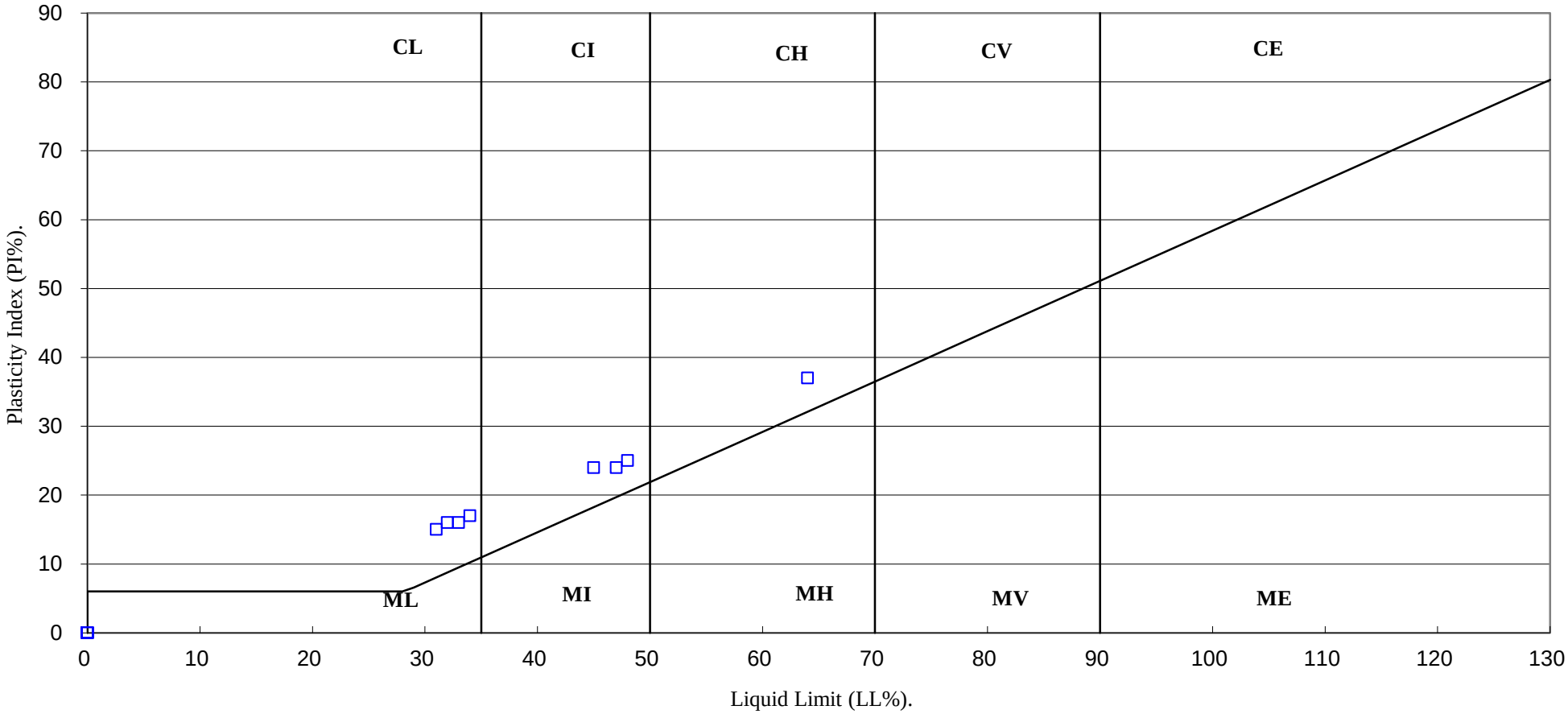
Contract No:

PSL17/0104

Client Ref:

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(BS5930 :2015)



UKAS TESTING 4043	PSL Professional Soils Laboratory	**New Islington Manchester**	**Contract No:**
			PSL17/0104
			Client Ref:

SUMMARY OF SOIL DENSITY RELATED TESTS

(BS1377 : PART 2 & 4 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Retained 20mm %	Retained 37.5mm %	Method of compaction kg	Maximum Dry Density Mg/m^3	Minimum Dry Density Mg/m^3	Remarks
101	X2		1.65		18	2.12	1.80						
101	X6		4.90		17	1.89	1.62						
102	X2		2.55		13	1.97	1.74						
102	X5		5.45		22	2.06	1.69						
102	U7		7.45		17	2.20	1.88						
102	U19		13.95		25	2.08	1.66						
103	X2		1.65		11	1.96	1.76						
103	X5		4.65		19	2.09	1.76						
103	B7		6.30		22	2.07	1.70						
103	U15		10.45		14	2.28	2.00						
103	B30		18.30		28	2.02	1.58						
105	X1		1.65		14	2.01	1.77						
105	B30		3.30		18	2.16	1.83						
105	U4		3.85		17	2.18	1.87						
105	U12		8.95		15	2.19	1.91						
106	X3		2.75		20	2.15	1.79						
106	U7		5.95		18	2.16	1.82						
106	U11		8.45		15	2.20	1.91						
106	U15		11.45		14	2.20	1.93						

PARTICLE SIZE DISTRIBUTION TEST

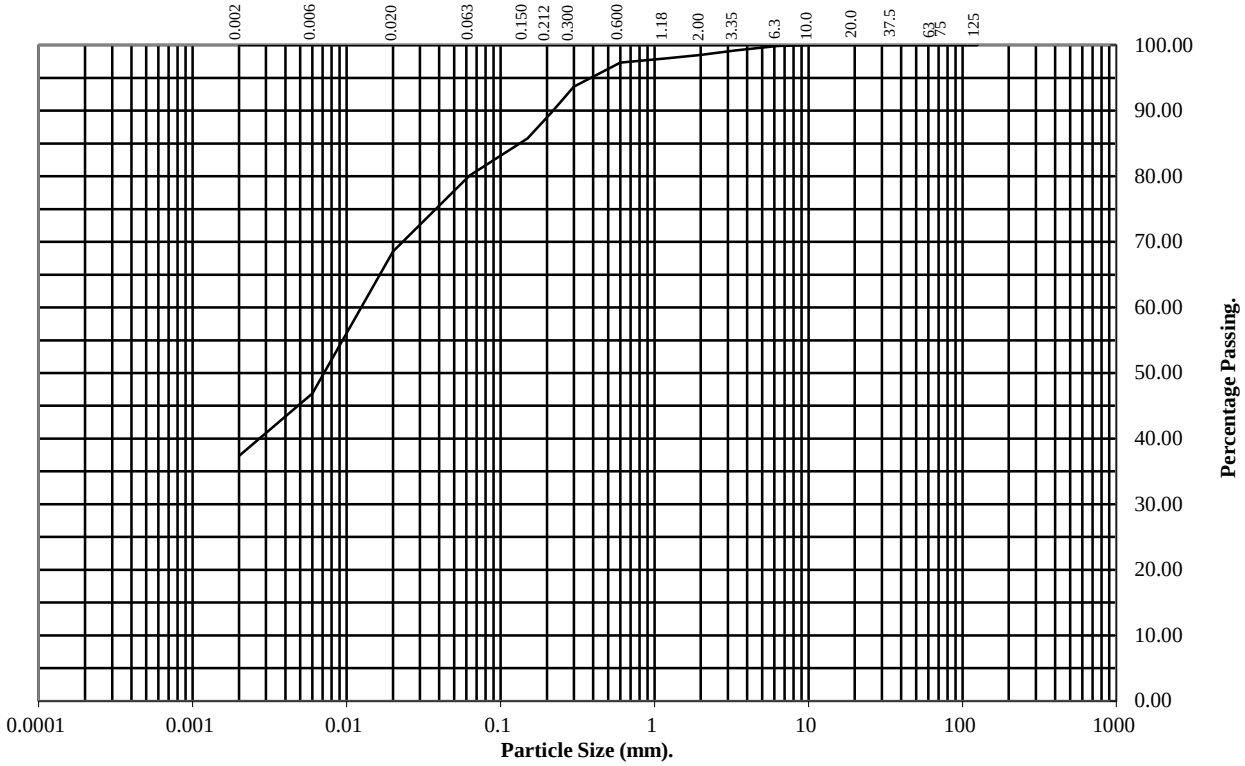
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **101** **Top Depth (m):** **12.80**

Sample Number: **B16** **Base Depth(m):**

Sample Type: **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	98
0.6	97
0.3	94
0.212	90
0.15	86
0.063	80

Particle Diameter	Percentage Passing
0.02	69
0.006	47
0.002	37

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	19
Silt	43
Clay	37

Remarks:

See summary of soil descriptions.

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PARTICLE SIZE DISTRIBUTION TEST

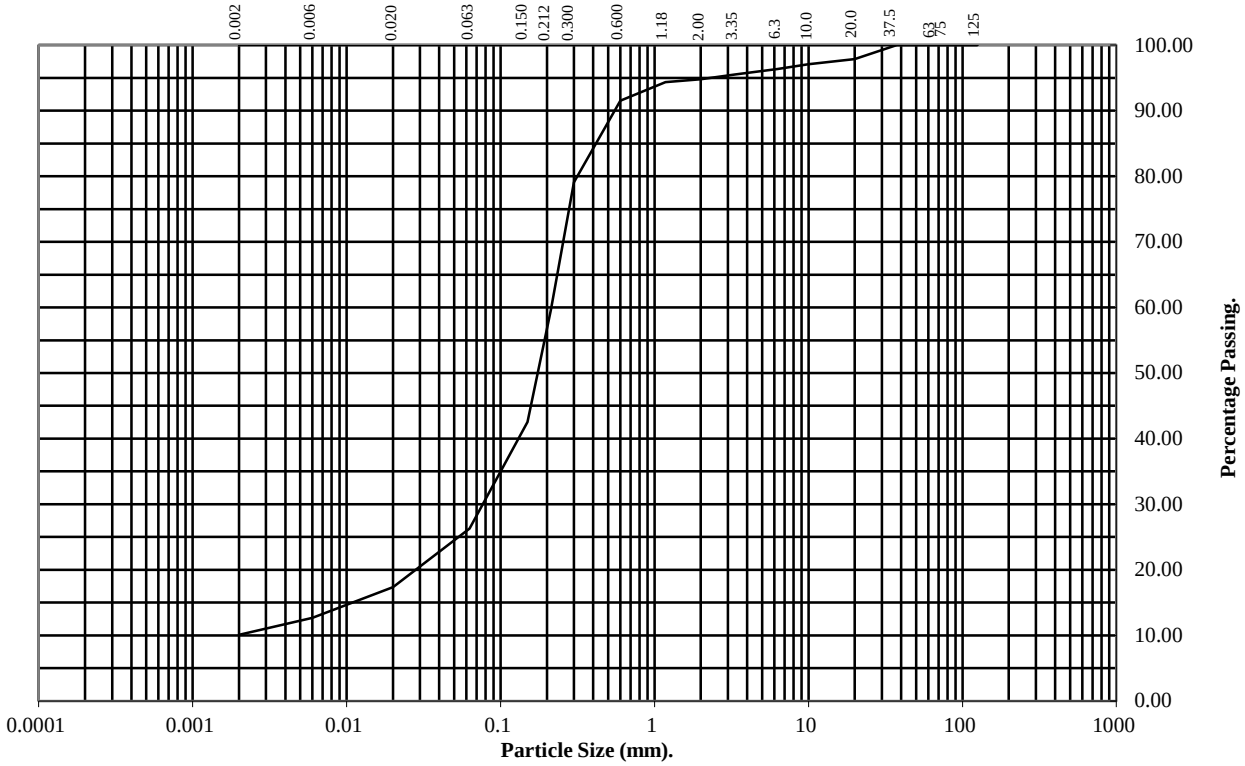
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **101** **Top Depth (m):** **14.50**

Sample Number: **B21** **Base Depth(m):**

Sample Type: **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	98
10	97
6.3	96
3.35	96
2	95
1.18	94
0.6	92
0.3	79
0.212	60
0.15	43
0.063	26

Particle Diameter	Percentage Passing
0.02	17
0.006	13
0.002	10

Soil Fraction	Total Percentage
Cobbles	0
Gravel	5
Sand	69
Silt	16
Clay	10

Remarks:
See summary of soil descriptions.

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PARTICLE SIZE DISTRIBUTION TEST

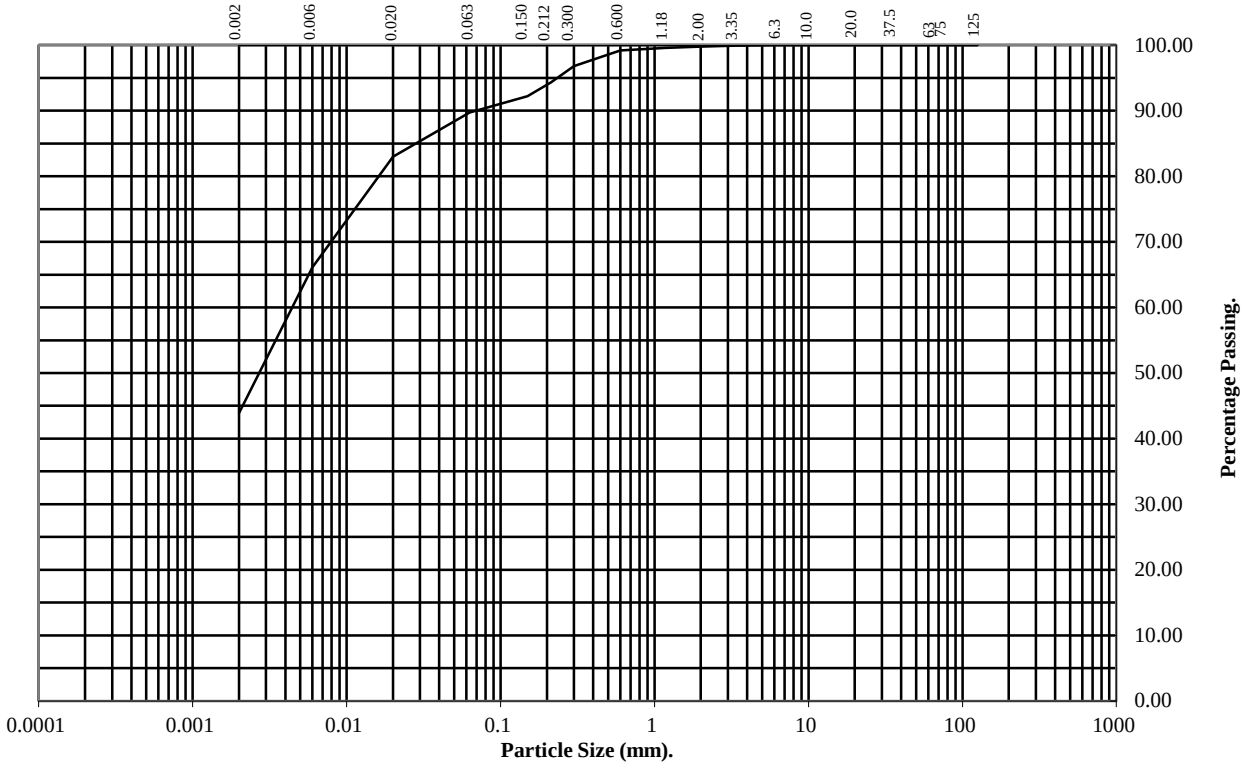
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **103** **Top Depth (m):** **13.50**

Sample Number: **B21** **Base Depth(m):**

Sample Type: **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	99
0.3	97
0.212	94
0.15	92
0.063	90

Particle Diameter	Percentage Passing
0.02	83
0.006	66
0.002	44

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	10
Silt	46
Clay	44

Remarks:
See summary of soil descriptions.

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PARTICLE SIZE DISTRIBUTION TEST

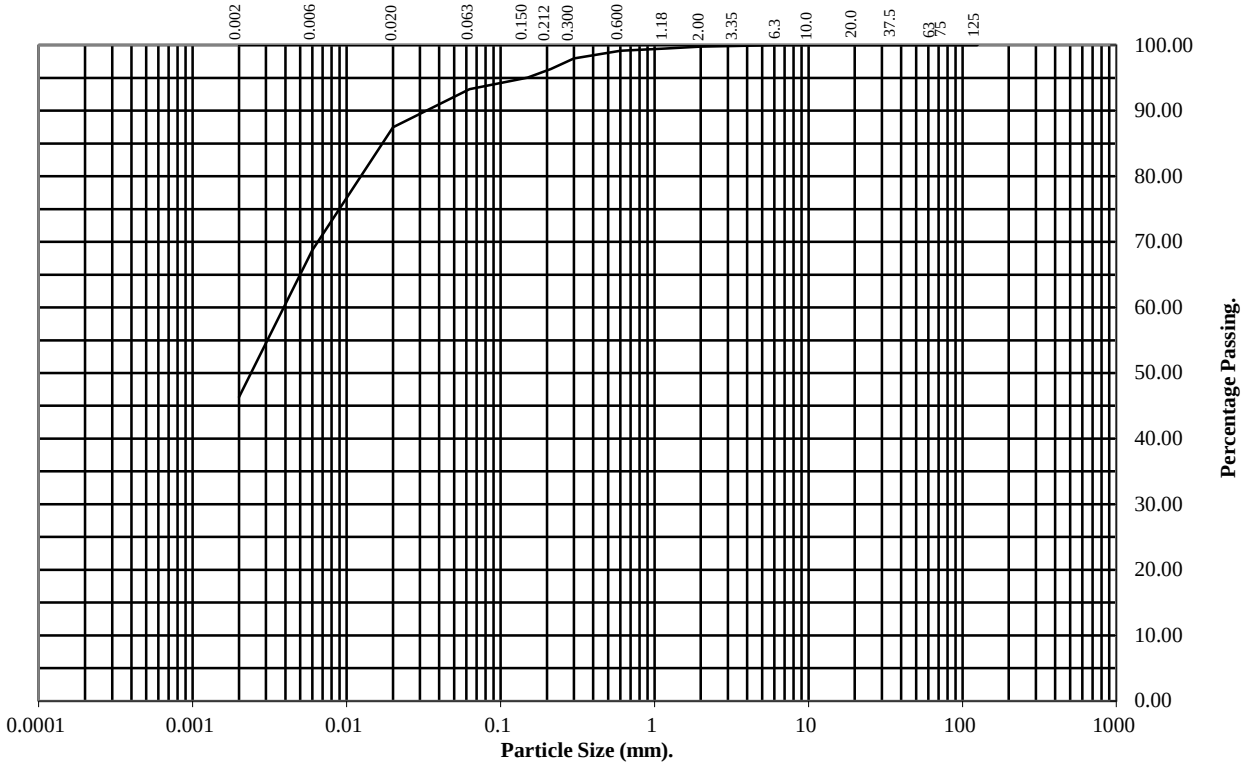
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **103** **Top Depth (m):** **18.30**

Sample Number: **B30** **Base Depth(m):**

Sample Type: **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	99
0.6	99
0.3	98
0.212	96
0.15	95
0.063	93

Particle Diameter	Percentage Passing
0.02	88
0.006	69
0.002	46

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	7
Silt	47
Clay	46

Remarks:
See summary of soil descriptions.

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PARTICLE SIZE DISTRIBUTION TEST

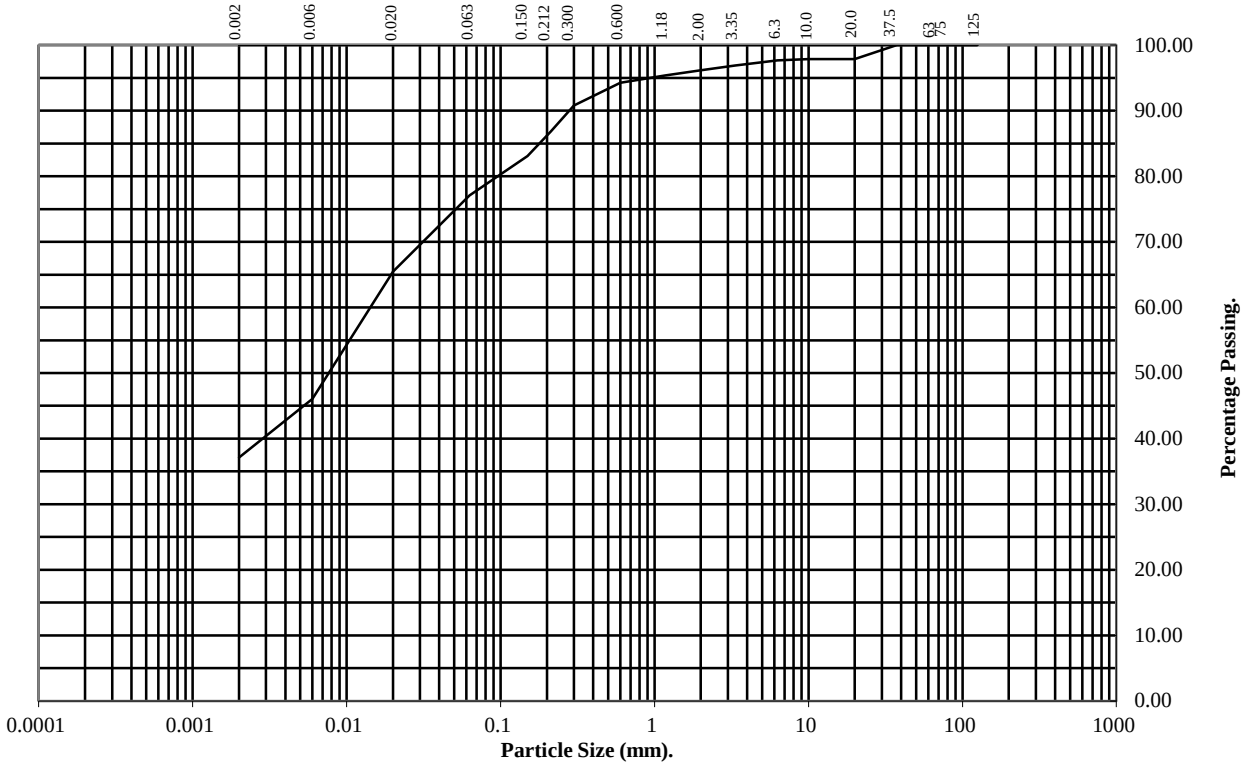
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: 105 **Top Depth (m):** 3.85

Sample Number: U4 **Base Depth(m):**

Sample Type: U



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	98
10	98
6.3	98
3.35	97
2	96
1.18	95
0.6	94
0.3	91
0.212	87
0.15	83
0.063	77

Particle Diameter	Percentage Passing
0.02	65
0.006	46
0.002	37

Soil Fraction	Total Percentage
Cobbles	0
Gravel	4
Sand	19
Silt	40
Clay	37

Remarks:
See summary of soil descriptions.

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PARTICLE SIZE DISTRIBUTION TEST

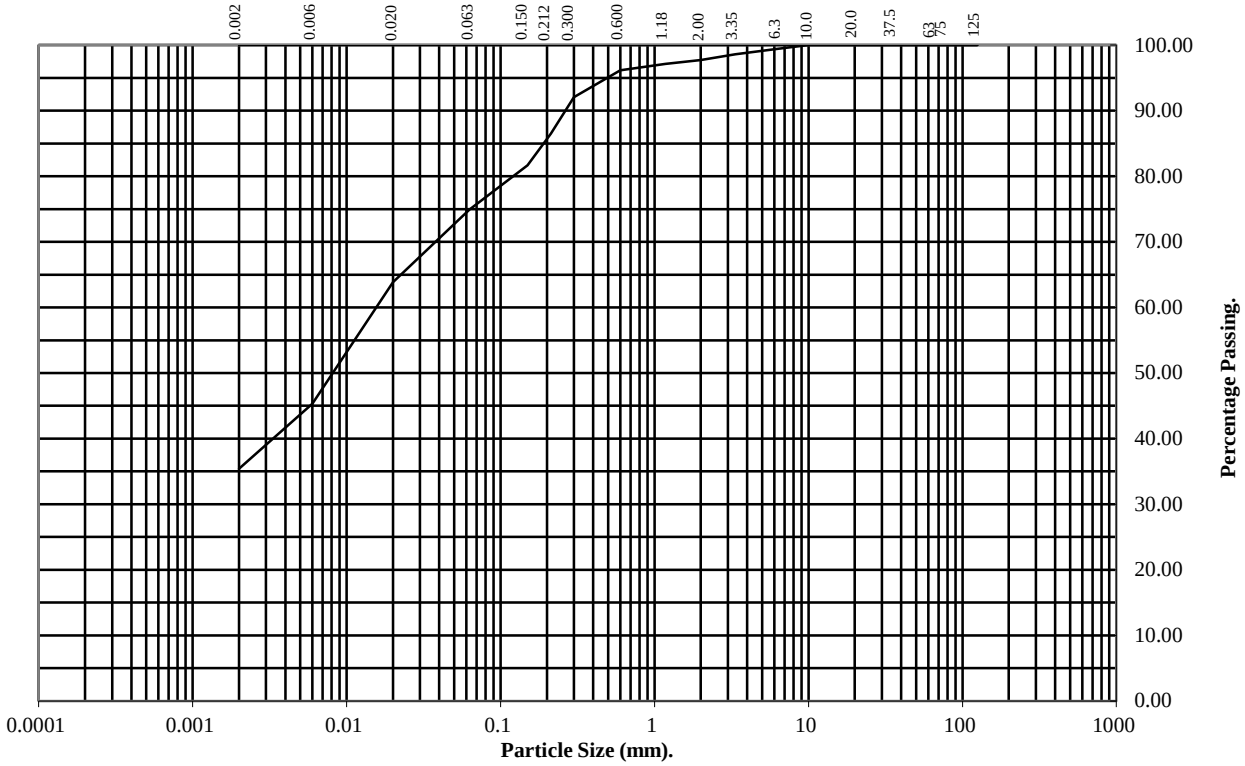
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **105** **Top Depth (m):** **8.95**

Sample Number: **U12** **Base Depth(m):**

Sample Type: **U**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	99
3.35	99
2	98
1.18	97
0.6	96
0.3	92
0.212	86
0.15	82
0.063	75

Particle Diameter	Percentage Passing
0.02	64
0.006	45
0.002	35

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	23
Silt	40
Clay	35

Remarks:

See summary of soil descriptions.

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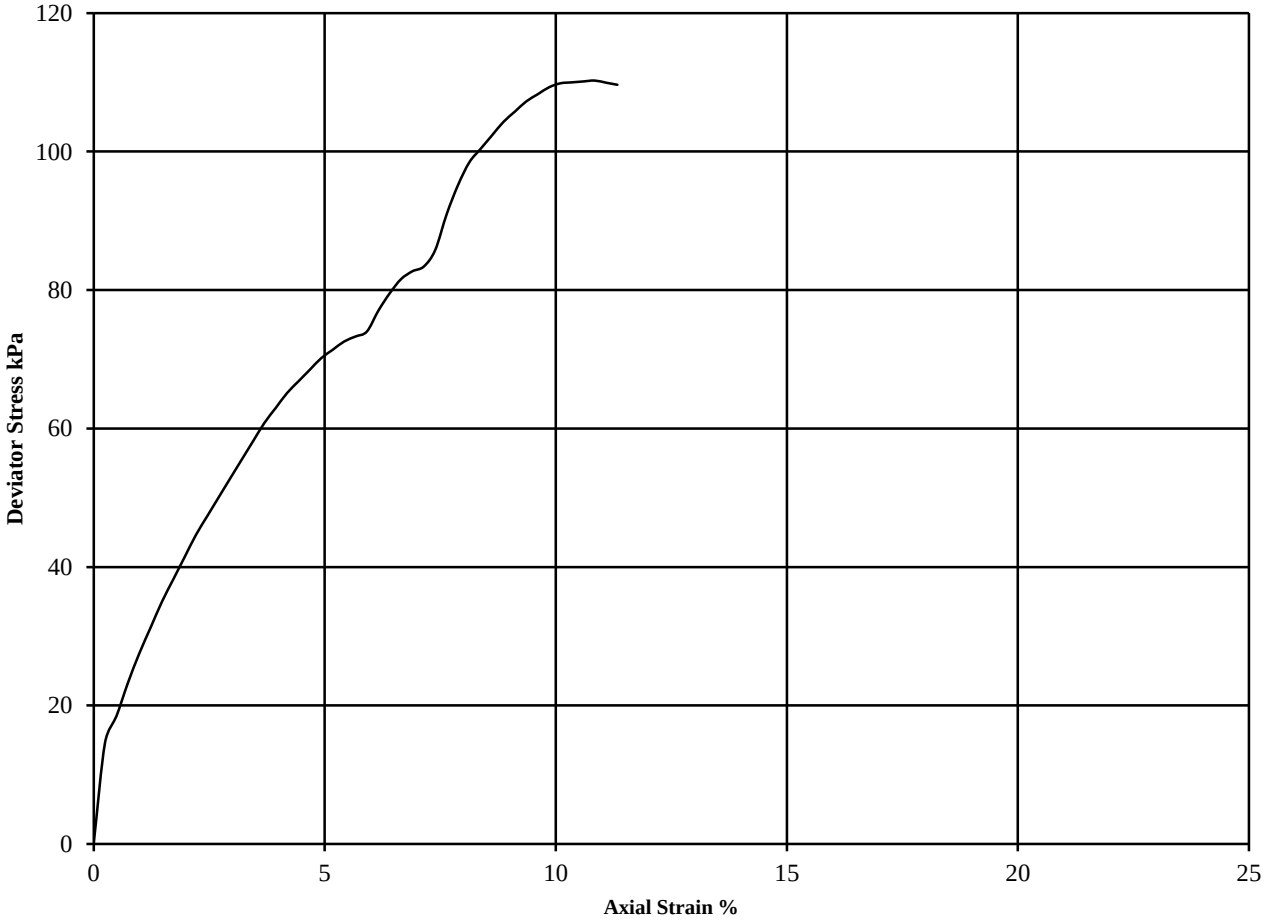
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**101**	**Top Depth (m):**	**10.55**
Sample Number:	**U11**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	18	2.16	1.83	100	73	37	5.7		0.36 0.36 0.35
				200	83	42	7.1		See summary of soil descriptions
				400	110	55	10.8	Plastic	

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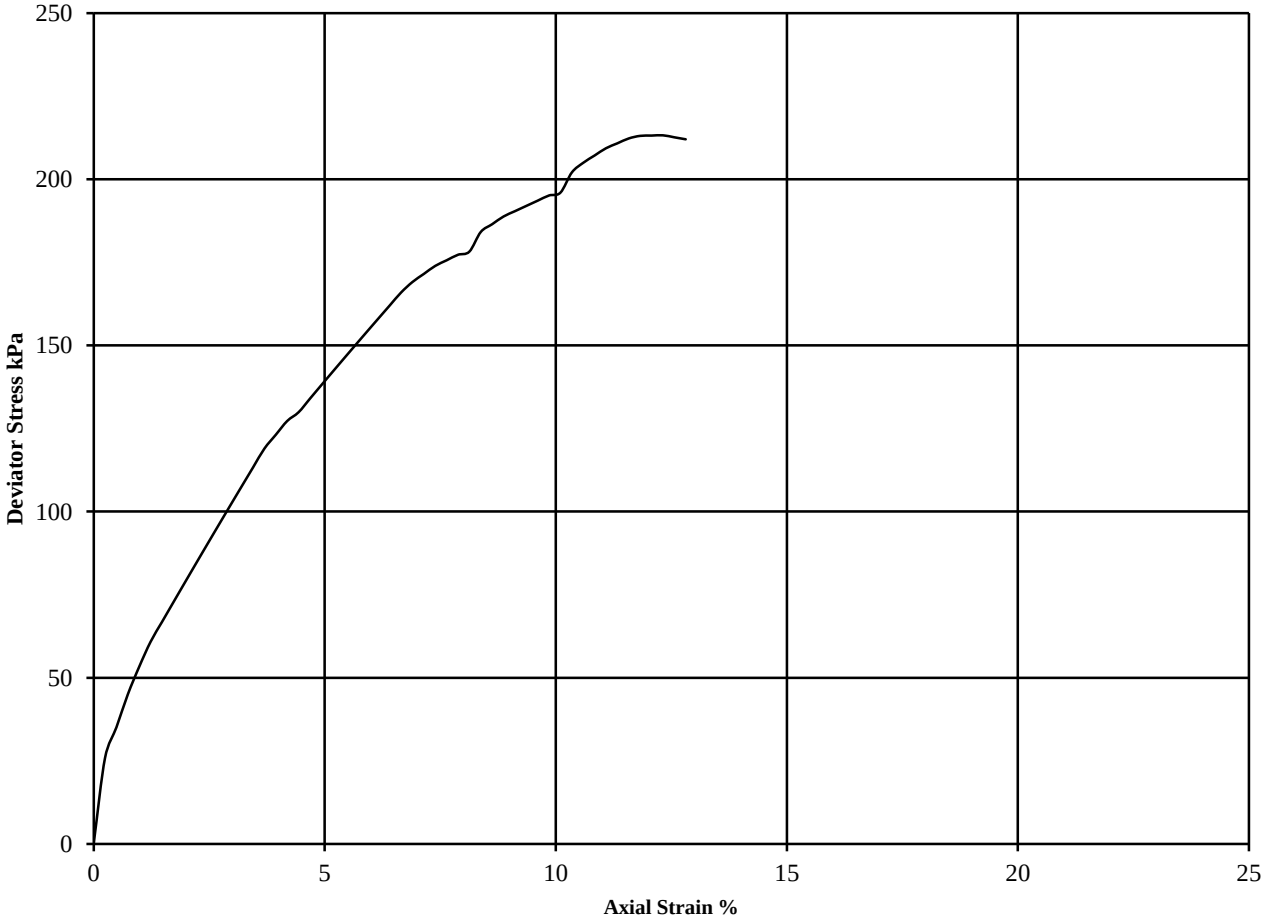
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**101**	**Top Depth (m):**	**12.45**
Sample Number:	**U14**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	23	2.02	1.64	125	178	89	8.1		0.36 0.35 0.35
				250	196	98	10.1		See summary of soil descriptions
				500	213	107	12.3	Plastic	

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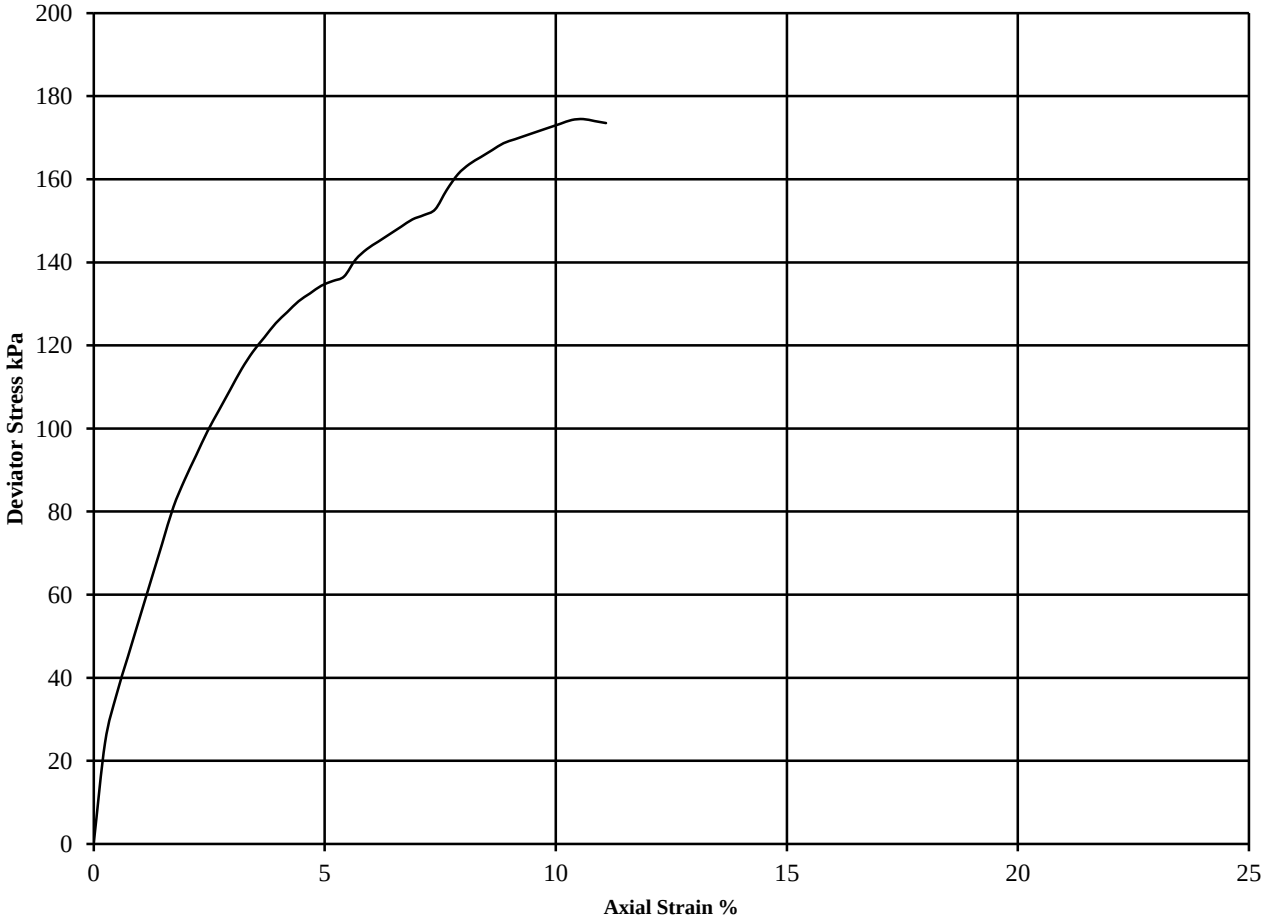
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**102**	**Top Depth (m):**	**7.45**
Sample Number:	**U7**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	17	2.20	1.88	75	135	68	5.2		0.36 0.36 0.35
				150	151	76	7.1		See summary of soil descriptions
				300	174	87	10.6	Plastic	

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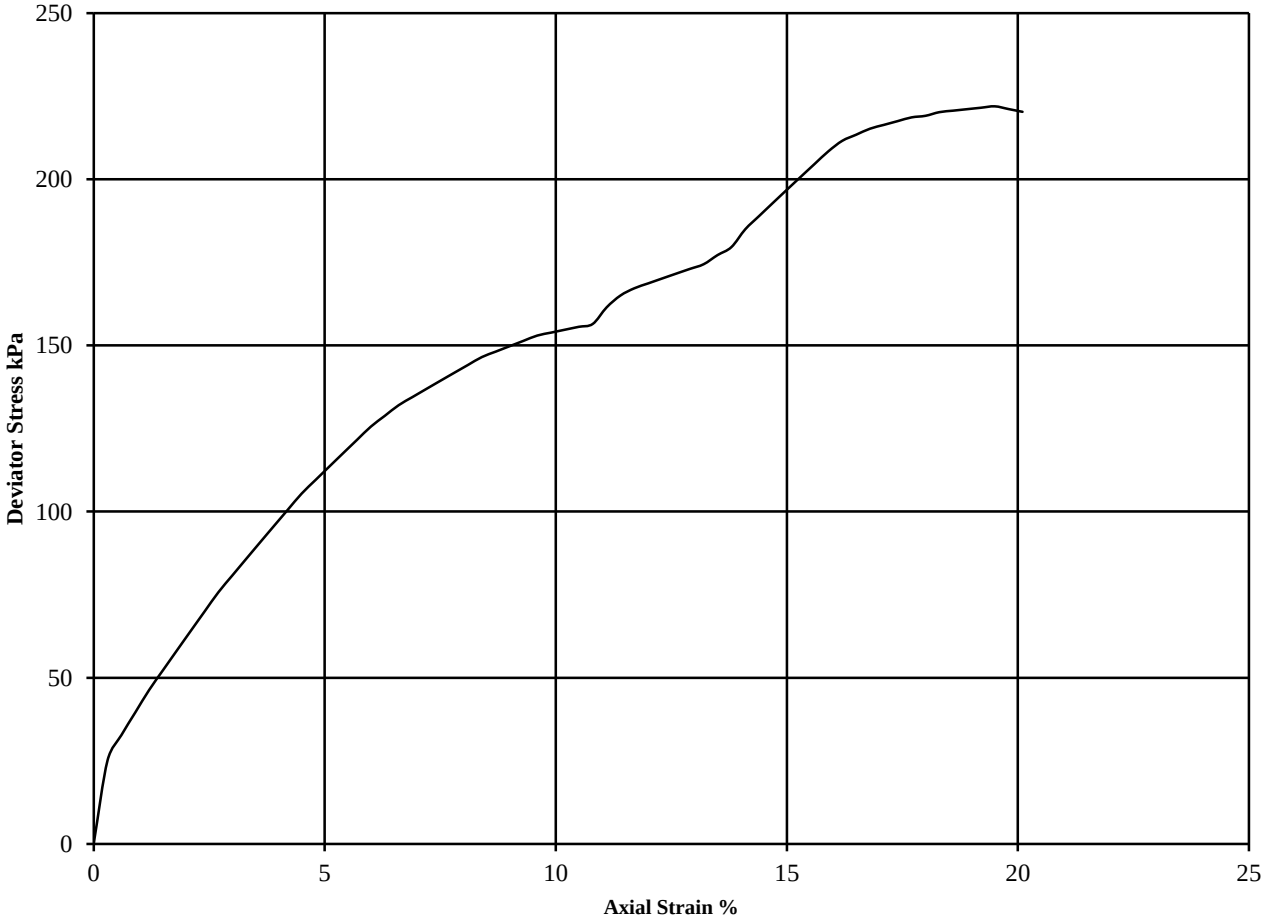
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**102**	**Top Depth (m):**	**8.95**
Sample Number:	**U11**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		170	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	17	2.08	1.78	100	156	78	10.5		0.35 0.35 0.33
				200	177	89	13.5		See summary of soil descriptions
				400	222	111	19.5	Plastic	

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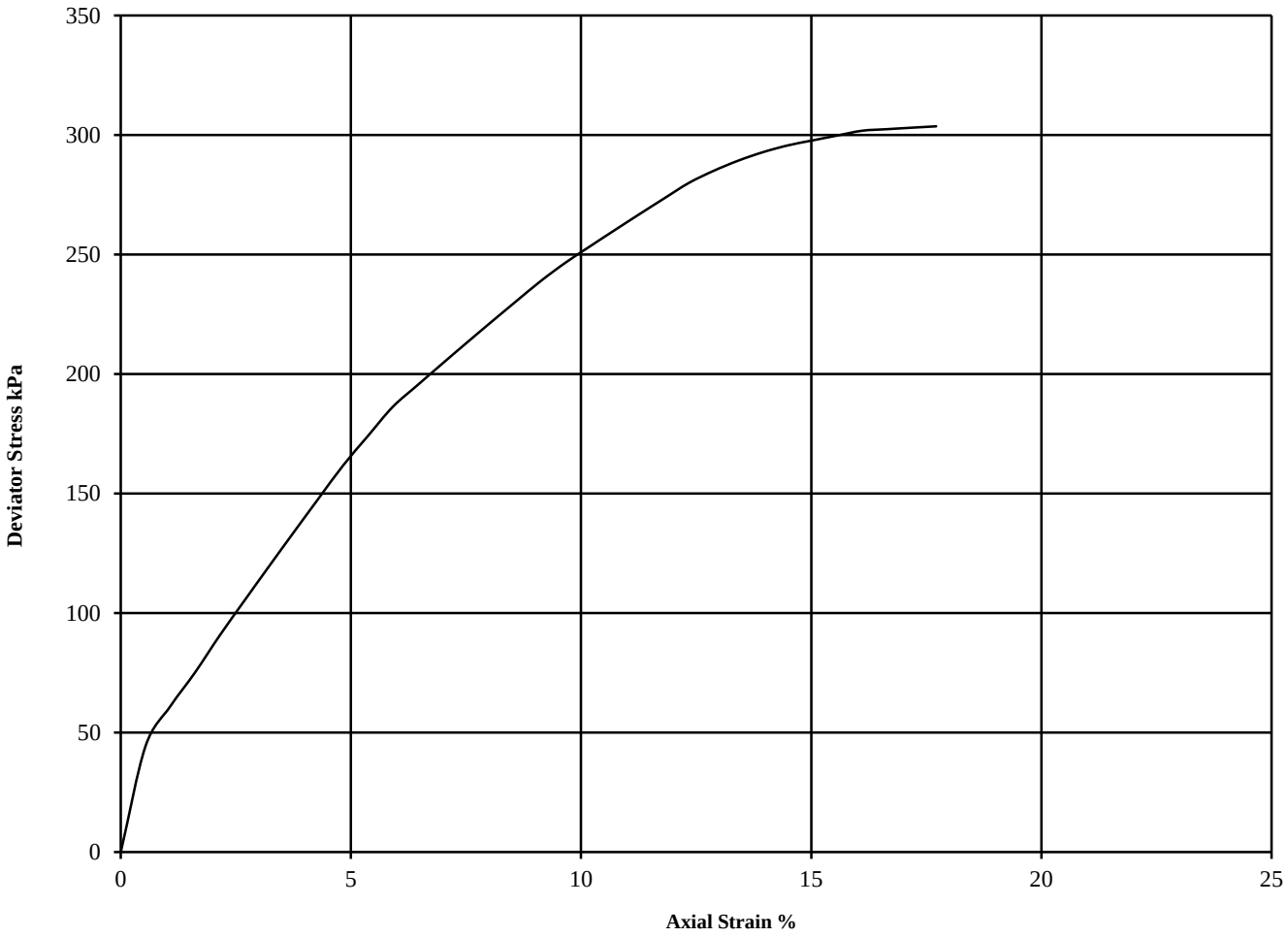
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**102**	**Top Depth (m):**	**10.55**
Sample Number	**U14**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		190.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	15	2.08	1.82	211	306	153	19.9	Plastic	See summary of soil descriptions

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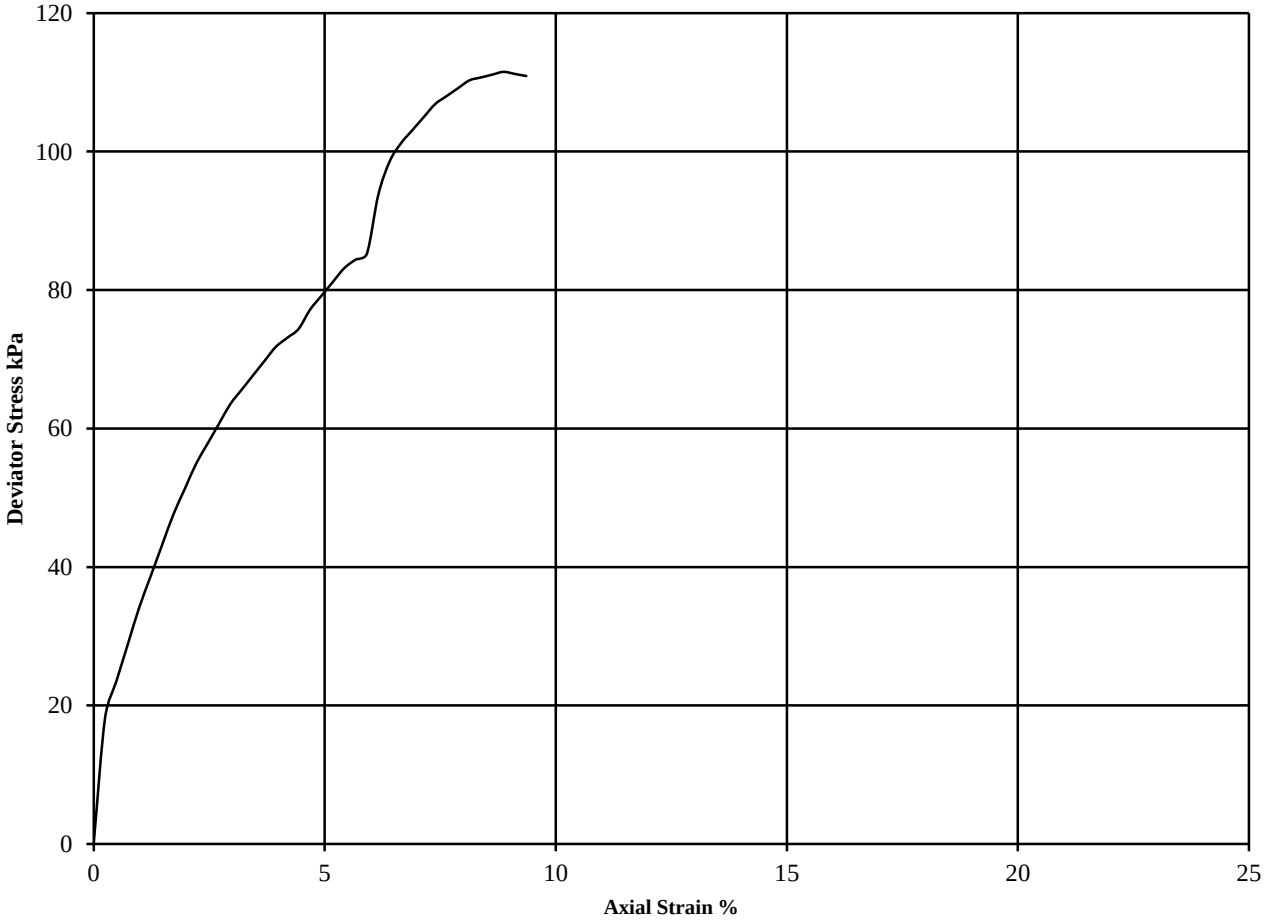
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**102**	**Top Depth (m):**	**13.95**
Sample Number:	**U19**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	25	2.08	1.66	140	73	37	4.2		0.36 0.36 0.36
				280	84	42	5.7		See summary of soil descriptions
				560	112	56	8.9	Plastic	

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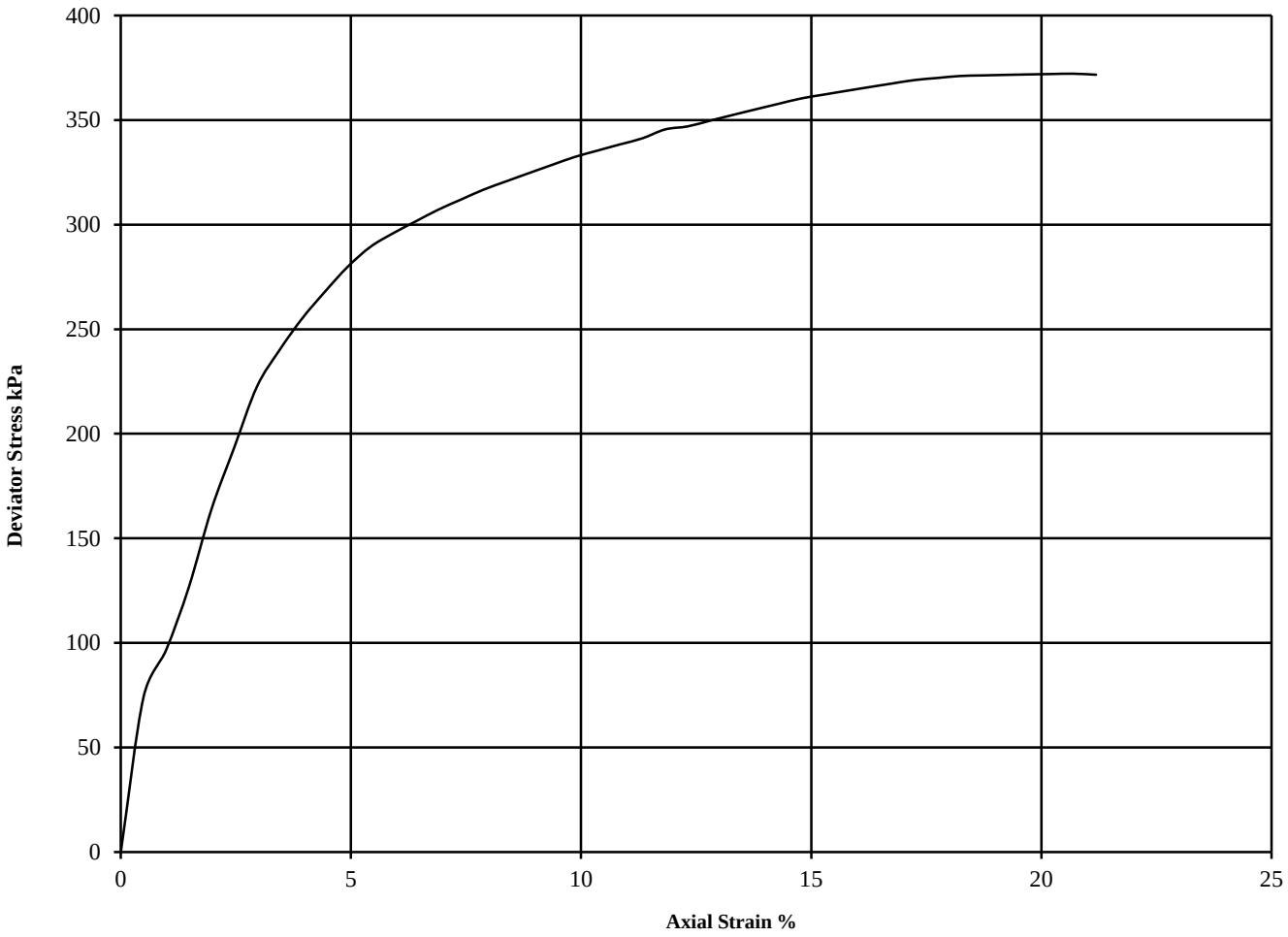
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**103**	**Top Depth (m):**	**6.95**
Sample Number	**U8**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	16	2.17	1.87	140	372	186	20.7	Plastic	See summary of soil descriptions

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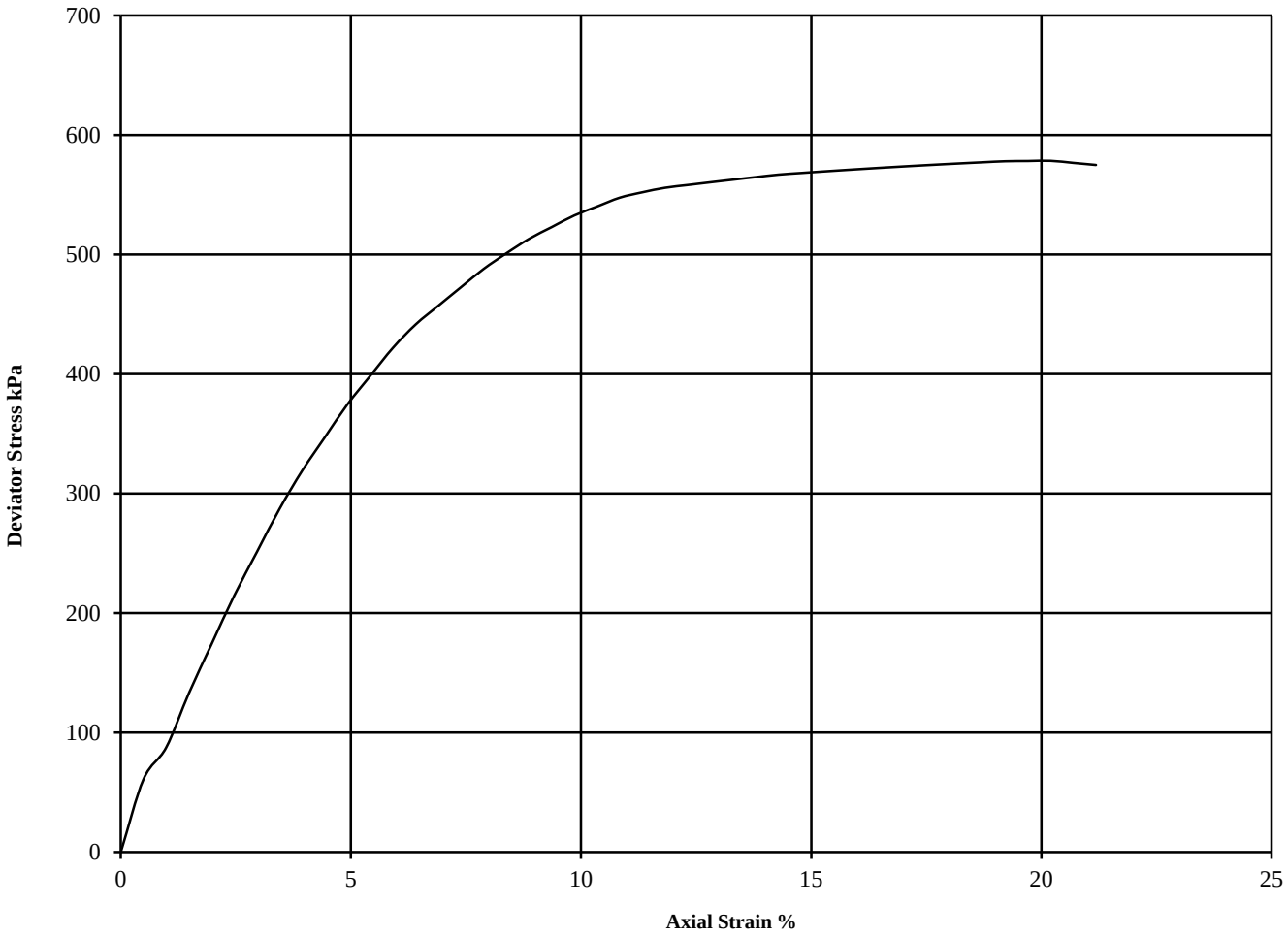
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

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BS1377 : Part7 : 1990: Clause 8

Hole Number:	**103**	**Top Depth (m):**	**8.55**
Sample Number	**U11**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	15	2.23	1.94	180	578	289	20.2	Plastic	See summary of soil descriptions

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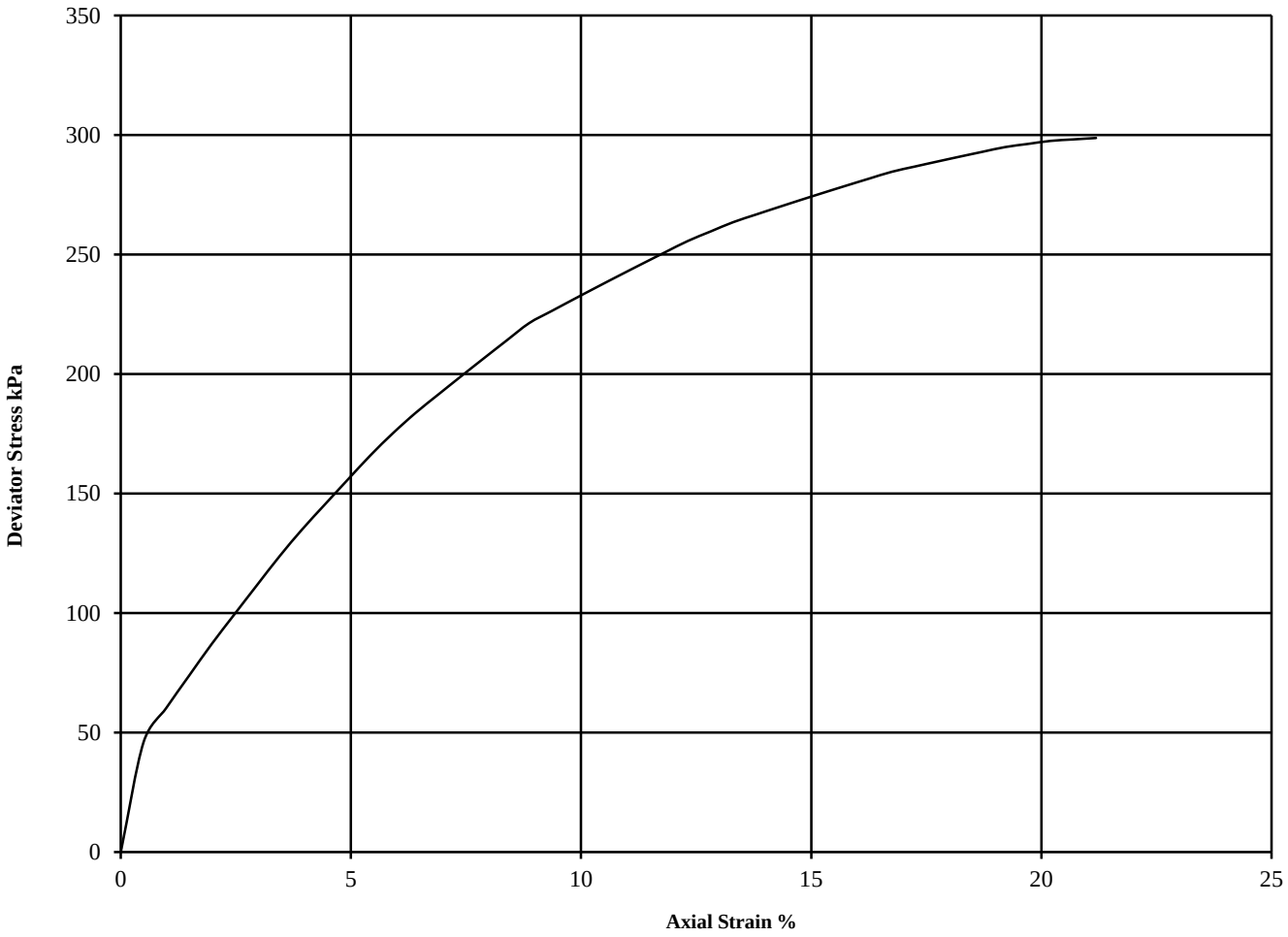
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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**103**	**Top Depth (m):**	**12.15**
Sample Number	**U18**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	14	2.24	1.96	240	299	149	21.2	Plastic	See summary of soil descriptions

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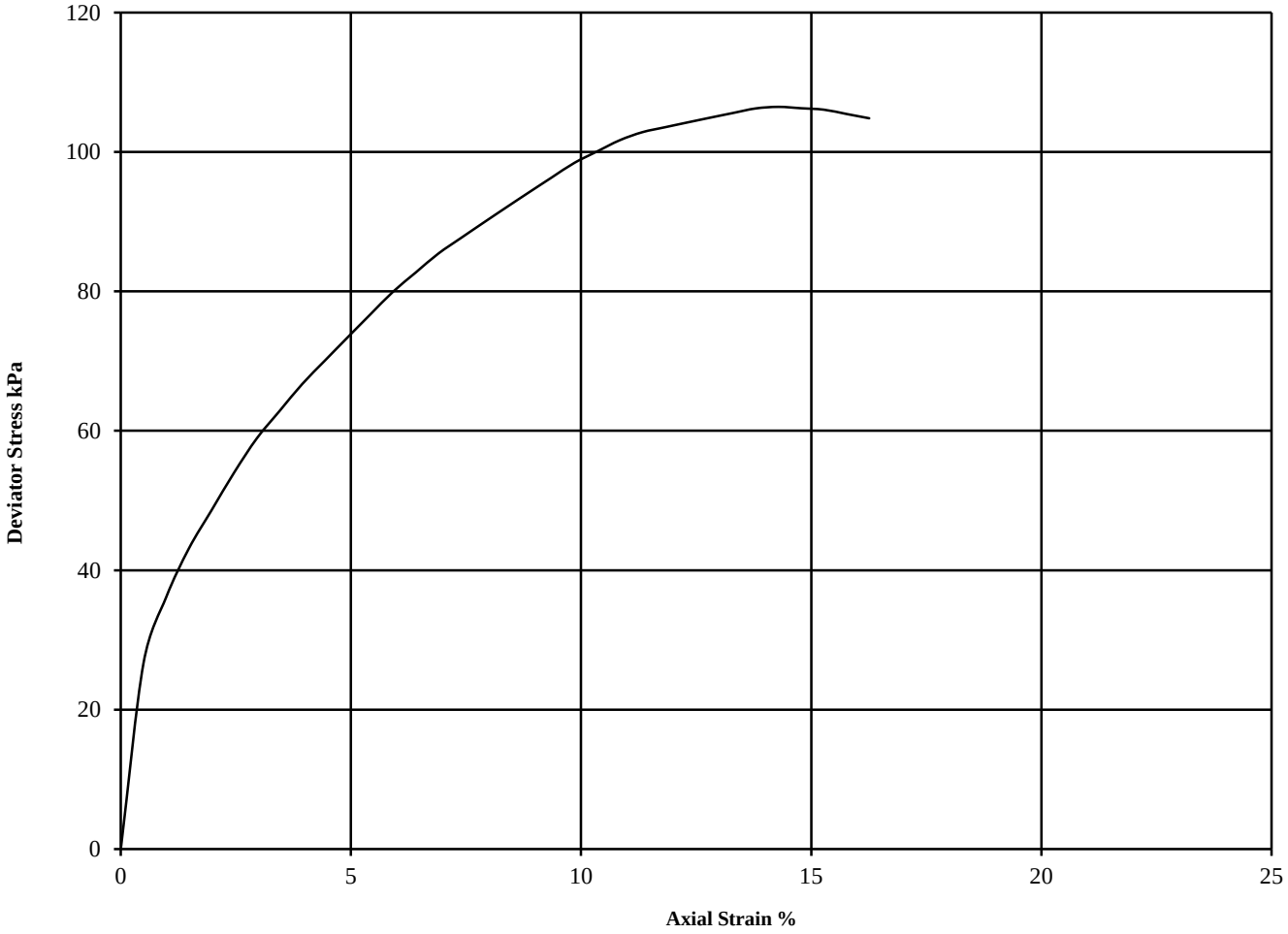
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Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**103**	**Top Depth (m):**	**13.95**
Sample Number	**U22**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35
1	25	2.07	1.66	280	106	53	14.3	Plastic	See summary of soil descriptions

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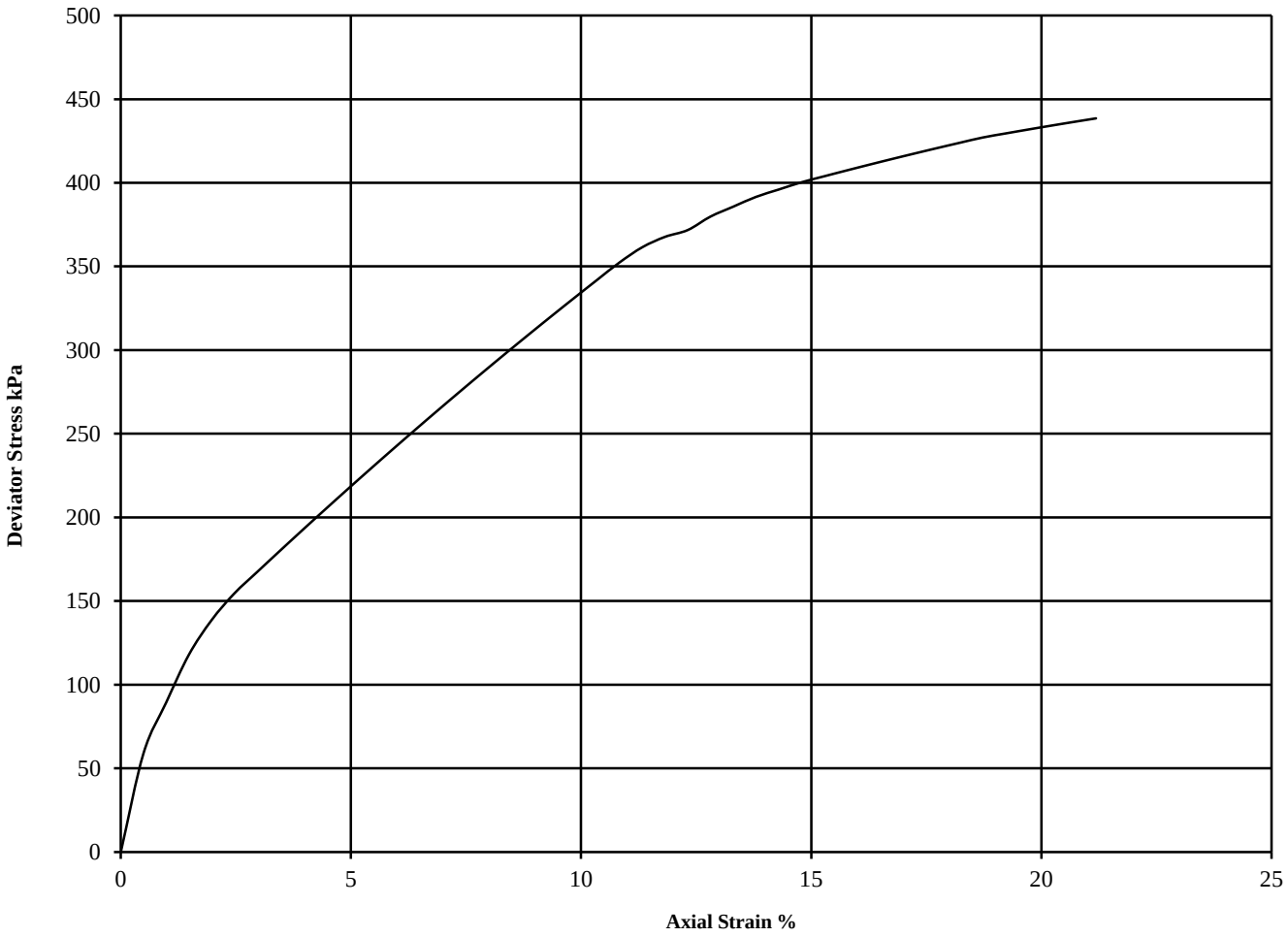
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**103**	**Top Depth (m):**	**17.75**
Sample Number	**U28**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	12	2.10	1.87	360	439	219	21.2	Plastic	See summary of soil descriptions

UKAS TESTING 4043

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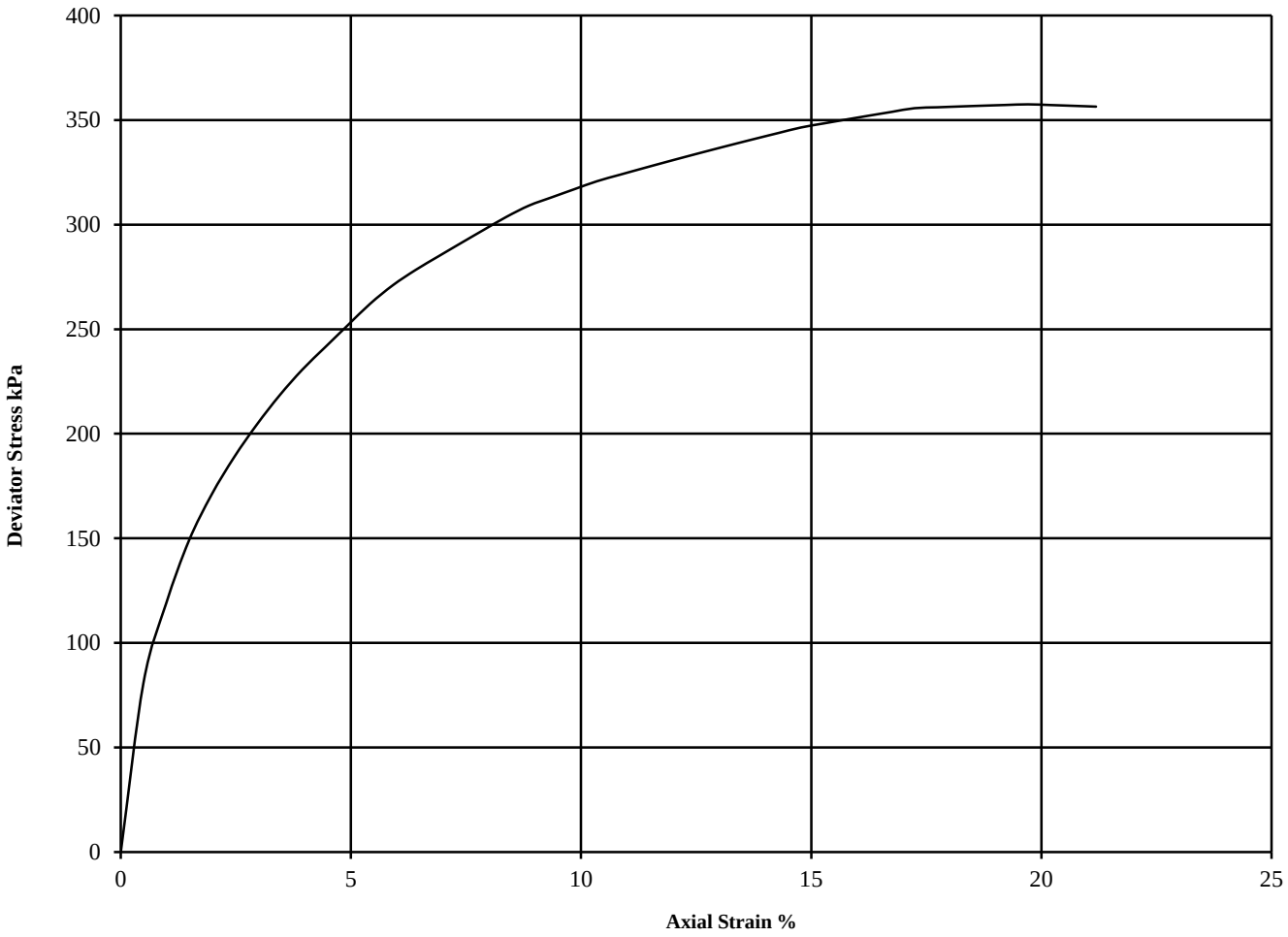
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**104**	**Top Depth (m):**	**7.95**
Sample Number	**U9**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	13	2.20	1.95	160	358	179	19.7	Plastic	See summary of soil descriptions

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New Islington Manchester

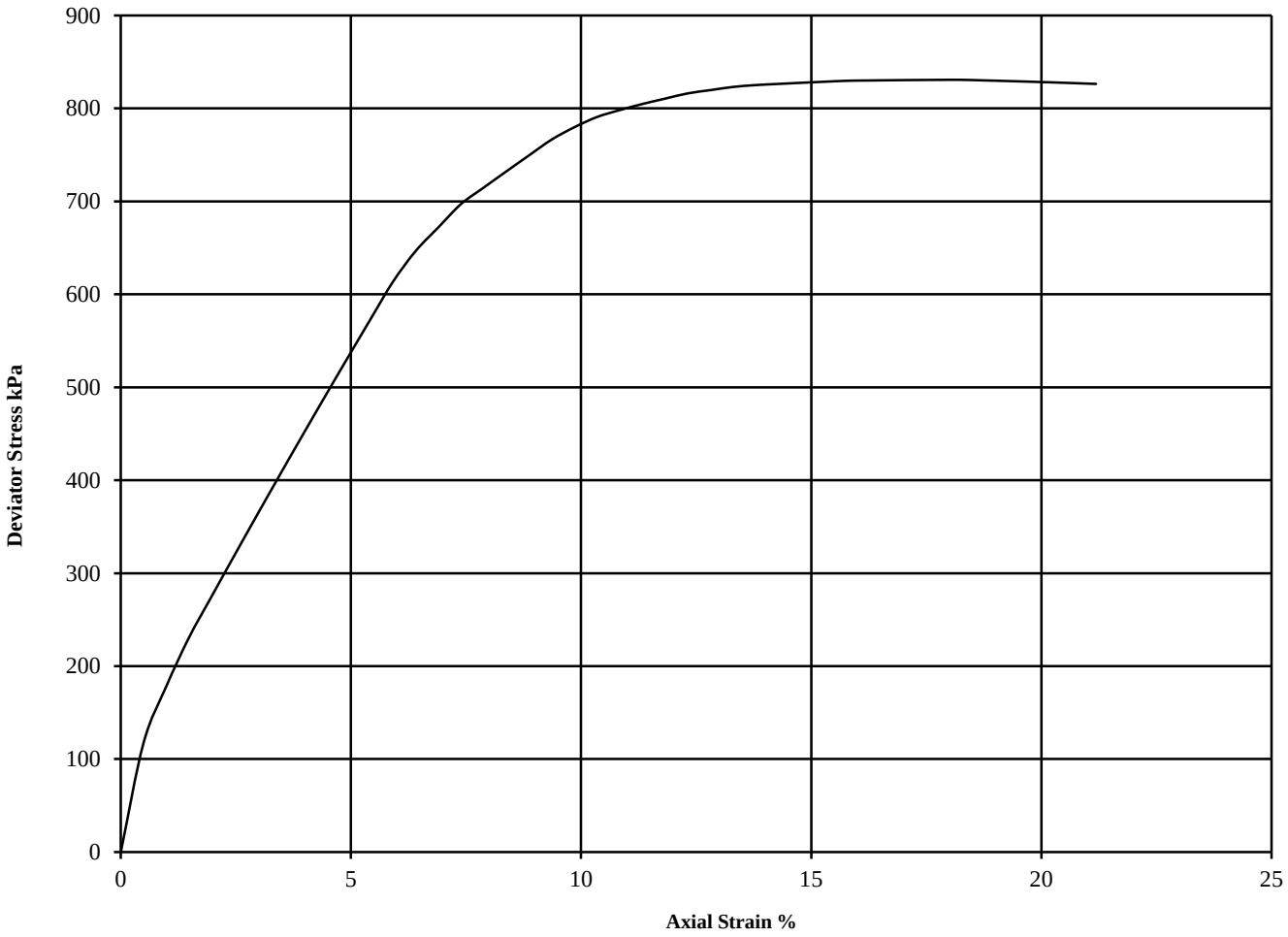
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**104**	**Top Depth (m):**	**10.95**
Sample Number	**U16**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	8.2	2.28	2.11	220	831	415	18.2	Plastic	See summary of soil descriptions

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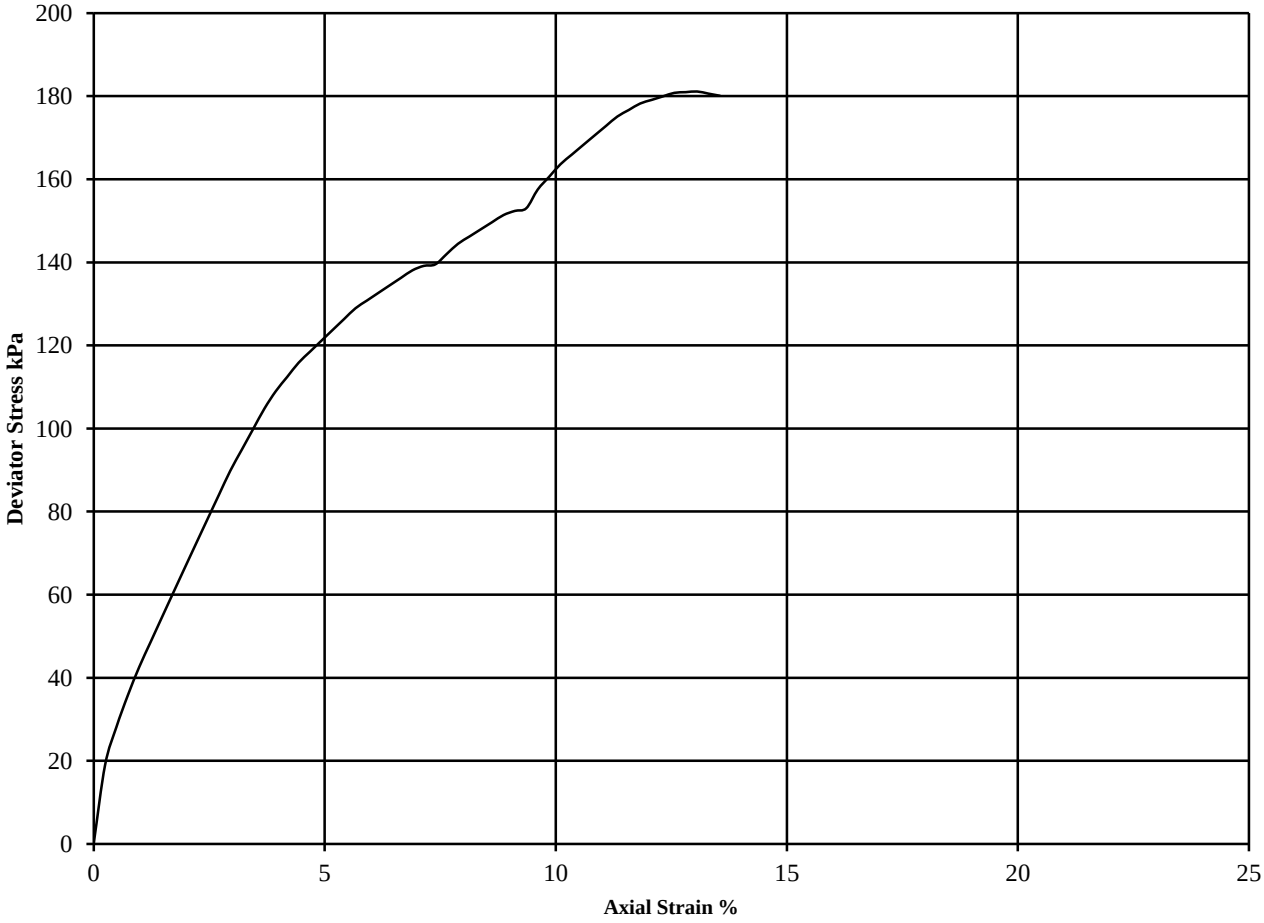
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**105**	**Top Depth (m):**	**3.85**
Sample Number:	**U4**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	17	2.18	1.87	50	139	70	7.1		0.36 0.36 0.35
				100	152	76	9.1		See summary of soil descriptions
				200	181	91	13.1	Plastic	

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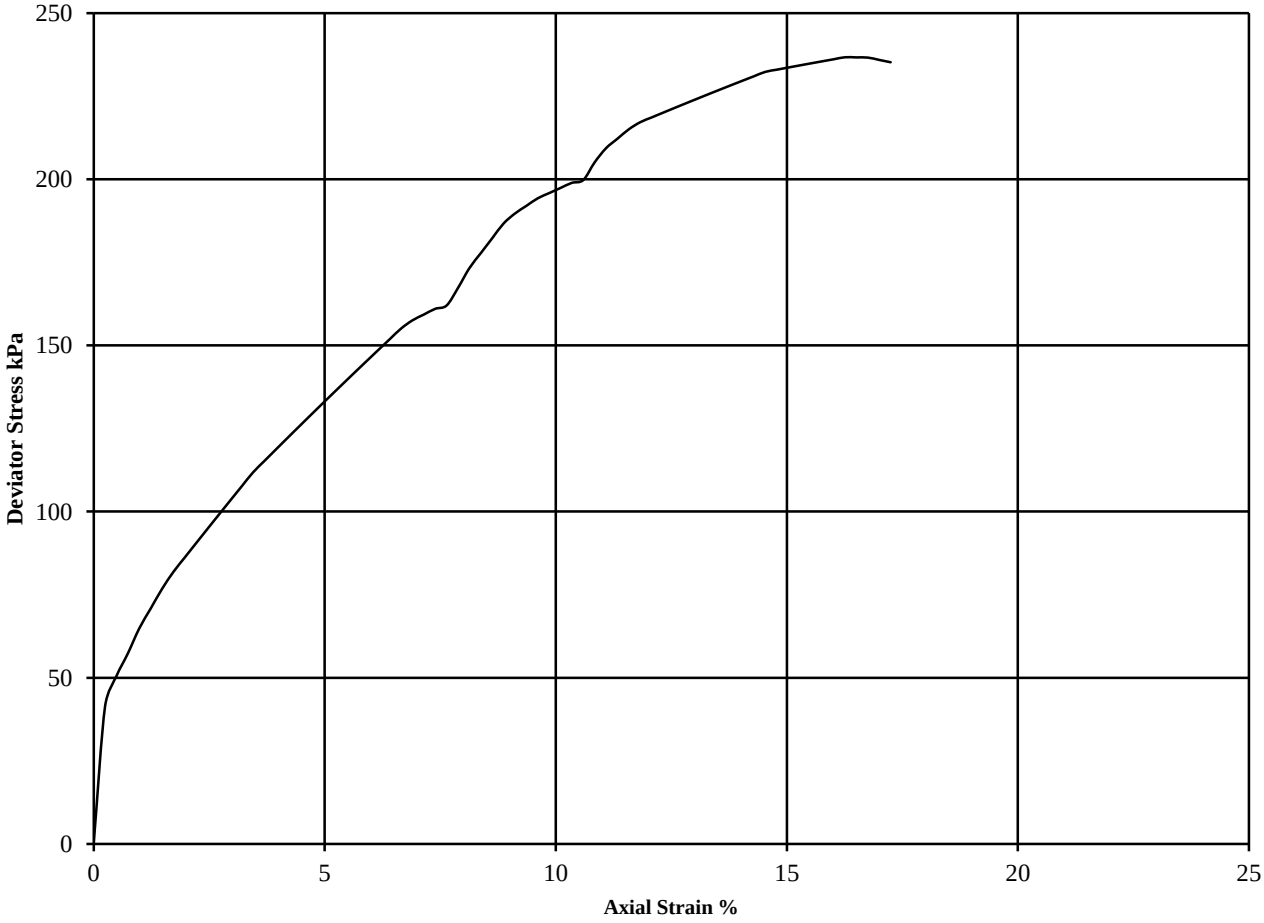
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**105**	**Top Depth (m):**	**7.05**
Sample Number:	**U9**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	18	2.12	1.80	70	162	81	7.6		0.36 0.35 0.34
				140	200	100	10.6		See summary of soil descriptions
				280	237	118	16.3	Plastic	

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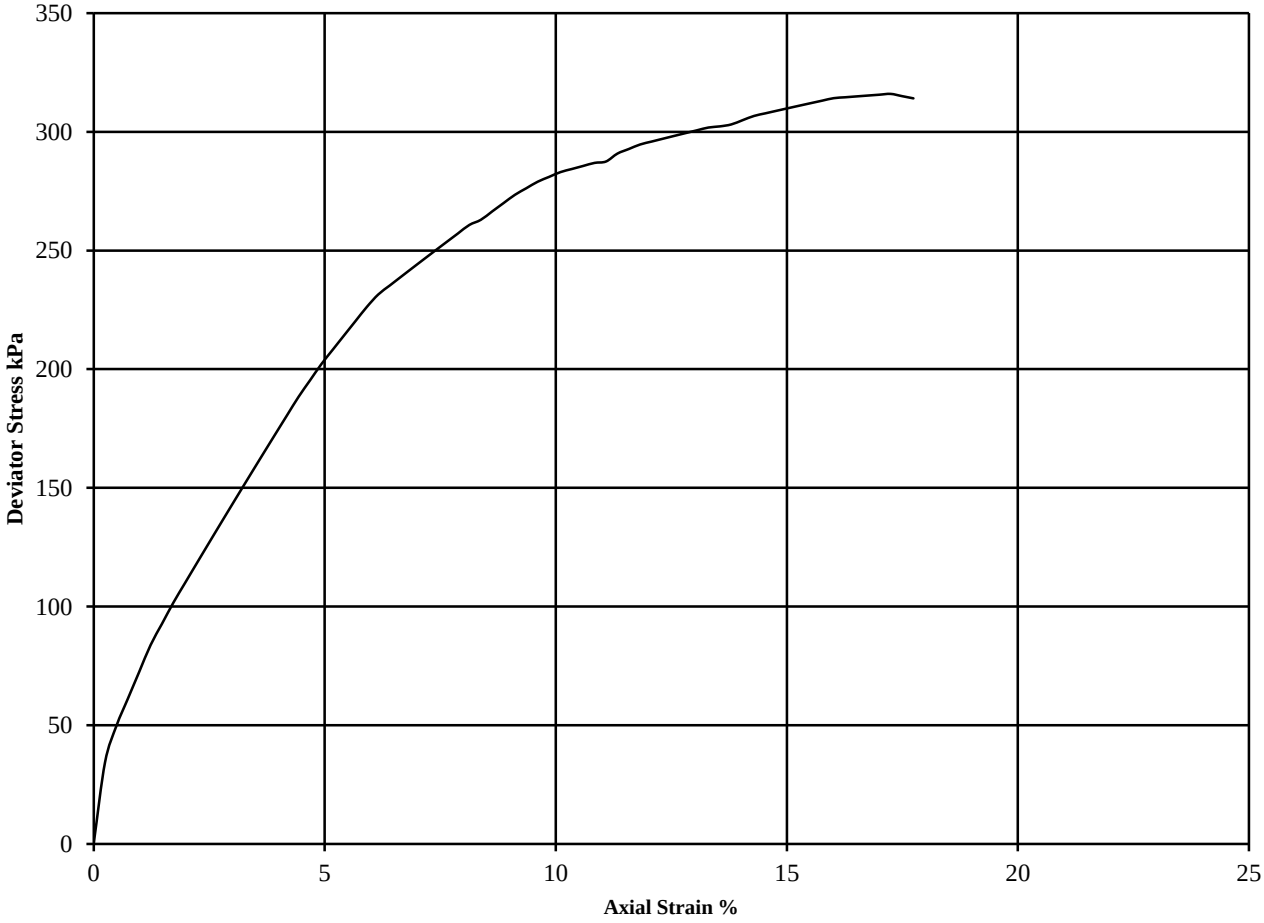
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**105**	**Top Depth (m):**	**8.95**
Sample Number:	**U12**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	15	2.19	1.91	90	287	144	11.1		0.35 0.35 0.34
				180	302	151	13.6		See summary of soil descriptions
				360	316	158	17.2	Plastic	

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New Islington Manchester

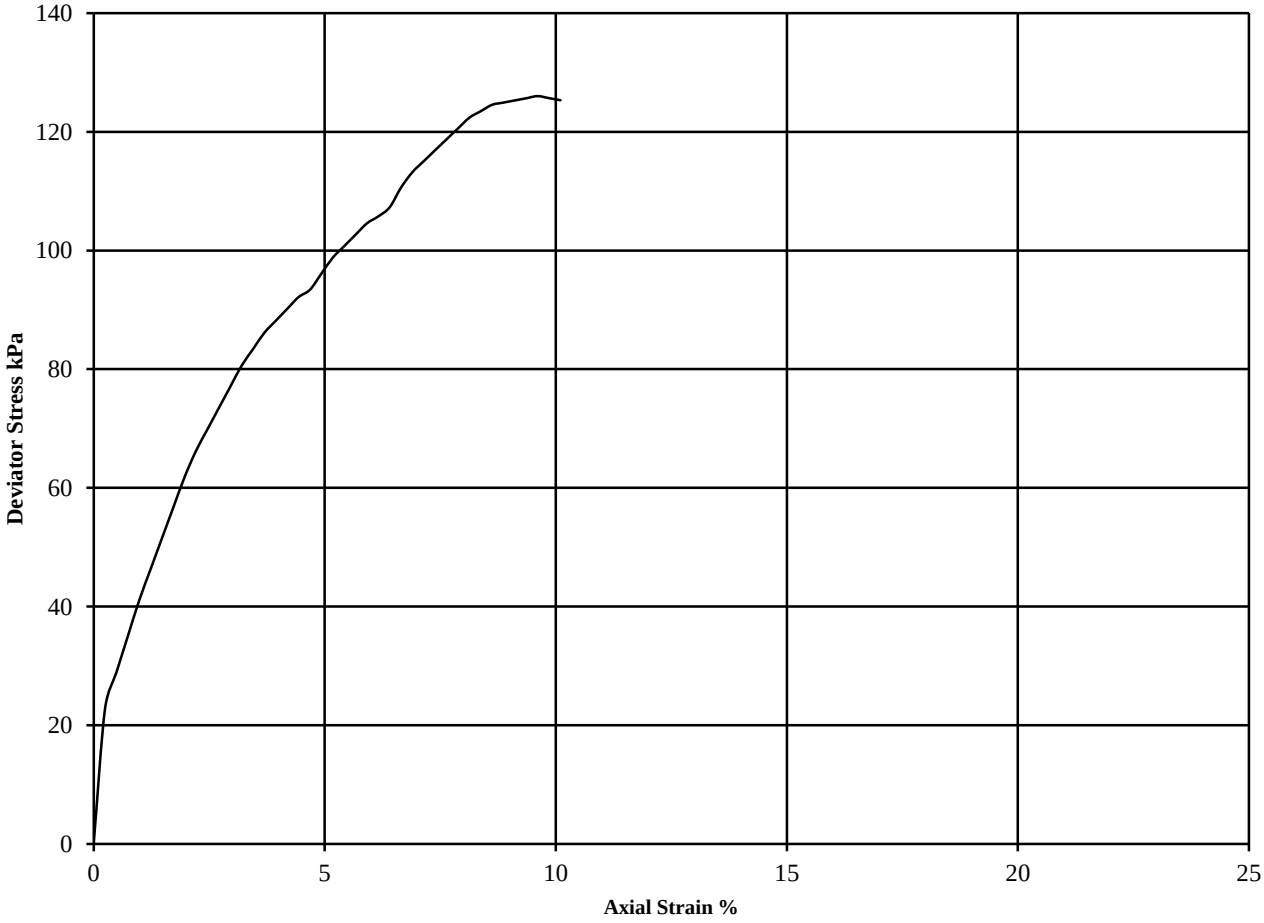
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**106**	**Top Depth (m):**	**5.95**
Sample Number:	**U7**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	18	2.16	1.82	60	93	47	4.7		0.36 0.36 0.35
				120	106	53	6.2		See summary of soil descriptions
				240	126	63	9.6	Plastic	

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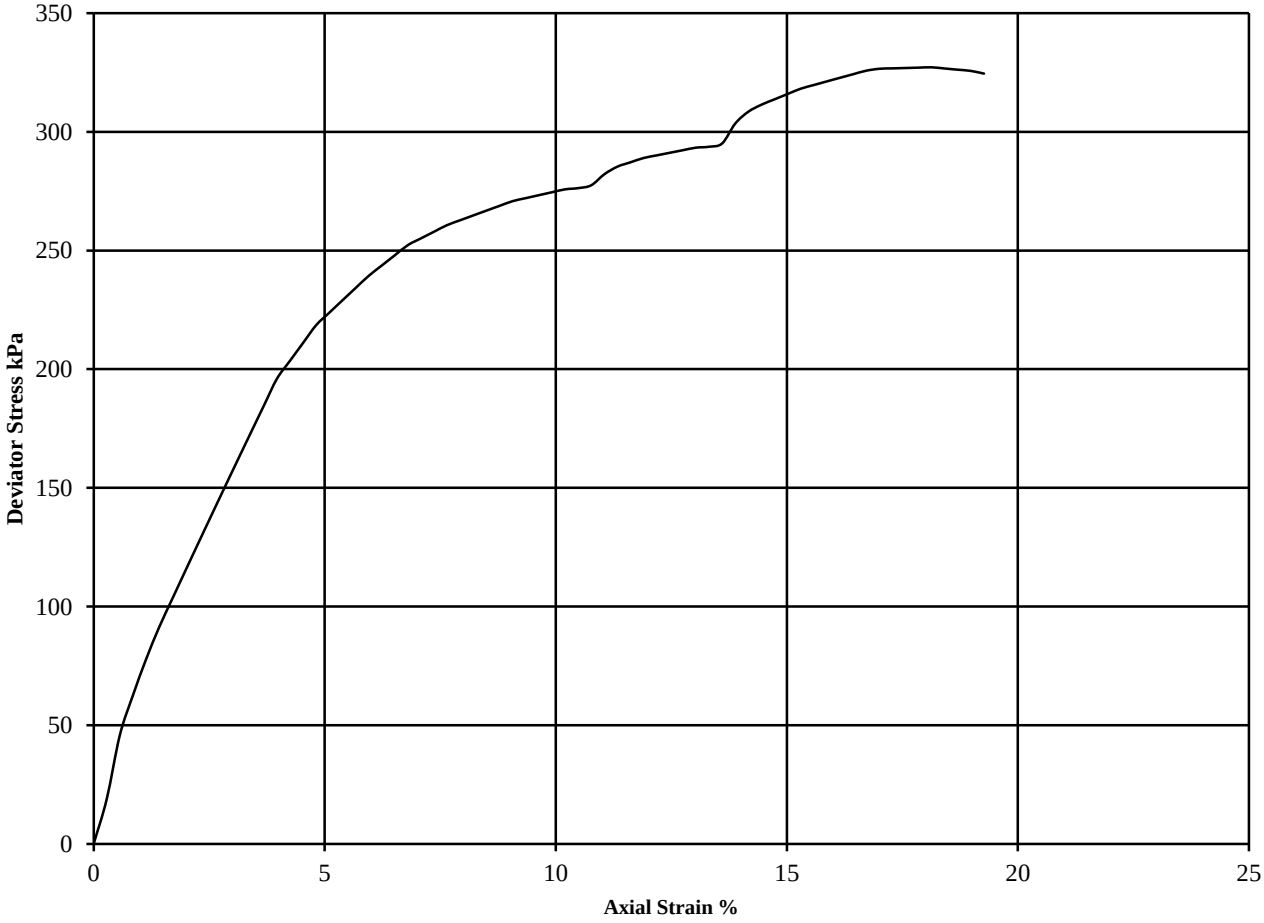
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**106**	**Top Depth (m):**	**8.45**
Sample Number:	**U11**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		180	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	15	2.20	1.91	90	276	138	10.5		0.35 0.35 0.34
				180	294	147	13.3		See summary of soil descriptions
				360	327	164	18.1	Plastic	

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New Islington Manchester

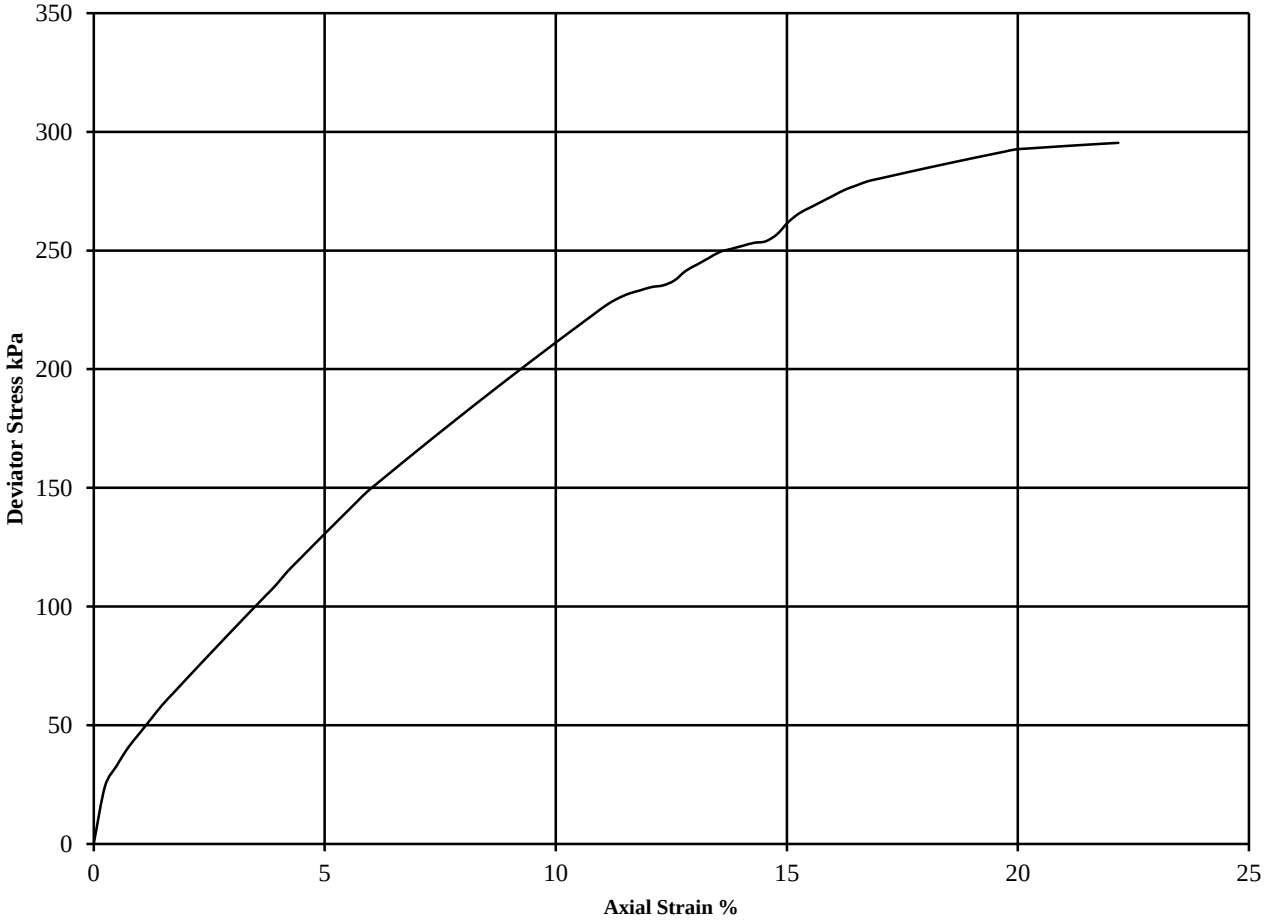
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 9

Hole Number:	**106**	**Top Depth (m):**	**11.45**
Sample Number:	**U15**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		207	Test:	UU Multistage		Remarks
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick Membrane Correction applied (kPa)
1	14	2.20	1.93	110	235	118	12.3		0.35 0.34 0.33
				220	254	127	14.5		See summary of soil descriptions
				440	295	148	22.2	Plastic	

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PSL Professional Soils Laboratory

New Islington Manchester

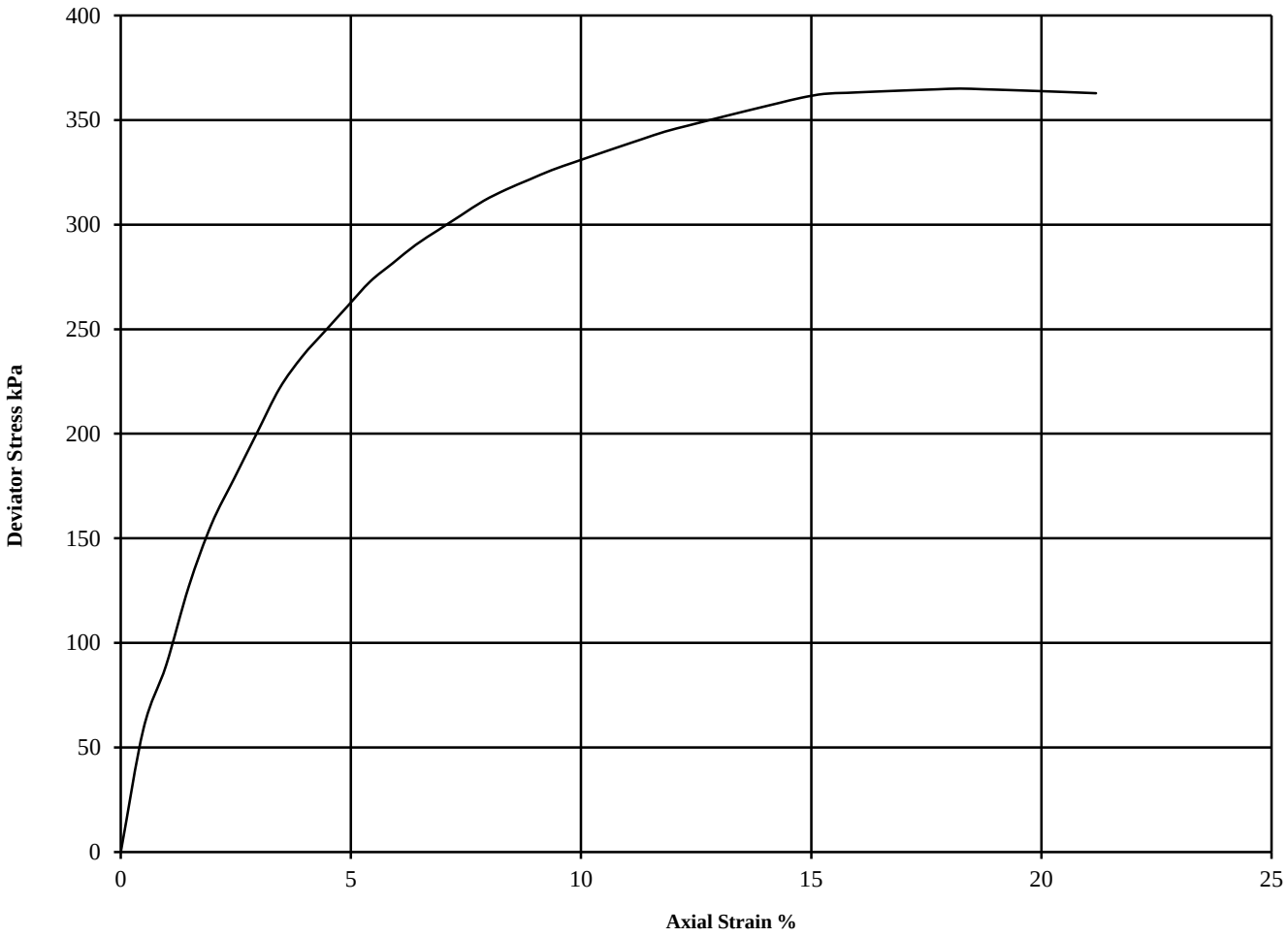
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**107**	**Top Depth (m):**	**6.65**
Sample Number	**U7**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	16	2.17	1.87	120	365	183	18.2	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

New Islington Manchester

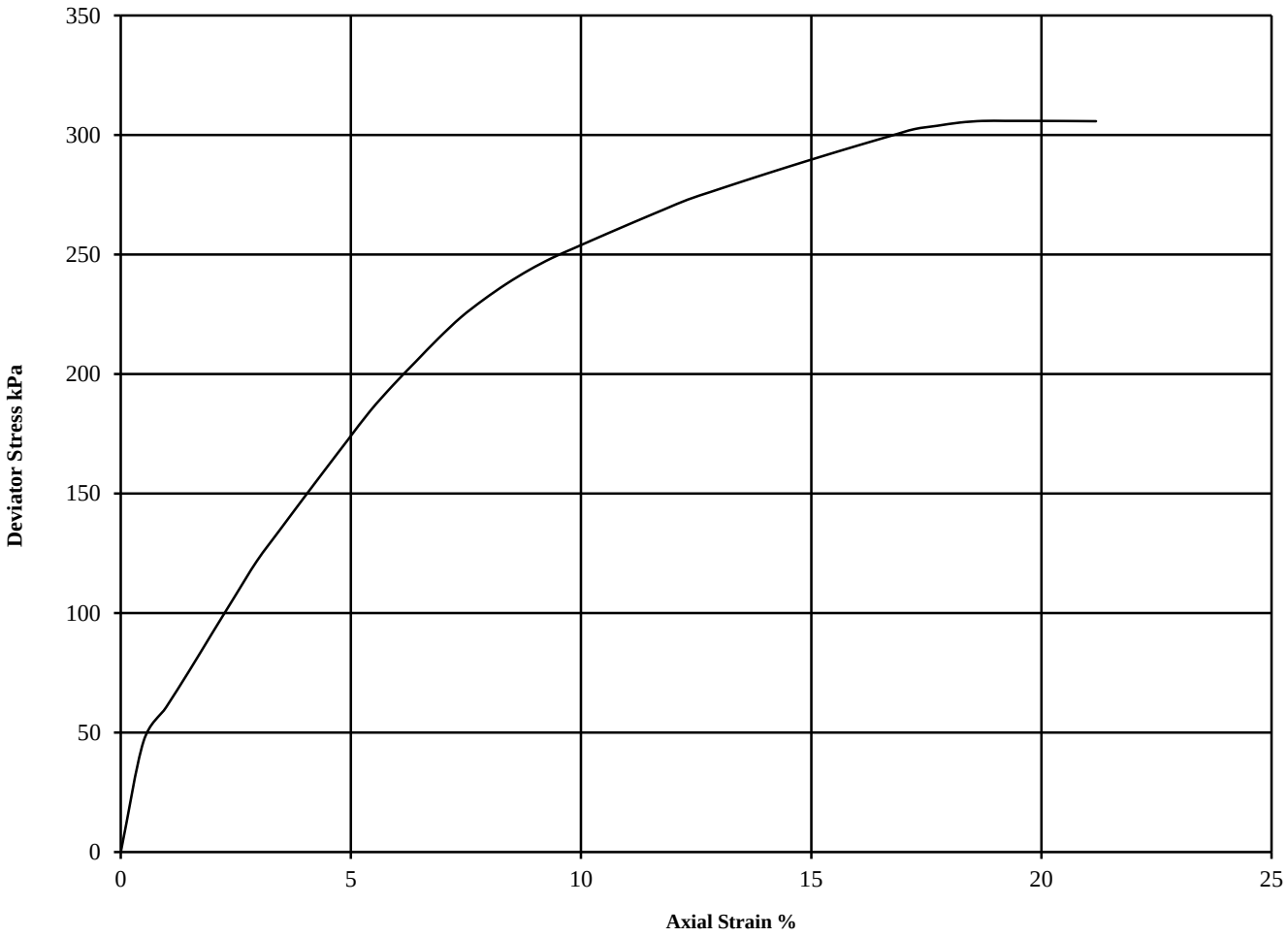
Contract No:
PSL17/0104
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**107**	**Top Depth (m):**	**11.45**
Sample Number	**U17**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	16	2.19	1.89	220	306	153	19.2	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

New Islington Manchester

Contract No:
PSL17/0104
Client Ref:

Certificate of Analysis

Certificate Number 17-88622

17-Jan-17

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 17-88622

Client Reference psl17/0104

Order No (not supplied)

Contract Title New Islington Manchester

Description 3 Soil samples.

Date Received 13-Jan-17

Date Started 13-Jan-17

Date Completed 17-Jan-17

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 17-88622
Client Ref psl17/0104
Contract Title New Islington Manchester

			Lab No	1109562	1109563	1109564
			Sample ID	BH101	BH101	BH105
			Depth	9.80	12.80	5.30
			Other ID			
			Sample Type	SOIL	SOIL	SOIL
			Sampling Date	10/01/17	10/01/17	10/01/17
			Sampling Time	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
Metals						
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	< 10	11	12
Inorganics						
pH	DETSC 2008#			8.4	8.5	8.6
Chloride Aqueous Extract	DETSC 2055	1	mg/l	5.1	6.5	10
Chloride	DETSC 2055	1	mg/kg	20.8	27.5	25.6
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	< 1.0	< 1.0	21
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	59	100	75

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 17-88622
Client Ref psl17/0104
Contract New Islington Manchester

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1109562	BH101 9.80 SOIL	10/01/17	PT 1L		
1109563	BH101 12.80 SOIL	10/01/17	PT 1L		
1109564	BH105 5.30 SOIL	10/01/17	PT 1L		

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

LABORATORY REPORT

4043

Contract Number: PSL17/0758

Report Date: 27 March 2017

Client's Reference:

Client Name: LK Group
Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

For the attention of: Rosie Cummings / Joule

Contract Title: New Islington Manchester

Date Received: 20/2/2017
Date Commenced: 20/2/2017
Date Completed: 27/3/2017

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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
L Knight (Senior Technician)	S Royle (Senior Technician)	A Fry (Senior Technician)

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awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
UUCP101	B1		6.20		Brown slightly gravelly very sandy CLAY.
UUCP101	U2		7.95		Hard brown slightly gravelly very sandy CLAY.
UUCP101	D3		8.00		Brown slightly gravelly very sandy CLAY.
UUCP101	B4		8.50		Brown slightly gravelly very sandy CLAY.
UUCP101	U5		9.45		Brown slightly gravelly very sandy CLAY.
UUCP101	D6		9.50		Brown slightly gravelly very sandy CLAY.
UUCP101	B7		10.00		Brown slightly gravelly very sandy CLAY.
UUCP101	U8		11.05		Stiff brown slightly gravelly very sandy CLAY.
UUCP101	D9		11.10		Brown slightly gravelly very sandy CLAY.
UUCP101	B10		11.80		Brown slightly gravelly very sandy CLAY.
UUCP102	B10		6.30		Brown slightly gravelly very sandy CLAY.
UUCP102	U2		7.85		Hard brown slightly gravelly very sandy CLAY.
UUCP102	D3		7.90		Brown slightly gravelly very sandy CLAY.
UUCP102	B4		8.30		Brown slightly gravelly very sandy CLAY.
UUCP102	U5		9.45		Stiff brown slightly gravelly very sandy CLAY.
UUCP102	D6		9.50		Brown slightly gravelly very sandy CLAY.
UUCP103	D1		5.50		Brown slightly gravelly very sandy CLAY.
UUCP103	U2		7.85		Very stiff brown slightly gravelly very sandy CLAY.
UUCP103	D3		7.90		Brown slightly gravelly very sandy CLAY.

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
UUCP103	B4		8.30		Brown slightly gravelly very sandy CLAY.
UUCP103	U5		9.45		Stiff brown slightly gravelly very sandy CLAY.
UUCP103	UU6		9.50		Brown slightly gravelly very sandy CLAY.
UUCP103	BB7		10.30		Brown slightly gravelly very sandy CLAY.
UUCP103	U8		10.95		Stiff brown slightly gravelly very sandy CLAY.
UUCP103	D9		11.00		Brown slightly gravelly very sandy CLAY.
UUCP103	B10		11.50		Brown slightly gravelly very sandy CLAY.

UKAS TESTING 4043	PSL Professional Soils Laboratory	New Islington Manchester	Contract No: PSL17/0758 Client Ref:

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
UUCP101	B1		6.20		16							
UUCP101	D3		8.00		15							
UUCP101	B4		8.50		15							
UUCP101	U5		9.45		14							
UUCP101	D6		9.50		10							
UUCP101	B7		10.00		14							
UUCP101	D9		11.10		11							
UUCP101	B10		11.80		14							
UUCP102	B10		6.30		16							
UUCP102	D3		7.90		15							
UUCP102	B4		8.30		16							
UUCP102	D6		9.50		15							
UUCP103	D1		5.50		15							
UUCP103	D3		7.90		17							
UUCP103	B4		8.30		13							
UUCP103	UU6		9.50		16							
UUCP103	BB7		10.30		15							
UUCP103	D9		11.00		17							
UUCP103	B10		11.50		19							

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

New Islington Manchester

Contract No:

PSL17/0758

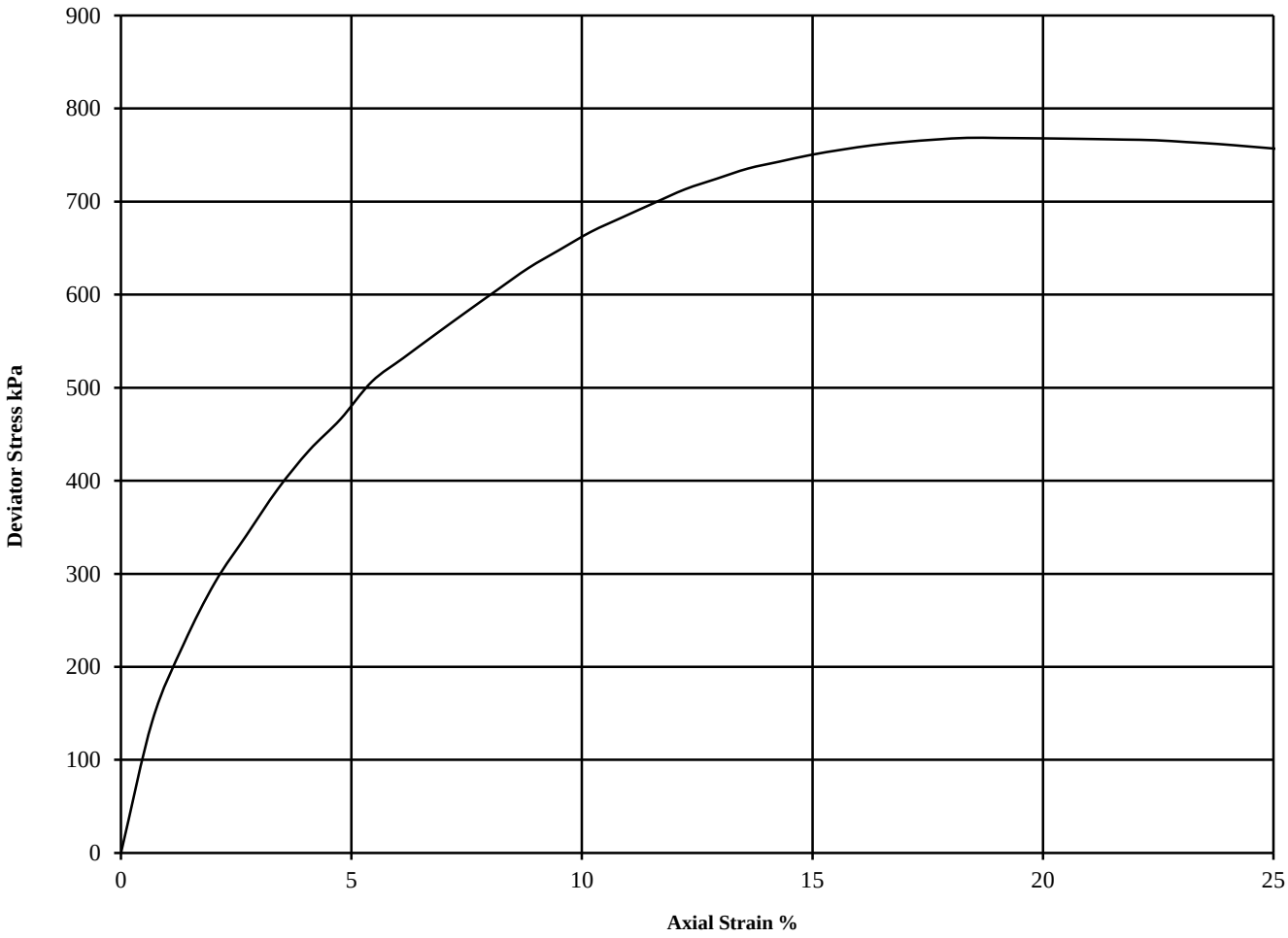
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**UUCP101**	**Top Depth (m):**	**7.95**
Sample Number	**U2**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		150.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	15	2.19	1.91	160	769	384	18.4	Plastic	See summary of soil descriptions

UKAS TESTING 4043

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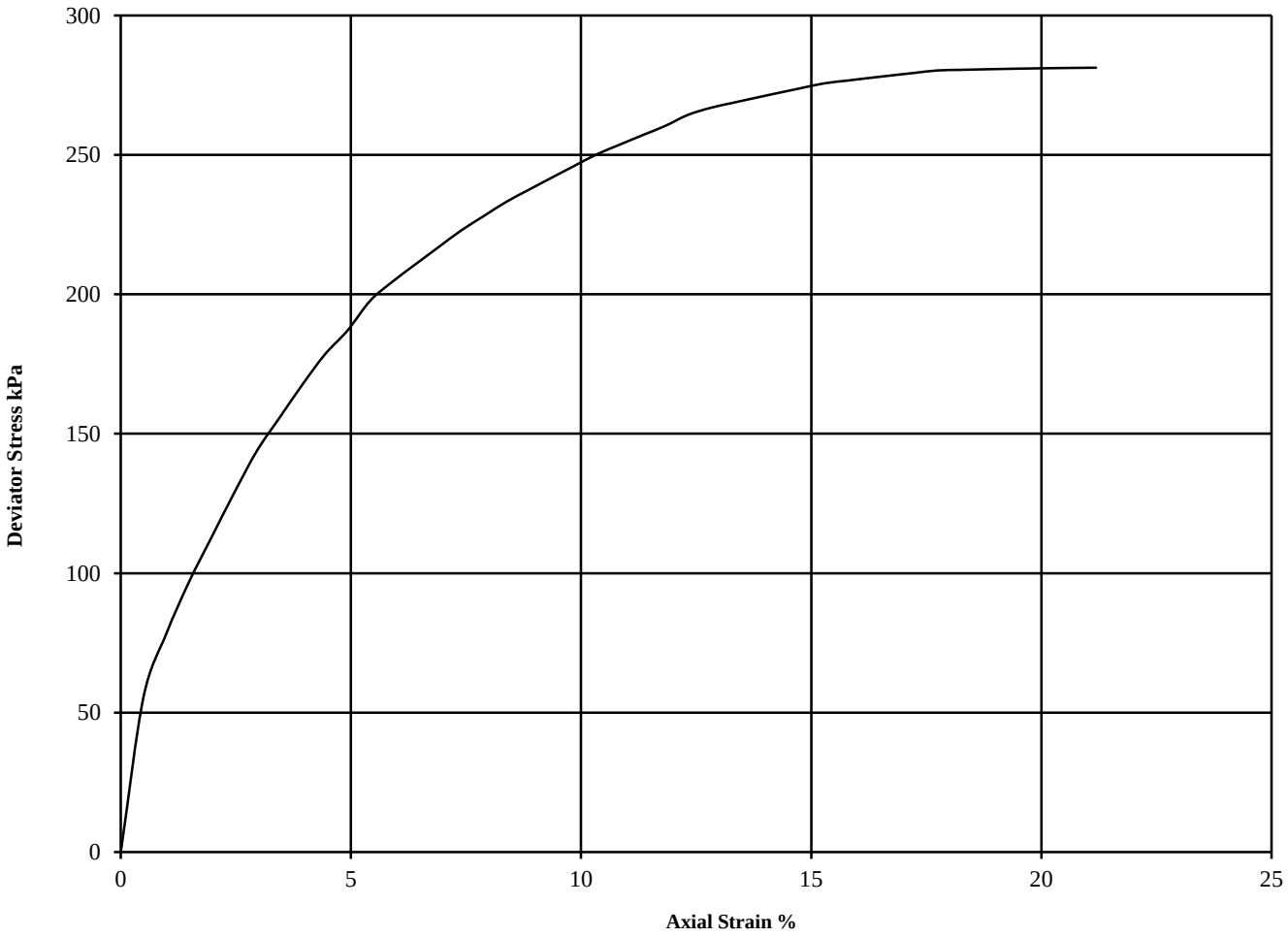
Contract No:
PSL17/0758
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**UUCP101**	**Top Depth (m):**	**11.05**
Sample Number	**U8**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	15	2.22	1.93	220	281	141	21.2	Plastic	See summary of soil descriptions

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Contract No:
PSL17/0758
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

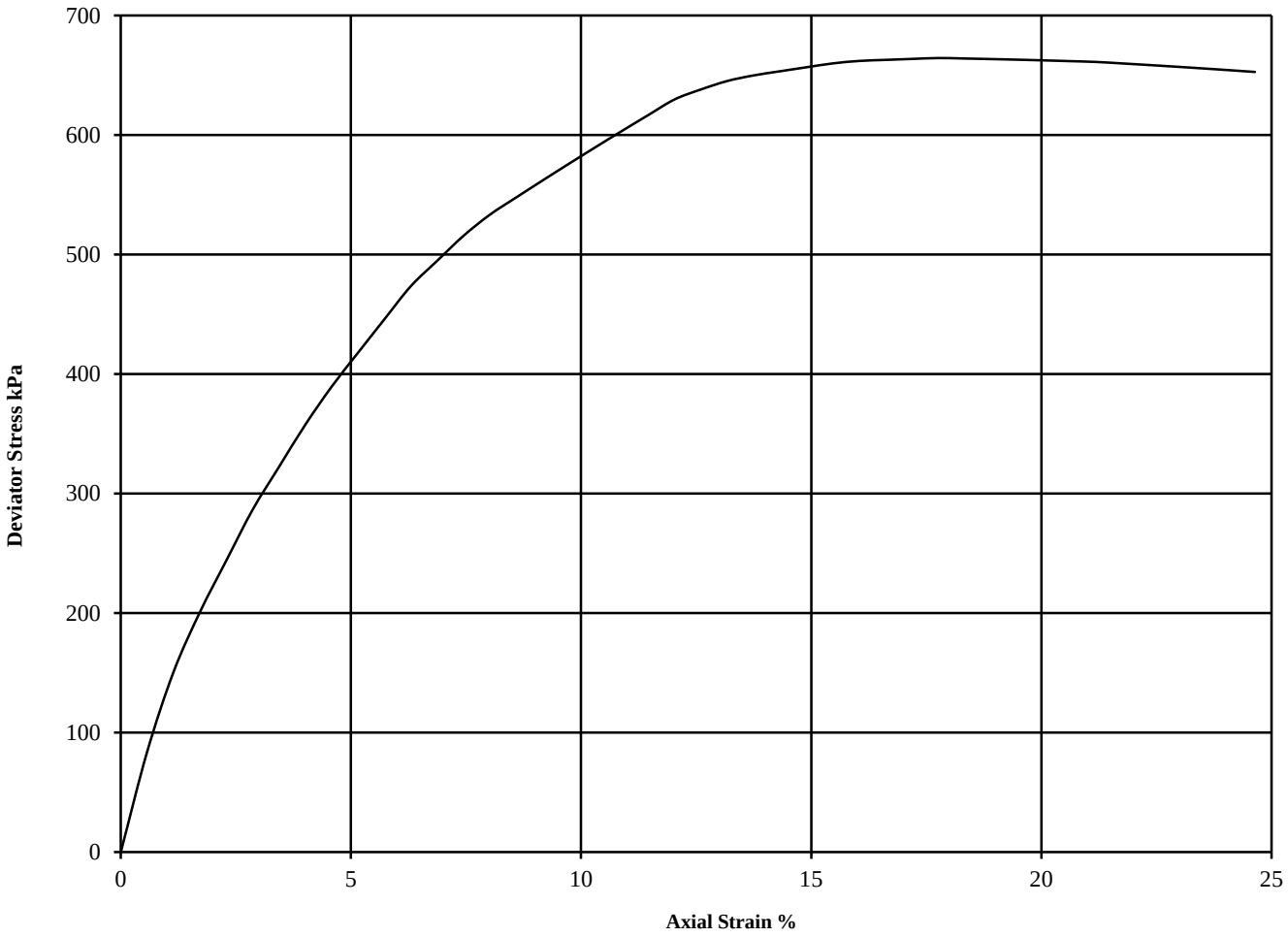
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: UUCP102 **Top Depth (m):** 7.85

Sample Number U2 **Base Depth (m):**

Sample Type



Diameter (mm):		102.0	Height (mm):		178.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	15	2.21	1.91	160	664	332	17.8	Plastic	See summary of soil descriptions

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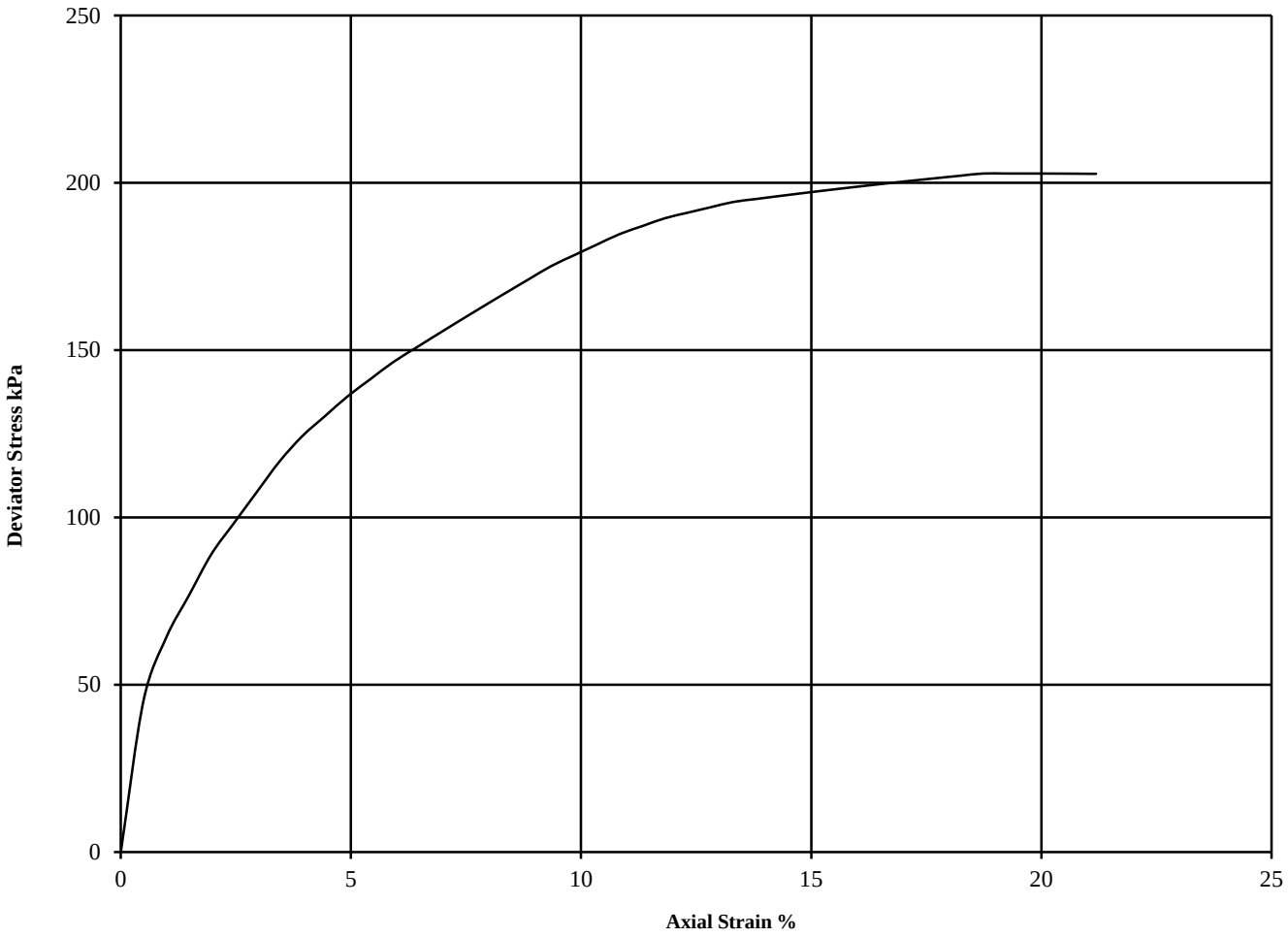
Contract No:
PSL17/0758
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**UUCP102**	**Top Depth (m):**	**9.45**
Sample Number	**U5**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	17	2.14	1.83	190	203	101	19.2	Plastic	See summary of soil descriptions

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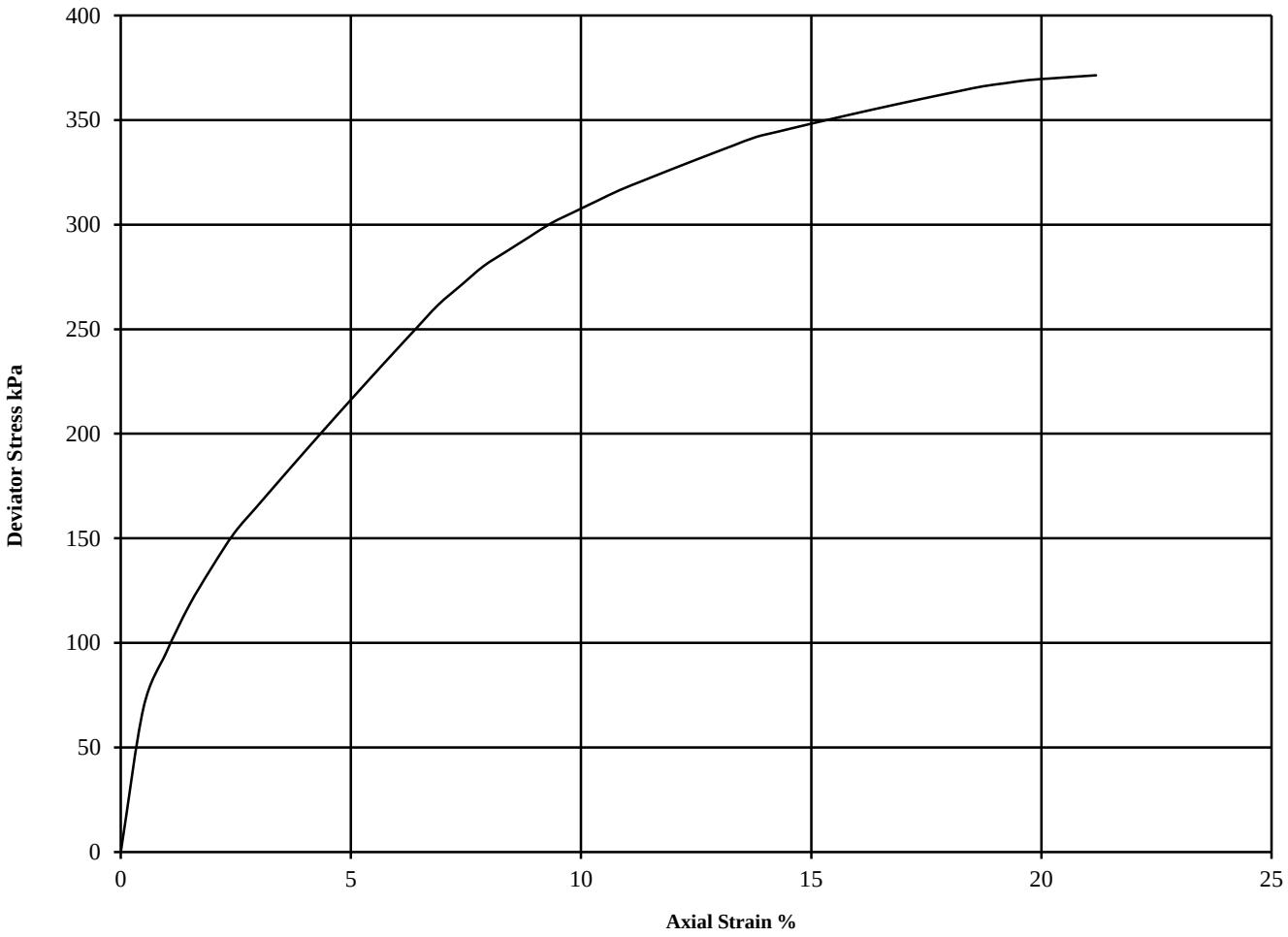
Contract No:
PSL17/0758
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**UUCP103**	**Top Depth (m):**	**7.85**
Sample Number	**U2**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	15	2.11	1.83	160	371	186	21.2	Plastic	See summary of soil descriptions

UKAS TESTING 4043

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New Islington, Manchester

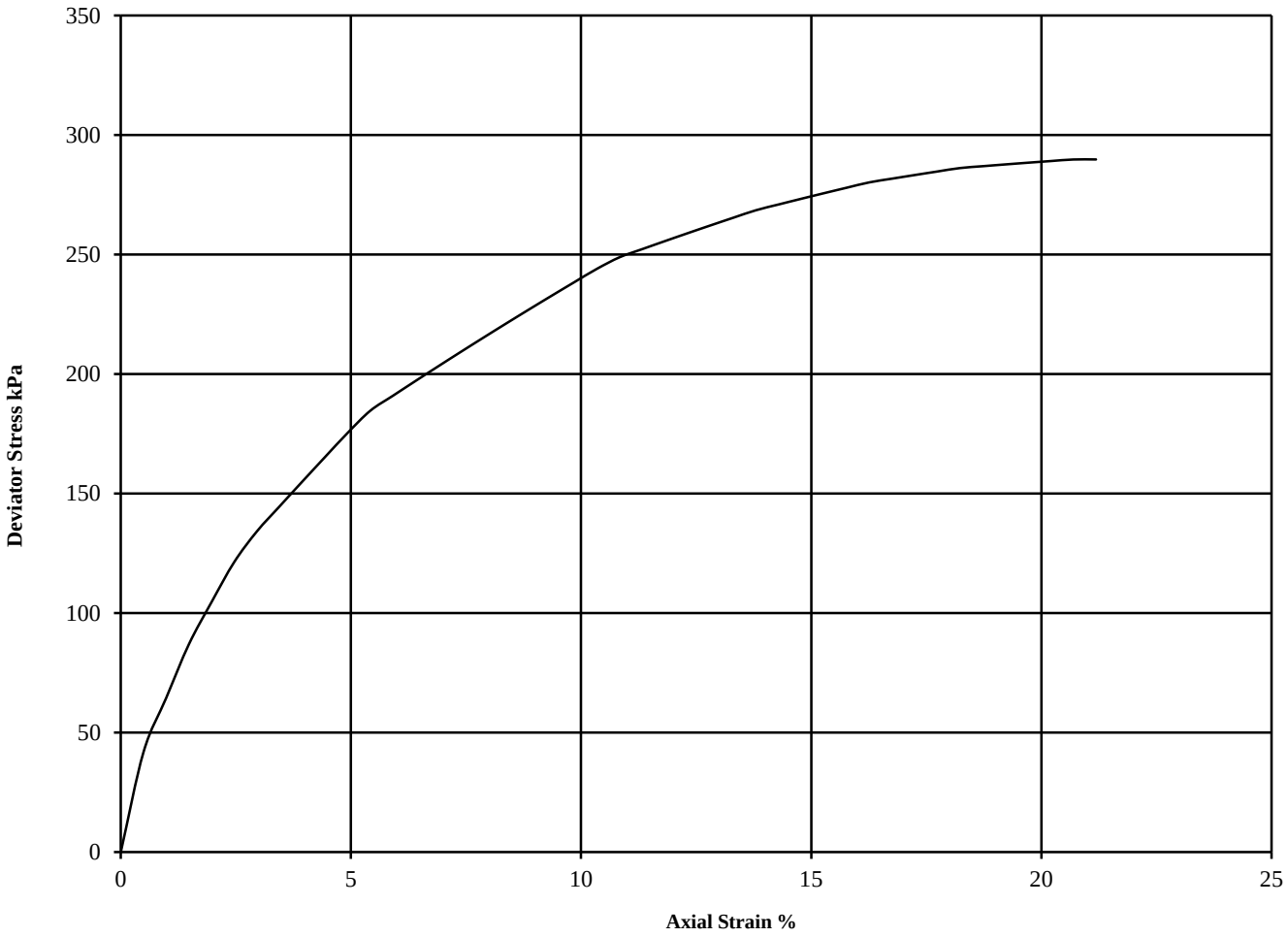
Contract No:
PSL17/0758
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**UUCP103**	**Top Depth (m):**	**9.45**
Sample Number	**U5**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	15	2.23	1.93	190	290	145	21.2	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

New Islington, Manchester

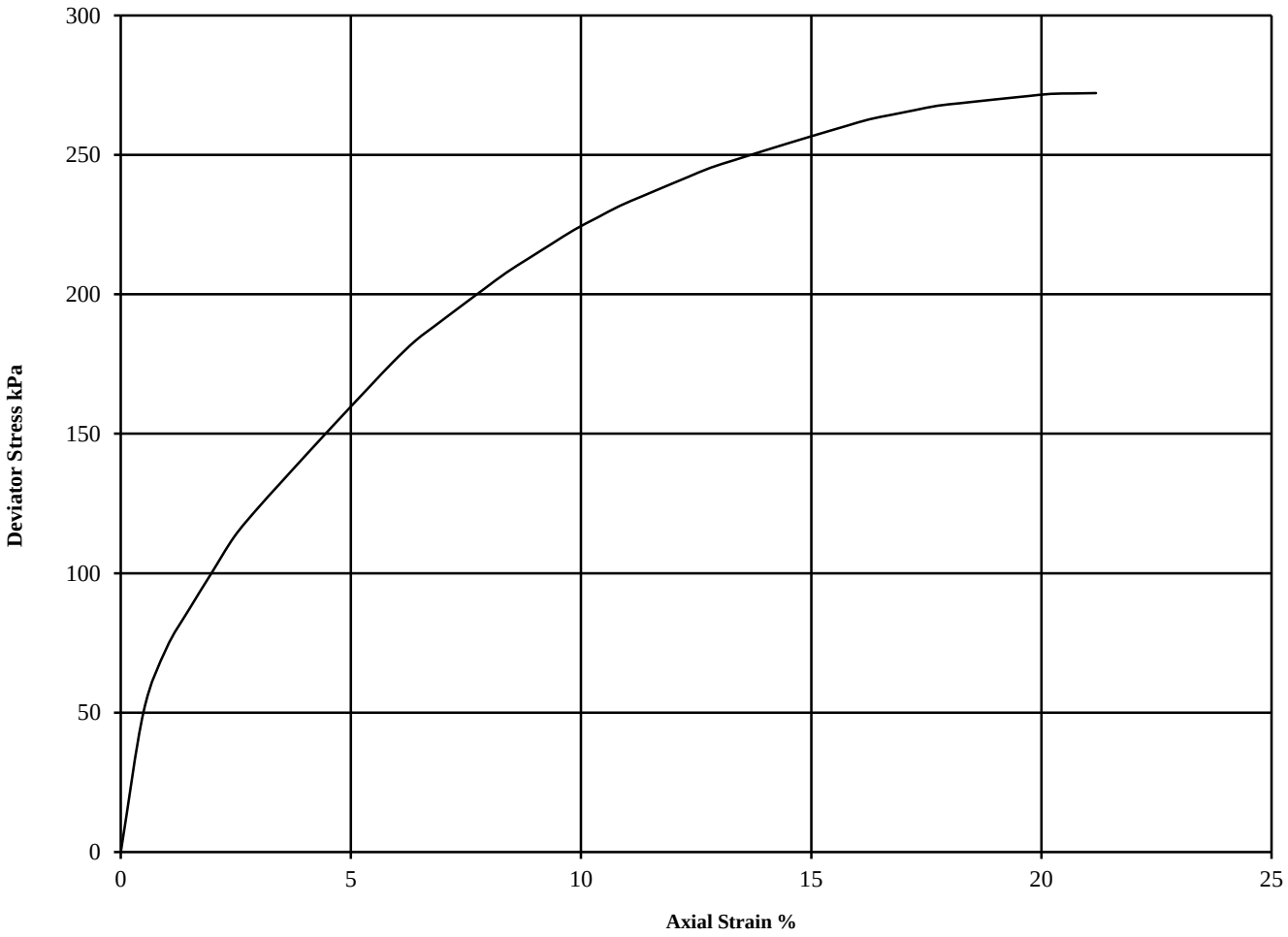
Contract No:
PSL17/0758
Client Ref:

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**UUCP103**	**Top Depth (m):**	**10.95**
Sample Number	**U8**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102.0	Height (mm):		207.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33
1	17	2.17	1.86	220	272	136	21.2	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

New Islington, Manchester

Contract No:
PSL17/0758
Client Ref:

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27 March 2017

Issue No : 01

For the attention of Mr R Berriman

Dear Sirs

Our ref **GEO / 25691**
Your Ref **PSL17/0758**

Project **NEW ISLINGTON MANCHESTER**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

Item No	Test Quantity	Description
1	4	Dispersibility - Pinhole Method

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of no less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after a period of 28 days from the date of this report. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**

J A Reynolds
Laboratory Manager

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BS1377 : Part 5 : 1990 Clause 6.2

DISPERSIBILITY - PINHOLE METHOD

BH/TP	UUCP101
Sample Ref	U2
Depth (m)	7.95
Sample Type	U

Description

Dark brown CLAY

PINHOLE TEST:

As Received Water Content: 15.5 %
(BS EN ISO 17892-1:2014)

Initial Conditions:

Remoulding:	At plastic limit by kneading
Water Content:	19.1 *%*
Plastic Limit:	19 *% approx*
Bulk density:	2.19 *Mg/m³*
Dry density:	1.84 *Mg/m³*

0 *approximate % material was retained on BS 2mm sieve.*

Flow data:

Head (mm)	**Flow Rate** (mL/s)	**Flow Duration** (min)	**Cloudiness** (descriptive)
50	0.27	5	Perfectly clear
180	0.96	5	Perfectly clear
380	1.80	5	Perfectly clear
1020	2.92	5	Perfectly clear

Hole: 1.0 *mm uniform intact diameter after test (approximately).*

Final Conditions: Water Content: 19.8 %

Dispersive Classification: ND1

Checked and Approved by

J A Reynolds - Laboratory Manager
27/03/2017

Project Number:

GEO / 25691

Project Name:

NEW ISLINGTON MANCHESTER
PSL17/0758

BS1377 : Part 5 : 1990 Clause 6.2

DISPERSIBILITY - PINHOLE METHOD

BH/TP	UUCP101
Sample Ref	U8
Depth (m)	11.05
Sample Type	U

Description

Dark brown CLAY

PINHOLE TEST:

As Received Water Content: 13.8 %
(BS EN ISO 17892-1:2014)

Initial Conditions:

Remoulding:	At plastic limit by kneading
Water Content:	14.8 *%*
Plastic Limit:	15 *% approx*
Bulk density:	2.24 *Mg/m³*
Dry density:	1.95 *Mg/m³*

0 *approximate % material was retained on BS 2mm sieve.*

Flow data:

Head (mm)	**Flow Rate** (mL/s)	**Flow Duration** (min)	**Cloudiness** (descriptive)
50	0.33	5	Perfectly clear
180	1.54	5	Perfectly clear
380	2.55	5	Perfectly clear
1020	3.81	5	Perfectly clear

Hole: 1.2 *mm uniform intact diameter after test (approximately).*

Final Conditions: Water Content: 15.1 %

Dispersive Classification: ND2

Checked and Approved by

J A Reynolds - Laboratory Manager
27/03/2017

Project Number:

GEO / 25691

Project Name:

NEW ISLINGTON MANCHESTER
PSL17/0758

GEOLABS

BS1377 : Part 5 : 1990 Clause 6.2

DISPERSIBILITY - PINHOLE METHOD

BH/TP	UUCP102
Sample Ref	U5
Depth (m)	9.45
Sample Type	U

Description

Dark brown CLAY

PINHOLE TEST:

As Received Water Content: 16.2 %
(BS EN ISO 17892-1:2014)

Initial Conditions:

Remoulding:	At plastic limit by kneading
Water Content:	17.8 *%*
Plastic Limit:	18 *% approx*
Bulk density:	2.18 *Mg/m³*
Dry density:	1.85 *Mg/m³*

0 *approximate % material was retained on BS 2mm sieve.*

Flow data:

Head (mm)	**Flow Rate** (mL/s)	**Flow Duration** (min)	**Cloudiness** (descriptive)
50	0.31	5	Perfectly clear
180	0.76	5	Perfectly clear
380	1.39	5	Perfectly clear
1020	4.30	5	Perfectly clear

Hole: 1.0 *mm uniform intact diameter after test (approximately).*

Final Conditions: Water Content: 18.9 %

Dispersive Classification: ND2

Checked and Approved by

J A Reynolds - Laboratory Manager
27/03/2017

Project Number:

GEO / 25691

Project Name:

NEW ISLINGTON MANCHESTER
PSL17/0758

GEOLABS

BS1377 : Part 5 : 1990 Clause 6.2

DISPERSIBILITY - PINHOLE METHOD

BH/TP	UUCP103
Sample Ref	U8
Depth (m)	10.95
Sample Type	U

Description

Dark brown CLAY.

PINHOLE TEST:

As Received Water Content: 16.7 %
(BS EN ISO 17892-1:2014)

Initial Conditions:

Remoulding:	At plastic limit by kneading
Water Content:	18.1 *%*
Plastic Limit:	18 *% approx*
Bulk density:	2.23 *Mg/m³*
Dry density:	1.89 *Mg/m³*

0 *approximate % material was retained on BS 2mm sieve.*

Flow data:

Head (mm)	**Flow Rate** (mL/s)	**Flow Duration** (min)	**Cloudiness** (descriptive)
50	0.54	5	Perfectly clear
150	1.28	5	Perfectly clear
380	2.46	5	Perfectly clear
1020	4.48	5	Perfectly clear

Hole: 1.0 *mm uniform intact diameter after test (approximately).*

Final Conditions: Water Content: 18.4 %

Dispersive Classification: ND2

Checked and Approved by

J A Reynolds - Laboratory Manager
27/03/2017

Project Number:

GEO / 25691

Project Name:

NEW ISLINGTON MANCHESTER
PSL17/0758

APPENDIX C

DCP Data

Penetration Data Report

Project Name: DCPs New Is

Chainage (km):	1.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Moderate
Test Date:	17/01/2017	Moisture adjustment factor:	Not adjusted

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
1	0	0	68	0.00	26	1	25	673	14.00
2	1	1	79	11.00	27	1	26	692	19.00
3	1	2	92	13.00	28	1	27	709	17.00
4	1	3	110	18.00	29	1	28	721	12.00
5	1	4	140	30.00	30	1	29	734	13.00
6	1	5	185	45.00	31	1	30	750	16.00
7	1	6	228	43.00	32	1	31	760	10.00
8	1	7	272	44.00	33	1	32	764	4.00
9	1	8	303	31.00	34	1	33	769	5.00
10	1	9	330	27.00	35	1	34	772	3.00
11	1	10	377	47.00	36	1	35	776	4.00
12	1	11	438	61.00	37	1	36	780	4.00
13	1	12	515	77.00	38	1	37	782	2.00
14	1	13	552	37.00	39	1	38	786	4.00
15	1	14	570	18.00	40	1	39	790	4.00
16	1	15	591	21.00	41	1	40	793	3.00
17	1	16	599	8.00	42	1	41	796	3.00
18	1	17	603	4.00	43	1	42	799	3.00
19	1	18	609	6.00	44	1	43	802	3.00
20	1	19	616	7.00	45	1	44	805	3.00
21	1	20	620	4.00	46	1	45	809	4.00
22	1	21	626	6.00	47	1	46	812	3.00
23	1	22	632	6.00	48	1	47	814	2.00
24	1	23	642	10.00	49	1	48	816	2.00
25	1	24	659	17.00	50	1	49	819	3.00
51	1	50	822	3.00	76	1	75	902	3.00
52	1	51	825	3.00	77	1	76	906	4.00
53	1	52	829	4.00	78	1	77	910	4.00
54	1	53	831	2.00	79	1	78	913	3.00
55	1	54	832	1.00	80	1	79	914	1.00
56	1	55	834	2.00	81	1	80	918	4.00
57	1	56	836	2.00	82	1	81	921	3.00
58	1	57	837	1.00	83	1	82	925	4.00
59	1	58	840	3.00	84	1	83	929	4.00
60	1	59	842	2.00	85	1	84	933	4.00
61	1	60	847	5.00	86	1	85	937	4.00
62	1	61	850	3.00	87	1	86	939	2.00
63	1	62	852	2.00	88	1	87	941	2.00
64	1	63	853	1.00	89	1	88	946	5.00
65	1	64	859	6.00	90	1	89	951	5.00
66	1	65	864	5.00	91	1	90	953	2.00
67	1	66	869	5.00	92	1	91	957	4.00
68	1	67	872	3.00	93	1	92	959	2.00
69	1	68	878	6.00	94	1	93	966	7.00
70	1	69	882	4.00	95	1	94	970	4.00
71	1	70	885	3.00	96	1	95	973	3.00
72	1	71	887	2.00	97	1	96	975	2.00
73	1	72	889	2.00	98	1	97	978	3.00
74	1	73	894	5.00					
75	1	74	899	5.00					

Penetration Data Report

Project Name: DCPs New Is

Chainage (km):	2.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Moderate
Test Date:	17/01/2017	Moisture adjustment factor:	Not adjusted

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
1	0	0	52	0.00	26	1	25	182	2.00
2	1	1	60	8.00	27	1	26	187	5.00
3	1	2	66	6.00	28	1	27	191	4.00
4	1	3	71	5.00	29	1	28	195	4.00
5	1	4	80	9.00	30	1	29	200	5.00
6	1	5	83	3.00	31	1	30	202	2.00
7	1	6	90	7.00	32	1	31	204	2.00
8	1	7	95	5.00	33	1	32	209	5.00
9	1	8	101	6.00	34	1	33	210	1.00
10	1	9	106	5.00	35	1	34	213	3.00
11	1	10	113	7.00	36	1	35	215	2.00
12	1	11	119	6.00	37	1	36	220	5.00
13	1	12	124	5.00	38	1	37	222	2.00
14	1	13	127	3.00	39	1	38	224	2.00
15	1	14	133	6.00	40	1	39	229	5.00
16	1	15	139	6.00	41	1	40	232	3.00
17	1	16	145	6.00	42	1	41	236	4.00
18	1	17	150	5.00	43	1	42	240	4.00
19	1	18	155	5.00	44	1	43	245	5.00
20	1	19	160	5.00	45	1	44	249	4.00
21	1	20	164	4.00	46	1	45	255	6.00
22	1	21	169	5.00	47	1	46	260	5.00
23	1	22	172	3.00	48	1	47	264	4.00
24	1	23	175	3.00	49	1	48	270	6.00
25	1	24	180	5.00	50	1	49	276	6.00
51	1	50	280	4.00	76	1	75	460	5.00
52	1	51	285	5.00	77	1	76	466	6.00
53	1	52	290	5.00	78	1	77	470	4.00
54	1	53	293	3.00	79	1	78	475	5.00
55	1	54	299	6.00	80	1	79	477	2.00
56	1	55	305	6.00	81	1	80	480	3.00
57	1	56	311	6.00	82	1	81	483	3.00
58	1	57	317	6.00	83	1	82	486	3.00
59	1	58	322	5.00	84	1	83	490	4.00
60	1	59	328	6.00	85	1	84	493	3.00
61	1	60	335	7.00	86	1	85	498	5.00
62	1	61	343	8.00	87	1	86	500	2.00
63	1	62	354	11.00	88	1	87	504	4.00
64	1	63	366	12.00	89	1	88	509	5.00
65	1	64	377	11.00	90	1	89	514	5.00
66	1	65	386	9.00	91	1	90	520	6.00
67	1	66	395	9.00	92	1	91	526	6.00
68	1	67	402	7.00	93	1	92	533	7.00
69	1	68	410	8.00	94	1	93	539	6.00
70	1	69	420	10.00	95	1	94	548	9.00
71	1	70	430	10.00	96	1	95	552	4.00
72	1	71	434	4.00	97	1	96	560	8.00
73	1	72	440	6.00	98	1	97	567	7.00
74	1	73	449	9.00	99	1	98	572	5.00
75	1	74	455	6.00	100	1	99	579	7.00

Penetration Data Report

Project Name: DCPs New Is

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
101	1	100	584	5.00	126	1	125	712	2.00
102	1	101	590	6.00	127	1	126	715	3.00
103	1	102	593	3.00	128	1	127	716	1.00
104	1	103	600	7.00	129	1	128	719	3.00
105	1	104	609	9.00	130	1	129	721	2.00
106	1	105	617	8.00	131	1	130	724	3.00
107	1	106	623	6.00	132	1	131	728	4.00
108	1	107	630	7.00	133	1	132	729	1.00
109	1	108	640	10.00	134	1	133	731	2.00
110	1	109	650	10.00	135	1	134	734	3.00
111	1	110	660	10.00	136	1	135	736	2.00
112	1	111	670	10.00	137	1	136	740	4.00
113	1	112	674	4.00	138	1	137	742	2.00
114	1	113	681	7.00	139	1	138	745	3.00
115	1	114	685	4.00	140	1	139	748	3.00
116	1	115	689	4.00	141	1	140	750	2.00
117	1	116	691	2.00	142	1	141	753	3.00
118	1	117	693	2.00	143	1	142	757	4.00
119	1	118	698	5.00	144	1	143	766	9.00
120	1	119	700	2.00	145	1	144	770	4.00
121	1	120	701	1.00	146	1	145	773	3.00
122	1	121	703	2.00	147	1	146	778	5.00
123	1	122	705	2.00	148	1	147	780	2.00
124	1	123	707	2.00	149	1	148	784	4.00
125	1	124	710	3.00	150	1	149	790	6.00
151	1	150	795	5.00					
152	1	151	799	4.00					
153	1	152	803	4.00					
154	1	153	807	4.00					
155	1	154	813	6.00					
156	1	155	818	5.00					
157	1	156	825	7.00					
158	1	157	831	6.00					
159	1	158	840	9.00					
160	1	159	848	8.00					
161	1	160	858	10.00					
162	1	161	870	12.00					
163	1	162	890	20.00					
164	1	163	898	8.00					
165	1	164	912	14.00					
166	1	165	928	16.00					
167	1	166	940	12.00					
168	1	167	958	18.00					

Penetration Data Report

Project Name: DCPs New Is

Chainage (km): 3.000
Direction:
Location/Offset: Carriageway
Cone Angle: 60 degrees
Zero Error (mm): 0
Test Date: 17/01/2017

Surface Type: Unpaved
Thickness (mm): 0
Base Type:
Thickness (mm):
Surface Moisture: Moderate
Moisture adjustment factor: Not adjusted

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
1	0	0	70	0.00	26	1	25	256	10.00
2	1	1	70	0.00	27	1	26	266	10.00
3	1	2	95	25.00	28	1	27	279	13.00
4	1	3	109	14.00	29	1	28	292	13.00
5	1	4	109	0.00	30	1	29	308	16.00
6	1	5	124	15.00	31	1	30	322	14.00
7	1	6	126	2.00	32	1	31	336	14.00
8	1	7	131	5.00	33	1	32	351	15.00
9	1	8	135	4.00	34	1	33	368	17.00
10	1	9	136	1.00	35	1	34	389	21.00
11	1	10	141	5.00	36	1	35	408	19.00
12	1	11	150	9.00	37	1	36	430	22.00
13	1	12	155	5.00	38	1	37	454	24.00
14	1	13	160	5.00	39	1	38	475	21.00
15	1	14	165	5.00	40	1	39	500	25.00
16	1	15	173	8.00	41	1	40	527	27.00
17	1	16	180	7.00	42	1	41	550	23.00
18	1	17	185	5.00	43	1	42	576	26.00
19	1	18	191	6.00	44	1	43	606	30.00
20	1	19	196	5.00	45	1	44	632	26.00
21	1	20	204	8.00	46	1	45	662	30.00
22	1	21	214	10.00	47	1	46	699	37.00
23	1	22	222	8.00	48	1	47	730	31.00
24	1	23	232	10.00	49	1	48	757	27.00
25	1	24	246	14.00	50	1	49	780	23.00
51	1	50	811	31.00					
52	1	51	850	39.00					
53	1	52	890	40.00					
54	1	53	920	30.00					
55	1	54	955	35.00					

Penetration Data Report

Project Name: DCPs New Is

Chainage (km): 4.000
Direction:
Location/Offset: Carriageway
Cone Angle: 60 degrees
Zero Error (mm): 0
Test Date: 17/01/2017

Surface Type: Unpaved
Thickness (mm): 0
Base Type:
Thickness (mm):
Surface Moisture: Moderate
Moisture adjustment factor: Not adjusted

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
1	0	0	66	0.00	26	1	25	153	3.00
2	1	1	72	6.00	27	1	26	156	3.00
3	1	2	76	4.00	28	1	27	157	1.00
4	1	3	82	6.00	29	1	28	159	2.00
5	1	4	86	4.00	30	1	29	161	2.00
6	1	5	91	5.00	31	1	30	163	2.00
7	1	6	96	5.00	32	1	31	164	1.00
8	1	7	101	5.00	33	1	32	165	1.00
9	1	8	106	5.00	34	1	33	167	2.00
10	1	9	107	1.00	35	1	34	170	3.00
11	1	10	112	5.00	36	1	35	172	2.00
12	1	11	115	3.00	37	1	36	174	2.00
13	1	12	118	3.00	38	1	37	177	3.00
14	1	13	122	4.00	39	1	38	179	2.00
15	1	14	126	4.00	40	1	39	183	4.00
16	1	15	129	3.00	41	1	40	185	2.00
17	1	16	131	2.00	42	1	41	187	2.00
18	1	17	132	1.00	43	1	42	190	3.00
19	1	18	135	3.00	44	1	43	192	2.00
20	1	19	135	0.00	45	1	44	194	2.00
21	1	20	141	6.00	46	1	45	198	4.00
22	1	21	144	3.00	47	1	46	200	2.00
23	1	22	146	2.00	48	1	47	203	3.00
24	1	23	148	2.00	49	1	48	205	2.00
25	1	24	150	2.00	50	1	49	206	1.00
51	1	50	209	3.00	76	1	75	258	2.00
52	1	51	210	1.00	77	1	76	259	1.00
53	1	52	212	2.00	78	1	77	262	3.00
54	1	53	215	3.00	79	1	78	264	2.00
55	1	54	219	4.00	80	1	79	267	3.00
56	1	55	222	3.00	81	1	80	300	33.00
57	1	56	224	2.00	82	1	81	302	2.00
58	1	57	226	2.00	83	1	82	305	3.00
59	1	58	228	2.00	84	1	83	307	2.00
60	1	59	230	2.00	85	1	84	309	2.00
61	1	60	230	0.00	86	1	85	310	1.00
62	1	61	232	2.00	87	1	86	310	0.00
63	1	62	234	2.00	88	1	87	311	1.00
64	1	63	236	2.00	89	1	88	312	1.00
65	1	64	239	3.00	90	1	89	312	0.00
66	1	65	240	1.00	91	1	90	312	0.00
67	1	66	242	2.00	92	1	91	312	0.00
68	1	67	244	2.00	93	1	92	312	0.00
69	1	68	246	2.00	94	1	93	312	0.00
70	1	69	246	0.00					
71	1	70	248	2.00					
72	1	71	251	3.00					
73	1	72	252	1.00					
74	1	73	254	2.00					
75	1	74	256	2.00					

Penetration Data Report

Project Name: DCPs New Is

Chainage (km): 5.000
Direction:
Location/Offset: Carriageway
Cone Angle: 60 degrees
Zero Error (mm): 0
Test Date: 17/01/2017

Surface Type: Unpaved
Thickness (mm): 0
Base Type:
Thickness (mm):
Surface Moisture: Moderate
Moisture adjustment factor: Not adjusted

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
1	0	0	86	0.00	26	1	25	460	9.00
2	1	1	97	11.00	27	1	26	471	11.00
3	1	2	108	11.00	28	1	27	485	14.00
4	1	3	120	12.00	29	1	28	499	14.00
5	1	4	135	15.00	30	1	29	509	10.00
6	1	5	151	16.00	31	1	30	522	13.00
7	1	6	170	19.00	32	1	31	534	12.00
8	1	7	187	17.00	33	1	32	543	9.00
9	1	8	210	23.00	34	1	33	550	7.00
10	1	9	234	24.00	35	1	34	560	10.00
11	1	10	253	19.00	36	1	35	567	7.00
12	1	11	273	20.00	37	1	36	575	8.00
13	1	12	289	16.00	38	1	37	582	7.00
14	1	13	305	16.00	39	1	38	594	12.00
15	1	14	323	18.00	40	1	39	610	16.00
16	1	15	340	17.00	41	1	40	620	10.00
17	1	16	360	20.00	42	1	41	630	10.00
18	1	17	370	10.00	43	1	42	638	8.00
19	1	18	386	16.00	44	1	43	643	5.00
20	1	19	405	19.00	45	1	44	649	6.00
21	1	20	419	14.00	46	1	45	652	3.00
22	1	21	428	9.00	47	1	46	656	4.00
23	1	22	436	8.00	48	1	47	660	4.00
24	1	23	444	8.00	49	1	48	665	5.00
25	1	24	451	7.00	50	1	49	670	5.00
51	1	50	678	8.00	76	1	75	755	4.00
52	1	51	687	9.00	77	1	76	759	4.00
53	1	52	690	3.00	78	1	77	761	2.00
54	1	53	694	4.00	79	1	78	766	5.00
55	1	54	698	4.00	80	1	79	771	5.00
56	1	55	700	2.00	81	1	80	776	5.00
57	1	56	702	2.00	82	1	81	779	3.00
58	1	57	705	3.00	83	1	82	782	3.00
59	1	58	707	2.00	84	1	83	786	4.00
60	1	59	710	3.00	85	1	84	789	3.00
61	1	60	713	3.00	86	1	85	792	3.00
62	1	61	715	2.00	87	1	86	798	6.00
63	1	62	718	3.00	88	1	87	801	3.00
64	1	63	720	2.00	89	1	88	804	3.00
65	1	64	724	4.00	90	1	89	808	4.00
66	1	65	728	4.00	91	1	90	814	6.00
67	1	66	730	2.00	92	1	91	819	5.00
68	1	67	732	2.00	93	1	92	826	7.00
69	1	68	734	2.00	94	1	93	832	6.00
70	1	69	736	2.00	95	1	94	838	6.00
71	1	70	738	2.00	96	1	95	847	9.00
72	1	71	741	3.00	97	1	96	856	9.00
73	1	72	745	4.00	98	1	97	867	11.00
74	1	73	749	4.00	99	1	98	874	7.00
75	1	74	751	2.00	100	1	99	884	10.00

Penetration Data Report

Project Name: DCPs New Is

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
101	1	100	890	6.00					
102	1	101	898	8.00					
103	1	102	902	4.00					
104	1	103	906	4.00					
105	1	104	910	4.00					
106	1	105	916	6.00					
107	1	106	920	4.00					
108	1	107	924	4.00					
109	1	108	928	4.00					
110	1	109	931	3.00					
111	1	110	937	6.00					
112	1	111	940	3.00					
113	1	112	947	7.00					
114	1	113	950	3.00					
115	1	114	954	4.00					
116	1	115	958	4.00					
117	1	116	960	2.00					
118	1	117	963	3.00					
119	1	118	969	6.00					

Penetration Data Report

Project Name: DCPs New Is

Chainage (km):	7.000	Surface Type:	Unpaved
Direction:		Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	0	Surface Moisture:	Moderate
Test Date:	17/01/2017	Moisture adjustment factor:	Not adjusted

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
1	0	0	142	0.00	26	1	25	906	28.00
2	1	1	215	73.00	27	1	26	934	28.00
3	1	2	289	74.00	28	1	27	960	26.00
4	1	3	321	32.00					
5	1	4	344	23.00					
6	1	5	370	26.00					
7	1	6	414	44.00					
8	1	7	462	48.00					
9	1	8	495	33.00					
10	1	9	514	19.00					
11	1	10	545	31.00					
12	1	11	579	34.00					
13	1	12	638	59.00					
14	1	13	706	68.00					
15	1	14	717	11.00					
16	1	15	726	9.00					
17	1	16	735	9.00					
18	1	17	744	9.00					
19	1	18	753	9.00					
20	1	19	765	12.00					
21	1	20	785	20.00					
22	1	21	808	23.00					
23	1	22	832	24.00					
24	1	23	854	22.00					
25	1	24	878	24.00					

Penetration Data Report

Project Name: DCPs New Is

Chainage (km): 8.000
Direction:
Location/Offset: Carriageway
Cone Angle: 60 degrees
Zero Error (mm): 0
Test Date: 17/01/2017

Surface Type: Unpaved
Thickness (mm): 0
Base Type:
Thickness (mm):
Surface Moisture: Moderate
Moisture adjustment factor: Not adjusted

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
1	0	0	55	0.00	26	1	25	193	2.00
2	1	1	59	4.00	27	1	26	195	2.00
3	1	2	64	5.00	28	1	27	198	3.00
4	1	3	73	9.00	29	1	28	200	2.00
5	1	4	80	7.00	30	1	29	201	1.00
6	1	5	83	3.00	31	1	30	203	2.00
7	1	6	88	5.00	32	1	31	205	2.00
8	1	7	90	2.00	33	1	32	208	3.00
9	1	8	94	4.00	34	1	33	210	2.00
10	1	9	97	3.00	35	1	34	213	3.00
11	1	10	100	3.00	36	1	35	215	2.00
12	1	11	102	2.00	37	1	36	218	3.00
13	1	12	104	2.00	38	1	37	222	4.00
14	1	13	106	2.00	39	1	38	227	5.00
15	1	14	109	3.00	40	1	39	235	8.00
16	1	15	122	13.00	41	1	40	242	7.00
17	1	16	128	6.00	42	1	41	250	8.00
18	1	17	136	8.00	43	1	42	258	8.00
19	1	18	144	8.00	44	1	43	267	9.00
20	1	19	156	12.00	45	1	44	275	8.00
21	1	20	169	13.00	46	1	45	281	6.00
22	1	21	181	12.00	47	1	46	288	7.00
23	1	22	186	5.00	48	1	47	296	8.00
24	1	23	188	2.00	49	1	48	305	9.00
25	1	24	191	3.00	50	1	49	316	11.00
51	1	50	329	13.00	76	1	75	759	4.00
52	1	51	342	13.00	77	1	76	765	6.00
53	1	52	356	14.00	78	1	77	772	7.00
54	1	53	373	17.00	79	1	78	776	4.00
55	1	54	393	20.00	80	1	79	780	4.00
56	1	55	410	17.00	81	1	80	783	3.00
57	1	56	427	17.00	82	1	81	787	4.00
58	1	57	446	19.00	83	1	82	790	3.00
59	1	58	468	22.00	84	1	83	794	4.00
60	1	59	485	17.00	85	1	84	800	6.00
61	1	60	499	14.00	86	1	85	805	5.00
62	1	61	513	14.00	87	1	86	812	7.00
63	1	62	530	17.00	88	1	87	819	7.00
64	1	63	552	22.00	89	1	88	827	8.00
65	1	64	575	23.00	90	1	89	837	10.00
66	1	65	595	20.00	91	1	90	849	12.00
67	1	66	614	19.00	92	1	91	862	13.00
68	1	67	635	21.00	93	1	92	874	12.00
69	1	68	660	25.00	94	1	93	889	15.00
70	1	69	685	25.00	95	1	94	901	12.00
71	1	70	716	31.00	96	1	95	910	9.00
72	1	71	740	24.00	97	1	96	916	6.00
73	1	72	746	6.00	98	1	97	920	4.00
74	1	73	750	4.00	99	1	98	926	6.00
75	1	74	755	5.00	100	1	99	931	5.00

Penetration Data Report

Project Name: DCPs New Is

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
101	1	100	936	5.00					
102	1	101	940	4.00					
103	1	102	945	5.00					
104	1	103	951	6.00					
105	1	104	957	6.00					
106	1	105	963	6.00					
107	1	106	969	6.00					
108	1	107	972	3.00					
109	1	108	975	3.00					

Penetration Data Report

Project Name: DCPs New Is

Chainage (km): 9.000
Direction:
Location/Offset: Carriageway
Cone Angle: 60 degrees
Zero Error (mm): 0
Test Date: 17/01/2017

Surface Type: Unpaved
Thickness (mm): 0
Base Type:
Thickness (mm):
Surface Moisture: Moderate
Moisture adjustment factor: Not adjusted

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
1	0	0	83	0.00	26	1	25	464	5.00
2	1	1	101	18.00	27	1	26	469	5.00
3	1	2	107	6.00	28	1	27	473	4.00
4	1	3	115	8.00	29	1	28	477	4.00
5	1	4	130	15.00	30	1	29	482	5.00
6	1	5	142	12.00	31	1	30	487	5.00
7	1	6	147	5.00	32	1	31	490	3.00
8	1	7	154	7.00	33	1	32	494	4.00
9	1	8	162	8.00	34	1	33	497	3.00
10	1	9	169	7.00	35	1	34	500	3.00
11	1	10	178	9.00	36	1	35	505	5.00
12	1	11	187	9.00	37	1	36	509	4.00
13	1	12	196	9.00	38	1	37	513	4.00
14	1	13	210	14.00	39	1	38	516	3.00
15	1	14	230	20.00	40	1	39	519	3.00
16	1	15	255	25.00	41	1	40	524	5.00
17	1	16	280	25.00	42	1	41	530	6.00
18	1	17	307	27.00	43	1	42	534	4.00
19	1	18	334	27.00	44	1	43	540	6.00
20	1	19	362	28.00	45	1	44	547	7.00
21	1	20	388	26.00	46	1	45	554	7.00
22	1	21	425	37.00	47	1	46	560	6.00
23	1	22	446	21.00	48	1	47	570	10.00
24	1	23	452	6.00	49	1	48	580	10.00
25	1	24	459	7.00	50	1	49	590	10.00
51	1	50	599	9.00	76	1	75	875	13.00
52	1	51	607	8.00	77	1	76	890	15.00
53	1	52	616	9.00	78	1	77	904	14.00
54	1	53	625	9.00	79	1	78	919	15.00
55	1	54	635	10.00	80	1	79	932	13.00
56	1	55	644	9.00	81	1	80	948	16.00
57	1	56	654	10.00	82	1	81	960	12.00
58	1	57	664	10.00	83	1	82	973	13.00
59	1	58	675	11.00					
60	1	59	685	10.00					
61	1	60	695	10.00					
62	1	61	705	10.00					
63	1	62	716	11.00					
64	1	63	726	10.00					
65	1	64	737	11.00					
66	1	65	749	12.00					
67	1	66	760	11.00					
68	1	67	772	12.00					
69	1	68	785	13.00					
70	1	69	799	14.00					
71	1	70	810	11.00					
72	1	71	824	14.00					
73	1	72	836	12.00					
74	1	73	849	13.00					
75	1	74	862	13.00					

Penetration Data Report

Project Name: DCPs New Is

Chainage (km): 10.000
Direction:
Location/Offset: Carriageway
Cone Angle: 60 degrees
Zero Error (mm): 0
Test Date: 17/01/2017

Surface Type: Unpaved
Thickness (mm): 0
Base Type:
Thickness (mm):
Surface Moisture: Moderate
Moisture adjustment factor: Not adjusted

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/blow)
1	0	0	141	0.00	26	1	25	700	24.00
2	1	1	193	52.00	27	1	26	714	14.00
3	1	2	227	34.00	28	1	27	736	22.00
4	1	3	247	20.00	29	1	28	745	9.00
5	1	4	269	22.00	30	1	29	749	4.00
6	1	5	290	21.00	31	1	30	752	3.00
7	1	6	325	35.00	32	1	31	754	2.00
8	1	7	355	30.00	33	1	32	759	5.00
9	1	8	376	21.00	34	1	33	760	1.00
10	1	9	406	30.00	35	1	34	763	3.00
11	1	10	431	25.00	36	1	35	766	3.00
12	1	11	443	12.00	37	1	36	769	3.00
13	1	12	451	8.00	38	1	37	771	2.00
14	1	13	460	9.00	39	1	38	773	2.00
15	1	14	471	11.00	40	1	39	776	3.00
16	1	15	490	19.00	41	1	40	779	3.00
17	1	16	518	28.00	42	1	41	782	3.00
18	1	17	536	18.00	43	1	42	785	3.00
19	1	18	559	23.00	44	1	43	787	2.00
20	1	19	575	16.00	45	1	44	790	3.00
21	1	20	583	8.00	46	1	45	793	3.00
22	1	21	595	12.00	47	1	46	796	3.00
23	1	22	614	19.00	48	1	47	800	4.00
24	1	23	646	32.00	49	1	48	802	2.00
25	1	24	676	30.00	50	1	49	806	4.00
51	1	50	809	3.00					
52	1	51	814	5.00					
53	1	52	819	5.00					
54	1	53	823	4.00					
55	1	54	830	7.00					
56	1	55	837	7.00					
57	1	56	845	8.00					
58	1	57	852	7.00					
59	1	58	858	6.00					
60	1	59	864	6.00					
61	1	60	870	6.00					
62	1	61	873	3.00					
63	1	62	882	9.00					
64	1	63	890	8.00					
65	1	64	896	6.00					
66	1	65	902	6.00					
67	1	66	911	9.00					
68	1	67	919	8.00					
69	1	68	929	10.00					
70	1	69	935	6.00					
71	1	70	945	10.00					
72	1	71	955	10.00					
73	1	72	972	17.00					

APPENDIX D

GEOTECHNICAL RISK REGISTER

	Geotechnical Risk Register				
Item	Hazards & Risks	Likelyhood of occurance	Likely Consequence if unmitigated	Mitigation	Mitigated Risk
1	Substantial archaeological find	VL to L	Extra delays due to unpreparedness.	Whole area was demolished and upfilled previously. Archaeologists have already been on site and dug trial trenches and obtained the information they need.	VL to L
2	Compliance to Sewerage Undertaker's requirements for building over or next to main public sewers (Shooters Brook)	H	Compliance may require 'remedial works' to the existing culvert. Deep excavations, draining and partial demolition of canal basin. High costs.	Re-design proposed site layout to avoid UU's requirements. Leave easement for future access to culvert.	L
3	Imposing additional stress on existing structures or foundations supporting existing structures	H	Collapse of culverts or defection of piled retaining walls supporting canal	Use sleeved piles and keep out of stress overlap zones. Use a safety margin so that disturbance of supporting ground does not occur.	L
4	Tension in piles, lateral forces in piles due to long narrow lightly loaded high sided buildings and rotational forces due to, eg, wind. Low shear strength in Made Ground.	H	Large permanent deflections in pile caps and ground beams.	Stiffer and deeper reinforced and larger diameter piles to cope with higher resistances required.	VL
5	Ground Conditions differ from GI.	M	Piling re-designs	Ground conditions are reasonably well known. The only unknown is bedrock.	M to L
6	Soft, weak or compressible ground. Pertains to Made Ground. The site has variable thicknesses (upto 8.7m thick) of clayey made ground	M to H	Excessive settlement spread footings and uncapped pavement.	Use piles, found on ground below problem soils, remove problem soils, piled foundations, use capping with soil reinforcing measures such as geogrids.	L
7	Large scale contamination found	L to M	Off-site disposal, on-site remediation	Results of contamination risk assessment are available.	L
8	Weather delays	M to H	Stiff over-consolidated clays weather and break down to very soft clays	Protection of earthworks by rolling/sealing stockpiles and new cuts. Using dry periods to full advantage for earthworks	L to M

9	Site run-off, mud on Coppersmith Road and works generated pollution	L to M	EA or 3rd party complaints & delays to put in place pollution prevention	Principal Contractor to have pre-works method statements, daily road sweeper required, wheel wash, dust suppressoin, emergency spill kits, settling ponds, bunds & plant pollution controls	L
10	Shallow mine workings, voids, shafts	VL to L	Subsidence, structural failure, piling &/or construction delays, re-designs, claims & damages, substantial extra costs	Coal Authority mining report confirming this is not a risk	VL
11	Historical canal known as Islington Branch Canal, now backfilled.	L to M	Loose and weak ground requiring special boring/piling techniques. Claims & damages. Delays due to road maintenance. Extra measures to line or seal the old canal to prevent gas potential gas ingress.	GI did not find any waste. Results of the GI shows Made Ground which already covers all the site. Piling solution is the best solution to deal with variable Made Ground.	L
12	Canal walls and Retaining Walls (short & long term stability). Slopes too steep, inadequate drainage measures.	M	Retaining wall instability or unserviceability. Long term maintenance issues.	Condition Report is required to log baseline structural state and ground conditions of canal for any future assessments.	L
13	Variable rockhead. Very hard glacial obstructions or soft glacial clay beds	M	Piling re-designs and delays and extra cost.	Installation quality control required. Bore through softer stratum into stiffer beds underneath	L
14	Buried obstructions, glacial boulders, relic foundations	M	Delays to construction. Delays in piling due to refusals during boring of piles.	Piling Contractor needs to fully appreciate the ground conditions and need for his method and plant to have capability to break through relic foundations, blocks and bricks etc.. Boulders unpredictable but relic foundations should be predictable.	L to M
15	Underground storage tanks (UST's)	M	Extra contamination to dispose of. Delays to characterise hazards & risk. Spreading contamination and increasing disposal costs.	walk-over survey, historical search, targeted and non-targeted intrusive survey, site & lab testing, human health & environmental risk assessment. Breaking out concrete slab & searching for UST's	L
16	Heave and swelling ground.	L	Differential settlement of lightly loaded structures.	Dig out soft cohesive and medium to high plasticity clays. Improve ground, found below potentially swelling/heaving ground. Use of capping and geogrids	L
17	Excavations & UXO	L	Human harm, delay, HSE investigations	The area was important part of WWII war effort and bombs would have been disposed of at the time. Area has been substantially redeveloped since WWII	

APPENDIX E

SOAKAWAY AND PERMEABILITY RESULTS

LK CONSULT LTD
Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Borehole Number
New Islington, Manchester	BHUU01

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	1	49.37	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385298.489 E 398484.024 N	09-Feb-17	LKC	1/12

Height of casing above ground level:	0.00 **m**
Depth to Base of Borehole:	5.00 **m bgl**
Depth to Base of Casing:	5.00 **m bgl**
Depth to equilibrium water level:	5.00 **m btoc**
Test Length L:	0.00 **m**
Diameter of Test Length D:	0.15 **m**
Area of Test Section:	0.0182 **m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191

PERMEABILITY (after Hvorslev, 1951)

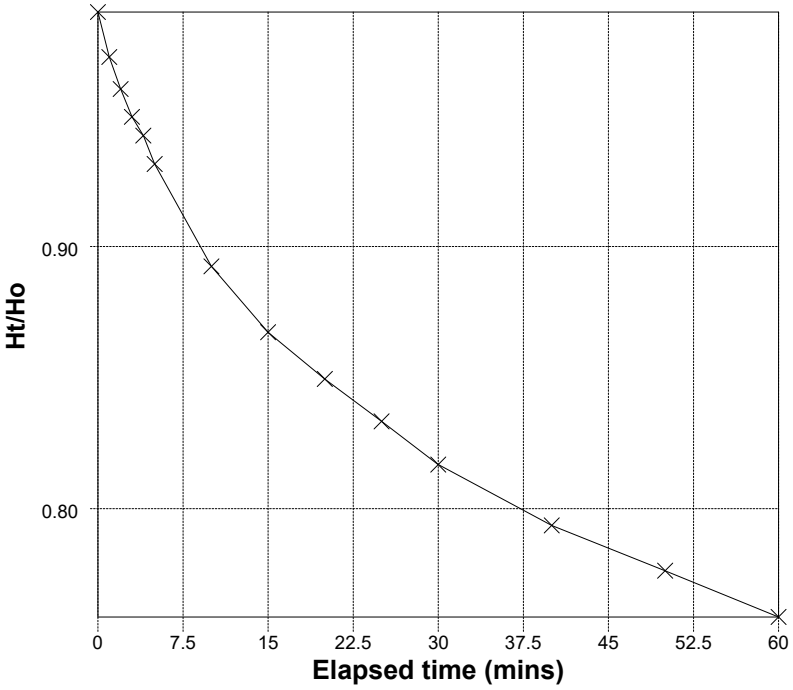
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	5.000	1.000
1.0	0.100	4.900	0.980
2.0	0.170	4.830	0.966
3.0	0.230	4.770	0.954
4.0	0.270	4.730	0.946
5.0	0.330	4.670	0.934
10.0	0.540	4.460	0.892
15.0	0.670	4.330	0.866
20.0	0.760	4.240	0.848
25.0	0.840	4.160	0.832
30.0	0.920	4.080	0.816
40.0	1.030	3.970	0.794
50.0	1.110	3.890	0.778
60.0	1.190	3.810	0.762



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Borehole Number
New Islington, Manchester	BHUU01

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	2	49.37	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385298.489 E 398484.024 N	09-Feb-17	LKC	2/12

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	7.00	**m bgl**
Depth to Base of Casing:	7.00	**m bgl**
Depth to equilibrium water level:	7.00	**m btoc**
Test Length L:	0.00	**m**
Diameter of Test Length D:	0.15	**m**
Area of Test Section:	0.0182	**m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191	

PERMEABILITY (after Hvorslev, 1951)

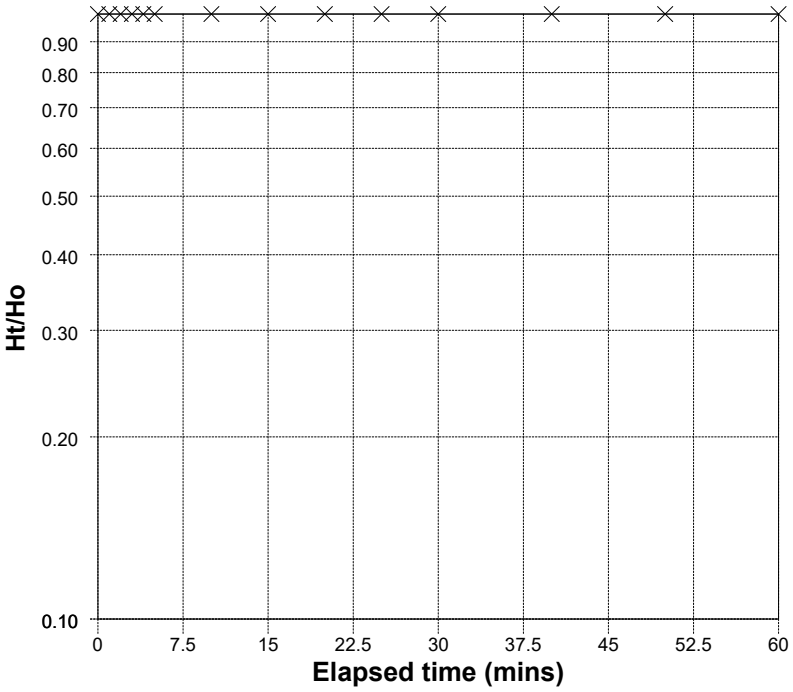
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	7.000	1.000
1.0	0.000	7.000	1.000
2.0	0.000	7.000	1.000
3.0	0.000	7.000	1.000
4.0	0.000	7.000	1.000
5.0	0.000	7.000	1.000
10.0	0.000	7.000	1.000
15.0	0.000	7.000	1.000
20.0	0.000	7.000	1.000
25.0	0.000	7.000	1.000
30.0	0.000	7.000	1.000
40.0	0.000	7.000	1.000
50.0	0.000	7.000	1.000
60.0	0.000	7.000	1.000



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Site	Borehole Number
New Islington, Manchester	BHUU01

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	3	49.37	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385298.489 E 398484.024 N	09-Feb-17	LKC	3/12

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	8.50	**m bgl**
Depth to Base of Casing:	8.50	**m bgl**
Depth to equilibrium water level:	8.50	**m btoc**
Test Length L:	0.00	**m**
Diameter of Test Length D:	0.15	**m**
Area of Test Section:	0.0182	**m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191	

PERMEABILITY (after Hvorslev, 1951)

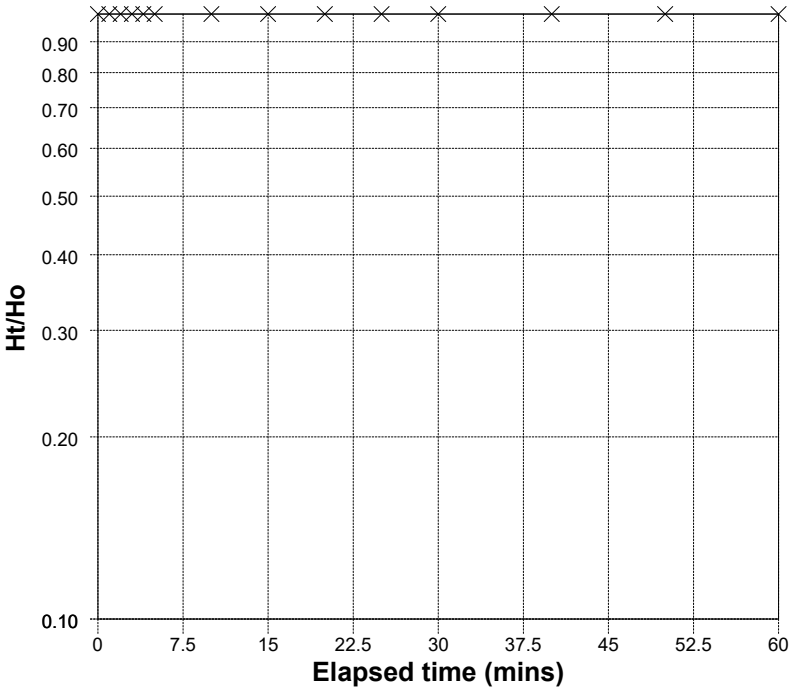
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	8.500	1.000
1.0	0.000	8.500	1.000
2.0	0.000	8.500	1.000
3.0	0.000	8.500	1.000
4.0	0.000	8.500	1.000
5.0	0.000	8.500	1.000
10.0	0.000	8.500	1.000
15.0	0.000	8.500	1.000
20.0	0.000	8.500	1.000
25.0	0.000	8.500	1.000
30.0	0.000	8.500	1.000
40.0	0.000	8.500	1.000
50.0	0.000	8.500	1.000
60.0	0.000	8.500	1.000



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Site	Borehole Number
New Islington, Manchester	BHUU01

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	4	49.37	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385298.489 E 398484.024 N	09-Feb-17	LKC	4/12

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	10.00	**m bgl**
Depth to Base of Casing:	10.00	**m bgl**
Depth to equilibrium water level:	10.00	**m btoc**
Test Length L:	0.00	**m**
Diameter of Test Length D:	0.15	**m**
Area of Test Section:	0.0182	**m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191	

PERMEABILITY (after Hvorslev, 1951)

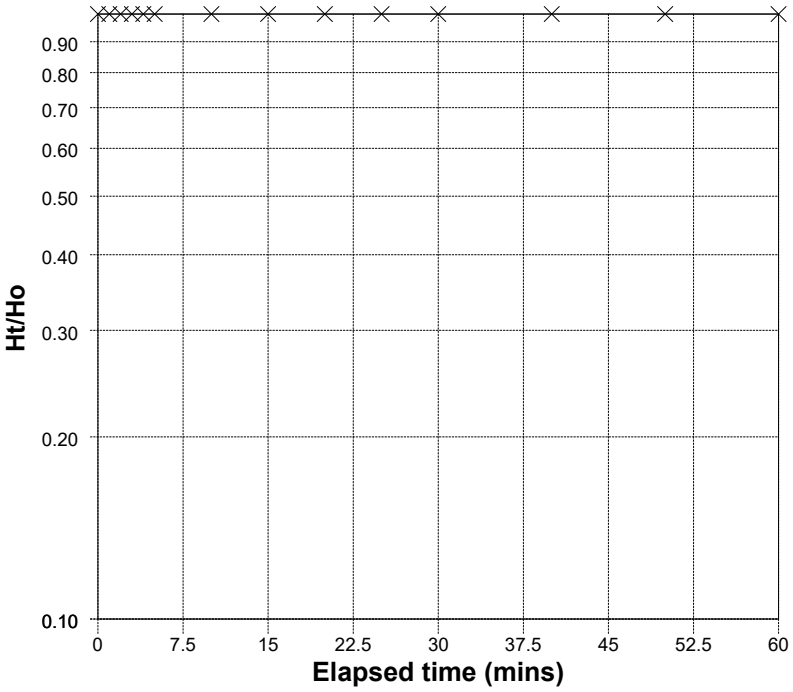
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T = 0.00

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	10.000	1.000
1.0	0.000	10.000	1.000
2.0	0.000	10.000	1.000
3.0	0.000	10.000	1.000
4.0	0.000	10.000	1.000
5.0	0.000	10.000	1.000
10.0	0.000	10.000	1.000
15.0	0.000	10.000	1.000
20.0	0.000	10.000	1.000
25.0	0.000	10.000	1.000
30.0	0.000	10.000	1.000
40.0	0.000	10.000	1.000
50.0	0.000	10.000	1.000
60.0	0.000	10.000	1.000



Remarks

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Site	Borehole Number
New Islington, Manchester	BHUU02

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	1	49.35	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385302.575 E 398495.351 N	03-Feb-17	LKC	5/12

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	5.00	**m bgl**
Depth to Base of Casing:	5.00	**m bgl**
Depth to equilibrium water level:	5.00	**m btoc**
Test Length L:	0.00	**m**
Diameter of Test Length D:	0.15	**m**
Area of Test Section:	0.0182	**m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191	

PERMEABILITY (after Hvorslev, 1951)

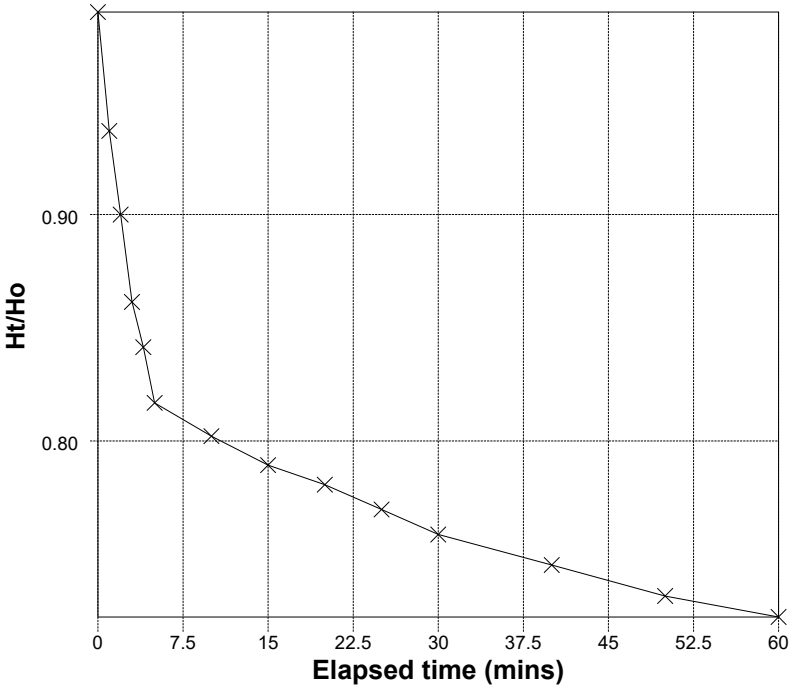
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	5.000	1.000
1.0	0.300	4.700	0.940
2.0	0.500	4.500	0.900
3.0	0.700	4.300	0.860
4.0	0.800	4.200	0.840
5.0	0.920	4.080	0.816
10.0	0.990	4.010	0.802
15.0	1.050	3.950	0.790
20.0	1.090	3.910	0.782
25.0	1.140	3.860	0.772
30.0	1.190	3.810	0.762
40.0	1.250	3.750	0.750
50.0	1.310	3.690	0.738
60.0	1.350	3.650	0.730



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Borehole Number
New Islington, Manchester	BHUU02

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	2	49.35	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385302.575 E 398495.351 N	03-Feb-17	LKC	6/12

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	7.00	**m bgl**
Depth to Base of Casing:	7.00	**m bgl**
Depth to equilibrium water level:	7.00	**m btoc**
Test Length L:	0.00	**m**
Diameter of Test Length D:	0.15	**m**
Area of Test Section:	0.0182	**m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191	

PERMEABILITY (after Hvorslev, 1951)

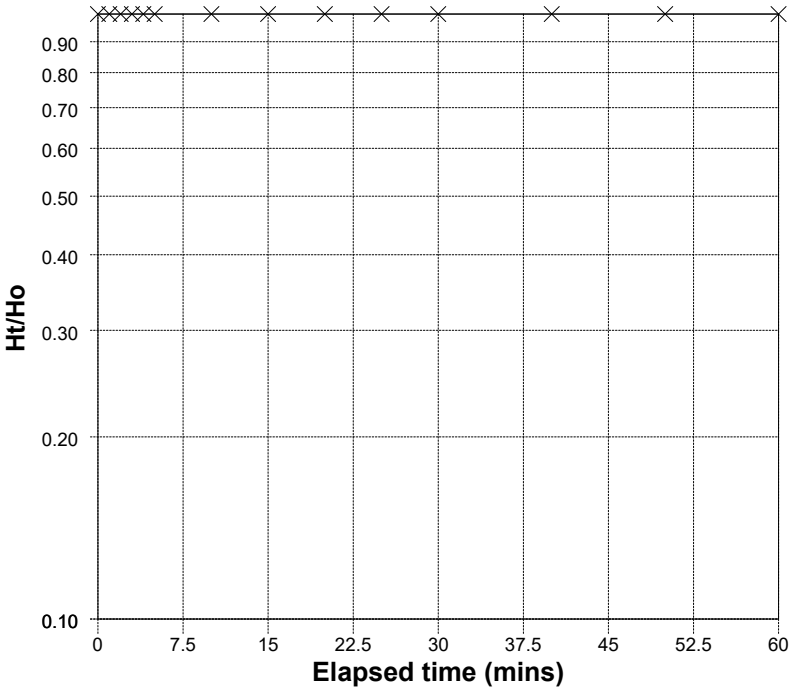
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	7.000	1.000
1.0	0.000	7.000	1.000
2.0	0.000	7.000	1.000
3.0	0.000	7.000	1.000
4.0	0.000	7.000	1.000
5.0	0.000	7.000	1.000
10.0	0.000	7.000	1.000
15.0	0.000	7.000	1.000
20.0	0.000	7.000	1.000
25.0	0.000	7.000	1.000
30.0	0.000	7.000	1.000
40.0	0.000	7.000	1.000
50.0	0.000	7.000	1.000
60.0	0.000	7.000	1.000



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Borehole Number
New Islington, Manchester	BHUU02

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	3	49.35	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385302.575 E 398495.351 N	03-Feb-17	LKC	7/12

Height of casing above ground level:	0.00 **m**
Depth to Base of Borehole:	8.50 **m bgl**
Depth to Base of Casing:	8.50 **m bgl**
Depth to equilibrium water level:	8.50 **m btoc**
Test Length L:	0.00 **m**
Diameter of Test Length D:	0.15 **m**
Area of Test Section:	0.0182 **m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191

PERMEABILITY (after Hvorslev, 1951)

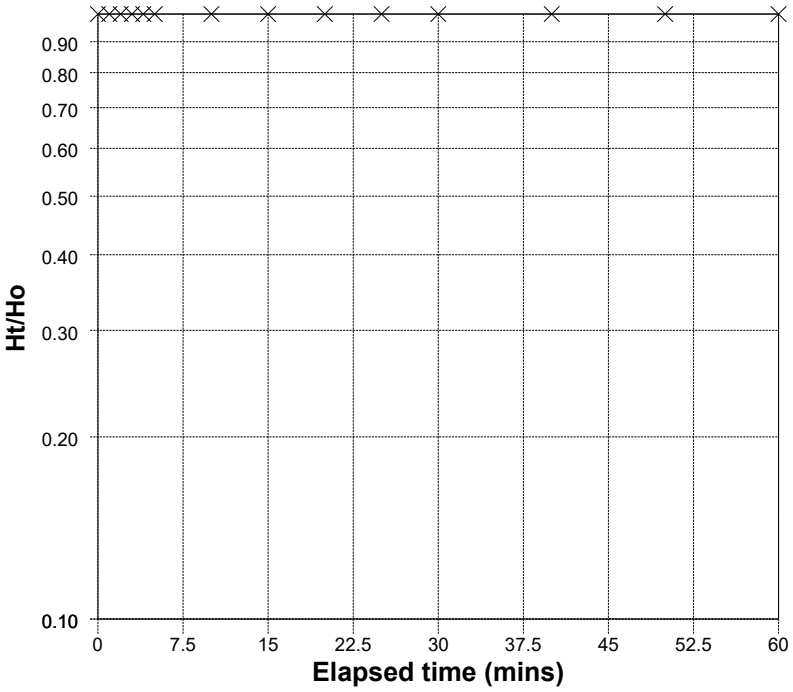
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	8.500	1.000
1.0	0.000	8.500	1.000
2.0	0.000	8.500	1.000
3.0	0.000	8.500	1.000
4.0	0.000	8.500	1.000
5.0	0.000	8.500	1.000
10.0	0.000	8.500	1.000
15.0	0.000	8.500	1.000
20.0	0.000	8.500	1.000
25.0	0.000	8.500	1.000
30.0	0.000	8.500	1.000
40.0	0.000	8.500	1.000
50.0	0.000	8.500	1.000
60.0	0.000	8.500	1.000



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Site	Borehole Number
New Islington, Manchester	BHUU02

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	4	49.35	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385302.575 E 398495.351 N	03-Feb-17	LKC	8/12

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	10.00	**m bgl**
Depth to Base of Casing:	10.00	**m bgl**
Depth to equilibrium water level:	10.00	**m btoc**
Test Length L:	0.00	**m**
Diameter of Test Length D:	0.15	**m**
Area of Test Section:	0.0182	**m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191	

PERMEABILITY (after Hvorslev, 1951)

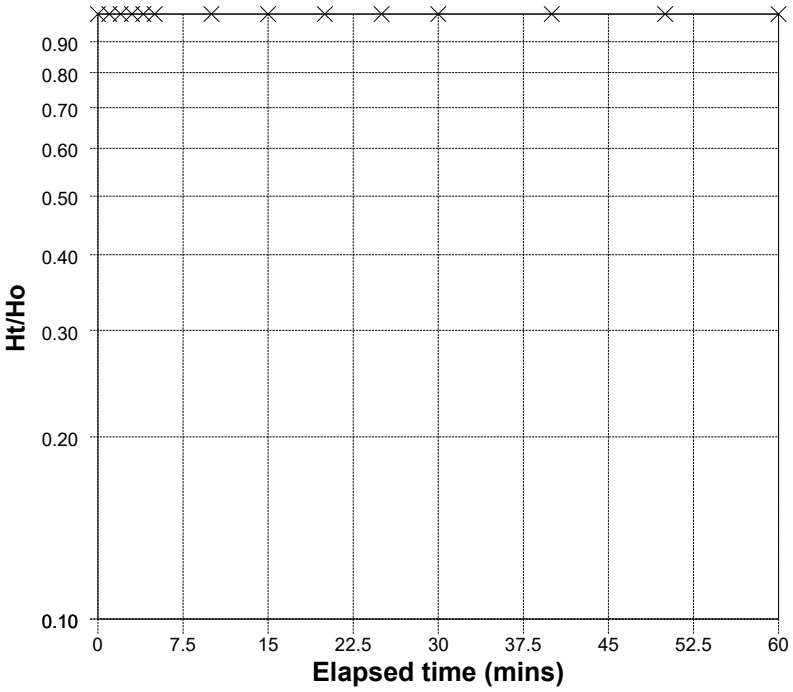
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	10.000	1.000
1.0	0.000	10.000	1.000
2.0	0.000	10.000	1.000
3.0	0.000	10.000	1.000
4.0	0.000	10.000	1.000
5.0	0.000	10.000	1.000
10.0	0.000	10.000	1.000
15.0	0.000	10.000	1.000
20.0	0.000	10.000	1.000
25.0	0.000	10.000	1.000
30.0	0.000	10.000	1.000
40.0	0.000	10.000	1.000
50.0	0.000	10.000	1.000
60.0	0.000	10.000	1.000



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Site	Borehole Number
New Islington, Manchester	BHUU03

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	1	49.24	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385308.101 E 398506.305 N	09-Feb-17	LKC	9/12

Height of casing above ground level:	0.00 **m**
Depth to Base of Borehole:	5.00 **m bgl**
Depth to Base of Casing:	5.00 **m bgl**
Depth to equilibrium water level:	5.00 **m btoc**
Test Length L:	0.00 **m**
Diameter of Test Length D:	0.15 **m**
Area of Test Section:	0.0182 **m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191

PERMEABILITY (after Hvorslev, 1951)

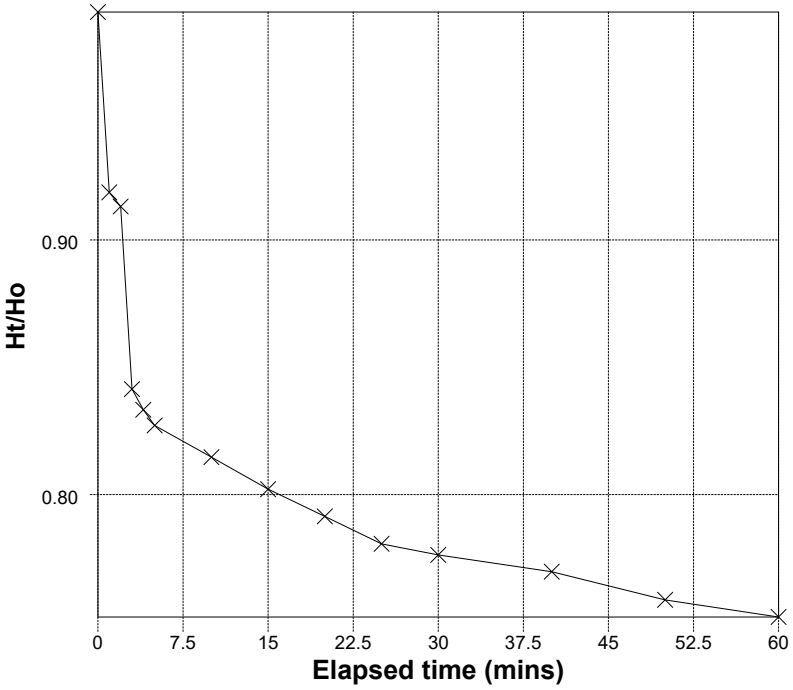
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	5.000	1.000
1.0	0.400	4.600	0.920
2.0	0.430	4.570	0.914
3.0	0.800	4.200	0.840
4.0	0.840	4.160	0.832
5.0	0.870	4.130	0.826
10.0	0.930	4.070	0.814
15.0	0.990	4.010	0.802
20.0	1.040	3.960	0.792
25.0	1.090	3.910	0.782
30.0	1.110	3.890	0.778
40.0	1.140	3.860	0.772
50.0	1.190	3.810	0.762
60.0	1.220	3.780	0.756



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Site	Borehole Number
New Islington, Manchester	BHUU03

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	2	49.24	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385308.101 E 398506.305 N	09-Feb-17	LKC	10/12

Height of casing above ground level:	0.00 **m**
Depth to Base of Borehole:	7.00 **m bgl**
Depth to Base of Casing:	7.00 **m bgl**
Depth to equilibrium water level:	7.00 **m btoc**
Test Length L:	0.00 **m**
Diameter of Test Length D:	0.15 **m**
Area of Test Section:	0.0182 **m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191

PERMEABILITY (after Hvorslev, 1951)

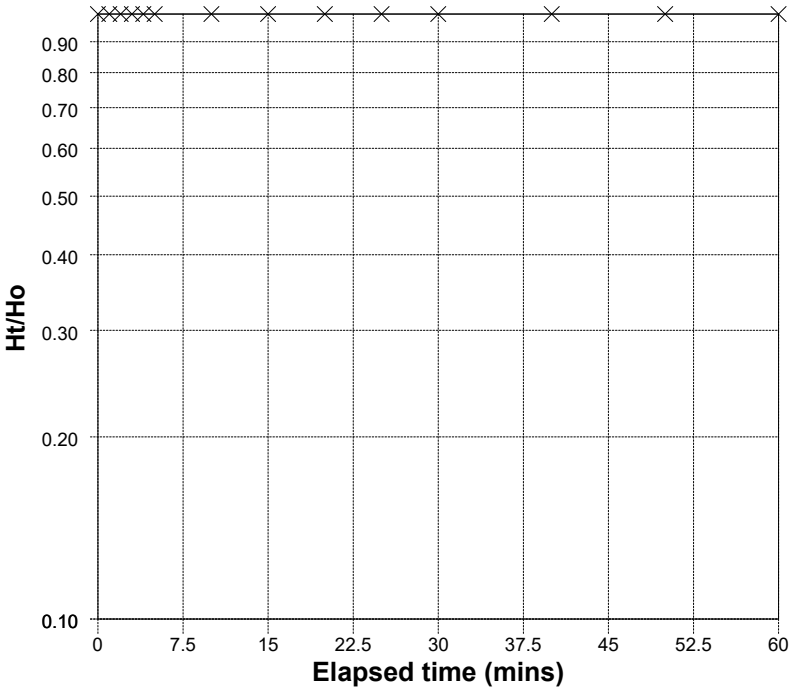
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	7.000	1.000
1.0	0.000	7.000	1.000
2.0	0.000	7.000	1.000
3.0	0.000	7.000	1.000
4.0	0.000	7.000	1.000
5.0	0.000	7.000	1.000
10.0	0.000	7.000	1.000
15.0	0.000	7.000	1.000
20.0	0.000	7.000	1.000
25.0	0.000	7.000	1.000
30.0	0.000	7.000	1.000
40.0	0.000	7.000	1.000
50.0	0.000	7.000	1.000
60.0	0.000	7.000	1.000



Remarks

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Site	Borehole Number
New Islington, Manchester	BHUU03

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	3	49.24	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385308.101 E 398506.305 N	09-Feb-17	LKC	11/12

Height of casing above ground level:	0.00 **m**
Depth to Base of Borehole:	8.50 **m bgl**
Depth to Base of Casing:	8.50 **m bgl**
Depth to equilibrium water level:	8.50 **m btoc**
Test Length L:	0.00 **m**
Diameter of Test Length D:	0.15 **m**
Area of Test Section:	0.0182 **m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191

PERMEABILITY (after Hvorslev, 1951)

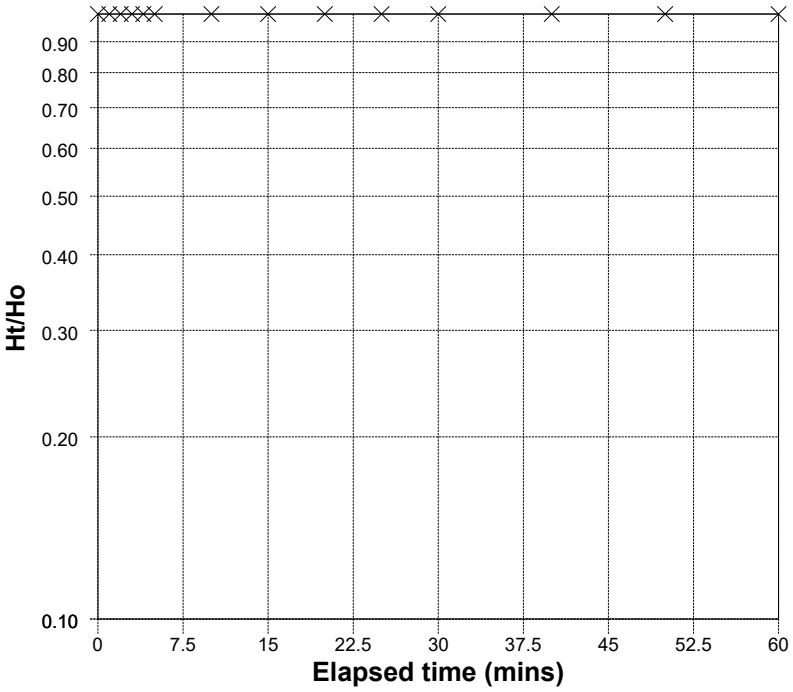
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	8.500	1.000
1.0	0.000	8.500	1.000
2.0	0.000	8.500	1.000
3.0	0.000	8.500	1.000
4.0	0.000	8.500	1.000
5.0	0.000	8.500	1.000
10.0	0.000	8.500	1.000
15.0	0.000	8.500	1.000
20.0	0.000	8.500	1.000
25.0	0.000	8.500	1.000
30.0	0.000	8.500	1.000
40.0	0.000	8.500	1.000
50.0	0.000	8.500	1.000
60.0	0.000	8.500	1.000



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Site	Borehole Number
New Islington, Manchester	BHUU03

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	4	49.24	Urban Splash	LKC 16 1334
	Location	**Dates**	**Engineer**	**Sheet**
	385308.101 E 398506.305 N	09-Feb-17	LKC	12/12

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	10.00	**m bgl**
Depth to Base of Casing:	10.00	**m bgl**
Depth to equilibrium water level:	10.00	**m btoc**
Test Length L:	0.00	**m**
Diameter of Test Length D:	0.15	**m**
Area of Test Section:	0.0182	**m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.4191	

PERMEABILITY (after Hvorslev, 1951)

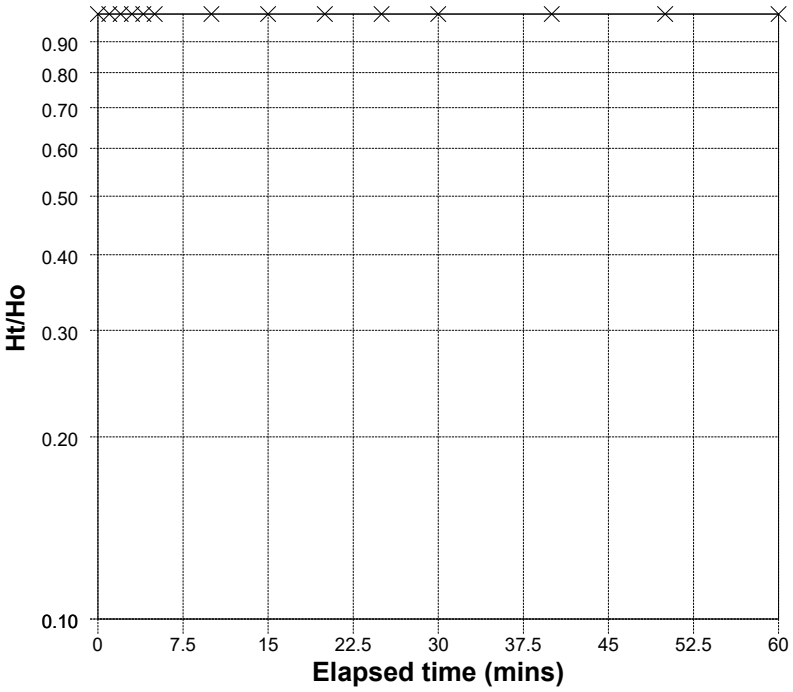
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T = 0.00

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	10.000	1.000
1.0	0.000	10.000	1.000
2.0	0.000	10.000	1.000
3.0	0.000	10.000	1.000
4.0	0.000	10.000	1.000
5.0	0.000	10.000	1.000
10.0	0.000	10.000	1.000
15.0	0.000	10.000	1.000
20.0	0.000	10.000	1.000
25.0	0.000	10.000	1.000
30.0	0.000	10.000	1.000
40.0	0.000	10.000	1.000
50.0	0.000	10.000	1.000
60.0	0.000	10.000	1.000



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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Soakaway Test (BRE Digest 365)

Site : New Islington, Manchester

Client : Urban Splash

Engineer : LKC

Job Number LKC 16 1334

Sheet 1 / 3

Location	Date	Level	Location
S101	01-02-2017		

Pit Width (m)	0.60
Pit Depth (m)	2.53
Pit Length (m)	2.20

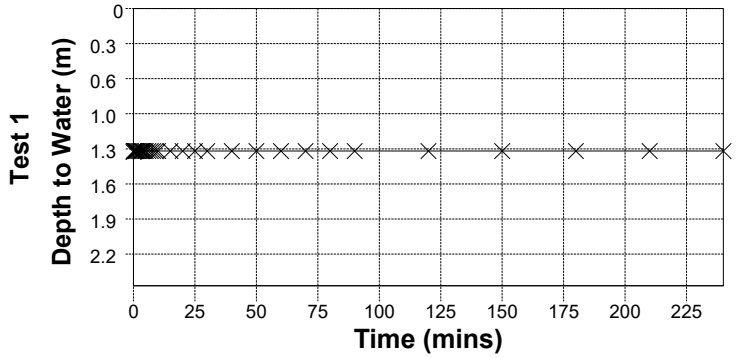
Soil type at test level	Made ground
Groundwater	None
Drain discharge depth	2.53
Sidewall stability	Stable
Stone filled or open pit	Stone Filled

	1
Effective depth (m)	1.22
Volume outflowing between 75% & 25% (m3)*	
Mean surface area through which outflow occurs (m2)	
Time for outflow between 75% & 25% (min)	
SOIL INFILTRATION RATE (ms-1), f	Test Failed

Remarks

* Volume outflowing reduced to account for granular backfill used during testing (30 % of free volume assumed).

Elapsed time (mins)	Depth to Water Test 1
0	1.31
0.083	1.30
0.167	1.30
0.333	1.30
0.5	1.30
0.667	1.30
0.833	1.30
1	1.30
1.5	1.30
2	1.30
2.5	1.30
3	1.30
3.5	1.30
4	1.30
4.5	1.30
5	1.30
6	1.30
7	1.30
8	1.30
9	1.30
10	1.30
15	1.30
20	1.30
25	1.30
30	1.30
40	1.30
50	1.30
60	1.30
70	1.30
80	1.30
90	1.30
120	1.30
150	1.30
180	1.30
210	1.30



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Soakaway Test (BRE Digest 365)

Site : New Islington, Manchester

Client : Urban Splash

Engineer : LKC

Job Number LKC 16 1334

Sheet 2 / 3

Location	Date	Level	Location
S102	01-02-2017		

Pit Width (m)	0.60
Pit Depth (m)	2.00
Pit Length (m)	1.70

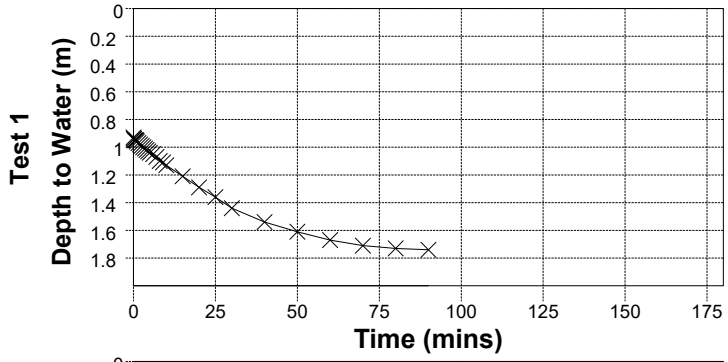
Soil type at test level	Made ground
Groundwater	None
Drain discharge depth	2.00
Sidewall stability	Stable
Stone filled or open pit	Stone Filled

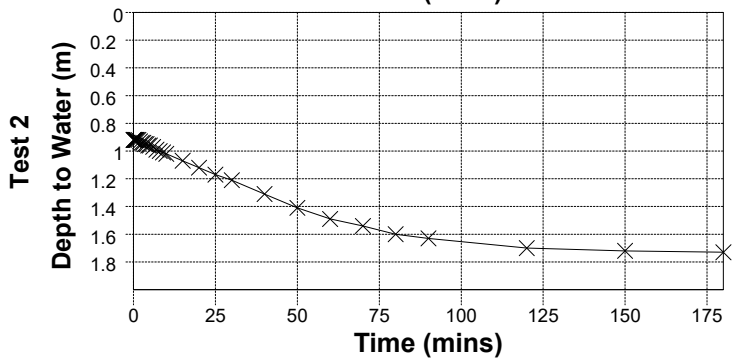
	1	2
Effective depth (m)	1.07	1.08
Volume outflowing between 75% & 25% (m3)*	0.16	0.17
Mean surface area through which outflow occurs (m2)	3.48	3.50
Time for outflow between 75% & 25% (min)	68.30	152.50
SOIL INFILTRATION RATE (ms-1), f	1.15E-5	5.16E-6

Remarks

* Volume outflowing reduced to account for granular backfill used during testing (30 % of free volume assumed).

Elapsed time (mins)	Depth to Water Test 1	Depth to Water Test 2
0	0.93	0.92
0.083	0.94	0.92
0.167	0.94	0.92
0.333	0.95	0.92
0.5	0.95	0.92
0.667	0.95	0.92
0.833	0.95	0.92
1	0.96	0.92
1.5	0.97	0.92
2	0.98	0.93
2.5	0.99	0.94
3	1.00	0.94
3.5	1.01	0.95
4	1.02	0.95
4.5	1.03	0.96
5	1.04	0.96
6	1.05	0.97
7	1.07	0.99
8	1.10	1.00
9	1.11	1.01
10	1.13	1.02
15	1.21	1.07
20	1.29	1.12
25	1.36	1.17
30	1.44	1.21
40	1.54	1.31
50	1.61	1.41
60	1.67	1.49
70	1.71	1.54
80	1.73	1.60
90	1.74	1.63
120		1.70
150		1.72
180		1.73





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Soakaway Test (BRE Digest 365)

Site : New Islington, Manchester

Client : Urban Splash

Engineer : LKC

Job Number LKC 16 1334

Sheet 3 / 3

Location	Date	Level	Location
S103	01-02-2017		

Pit Width (m)	0.60
Pit Depth (m)	2.00
Pit Length (m)	1.80

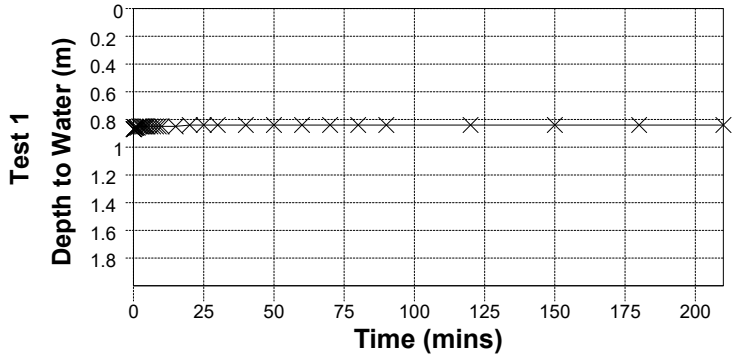
Soil type at test level	Made ground
Groundwater	None
Drain discharge depth	2.00
Sidewall stability	Stable
Stone filled or open pit	Stone Filled

	1
Effective depth (m)	1.13
Volume outflowing between 75% & 25% (m3)*	
Mean surface area through which outflow occurs (m2)	
Time for outflow between 75% & 25% (min)	
SOIL INFILTRATION RATE (ms-1), f	Test Failed

Remarks

* Volume outflowing reduced to account for granular backfill used during testing (30 % of free volume assumed).

Elapsed time (mins)	Depth to Water Test 1
0	0.87
0.083	0.87
0.167	0.87
0.333	0.87
0.5	0.86
0.667	0.86
0.833	0.86
1	0.86
1.5	0.86
2	0.85
2.5	0.85
3	0.85
3.5	0.85
4	0.85
4.5	0.85
5	0.85
6	0.85
7	0.85
8	0.85
9	0.85
10	0.85
15	0.85
20	0.84
25	0.84
30	0.84
40	0.84
50	0.84
60	0.84
70	0.84
80	0.84
90	0.84
120	0.84
150	0.84
180	0.84
210	0.84



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