APPENDIX 7-1

GROUND INVESTIGATION REPORT, CAUSEWAY 2019

CAUSEWAY GEOTECH

Kingston, Galway – Ground Investigation

Client:	Lioncor Developments Limited
Client's Representative:	Tobin Consulting Engineers
Report No.:	19-0472
Date:	June 2019
Status:	Final for Issue

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APPENDICES

Document Control Sheet

Report No.:		19-0472			
Project Title:		Kingston, Galway – Ground Investigation			
Client:		Lioncor Developments Limited			
Client's Representative:		Tobin Consulting Engineers			
Revision:	A01	**Status:**	Final for Issue	**Issue Date:**	14 June 2019
Prepared by:		**Reviewed by:**		**Approved by:**	
 Carin Cornwall BSc MSc PhD		 Paul McNamara BEng MICE		 Darren O'Mahony BSc MSc MIEI	

The works were conducted in accordance with:

UK Specification for Ground Investigation 2nd Edition, published by ICE Publishing (2012)

British Standards Institute (2015) BS 5930:2015, Code of practice for site investigations.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler)
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler)
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
LB	Large bulk disturbed sample
D	Small disturbed sample
C	Core sub-sample (displayed in the Field Records column on the logs)
L	Liner sample from dynamic sampled borehole
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (c)	Standard penetration test using 60 degree solid cone
x,x/x,x,x,x	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
▽	Water strike: initial depth of strike
▼	Water strike: depth water rose to
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum).

Kingston, Galway

1 AUTHORITY

On the instructions of Tobin Consulting Engineers, ("the Client's Representative"), acting on the behalf of Lioncor Developments Limited ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical and environmental information for input to the design and construction of proposed residential and commercial blocks.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results. A discussion on the recommendations for construction is also provided.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included boreholes, trial pits, DCPs, soil and rock core sampling, environmental sampling, in-situ and laboratory testing, and the preparation of a report on the findings including recommendations for construction.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted within an undeveloped area adjacent to the western distributor road. The site is bordered by residential developments to the north, east and west and fields to the south and southwest.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 30 April and 14 May 2019, comprised:

- three boreholes by dynamic (windowless) sampling methods
- eleven boreholes by dynamic (windowless) sampling methods and rotary follow-on drilling
- one borehole by rotary drilling methods only
- twelve machine dug trial pits
- indirect CBR tests at eight locations.

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Boreholes

A total of fifteen boreholes were put down in a minimum diameter of 150mm through soil and rock strata to their completion depths by a combination of methods, including light percussion boring using a Dando Terrier rig and rotary drilling by a Comacchio 205 rotary drilling rig.

Boreholes BH01 and BH01A were put down by light percussion boring techniques but met shallow refusal before a third borehole (BH01B) was advanced deeper. Eleven boreholes (BH01B, BH02, and BH04-BH12) were put down by a combination of light percussion boring and rotary follow-on drilling techniques with core recovery in bedrock. Rotary drilling at borehole BH03A was put down a short distance away from BH03 because the rotary rig was not able to access the location of the percussive borehole.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions. Where the percussion borehole had not been advanced onto bedrock, rotary percussive methods were employed to advance the borehole to completion/bedrock.

Standard penetration tests were carried out in accordance with BS EN 22476-3: 2005 at standard depth intervals throughout the overburden using the split spoon sampler ($SPT_{(s)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix I.

Disturbed (bulk and small bag) samples were taken within the encountered strata.

Where coring was carried out within bedrock strata, Geobor S Coring was used. The core was extracted in up to 1.5m lengths using a SK6L core barrel, which produced core of nominal 102mm diameter, and was placed in single channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015: Code of practice for ground investigations*.

Appendix B presents the draft borehole logs, with core photographs soon to be presented in Appendix C.

4.3 Trial Pits

Twelve trial pits (TP01–TP12) were excavated using a 6t tracked excavator fitted with a 600mm wide bucket, to depths up to 3.20m.

Disturbed bulk bag samples were taken at standard depth intervals and at change of strata. Environmental samples were taken at regular depths across the site.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

Appendix D presents the draft trial pit logs with photographs of the pits and arising provided in Appendix E.

4.4 Indirect CBR tests

An indirect CBR test was conducted at eight locations (TP01, TP02, TP05, TP06, TP08, TP10-TP12) using a Dynamic Cone Penetrometer (DCP). The equipment was developed in conjunction with the UK Transport Research Laboratory, is used widely throughout the world, and is referred to in the UK Highway Agency Interim Advice Note 73/06.

The test results are presented in Appendix F in the form of plots of the variation with depth of the penetration per blow. Straight lines have been fitted to the plots and the CBR for each depth range estimated using the following relationship, which is derived from Kleyn & Van Heerden (1983):

$$\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$$

The frequently elevated CBR values are a consequence of the coarse-grained content of the penetrated soils and are often not representative of the soil matrix.

4.5 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish National Grid) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described and their descriptions incorporated into the borehole logs.

5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **soil chemistry:** pH and water soluble sulphate content

Laboratory testing of soils samples was carried out in accordance with British Standards Institute: *BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).*

The test results are presented in Appendix G.

5.2 Geotechnical laboratory testing of rock

Laboratory testing of rock sub-samples comprised:

- point load index

Test	Test carried out in accordance with
Point load index	ISRM Suggested Methods (1985) Suggested method for determining point-load strength. Int. J. Rock Mech. Min. Sci. Geomech. Abstr. 22, pp. 53–60

The test results are presented in Appendix G.

5.3 Environmental laboratory testing of soils

Environmental testing, as specified by the Client's Representative was conducted on selected environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

Testing was carried out for a range of determinants, including:

- Metals
- Speciated total petroleum hydrocarbons (TPH)
- Speciated polycyclic aromatic hydrocarbons (PAH)
- Cyanides
- Asbestos screen
- pH.

Waste acceptance criteria (WAC) testing was carried out on selected samples.

Results of environmental laboratory testing are presented in Appendix H.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise Till derived from granite. These deposits are underlain by granite of the Murvey Granite and Errisbeg Townland Granite which may contain Quartz Porphyry and Felsite dykes.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Topsoil:** encountered in 100-200mm thickness in boreholes BH02-BH03, BH04-BH08, and BH12 and 400-500mm in borehole BH09-BH11.

- **Made Ground (fill):** reworked sandy clayey gravel fill with high cobble content encountered in most of the exploratory holes, particularly in the west of the site (e.g. BH01B, BH08 and BH12) where fill was found to extent to depths of 3.70-3.90m.

- **Recent deposits (peat):** Peat layers were encountered in boreholes BH02 at 2.30-2.50m; BH03B at 1.20-2.00m and 3.80-4.10m; BH04 at 0.90-1.80m; BH08 at 3.70-4.00m; and BH09 at 0.00- 0.50m

- **Fluvioglacial deposits:** typically medium dense to dense sands and gravels with localised pockets of sandy gravelly clays interspersed throughout encountered across much of the site.

- **Bedrock (Granite):** Rockhead was encountered at depths ranging from 2.00m in boreholes BH06 and BH11 to 5.40m in boreholes BH03B and BH08.

6.3 Groundwater

Groundwater was encountered during percussion boring through soil as a water strike at 1.80m in borehole BH09. Groundwater was also encountered at 0.10m and 2.50m in nearby trial pit TP09. Groundwater strikes were not observed in any of the other exploratory hole locations.

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Although groundwater was not noted during drilling in many locations, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any groundwater strikes and the possibility of encountering groundwater during excavation works should not be ruled out. Seasonal variation in groundwater levels should also be factored into design considerations.

It should also be noted that any groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium.

7 DISCUSSION

7.1 Proposed construction

It is proposed to construct a number of mixed residential and commercial blocks.

No further details were available to Causeway Geotech at the time of preparing this report and any designs based on the recommendations or conclusions within this report should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory holes. Causeway Geotech were commissioned to provide a geotechnical report, and it is outwith our remit to advise on structure design.

7.2 Recommendations for construction

7.2.1 Summary

Based on the presence of significant depths of made ground (often underlain by peat) across much of the site, the implementation of shallow foundation methods is likely to be problematic. It follows that the most practicable solution for installing safe working foundations across the site will be by a "deep" foundation method, such as piling to transfer loadings to depth. In parts of the eastern side of the side, the implementation of trench fill foundations may be considered suitable.

7.2.2 Soil strength parameters

When estimating the shear strength of fine soils (silt/clay), reference is made to the results of Standard Penetration Tests (SPT's) carried out within the boreholes. The undrained shear strength of fine soils can be estimated using the correlation developed by Stroud & Butler:

$$C_u = f_1 \times N$$

where f_1 is typically in the range 4 to 6. A median f_1 value of 5 is adopted for this report.

For granular soils (sand/gravel), a graphical relationship between SPT "N" value and angle of shearing resistance, φ, has been developed by Peck, Hanson and Thorburn. This is published in *Foundation Design and Construction* (Tomlinson, 2001) and is referenced in this report when deriving angles of shearing resistance for the gravel soils.

7.2.3 Foundations and ground floor construction

Foundations should transfer loading to below any Made Ground or subsoil. The recommended foundation construction and allowable bearing pressure (ABP) at the borehole locations are presented in Table 1.

Table 1: Construction recommendations

Borehole	Depth below EGL* to suitable bearing stratum	Estimated ABP (kPa)	Strata description	Foundation type	Ground floor construction	Groundwater
BH01	4.30m	>500	Weathered Granite	Piled	Suspended	Not encountered
BH02	4.70m	>500	Weathered Granite	Piled	Suspended	Not encountered
BH03B	5.40m	>500	Weathered Granite	Piled	Suspended	Not encountered
BH04	3.00m	300	Dense Gravel	Trench fill	Suspended	Not encountered
	4.40m	>500	Weathered Granite	Piled	Suspended	Not encountered
BH05	2.00m	200	Dense Gravel	Trench fill	Suspended	Not encountered
	4.00m	>500	Weathered Granite	Piled	Suspended	Not encountered
BH06	1.20m	250	Medium dense Gravel	Trench fill	Ground bearing	Not encountered
	2.00m	>500	Weathered Granite	Trench fill	Suspended	Not encountered
BH07	1.20m	300	Dense Gravel	Trench fill	Ground bearing	Not encountered
	4.60m	>500	Weathered Granite	Piled	Suspended	Not encountered
BH08	5.10m	>500	Weathered Granite	Piled	Suspended	Not encountered
BH09	1.80m	250	Medium dense Gravel	Trench fill	Suspended	Encountered at 1.80m
	3.90m	>500	Weathered Granite	Piled	Suspended	
BH10	3.40m	>500	Weathered Granite	Piled	Suspended	Not encountered
BH11	2.10m	>500	Weathered Granite	Piled	Suspended	Not encountered
BH12	5.50m	>500	Weathered Granite	Piled	Suspended	Not encountered

*Existing Ground Level

Based on the findings of the site investigation, spread foundations (trench fill) are only considered suitable in some areas at the north eastern part of the site. At these locations (e.g. boreholes BH04-BH07 and BH09) allowable bearing pressures on the fluvioglacial deposits were estimated at between 200kPa and 300kPa.

The base of foundation excavations should be thoroughly inspected; any soft soils should be removed with the resultant void backfilled with ST1 concrete. A consistent bearing stratum should be provided for any building unit to limit differential settlements.

Given the predominance of granular strata, and the findings of the trial pit excavations (some of which were found to be unstable), excavations for foundations are not likely to be stable. Where space allows, instability can be minimised by battering the side slopes at 2 vertical to 1 horizontal and by limiting the duration that the excavation is open. Groundwater control, where required, will be possible by pumping from sumps formed in the base of excavations.

Across much of the site, particularly in the western area, made ground was found to extend to depths of up to 3.90m, and was often underlain by a layer of peat. Piling to transfer loadings to depth is therefore suggested to be the most practicable and applicable foundation option.

Driven piles are the preferred pile type – of precast concrete or steel/ductile iron. The piles should be driven to a predetermined set – each pile will, therefore, be effectively proof tested by the installation method.

If the surrounding land use precludes the use of hard drive piles, due to environmental restrictions with respect to noise and vibration, low vibration driven piles, continuous flight auger (CFA) or continuous helical displacement (CHD) piles will be required.

Piles will acquire capacity from shaft friction through the fluvioglacial deposits, and end bearing on the weathered igneous bedrock.

Where site levels are to be raised, piles should be designed to resist additional loading that will arise due to negative skin friction along the pile length passing through Made Ground and soft soils.

The detailed design of piles should be undertaken in conjunction with specialist piling contractors. Their proposals should include the means to verify that the required load capacity has been achieved: for example, dynamic pile tests and/or static load tests.

Where pile foundation solution is adopted, floor slabs should be supported by ground beams spanning between piles caps supported by piles.

7.2.4 Floor slabs

Floor slabs should not bear directly onto Made Ground or soft soils. Therefore, the use of ground bearing floor slabs is only appropriate following the removal of any surface Made Ground and soft clay layers and their replacement using well-graded well-compacted granular fill. However, a suspended floor slab should be adopted where the difference in levels of the proposed floor and the base of Made Ground/soft soils is greater than 600mm.

Therefore, given the depth to the base of Made Ground, a suspended floor slab may be required over parts of the site. The use of intermediate lines of support stub walls would reduce the spans required for flooring units.

7.2.5 Excavations for services

For the installation of services ducts/trenches, it is suggested that open trenching will be the most practicable construction method. Generally speaking, the ground conditions should render the use of open trenching by backhoe excavator possible, with some trench support required for the granular stratas.

Where working in open trenches, it is thought that trench support systems, by way of a trench box (or possibly sheet piles), will be required to maintain trench stability and safe working conditions. Groundwater control at these locations should be possible by means of sump pumping.

To preclude the eventuality of differential settlements in pipes, they should be laid on a consistent stratum of appropriate allowable bearing capacity and protected with appropriate fill cover.

Where ducts and chambers must be installed in areas where localised soft spots are encountered, the use of geogrid reinforcement along the base of the very soft/soft soil (e.g. peat) below the trench base is recommended. This will stiffen the base of the trench and help control longitudinal differential settlement.

Backfilling of trenches may be completed by using compacted Cl 804 granular fill and reinstated as appropriate.

7.2.6 Soil aggressivity

An assessment of the Aggressive Chemical Environment for Concrete (ACEC) was undertaken through reference to the Building Research Establishment (BRE) Special Digest 1 (2017).

As noted by BRE Special Digest 1, sulphates in the soil and groundwater are the chemical agents most likely to attack concrete. The extent to which sulphates affect concrete is linked to their concentrations, the type of ground, the presence of groundwater, the type of concrete and the form of construction in which concrete is used.

BRE Special Digest 1 identifies four different categories of site which require specific procedures for investigation for aggressive ground conditions:

- Sites not subjected to previous industrial development and not perceived as containing pyrite;
- Sites not subjected to previous industrial development and perceived as containing pyrite;
- Brownfield sites not perceived as containing pyrite;
- Brownfield sites perceived as containing pyrite.

For the purposes of this report the site was classified as not having been subject to previous industrial development and not perceived as containing pyrite.

The results of chemical tests (pH and water soluble sulphate contents) on soil samples indicate Design Sulphate Class DS-1 and ACEC Class AC-1 – reference Table C1 of BRE Special Digest 1 (Building Research Establishment, 2005). The Special Digest does not require any measures to protect underground concrete elements greater that 140mm thick.

7.2.7 Access roads, car parks and hard standing

Based on a summary of the CBR tests undertaken at the site, it is envisaged that the upper made ground and glaciogluvial deposits would be suitable for the placement of road make up layers. Most areas across the site have CBR values in excess of 5% at a depth of 0.5mbgl.

Table 2.1 of volume 7 section2 of the Design Manual for Roads and Bridges (below), gives guidance on the average thickness of the pavement layers in relation to the CBR results. As can be seen, a CBR in excess of 5% requires a 400mm thick capping layer.

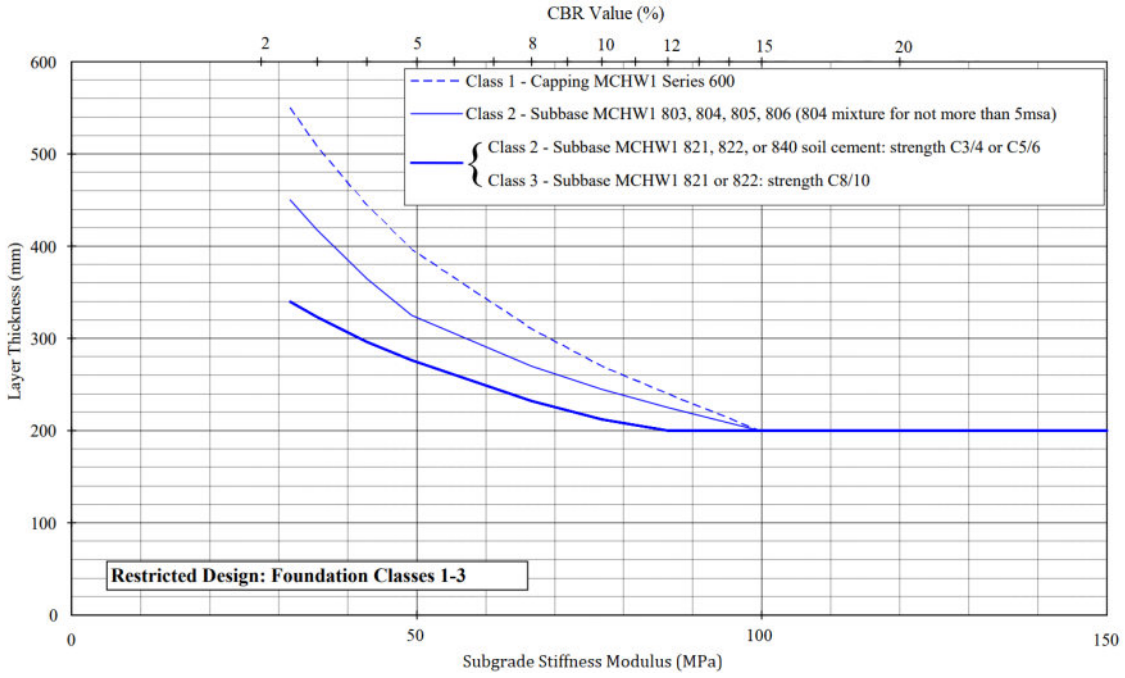


Table 2.1 (DMRB Vol.7 Sec2) 2009

Some tests provided lower CBR values in certain areas of the site. The above plot should be used to determine the thicknesses of any capping or sub-base layers that may need to be placed in these areas.

It is recommended that further testing be undertaken during the course of construction works at intervals as set out in the Earthworks Specification, and should any areas indicate lower than expected value, the above plot should be used to determine the thicknesses of any capping or sub-base layers that may need to be placed in these areas.

The use of geosynthetics in the construction of paved areas, will be beneficial, particularly in areas of Made Ground. These could include a geosynthetic (e.g., a geogrid) at subgrade level with further benefit gained by incorporating further layer(s) within the capping/sub-base layer. Road design should be undertaken by a specialist earthworks contractor/designer.

8 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

IS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930: 2015: Code of practice for ground investigations. British Standards Institution.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. British Standards Institution.

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS EN ISO 14689-1:2018: Geotechnical investigation and testing. Identification and classification of rock. Identification and description.

BS EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test.

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

Contaminated Land Report (CLR) 11, (2009) Model Procedures for the Management of Land Contamination, The Department for Environment, Food and Rural Affairs (Defra) and the Environment Agency.

CAUSEWAY GEOTECH

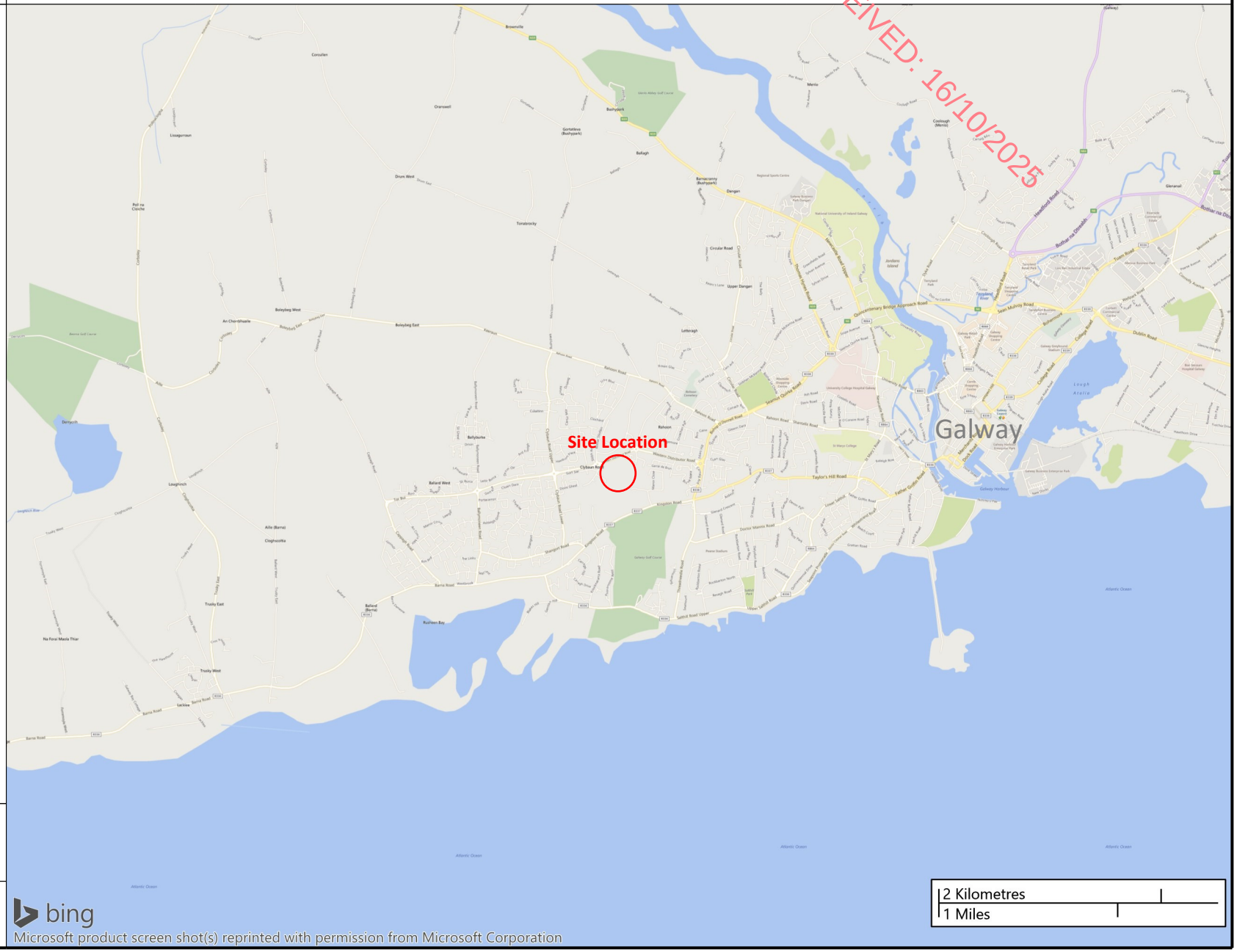
APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLANS

CAUSEWAY GEOTECH

Project No.:	19-0472	**Client:**	Lioncor Developments Limited
Project Name:	Kingston, Galway	**Client's Representative:**	Tobin Consulting Engineers

Legend Key



Title:
Site Location Plan

Last Revised:	**Scale:**
07/06/2019	1:50000

CAUSEWAY GEOTECH

Project No.:	19-0472	**Client:**	Lioncor Developments Limited
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Legend Key

- Locations By Type - CP
- Locations By Type - CP+RC
- Locations By Type - RC
- Locations By Type - TP

Title:
Exploratory Hole Location Plan

Last Revised:	**Scale:**
07/06/2019	1:2000

CAUSEWAY GEOTECH

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	0.40

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH01

Coordinates: 126617.42 E 224918.75 N

Client: Lioncor Developments Limited

Client's Representative: Tobin Consulting Engineers

Ground Level: 22.34 mOD

Dates: 30/04/2019 - 30/04/2019

Sheet 1 of 1

Scale: 1:50

Driller: JL

Logger: MFG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.40)		MADE GROUND: Grey sandy slightly clayey subangular fine to coarse GRAVEL with high cobble content. Sand is fine to coarse.		
					21.94	0.40		End of Borehole at 0.40m		

Remarks

Hand dug inspection pit excavated.

Four attempts at borehole refused at 0.40m. Moved to 5th location at BH01A.

Terminated at refusal on cobbles.

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	1.20

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH01A

Coordinates: 126613.08 E, 224916.14 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Driller: JL

Ground Level: 22.12 mOD

Dates: 30/04/2019 - 30/04/2019

Logger: MFG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.90)		MADE GROUND: Grey sandy slightly clayey subangular fine to coarse GRAVEL with high cobble content. Sand is fine to coarse.		
					21.22	0.90 (0.30)		MADE GROUND: Yellowish grey sandy subangular fine to coarse GRAVEL with high cobble content. Sand is fine to coarse.		
					20.92	1.20		End of Borehole at 1.20m		

Remarks

Hand dug inspection pit excavated.

5th and 6th attempts at borehole refused at 1.20m. Moved to BH01B.

Terminated at refusal on cobbles.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	2.00
Rotary Drilling	Comacchio 205	2.00	5.30
Rotary Coring	Comacchio 205	5.30	8.30

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH01B

Coordinates: 126607.50 E, 224913.82 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Ground Level: 22.06 mOD

Dates: 30/04/2019 - 30/04/2019

Driller: JL+RS

Logger: MFG+CC

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.00 - 0.90	B1					(0.90)		MADE GROUND: Grey sandy subangular fine to coarse GRAVEL with high cobble content and bands of peaty clay throughout.		
					21.16	0.90				
1.00 - 2.00	B2							MADE GROUND: Dense yellowish grey sandy subangular fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse.		
1.20	D3									
1.20 - 1.65	SPT (S) N=35		Dry	N=35 (14,11/14,8,8,5)		(1.40)				
2.00	D4									
2.00 - 2.32	SPT (S)		Dry	N=50 (11,13/50 for 165mm)						
					19.76	2.30		Dark brown sandy gravelly silty CLAY (Driller's description)		
						(0.50)				
					19.26	2.80		Light grey sandy GRAVEL / Possible destructured GRANITE (Driller's description)		
						(1.50)				
					17.76	4.30		Weathered GRANITE (Driller's description)		
						(1.00)				
			3		16.76	5.30		Medium strong light pink and white speckled black GRANITE. Partially weathered: closer fracture spacing discolouration on joint surfaces. Discontinuities: 1. 10 to 20 degree joints, closely spaced (40/150/900) undulating, rough, pale green and patchy black staining on joint surfaces. 2. 35 to 45 degree joints, medium spaced (60/250/600) planar, rough, pale green, yellowish orange and patchy black staining on joint surface.		
	100 80 55		20							
6.30										
	100 80 60		11			(3.00)				
			16							
7.30										
	100 100 90		2							
8.30					13.76	8.30		End of Borehole at 8.30m		
	TCR SCR RQD		FI							

Remarks
Hand dug inspection pit excavated.

Core Barrel	Water Strikes				Chiselling Details		
SK6L	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Flush Type	Water Added		Casing Details	
Polymer	From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	2.00
Rotary Drilling	Comacchio 205	2.00	5.30
Rotary Coring	Comacchio 205	5.30	8.30

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH02

Coordinates: 126743.33 E, 224942.19 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Driller: JL+RS

Ground Level: 26.34 mOD

Dates: 01/05/2019 - 01/05/2019

Logger: MFG+CC

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.20 - 1.00	B1				26.14	(0.20) 0.20		TOPSOIL		
						(0.80)		MADE GROUND: Brown gravelly slightly clayey fine to coarse SAND with low cobble content. Gravel is subangular fine to coarse.		
1.00 - 1.80	B2				25.34	1.00		MADE GROUND: Loose grey slightly gravelly very silty fine to coarse SAND. Gravel is subangular fine.		
1.20	D4									
1.20 - 1.65	SPT (S) N=9		Dry	N=9 (1,1/2,2,2,3)		(0.80)				
1.80 - 2.00	B3				24.54	1.80		MADE GROUND: Dense grey slightly sandy subangular fine to coarse GRAVEL with occasional thin lenses of light brown sandy clay. Sand is fine to coarse.		
2.00	D5					(0.50)				
2.00 - 2.28	SPT (S)		Dry	N=50 (25 for 85mm/50 for 190mm)	24.04	2.30		PEAT (Driller's description)		
					23.84	(0.20) 2.50		Light brownish grey gravelly very silty SAND/possible destructured GRANITE (Driller's description)		
						(2.20)				
					21.64	4.70		GRANITE (Driller's description)		
						(0.60)				
	100	100	65	8	21.04	5.30		Medium strong pink and white speckled white speckled black GRANITE. Partially weathered: discolouration on joint surfaces. Discontinuities: 1. 20 to 30 degree joints, closely spaced (30/80/150) undulating, rough, pale green and patchy black and reddish orange staining.		
						(0.90)				
6.30					20.14	6.20		Strong pink, white and green speckled black GRANITE. Partially weathered: silt deposits and discolouration on joint surfaces. Discontinuities: 1. 5 to 25 degree joints, closely spaced (20/130/220) undulating, rough, patchy orange, black and green staining with light brown patchy silt deposits on joint surfaces.		
	100	100	95	6		(1.50)				
7.30										
	100	85	85	5	18.64	7.70		Medium strong white and green saussuritic GRANITE. Partially weathered: pervasive discolouration. Discontinuities: 1. 0 to 15 degree joints, closely spaced (30/130/300) undulating, rough, strong dark green and patchy black and brown staining on joint surfaces.		
						(0.60)				
8.30					18.04	8.30		End of Borehole at 8.30m		
	TCR	SCR	RQD	FI						

Remarks
Hand dug inspection pit excavated.

Core Barrel	Water Strikes				Chiselling Details		
SK6L	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Flush Type	Water Added		Casing Details	
Polymer	From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	1.20

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH03

Coordinates: 126685.34 E, 224848.29 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Ground Level: 26.29 mOD

Dates: 10/05/2019 - 10/05/2019

Driller: JL

Logger: MFG

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.20)		TOPSOIL		
0.20 - 1.20	B1				26.09	0.20		MADE GROUND: Grey slightly sandy angular fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse.		
						(1.00)				
1.20	D2				25.09	1.20		End of Borehole at 1.20m		
1.20 - 1.52	SPT (S)		Dry	N=50 (25 for 110mm/50 for 205mm)						

Remarks
Hand dug inspection pit excavated.

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Rotary Drilling	Comacchio 205	0.00	5.40
Rotary Coring	Comacchio 205	5.40	8.40

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH03B

Coordinates: 126667.65 E, 224850.62 N

Client: Lioncor Developments Limited

Client's Representative: Tobin Consulting Engineers

Ground Level: 26.81 mOD

Date(s): 03/06/2019 - 03/06/2019

Sheet 1 of 1

Scale: 1:50

Driller: RS

Logger: MFG+CC

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
							(1.10)		MADE GROUND: Hardcore fill (Driller's description)		
						25.71	1.10				
						25.61	(0.10) 1.20		MADE GROUND: GRAVEL (Driller's description)		
							(0.80)		MADE GROUND: Reworked PEAT and GRAVEL (Driller's description)		
						24.81	2.00				
							(0.60)		MADE GROUND: BOULDER (Driller's description)		
						24.21	2.60				
							(1.20)		MADE GROUND: GRAVEL (Driller's description)		
						23.01	3.80				
							(0.30)		PEAT (Driller's description)		
						22.71	4.10				
							(0.30)		BOULDER (Driller's description)		
						22.41	4.40				
							(1.00)		Light grey gravelly silty SAND/Possible destructured GRANITE (Driller's description)		
	100	100	90	5		21.41	5.40		Medium strong light pink and white speckled black GRANITE. Partially weathered: discolouration on joint surfaces. Discontinuities: 1. 5 to 15 degree joints, medium spaced (10/280/750) undulating, rough, pale green and pacthy black staining on joint surfaces. 2. 45 degree to 60 degree joints, medium spaced (10/300/500) slightly undulating, rough, patchy brownish orange, pale green, and black staining on joint surfaces.		
6.40	100	100	50	12			(2.30)				
7.40				2							
	100	100	90	6		19.11	7.70		Medium strong pale pinkish white speckled black GRANITE. Partially weathered: discolouration on joint surfaces. Discontinuities: 1. 5 to 15 degree joints, closely spaced (30/130/300) undulating, rough, pal green, yellowish brown and black staining on joint surface.		
				2			(0.70)				
8.40						18.41	8.40		End of Borehole at 8.40m		
	TCR	SCR	RQD	FI							

Remarks

Casing Details		Water Strikes			
To (m)	Diam (mm)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Core Barrel: SK6L

Flush Type: Polymer

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	3.00
Rotary Drilling	Comacchio 205	3.00	4.70
Rotary Coring	Comacchio 205	4.70	7.70

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH04

Coordinates: 126800.10 E, 224897.81 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Ground Level: 27.56 mOD

Dates: 02/05/2019 - 02/05/2019

Driller: JL+RS

Logger: MFG+CC

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.10 - 0.90	B4				27.46	(0.10) 0.10		TOPSOIL		
						(0.80)		MADE GROUND: Grey slightly sandy subangular fine to coarse GRAVEL with high cobble content. Sand is fine to coarse.		
1.00 - 1.80	B5				26.66	0.90		Spongy dark brown fibrous PEAT		
1.20	D1									
1.20 - 1.65	SPT (S) N=5		Dry	N=5 (0,1/1,2,1,1)		(0.90)				
					25.76	1.80		Medium dense orangish grey slightly sandy subangular fine to medium GRAVEL with low cobble content. Sand is fine to coarse.		
2.00	D2									
2.00 - 3.00	B6									
2.00 - 2.45	SPT (S) N=12		Dry	N=12 (3,3/3,3,3,3)		(1.20)				
3.00	D3				24.56	3.00		Dense grey sandy subangular fine to coarse GRAVEL. (Possibly destructured granite.)		
3.00 - 3.28	SPT (S)		Dry	N=47 (9,11/47 for 130mm)		(1.40)				
					23.16	4.40		Weathered GRANITE (Driller's description)		
						(0.30)				
	100 100	44	10		22.86	4.70		Strong pale green saussuritic GRANITE with very narrow black veins. Partially weathered: pervasive discolouration. Discontinuities: 1. 0 to 10 degree joints, closely spaced (20/190/450) slightly undulating, rough, strong patchy orange, green and black staining on joint surfaces. 2. 25 to 35 degree joints medium spaced (180/550/750) slightly undulating, rough, strong patchy ornage, green and black staining on joint surfaces.		
5.70										
	100 100	55	6			(3.00)				
			17							
6.70	100 100	90	5							
7.70					19.86	7.70		End of Borehole at 7.70m		
	TCR SCR	RQD	FI							

Remarks
Hand dug inspection pit excavated.

Core Barrel
SK6L

Flush Type
Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	2.00
Rotary Drilling	Comacchio 205	2.00	4.90
Rotary Coring	Comacchio 205	4.90	7.90

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH05

Coordinates: 126849.31 E, 224906.11 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Ground Level: 27.09 mOD

Dates: 02/05/2019 - 02/05/2019

Driller: JL+RS

Logger: MFG+CC

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.20 - 1.10	B1				26.89	(0.20) 0.20		TOPSOIL		
						(0.90)		MADE GROUND: Medium dense dark orangish brown sandy slightly clayey subangular fine to coarse GRAVEL with low cobble content. Sand is fine to coarse.		
1.10 - 2.00	B2				25.99	1.10				
1.20	D3							Medium dense yellowish grey sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse.		
1.20 - 1.65	SPT (S) N=20		Dry	N=20 (7,7/6,5,4,5)		(0.90)				
2.00	D4				25.09	2.00				
2.00 - 2.22	SPT (S)		Dry	N=50 (25 for 80mm/50 for 135mm)				Dense grey slightly sandy subangular fine to coarse GRAVEL with high boulder content. Sand is fine to coarse.		
						(2.00)				
					23.09	4.00		Weathered GRANITE (Driller's description)		
						(0.90)				
					22.19	4.90		Medium strong green and pale yellowish green speckled black saussuritic GRANITE. Partially weathered: closer fracture spacing, pervasive discolouration. Discontinuities: 1. 5 to 15 degree joints closely spaced (120/170/230) undulating, rough, strong green staining on joint surfaces.		
	100 100 90		7			(0.55)				
					21.64	5.45				
5.90	100 100 100		4					Medium strong pale green and pale pinkish white speckled black GRANITE. Partially weathered: closer fracture spacing, discolouration on joint surfaces. Discontinuities: 1. 15 to 25 degree joints medium spaced (20/210/440) undulating, rough, pale green, greenish yellow and patchy black staining on joint surfaces. 2. 60 to 70 degree joints at 5.45m to 5.60m and 6.35m to 6.45m, undulating, rough, pale green, greenish yellow and patchy black staining on joint surfaces.		
						(2.45)				
6.90	100 100 88		9							
7.90					19.19	7.90		End of Borehole at 7.90m		
	TCR SCR RQD		FI							

Remarks
Hand dug inspection pit excavated.

Core Barrel
SK6L

Flush Type
Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	2.00
Rotary Drilling	Comacchio 205	2.00	2.40
Rotary Coring	Comacchio 205	2.40	5.40

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH06

Coordinates: 126979.75 E, 224867.54 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Driller: JL+RS

Ground Level: 33.95 mOD

Dates: 01/05/2019 - 01/05/2019

Logger: MFG+CC

Depth (m)	Sample / Tests	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.20 - 0.70	B1								33.75	(0.20) 0.20		TOPSOIL		
										(0.50)		Soft dark brown peaty slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse.		
0.70 - 2.00	B2								33.25	0.70		Medium dense greyish yellow fine to coarse SAND and subangular fine to coarse GRAVEL with medium cobble content.		
1.20	D3													
1.20 - 1.65	SPT (S) N=25						Dry	N=25 (9,7/7,6,1,11)		(1.30)				
2.00	D4								31.95	2.00 (0.40)		GRANITE (Driller's description)		
2.00 - 2.34		100	100	85	5 >20			N=50 (11,12/50 for 190mm)	31.55	2.40		Medium strong pale pink and white speckled medium grained GRANITE with very narrow green veins. Partially weathered: silt deposits and discolouration on joint surfaces. Discontinuities: 1. 10 to 20 degree joints closely spaced (30/180/700) undulating, rough, strong green and patchy black, orange and yellow staining with patchy white and light brown silt deposits on joint surfaces. 2. 50 to 65 degree joints medium spaced (400/590/800) planar, rough, strong green and patchy black, orange and yellow staining with patchy white and light brown silt deposits on joint surfaces. 3. >80 degree joint at 2.55m to 2.80m, undulating, rough, strong green and patchy black staining with patchy white silt deposits on joint surfaces. *2.70m to 2.90m: Zone of dark green weak saussuritic granite*		
3.40		100	100	100	5					(3.00)				
4.40		100	100	95	3 10							*5.20m to 5.40m: Coarse grained pink and white granite.*		
5.40									28.55	5.40		End of Borehole at 5.40m		

Remarks
Hand dug inspection pit excavated.

Core Barrel
SK6L

Flush Type
Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	1.75
Rotary Drilling	Comacchio 205	1.75	4.70
Rotary Coring	Comacchio 205	4.70	6.70

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH07

Coordinates: 126885.72 E, 224830.69 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Ground Level: 27.18 mOD

Dates: 02/05/2019 - 02/05/2019

Driller: JL+RS

Logger: MFG+CC

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.20 - 0.50	B1				26.98	(0.20) 0.20		TOPSOIL		
						(0.30)		Possible MADE GROUND: Greyish brown gravelly fine to coarse SAND. Gravel is subangular fine to coarse.		
0.50 - 0.90	B2				26.68	0.50		Soft grey slightly gravelly very sandy SILT. Sand is fine to coarse. Gravel is subangular fine to medium.		
						(0.40)				
0.90 - 1.50	B3				26.28	0.90		Dense grey slightly gravelly fine to coarse SAND. Gravel is subangular fine to medium.		
1.20	D5					(0.60)				
1.20 - 1.65	SPT (S) N=37		Dry	N=37 (3,4/7,6,6,18)	25.68	1.50		Dense greyish orange slightly sandy slightly silty angular fine to coarse GRAVEL. Sand is fine to coarse.		
1.50 - 1.75	B4									
1.75	D6									
1.75 - 1.97	SPT (S)		Dry	N=50 (25 for 105mm/50 for 115mm)		(1.00)				
					24.68	2.50		Light grey sandy GRAVEL / Possible destructured GRANITE (Driller's description)		
						(2.10)				
					22.58	4.60		Medium strong purplish pink speckled black fine grained GRANITE. Partially weathered: discolouration on joint surfaces. Discontinuities: 1. 25 to 35 degree joints, closely s[paced (10/130/200) slightly undulating, rough, strong black and orange and patchy yellow and green staining on joint surfaces.		
	100 85 70		20 20							
5.70						(2.10)				
	100 90 85		20 6							
6.70					20.48	6.70		End of Borehole at 6.70m		
	TCR SCR RQD		FI							

Remarks
Hand dug inspection pit excavated.

Core Barrel
SK6L

Flush Type
Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	1.20
Rotary Drilling	Comacchio 205	1.20	5.50
Rotary Coring	Comacchio 205	5.50	8.50

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH08

Coordinates: 126774.87 E, 224862.37 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Ground Level: 26.89 mOD

Dates: 10/05/2019 - 10/05/2019

Driller: JL+RS

Logger: MFG+CC

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.20 - 1.20	B1				26.68	(0.20) 0.20		TOPSOIL		
						(1.00)		MADE GROUND: Dense grey slightly sandy subangular fine to medium GRAVEL with medium cobble content. Sand is fine to coarse.		
1.20					25.68	1.20				
1.20 - 1.54	D2 SPT (S)		Dry	N=50 (25 for 115mm/50 for 220mm)		(0.80)		MADE GROUND: GRAVEL (Driller's description)		
					24.88	2.00				
						(1.70)		MADE GROUND: Sandy GRAVEL (Driller's description)		
					23.18	3.70				
						(0.30)		PEAT (Driller's description)		
					22.88	4.00				
						(0.20)		SAND (Driller's description)		
					22.68	4.20		GRAVEL/possible destructured GRANITE (Driller's description)		
						(0.90)				
					21.78	5.10				
						(0.30)		Weathered GRANITE (Driller's description)		
					21.48	5.40				
	100 70 70		7			(0.90)		Medium strong very pale pinkish white speckled black GRANITE. Partially weathered: closer fracture spacing, discolouration on joint surfaces. Discontinuities: 1. 50 to 70 degree joints, closely spacing (100/190/300) undulating, rough, strong brownish orange and green staining on joint surfaces.		
					20.58	6.30				
6.50	100 100 85		7					Strong pale pink and white speckled black GRANITE. Partially weathered: closer fracture spacing, discolouration on joint surfaces. Discontinuities: 1. 0 to 10 degree joints closely spaced (100/180/550) undulating, rough, pale green, yellowish green and patchy black staining on joint surfaces. 2. 45 degree to 60 degree joints at 6.95m to 7.05m and 7.75m to 7.90m, slightly undulating, rough, pale green, yellowish green and patchy black staining on joint surfaces.		
7.50	100 100 100		3			(2.20)				
8.50					18.39	8.50		End of Borehole at 8.50m		
	TCR SCR RQD		FI							

Remarks
Hand dug inspection pit excavated.

Core Barrel
SK6L

Flush Type
Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	2.70
Rotary Drilling	Comacchio 205	2.70	3.90
Rotary Coring	Comacchio 205	3.90	6.90

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH09

Coordinates: 126835.00 E 224775.53 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Ground Level: 23.48 mOD

Dates: 09/05/2019 - 09/05/2019

Driller: JL+RS

Logger: MFG+CC

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.50)		Peaty TOPSOIL		
0.50 - 1.00	B1				22.98	0.50		MADE GROUND: Grey slightly silty slightly gravelly fine SAND. Gravel is subrounded fine.		
						(0.50)				
1.00 - 1.80	B2				22.48	1.00		Soft grey slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is subrounded fine.		
1.20	D4									
1.20 - 1.65	SPT (S) N=7		Dry	N=7 (2,2/1,1,2,3)		(0.80)				
1.80 - 2.00	B3			Water strike at 1.80m	21.68	1.80		Medium dense grey slightly sandy subangular fine to coarse GRAVEL. Sand is fine to coarse.	▼	
2.00	D5					(0.90)				
2.00 - 2.45	SPT (S) N=25		1.20	N=25 (3,8/4,2,5,14)					▼	
2.45	D6				20.78	2.70		Light grey sandy silty GRAVEL / Possible destructured GRANITE (Driller's description)		
2.45 - 2.71	SPT (S)		1.20	N=50 (25 for 79mm/50 for 180mm) Water strike at 2.50m		(1.20)				
	100 90 60			7	19.58	3.90		Medium strong pink and white speckled black medium grained GRANITE with narrow dark green veins. Partially weathered: silt deposits and discolouration on joint surfaces. Discontinuities: 1. 0 to 10 degree medium spaced (180/400/600) undulating, rough, strong green and patchy orangish yellow and greenish yellow staining with patchy white silt deposits on joint surfaces. 2. 40 to 50 degree joints, medium spaced (130/350/650) planar, rough, strong green and patchy orangish yellow ad greenish yellow staining with patchy white silt deposits on joint surfaces. 3. 65 to 75 degree joints, widely spaced (350/850/1050) slightly undulating, rough, strong green and black patchy orangish yellow staining with patchy white silt deposits on joint surfaces.		
4.90	100 95 80					(3.00)				
5.90	100 100 90			5						
6.90					16.58	6.90		End of Borehole at 6.90m		
	TCR SCR RQD		FI							

Remarks
Hand dug inspection pit excavated.

Core Barrel
SK6L

Flush Type
Polymer

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.80 2.50	1.80 2.50		

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion Rotary Coring	Dando Terrier Comacchio 205	0.00 3.40	3.40 5.00

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH10

Coordinates: 126740.88 E, 224740.11 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Driller: JL+RS

Ground Level: 23.52 mOD

Dates: 09/05/2019 - 09/05/2019

Logger: MFG+CC

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Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.50)		Peaty TOPSOIL		
0.50 - 1.00	B1				23.02	0.50		Possible MADE GROUND: Soft dark grey slightly gravelly sandy SILT. Sand is fine to coarse. Gravel is subrounded fine to coarse.		
						(0.50)				
1.00 - 2.00	B2				22.52	1.00		Medium dense grey slightly silty sandy subangular fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium.		
1.20	D4									
1.20 - 1.65	SPT (S) N=16		Dry	N=16 (4,5/4,3,3,6)		(1.00)				
2.00	D5				21.52	2.00		Firm grey sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular fine to medium.		
2.00 - 3.00	B3									
2.00 - 2.45	SPT (S) N=11		1.80	N=11 (2,0/3,3,3,2)		(1.40)				
3.00	D6									
3.00 - 3.44	SPT (S)		1.30	N=50 (9,11/50 for 295mm)						
	100 100 70		8		20.12	3.40		Weak to medium strong reddish pink, white and pale green speckled black coarse grained GRANITE. Partially weathered: silt deposits and discolouration on joint surfaces. Discontinuities: 1. 35 to 45 degree joints, closely spaced (30/150/200) slightly undulating, rough, strong black and green staining, patchy orange and greenish yellow staining with patchy white silt deposits on joint surfaces.		
4.40						(1.60)				
	100 100 100									
5.00					18.52	5.00		End of Borehole at 5.00m		
	TCR SCR RQD FI									

Remarks
Hand dug inspection pit excavated.

Core Barrel	Water Strikes				Chiselling Details		
SK6L	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Flush Type	Water Added		Casing Details	
Polymer	From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
19-0472	Kingston, Galway	BH11
Coordinates:	**Client:**	Sheet 1 of 1
126795.45 E	Lioncor Developments Limited	
224695.08 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:50
Ground Level: 24.87 mOD	**Dates:** 09/05/2019 - 09/05/2019	**Driller:** JL+RS
		Logger: MFG+CC

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	2.10
Rotary Coring	Comacchio 205	2.10	5.10

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Depth (m)	Sample / Tests	TCR	SCR	RQD	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									(0.40)		Peaty TOPSOIL		
0.40 - 1.00	B1							24.47	0.40		Medium dense orangish brown gravelly slightly silty fine to coarse SAND. Gravel is subrounded fine.		
1.00 - 1.70	B2								(1.30)				
1.20	D4												
1.20 - 1.65	SPT (S) N=22					Dry	N=22 (4,4/6,5,6,5)						
1.70 - 2.00	B3							23.17	1.70		Dense yellow orange sandy angular fine to coarse GRAVEL with low cobble content. Sand is fine to coarse.		
2.00	D5								(0.40)				
2.00 - 2.45		100	95	95		4	N=50 (5,10/11,12,13,14)	22.77	2.10		Medium strong pink and white speckled black medium grained GRANITE. Partially weathered: silt deposits and discolouration on joint surfaces. Discontinuities: 1. 35 to 45 degree joints closely spaced (40/180/260) planar, rough, strong black and green staining, patchy yellowish orange, brownish yellow and white staining with patchy light brown silt deposits. 2. 65 degree joint at 3.60m to 3.70m, planar, rough, strong black and green staining with patchy light brown silt deposits on joint surfaces.		
						8							
3.10		100	100	100		6			(3.00)				
4.10		100	95	95		7							
5.10								19.77	5.10		End of Borehole at 5.10m		

Remarks
Hand dug inspection pit excavated.

Core Barrel	Water Strikes				Chiselling Details		
SK6L	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Flush Type	Water Added		Casing Details	
Polymer	From (m)	To (m)	To (m)	Diam (mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	3.00
Rotary Drilling	Comacchio 205	3.00	5.50
Rotary Coring	Comacchio 205	5.50	8.50

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.: BH12

Coordinates: 126703.46 E, 224699.86 N

Client: Lioncor Developments Limited

Sheet 1 of 1

Client's Representative: Tobin Consulting Engineers

Scale: 1:50

Ground Level: 26.72 mOD

Dates: 09/05/2019 - 09/05/2019

Driller: JL+RS

Logger: MFG+CC

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.20)		TOPSOIL		
0.20 - 1.00	B1				26.52	0.20		MADE GROUND: Very soft dark brown peaty slightly gravelly SILT with rootlets throughout.		
1.00 - 2.00	B2									
1.20	D5									
1.20 - 1.65	SPT (S) N=2		Dry	N=2 (0,0/0,0,1,1)		(2.70)				
1.90 - 3.00	D7									
2.00	D6									
2.00 - 2.90	B3									
2.00 - 2.45	SPT (S) N=12		Dry	N=12 (0,0/0,0,6,6)						
2.90 - 3.00	B4				23.82	2.90		MADE GROUND: Dense grey slightly sandy angular fine to medium GRAVEL. Sand is fine to coarse.		
3.00 - 3.44	SPT (S)		Dry	N=50 (2,6/50 for 290mm)		(1.00)				
					22.82	3.90		PEAT (Driller's description)		
						(0.70)				
					22.12	4.60		Light grey GRAVEL / Possible destructured GRANITE (Driller's description)		
						(0.90)				
	100 80	37	>20 8		21.22	5.50 (1.00)		Medium strong pink and white speckled black coarse grained GRANITE. Partially weathered: silt deposits and discolouration on joint surfaces. Discontinuities: 1. 20 to 35 degree joints, closely spaced (10/60/120) slightly undulating, rough, strong green and black staining with patchy white silt deposits on joint surfaces		
6.50					20.22	6.50		Strong reddish pink speckled black fine grained GRANITE. Partially weathered: silt deposits and discolouration on joint surfaces. Discontinuities: 1. 15 to 30 degree joints, closely spaced (40/150/290) slightly undulating, rough, strong patchy green ad black staining with patchy films of white silt deposits on joint surfaces.		
	100 100	87	5			(0.90)				
7.50					19.32	7.40		Medium strong pale pink and white fine grained GRANITE. Partially weathered: silt deposits and discolouration on joint surfaces. Discontinuities: 1. 20 to 35 degree joints, closely spaced (40/120/230) undulating, rough, strong patchy green, black and orange staining with patchy films of white silt deposits on joint surfaces.		
	100 100	75	5 15 6			(1.10)				
8.50					18.22	8.50		End of Borehole at 8.50m		
	TCR	SCR	RQD	FI						

Remarks
Hand dug inspection pit excavated.

Core Barrel
SK6L

Flush Type
Polymer

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

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APPENDIX C

CORE PHOTOGRAPHS

Borehole BH01B (5.30-8.20m)

Borehole BH02 (5.30-8.30m)

Borehole BH03B (5.40-8.40m)

Borehole BH04 (4.70-7.70m)

Borehole BH05 (4.90-7.90m)

Borehole BH06 (2.30-5.40m)

Borehole BH07 (4.70-6.70m)

Borehole BH08 (5.50-8.50m)

Borehole BH09 (3.90-6.90m)

Borehole BH10 (3.40-5.00m)

Borehole BH11 (2.10-5.10)

Borehole BH12 (5.50-8.50m)

CAUSEWAY GEOTECH

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APPENDIX D

TRIAL PIT LOGS

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP01
Co-ordinates: 126609.14 E 224902.24 N	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Tobin Consulting Engineers		**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 21.70 mOD	**Date:** 13/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			21.65	(0.05) 0.05		Grass roots and vegetation	
0.40	B2					MADE GROUND: Dark greyish brown sandy very gravelly slightly silty angular to subangular COBBLES. Sand is fine to coarse. Gravel is angular to subangular fine to coarse.	
0.40	ES1			(0.85)			
			20.80	0.90			
1.00	B3					MADE GROUND: Stiff dark greyish brown slightly organic slightly sandy very gravelly clayey SILT with medium to high cobble and boulder content. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are angular to subangular.	
				(1.10)			
			19.70	2.00		Firm dark brown fibrous PEAT	
2.20	B4			(0.50)			
			19.20	2.50		Very weak light brownish grey GRANITE excavated as slightly silty gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse.	
				(0.20)			
			19.00	2.70		End of trial pit at 2.70m	

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 2.70

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP02
Co-ordinates: 126744.62 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224956.89 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 24.59 mOD	**Date:** 13/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.60)		Grass roots and TOPSOIL	
0.40	B2		23.99	0.60		Possible MADE GROUND: Light orangish brown very gravelly fine to coarse SAND with medium cobble and boulder content. Gravel is angular to subangular fine to coarse. Cobbles and boulders are angular to subangular.	
0.90	B3			(0.60)			
0.90	ES1		23.39	1.20		End of trial pit at 1.20m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encounetred

Terminated on large boulders or possible bedrock

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 1.20

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP03
Co-ordinates: 126671.80 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224834.81 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 22.14 mOD	**Date:** 13/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			22.09	(0.05) 0.05		Grass roots and TOPSOIL	
						End of trial pit at 0.05m	

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:

Struck at (m):	Remarks:

Stability:

Width: 0.80
Length: 0.05

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP04
Co-ordinates: 126752.18 E 224900.22 N	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Tobin Consulting Engineers		**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 27.44 mOD	**Date:** 13/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.50	B1			(0.65)		MADE GROUND: Dark greyish brown sandy slightly silty angular to subrounded fine to coarse GRAVEL with high cobble content. Sand is fine to coarse. Cobbles are angular to subangular.	
			26.79	0.65		End of trial pit at 0.65m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 0.65

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP05
Co-ordinates: 126845.84 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224912.63 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 27.37 mOD	**Date:** 14/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			27.36	(0.01)		Grass roots and vegetation	
						MADE GROUND: Brown slightly gravelly fine to coarse SAND with low cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are angular to subrounded.	
				(1.19)			
1.00	B2						
1.00	ES1						
			26.17	1.20		Brown slightly silty slightly gravelly fine to medium SAND with high cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are rounded to subrounded.	
1.40	B3						
				(0.80)			
			25.37	2.00		Brownish grey very sandy slightly silty subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content. Sand is fine to coarse. Cobbles and boulders are rounded to subrounded.	
2.20	B4						
				(1.20)			
			24.17	3.20		End of trial pit at 3.20m	

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 3.20

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP06
Co-ordinates: 126965.76 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224869.99 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 32.50 mOD	**Date:** 14/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.30)		Grass roots and TOPSOIL	
			32.20	0.30		Light orangish brown sandy silty subangular to subrounded fine to coarse GRAVEL with low cobble and boulder content. Sand is fine to coarse. Cobbles and boulders are angular to subangular.	
0.60 0.60	B2 ES1			(1.10)			
			31.10	1.40		End of trial pit at 1.40m	

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 1.40

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP07
Co-ordinates: 126878.51 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224836.07 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 26.04 mOD	**Date:** 13/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			25.94	(0.10) 0.10		Grass roots and TOPSOIL	
0.60	B2			(0.60)		Possible MADE GROUND: Very stiff orangish brown slightly sandy gravelly clayey SILT with medium to high cobble content. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse. Cobbles are angular to subangular.	
0.60	ES1		25.34	0.70		Light greyish cream very gravelly fine to coarse SAND with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are angular to subangular.	
1.20	B3			(1.10)			
			24.24	1.80		End of trial pit at 1.80m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:

Struck at (m):	Remarks:

Stability: Unstable

Width: 0.80

Length: 1.80

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP08
Co-ordinates: 126767.86 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224836.01 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 26.75 mOD	**Date:** 14/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.30	ES1			(1.20)		MADE GROUND: Grey slightly silty slightly sandy gravelly angular to subangular COBBLES and BOULDERS. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.	
			25.55	1.20		End of trial pit at 1.20m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:

Struck at (m):	Remarks:

Stability: Unstable

Width: 0.80

Length: 1.20

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP09
Co-ordinates: 126820.04 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224760.04 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 23.63 mOD	**Date:** 13/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
		Small seepage from 0.70m to 0.70m	23.53	(0.10) 0.10		Grass roots and TOPSOIL	
				(0.60)		MADE GROUND: Light brown slightly silty angular to subangular COBBLE and BOULDERS. (Possible old land drain)	
0.90	B3		22.93	0.70		Grey very silty fine to coarse SAND	
0.90	ES1			(1.20)			
			21.73	1.90		Firm grey slightly sandy CLAY. Sand is fine.	
2.40	B4						
2.40	ES2	Small seepage from 2.50m to 2.70m		(1.30)			
			20.43	3.20		End of trial pit at 3.20m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks

Terminated at scheduled depth

Water Strikes:

Struck at (m):	Remarks:
0.10	Small seepage from 0.70m to 0.70m
2.50	Small seepage from 2.50m to 2.70m

Stability: Unstable

Width: 0.80

Length: 3.20

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP10
Co-ordinates: 126717.86 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224774.08 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 25.92 mOD	**Date:** 13/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			25.91	(0.01)		Grass roots and vegetation	
0.40	B2					MADE GROUND: Dark brown slightly silty very gravelly fine to coarse SAND with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles ad boulders are subangular to subrounded.	
0.40	ES1			(1.19)			
			24.72	1.20		Possible MADE GROUND: Dark brown slightly clayey silty very gravelly fine to coarse SAND with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are angular to subangular.	
1.40	B3			(0.40)			
			24.32	1.60		End of trial pit at 1.60m	

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 1.60

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP11
Co-ordinates: 126780.63 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224677.06 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 29.52 mOD	**Date:** 13/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			29.47	(0.05) 0.05		Grass roots and TOPSOIL	
				(0.80)		Very stiff dark brownish black slightly sandy gravelly SILT with medium cobble and boulder content. Sand is fine to coarse. Gravel is angular to subangular. Cobbles and boulders are angular to subangular.	
0.80	B3		28.67	0.85			
0.80	ES1					Dark reddish brown very silty sandy gravelly angular to subangular COBBLES and BOULDERS. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse,	
1.00	B4			(0.35)			
1.00	ES2		28.32	1.20		End of trial pit at 1.20m	

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 1.20

CAUSEWAY GEOTECH

Project No.: 19-0472	**Project Name:** Kingston, Galway		**Trial Pit No.:** TP12
Co-ordinates: 126691.89 E	**Client:** Lioncor Developments Limited		Sheet 1 of 1
Method: Trial Pitting	224682.40 N	**Client's Representative:** Tobin Consulting Engineers	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 25.12 mOD	**Date:** 13/05/2019	**Logger:** FG

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			25.07	(0.05) 0.05		Grass roots and TOPSOIL	
0.60 0.60	B3 ES1			(1.15)		MADE GROUND: Dark greyish black slightly organic gravelly sandy clayey SILT with medium cobble and boulder content. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse.	
			23.92	1.20		Possible MADE GROUND: Light brown very sandy silty subangular to subrounded fine to coarse GRAVEL with low to medium cobble and boulder content. Sand is fine to coarse. Cobbles an boulders are angular to subangular.	
1.60 1.60	B4 ES2			(0.60)			
			23.32	1.80		End of trial pit at 1.80m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated on large boulders or possible bedrock

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 1.80

CAUSEWAY GEOTECH

RECEIVED: 16/10/2025

APPENDIX E

TRIAL PIT PHOTOGRAPHS

Trial Pit TP01

Trial Pit TP01

Trial Pit TP02

Trial Pit TP02

Trial Pit TP03

Trial Pit TP04

Trial Pit TP04

Trial Pit TP05

Trial Pit TP05

Trial Pit TP06

Trial Pit TP06

CAUSEWAY GEOTECH

Trial Pit TP07

Trial Pit TP07

Trial Pit TP08

Trial Pit TP08

Trial Pit TP09

Trial Pit TP09

Trial Pit TP10

Trial Pit TP10

Trial Pit TP11

Trial Pit TP11

Trial Pit TP12

CAUSEWAY GEOTECH

Trial Pit TP12

CAUSEWAY GEOTECH

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APPENDIX F

INDIRECT IN-SITU CBR TEST RESULTS

Causeway Geotech Ltd

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Kingston Galway

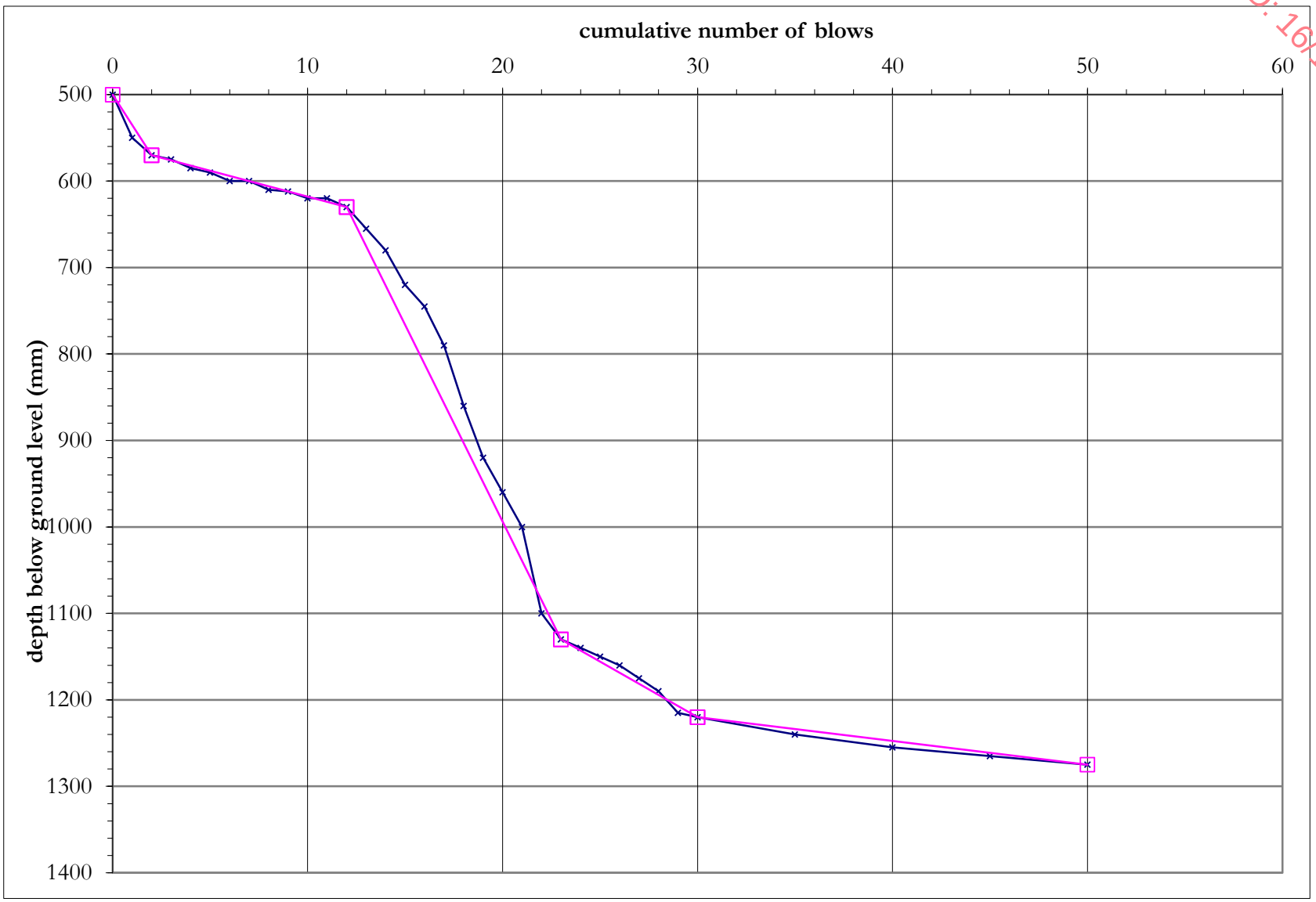
Test Number: TP01

CBR estimated using TRL Road Note 8:

Log CBR = 2.48-1.057 Log (mm/blow)

Project No: 19-0472

Date: 16-May-19



depth from to (mm)	mm/blow	CBR (%)
500	35	7
570		
570	6	45
630		
630	45	5.3
1130		
1130	13	20
1220		
1220	2.8	>100
1275		

Causeway Geotech Ltd

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Kingston Galway

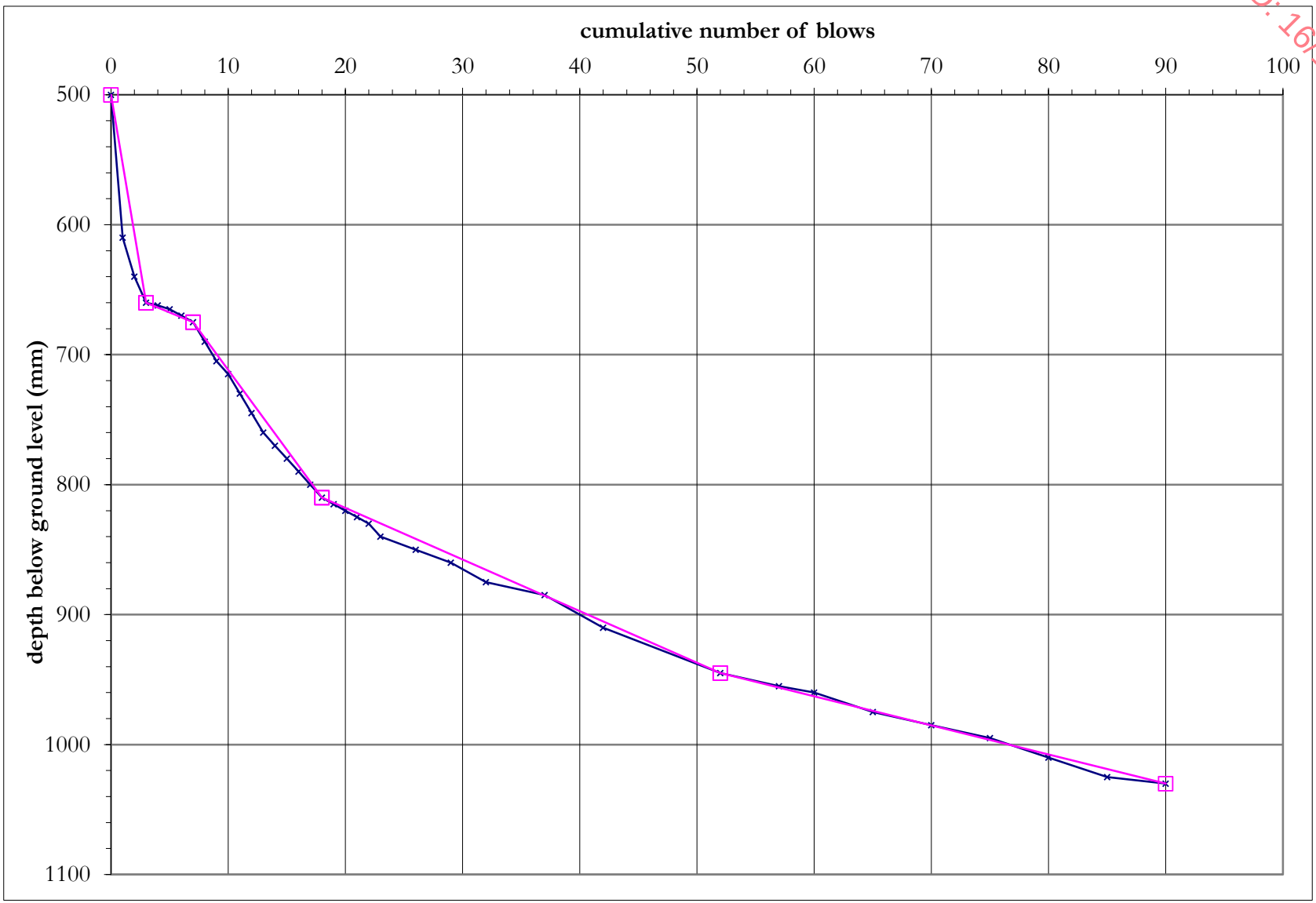
Test Number: TP02

CBR estimated using TRL Road Note 8:

Log CBR = 2.48-1.057 Log (mm/blow)

Project No: 19-0472

Date: 16-May-19



depth from to (mm)	mm/blow	CBR (%)
500	53	4.5
660		
660	3.8	75
675		
675	12	21
810		
810	4	70
945		
945	2.2	>100
1030		

Causeway Geotech Ltd

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Kingston Galway

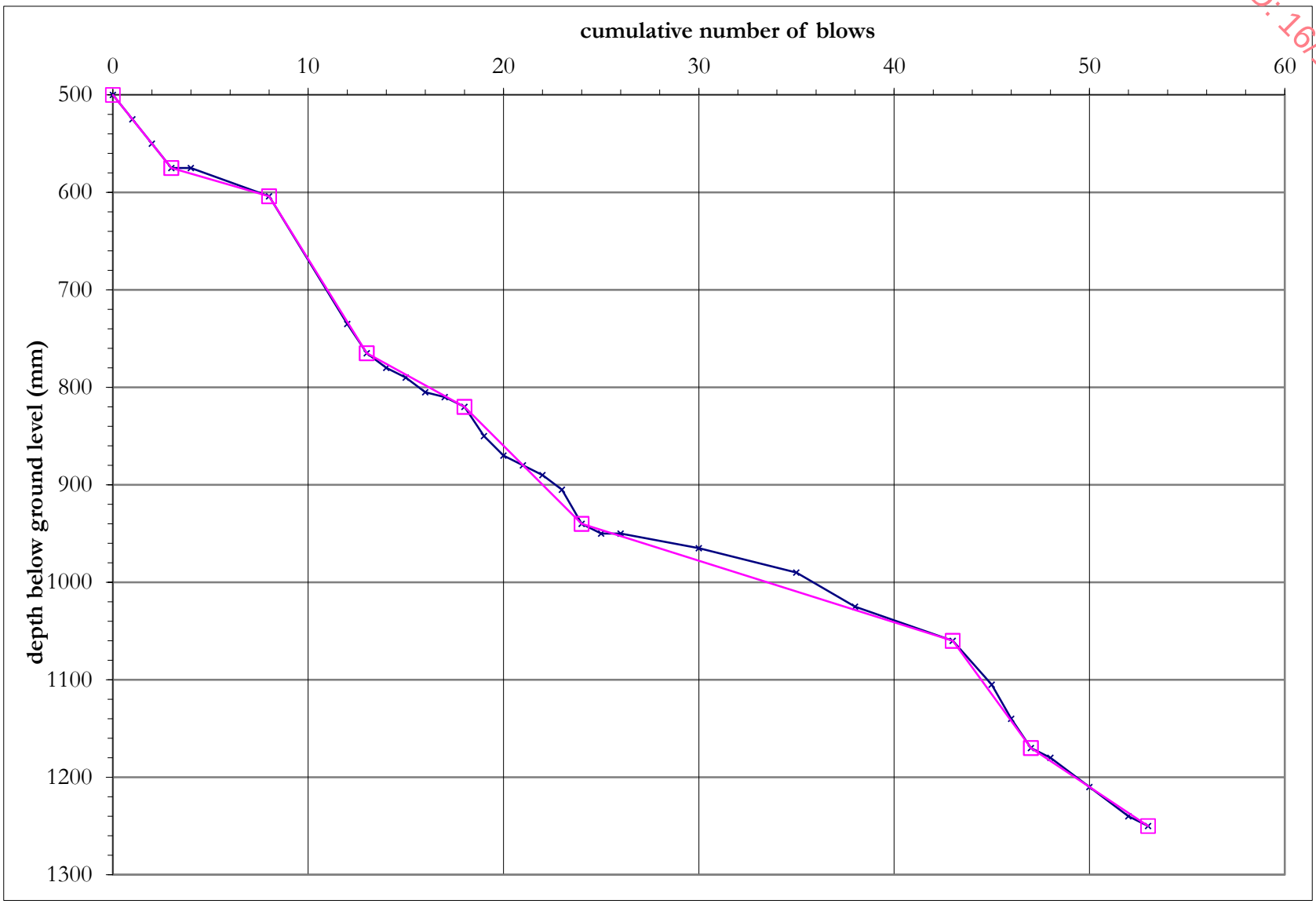
Test Number: TP05

CBR estimated using TRL Road Note 8:

Log CBR = 2.48-1.057 Log (mm/blow)

Project No: 19-0472

Date: 16-May-19



depth from to (mm)	mm/blow	CBR (%)
500	25	10
575		
575	5.8	47
604		
604	32	7.7
765		
765	11	24
820		
820	20	13
940		
940	6.3	43
1060		
1060	28	9.1
1170		
1170	13	20
1250		

Causeway Geotech Ltd

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Kingston Galway

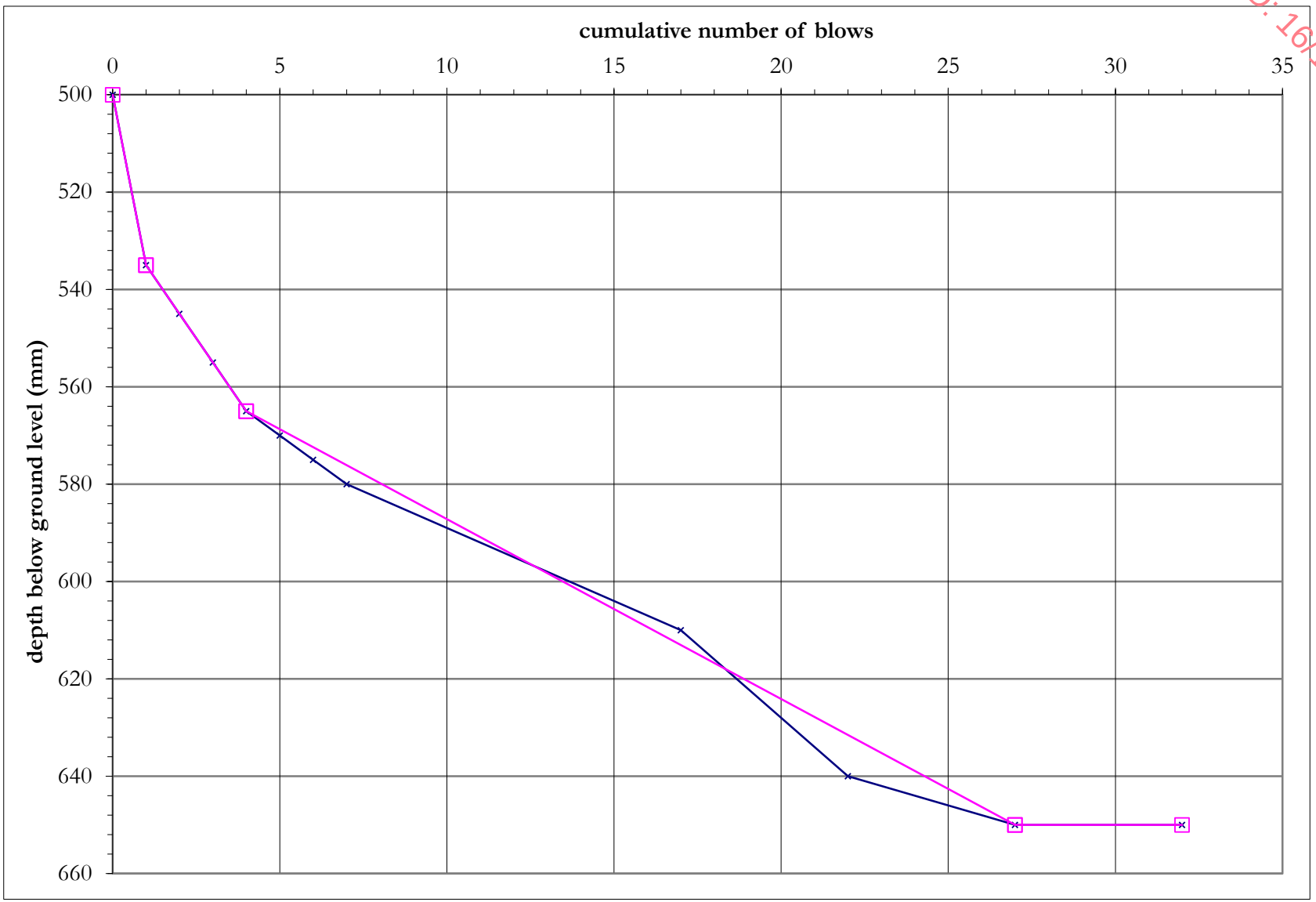
Test Number: TP06

CBR estimated using TRL Road Note 8:

Log CBR = 2.48-1.057 Log (mm/blow)

Project No: 19-0472

Date: 14-May-19



depth from to (mm)	mm/blow	CBR (%)
500	35	7
535		
535	10	26
565		
565	3.7	76
650		
650	0	>100
650		

Causeway Geotech Ltd

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Kingston Galway

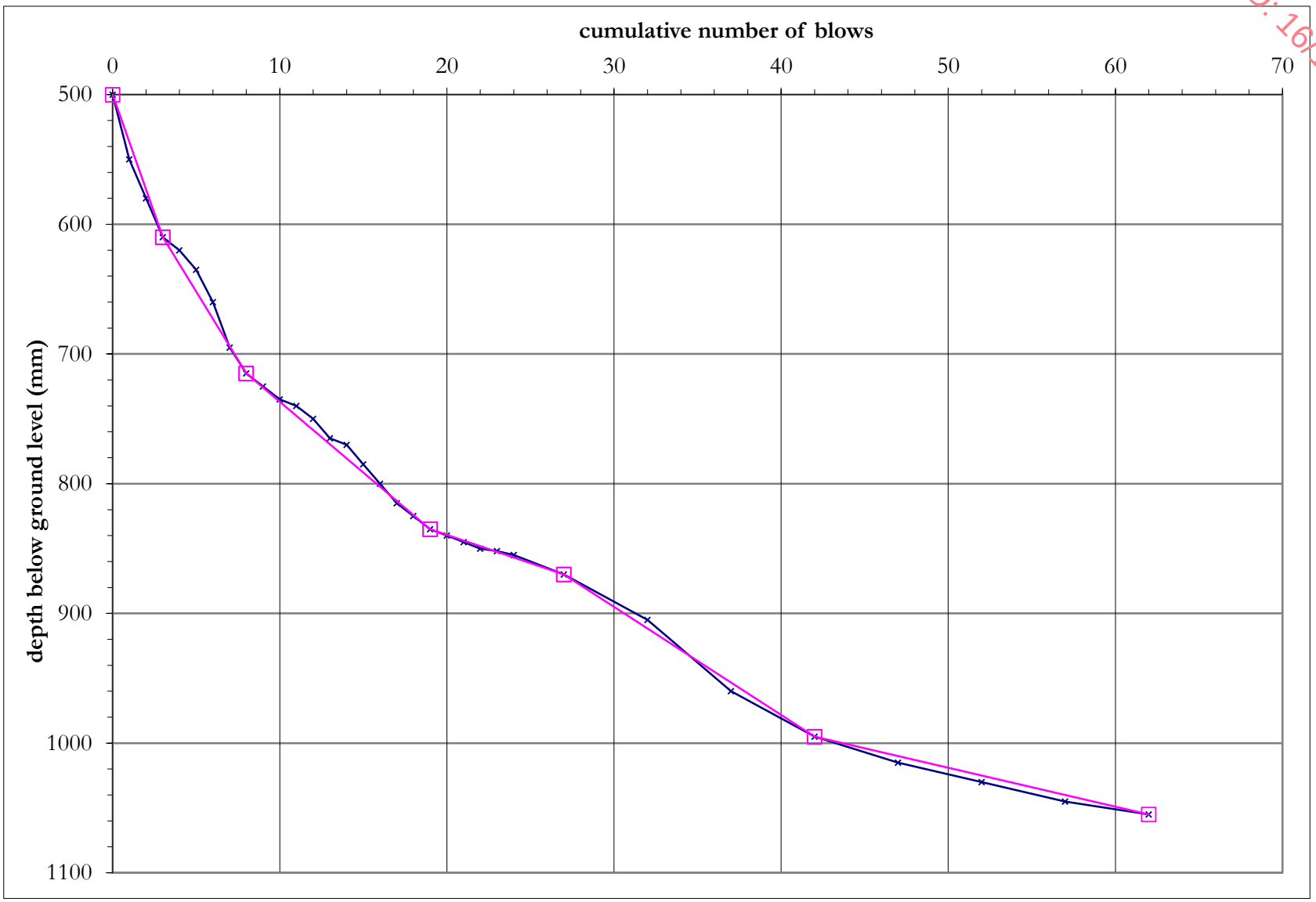
Test Number: TP08

CBR estimated using TRL Road Note 8:

Log CBR = 2.48-1.057 Log (mm/blow)

Project No: 19-0472

Date: 14-May-19



depth from to (mm)	mm/blow	CBR (%)
500	37	6.7
610		
610	21	12
715		
715	11	24
835		
835	4.4	63
870		
870	8.3	32
995		
995	3	95
1055		

Causeway Geotech Ltd

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Kingston Galway

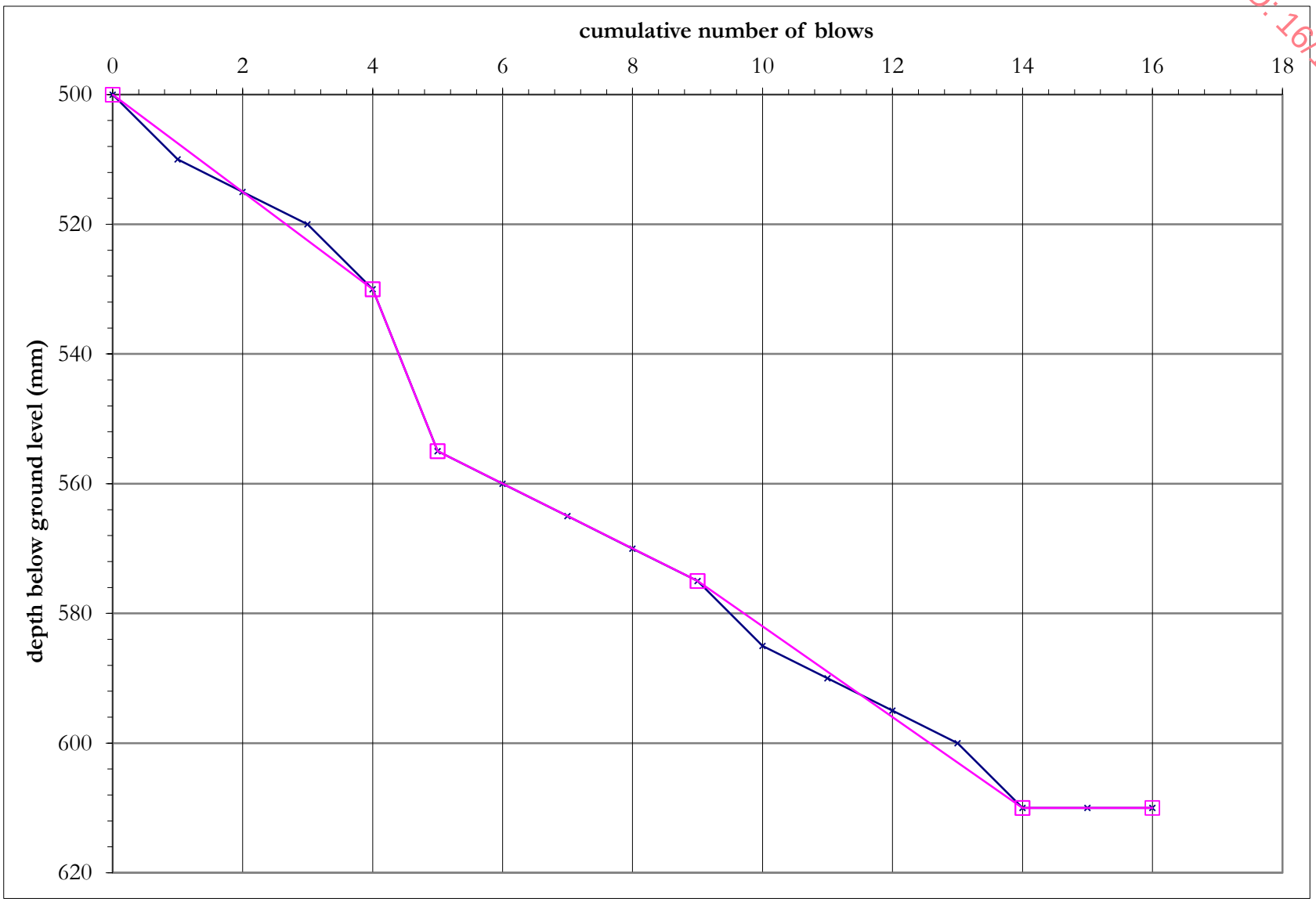
Test Number: TP10

CBR estimated using TRL Road Note 8:

Log CBR = 2.48-1.057 Log (mm/blow)

Project No: 19-0472

Date: 13-May-19



depth from (mm)	to (mm)	mm/blow	CBR (%)
500	530	7.5	36
530	555	25	10
555	575	5	55
575	610	7	39
610	610	0	>100

Causeway Geotech Ltd

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Kingston Galway

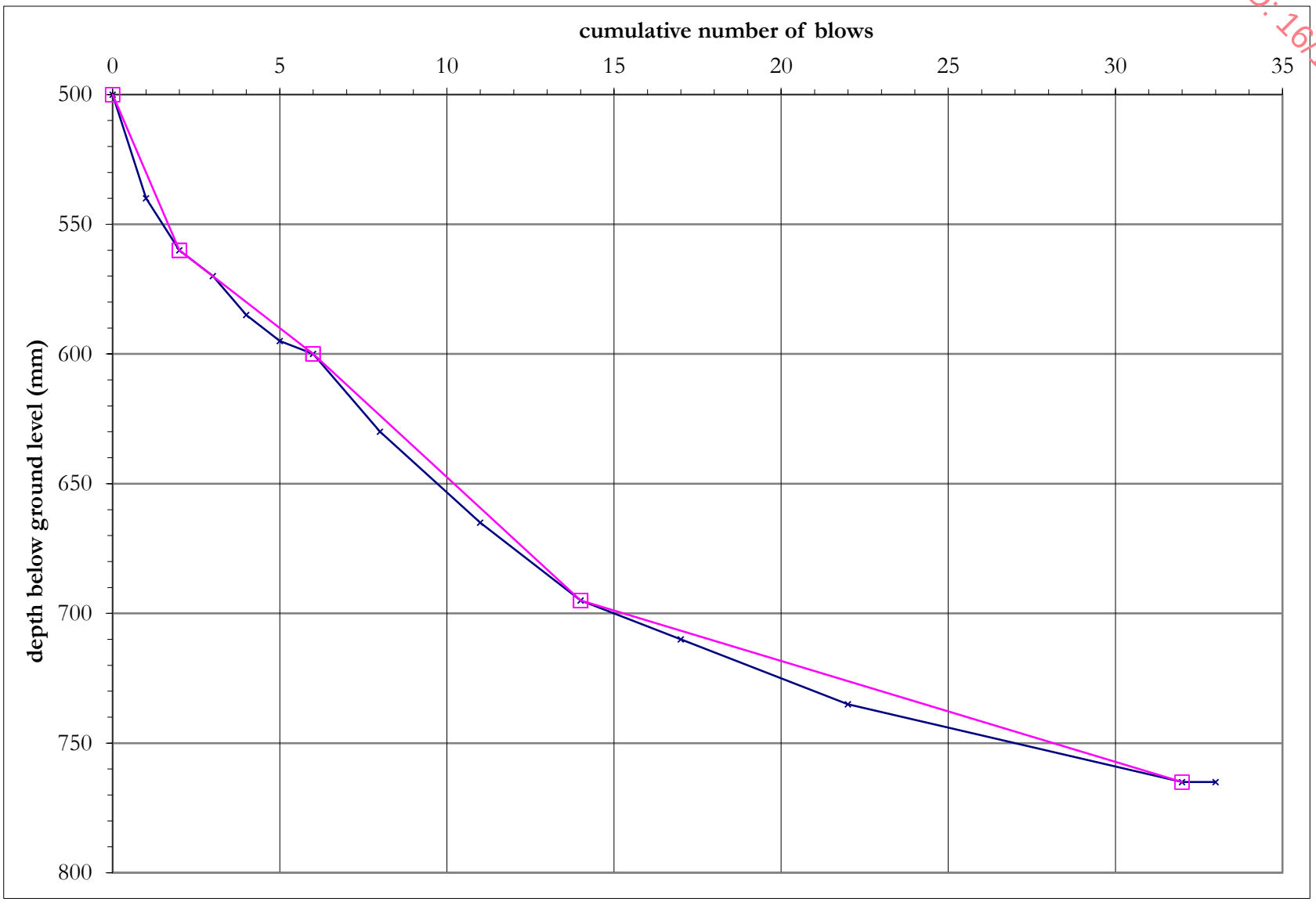
Test Number: TP11

CBR estimated using TRL Road Note 8:

Log CBR = 2.48-1.057 Log (mm/blow)

Project No: 19-0472

Date: 13-May-19



depth from to (mm)	mm/blow	CBR (%)
500	30	8.3
560		
560	10	26
600		
600	12	22
695		
695	3.9	72
765		

Causeway Geotech Ltd

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Kingston Galway

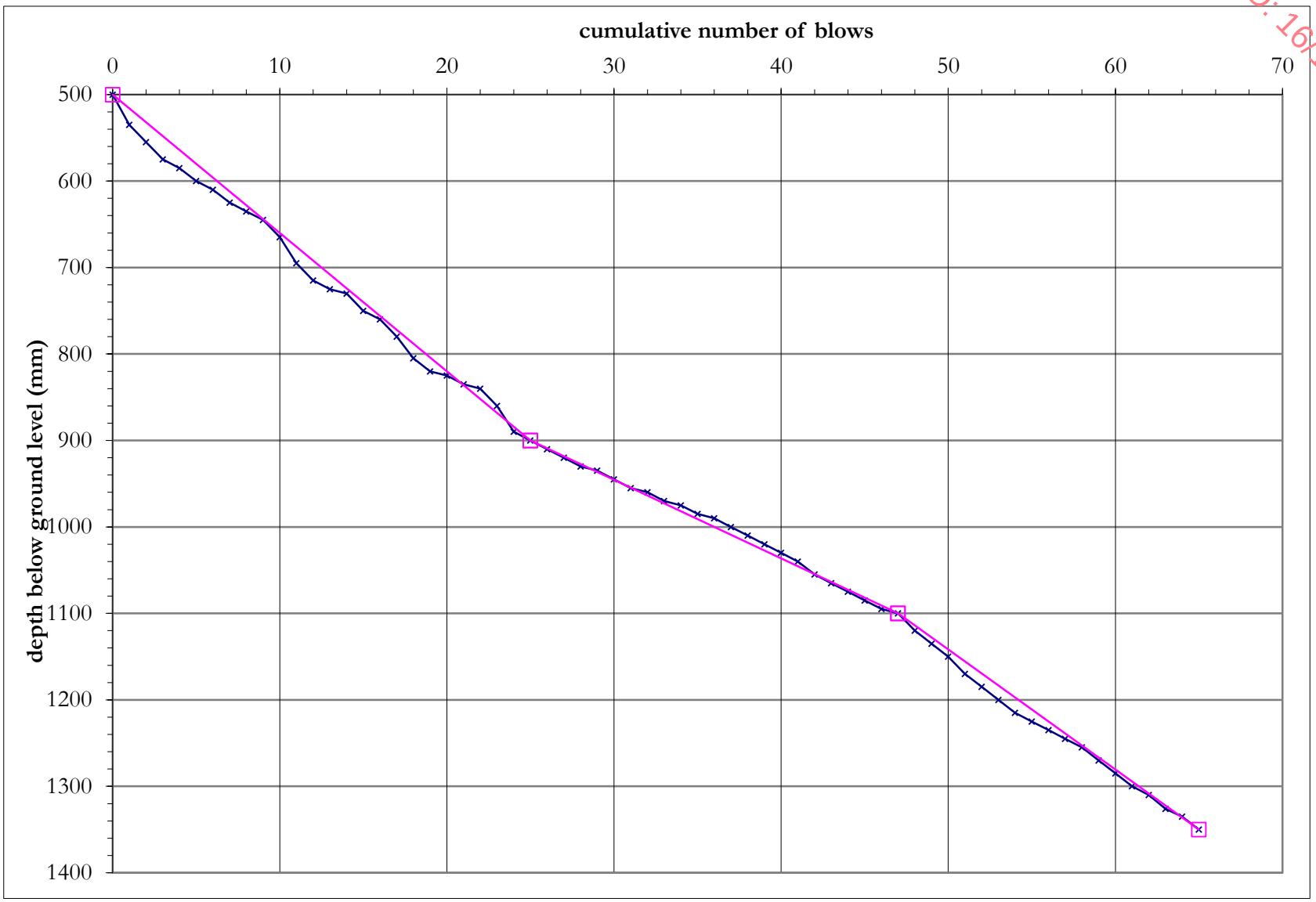
Test Number: TP12

CBR estimated using TRL Road Note 8:

Log CBR = 2.48-1.057 Log (mm/blow)

Project No: 19-0472

Date: 13-May-19



depth from to (mm)	mm/blow	CBR (%)
500 900	16	16
900 1100	9.1	29
1100 1350	14	19

CAUSEWAY GEOTECH

APPENDIX G

GEOTECHNICAL LABORATORY TEST RESULTS

CAUSEWAY GEOTECH

10122

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SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

Project Name:	Kingston, Galway –Ground Investigation
Project No.:	19-0472
Client:	Lioncor Developments Limited
Engineer:	Tobin Consulting Engineers
Date:	08/06/19

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s).

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Approved Signatory

Stephen Watson
Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

CAUSEWAY GEOTECH

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10122

Project Name: Kingston, Galway –Ground Investigation

Report Reference: Schedule 1

The table below details the tests carried out, the specifications used, and the number of tests included in this report.

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	14
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	9
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	13
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	6

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – Subcontracted to Pro Soils Limited *(UKAS 2183)*	pH Value of Soil		3
SOIL – Subcontracted to Chemtest Ltd *(UKAS 2183)*	Sulphate Content water extract		3
SOIL – Subcontracted to Chemtest Ltd *(UKAS 2183)*	Organic Matter Content		2

Summary of Classification Test Results

CAUSEWAY GEOTECH

Project No.	Project Name
19-0472	Kingston, Galway

Hole No.	Sample				Soil Description	Density bulk / dry Mg/m3		w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type										
BH01B	2	1.00		B	Brown slightly gravelly silty fine to coarse SAND.			6.3						
BH02	2	1.00		B	Brown slightly gravelly silty fine to coarse SAND.			15.0						
BH04	5	1.00		B	Dark brown slightly gravelly fibrous PEAT.			126.0						
BH05	2	1.10		B	Brown slightly sandy subangular fine to coarse GRAVEL with some cobbles.			5.1						
BH06	1	0.20		B	Brown sandy gravelly clayey SILT.			12.0	42	66 -1pt	43	23		MH
BH07	2	0.50		B	Grey sandy slightly gravelly SILT.			14.0	72	22 -1pt	18	4		ML
BH09	2	1.00		B	Grey sandy slightly gravelly silty CLAY.			14.0	94	20 -1pt	13	7		CL
BH10	3	2.00		B	Greyish brown sandy gravelly silty CLAY.			6.9	40	21 -1pt	10	11		CL
BH11	2	1.00		B	Brown slightly gravelly silty fine to coarse SAND.			9.7						
BH12	2	1.00		B	Dark brown sandy slightly gravelly SILT with large pockets of organic matter throughout.			107.0	72	205 -1pt	108	97		ME
TP01	3	1.00		B	Brown gravelly slightly silty fine to coarse SAND.			18.0	37	63 -1pt	NP			
TP07	2	0.60		B	Brown sandy gravelly SILT with medium cobble content.			12.0	45	37 -1pt	31	6		MI

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed: 06/08/2019 00:00

Approved By: Stephen.Watson

UKAS TESTING 10122

Summary of Classification Test Results

CAUSEWAY GEOTECH

Project No.	Project Name
19-0472	Kingston, Galway

Hole No.	Sample Ref	Top	Base	Type	Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
TP09	4	2.40		B	Brown slightly sandy silty CLAY.			19.0	100	26 -1pt	15	11		CL
TP11	3	0.80		B	Brown sandy gravelly clayey SILT.			8.3	41	76 -1pt	64	12		MV

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

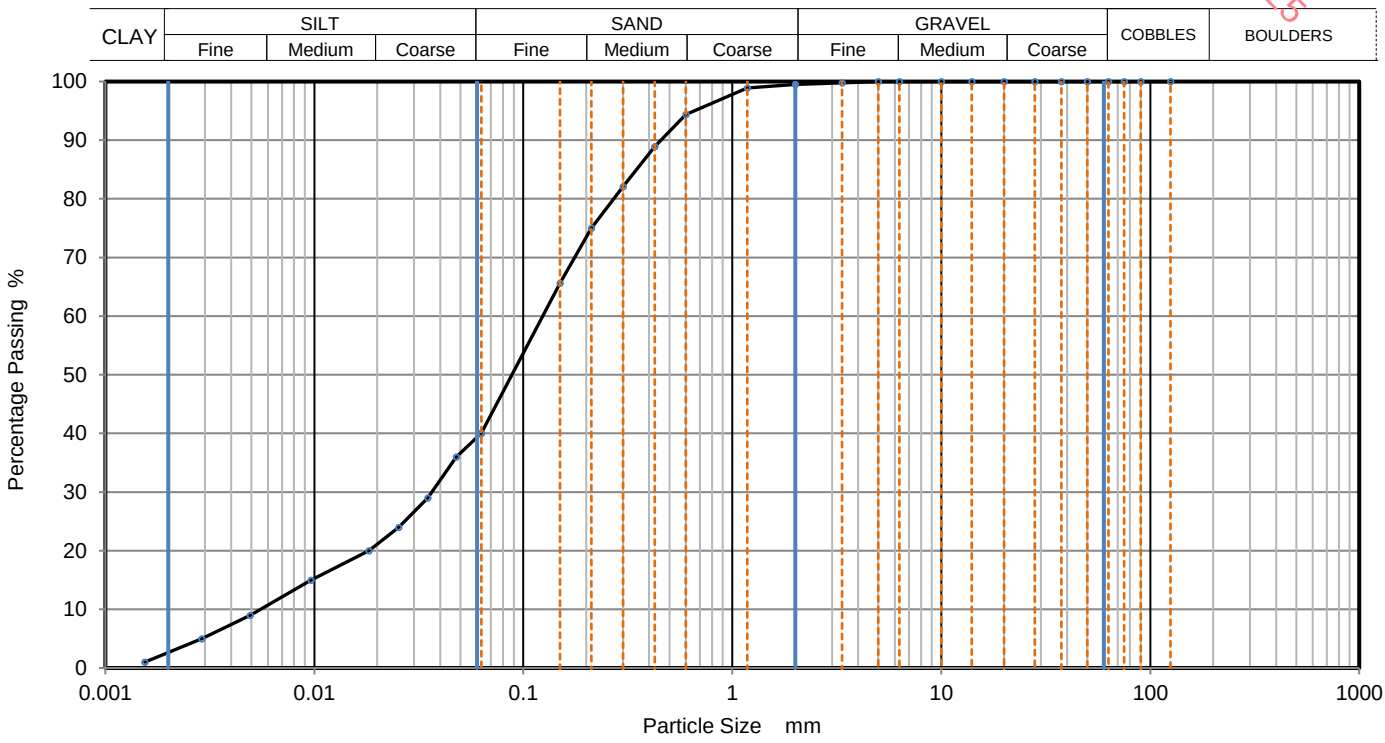
Date Printed: 06/08/2019 00:00

Approved By: Stephen.Watson

UKAS TESTING 10122

PARTICLE SIZE DISTRIBUTION

				Job Ref	**19-0472**
				Borehole/Pit No.	BH02
Site Name	Kingston, Galway			Sample No.	2
Soil Description	Brown slightly gravelly silty fine to coarse SAND.			Depth, m	1.00
Specimen Reference	4	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201905171



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0629	40
90	100	0.0478	36
75	100	0.0349	29
63	100	0.0253	24
50	100	0.0182	20
37.5	100	0.0096	15
28	100	0.0049	9
20	100	0.0029	5
14	100	0.0015	1
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	94	Particle density	(assumed)
0.425	89	2.65	Mg/m3
0.3	82		
0.212	75		
0.15	66		
0.063	40		

Dry Mass of sample, g	202

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	60
Silt	37
Clay	3

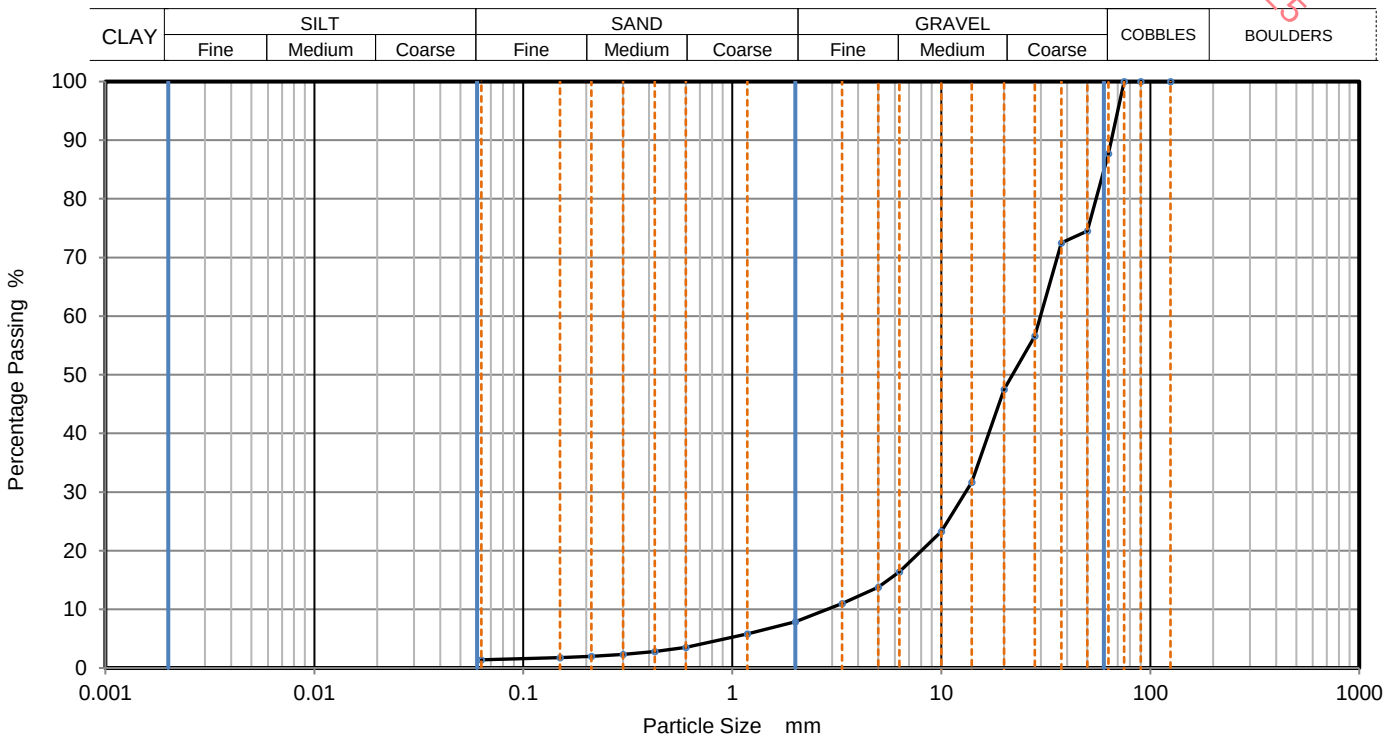
Grading Analysis		
D100	mm	
D60	mm	0.124
D30	mm	0.036
D10	mm	0.00536
Uniformity Coefficient		23
Curvature Coefficient		2

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0472**
				Borehole/Pit No.	BH05
Site Name	Kingston, Galway			Sample No.	2
Soil Description	Brown slightly sandy subangular fine to coarse GRAVEL with some cobbles.			Depth, m	1.10
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201905173



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	88		
50	75		
37.5	73		
28	57		
20	48		
14	32		
10	23		
6.3	16		
5	14		
3.35	11		
2	8		
1.18	6		
0.6	4		
0.425	3		
0.3	2		
0.212	2		
0.15	2		
0.063	1		

Dry Mass of sample, g	3995

Sample Proportions	% dry mass
Cobbles	12
Gravel	80
Sand	7
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	29.8
D30	mm	13.1
D10	mm	2.83
Uniformity Coefficient		11
Curvature Coefficient		2

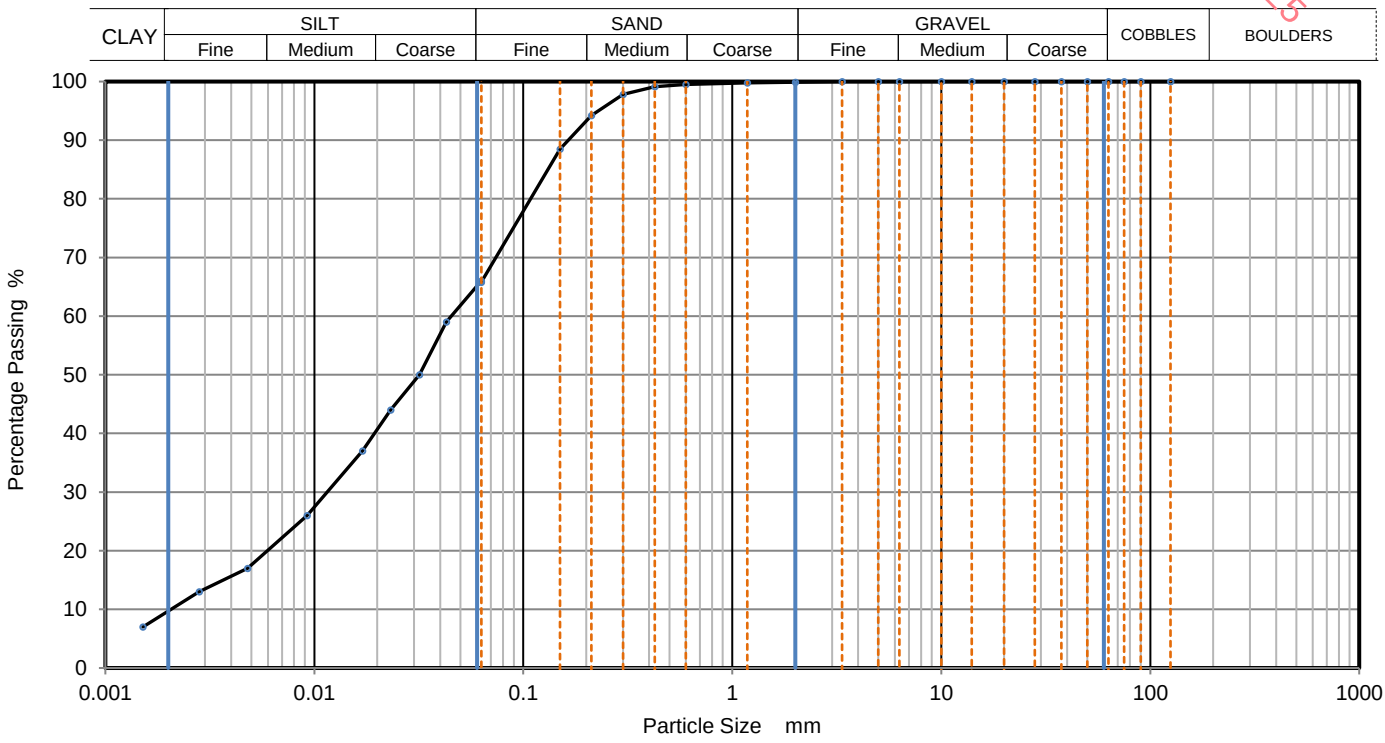
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0472**
				Borehole/Pit No.	BH09
Site Name	Kingston, Galway			Sample No.	2
Soil Description	Grey sandy slightly gravelly silty CLAY.			Depth, m	1.00
Specimen Reference	5	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201905176



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	66
90	100	0.0429	59
75	100	0.0318	50
63	100	0.0232	44
50	100	0.0170	37
37.5	100	0.0092	26
28	100	0.0048	17
20	100	0.0028	13
14	100	0.0015	7
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	98		
0.212	94		
0.15	89		
0.063	66		

Dry Mass of sample, g	214

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	34
Silt	56
Clay	10

Grading Analysis		
D100	mm	
D60	mm	0.0461
D30	mm	0.0116
D10	mm	0.00206
Uniformity Coefficient		22
Curvature Coefficient		1.4

Remarks

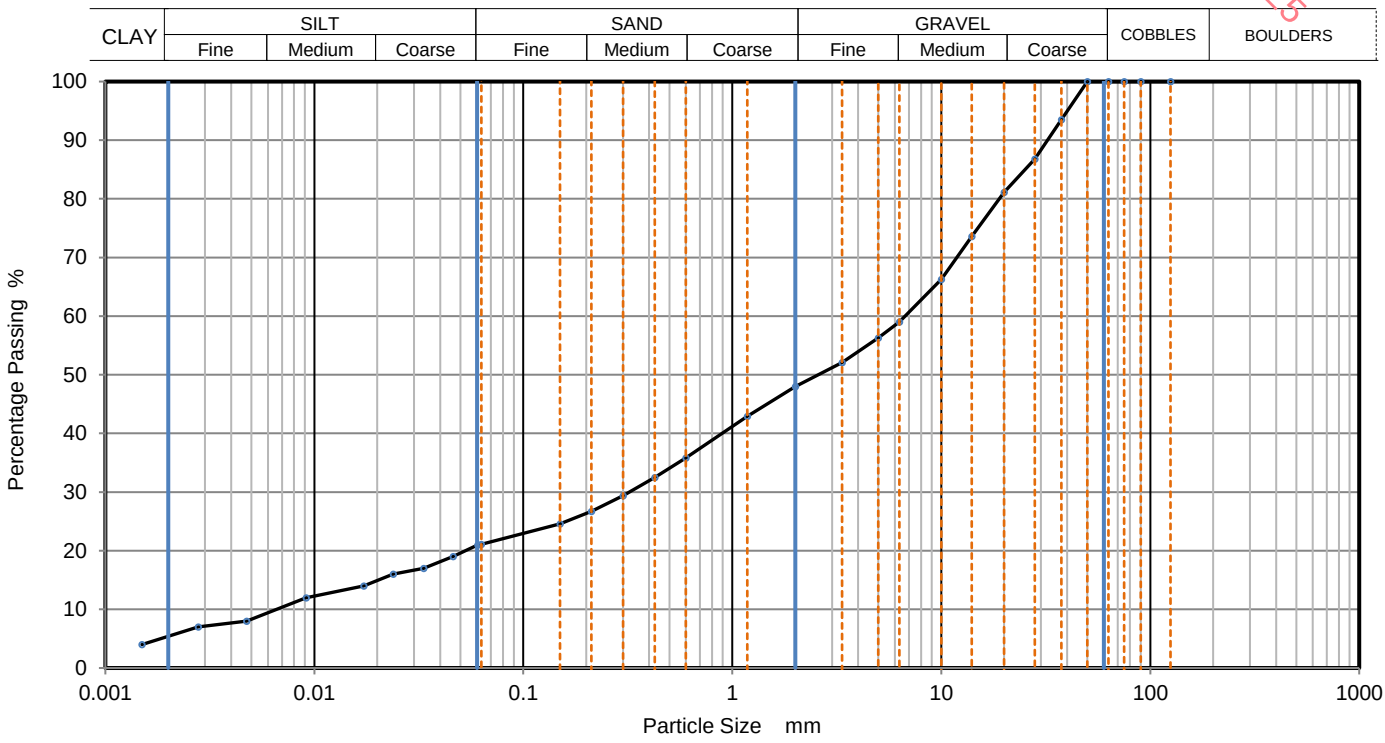
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

LAB 05R Version 4

UKAS TESTING
10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0472
				Borehole/Pit No.	BH10
Site Name	Kingston, Galway			Sample No.	3
Soil Description	Greyish brown sandy gravelly silty CLAY.			Depth, m	2.00
Specimen Reference	5	Specimen Depth	2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201905177



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0606	21
90	100	0.0461	19
75	100	0.0333	17
63	100	0.0239	16
50	100	0.0172	14
37.5	94	0.0091	12
28	87	0.0047	8
20	81	0.0028	7
14	74	0.0015	4
10	66		
6.3	59		
5	56		
3.35	52		
2	48		
1.18	43		
0.6	36	Particle density	(assumed)
0.425	33	2.65	Mg/m3
0.3	29		
0.212	27		
0.15	25		
0.063	21		

Dry Mass of sample, g	5672

Sample Proportions	% dry mass
Cobbles	0
Gravel	52
Sand	27
Silt	16
Clay	5

Grading Analysis		
D100	mm	
D60	mm	6.69
D30	mm	0.322
D10	mm	0.00628
Uniformity Coefficient		1100
Curvature Coefficient		2.5

Remarks

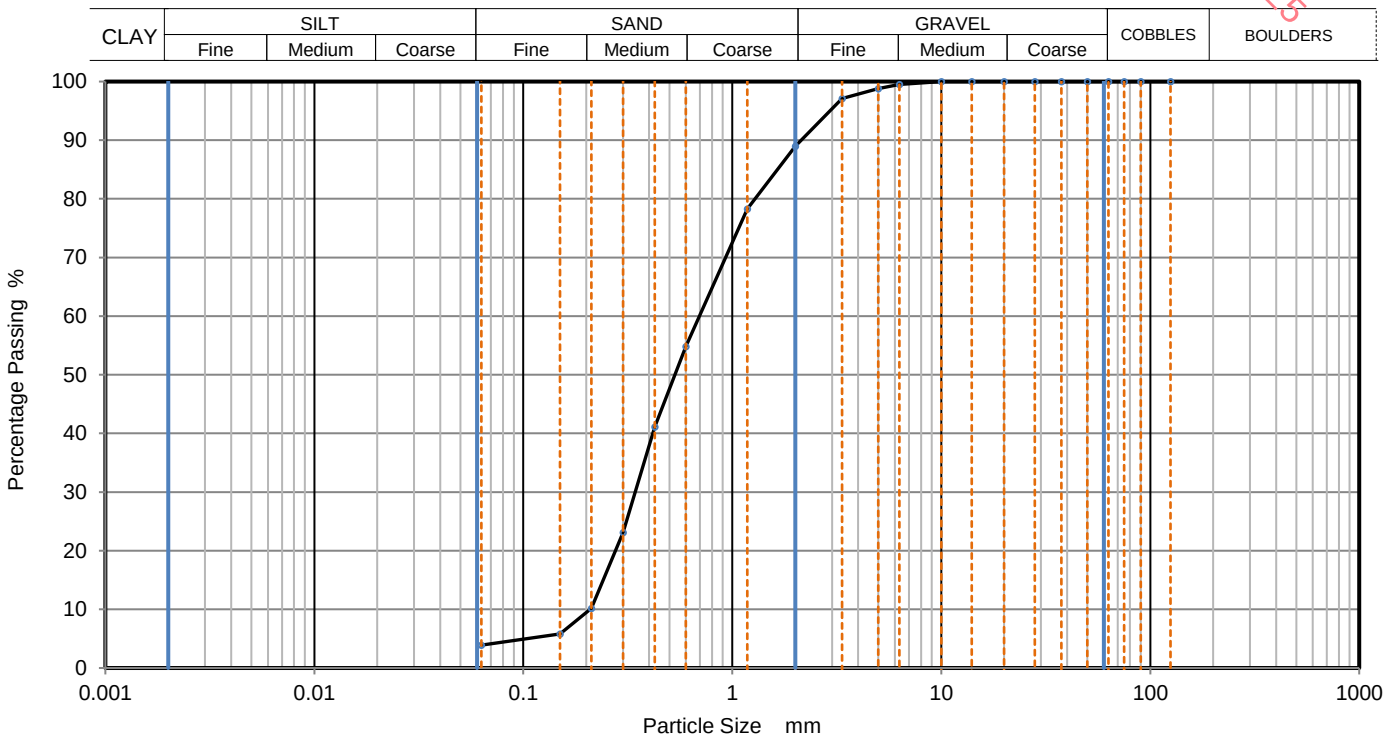
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0472**
				Borehole/Pit No.	BH11
Site Name	Kingston, Galway			Sample No.	2
Soil Description	Brown slightly gravelly silty fine to coarse SAND.			Depth, m	1.00
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus201905178



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	97		
2	89		
1.18	78		
0.6	55		
0.425	41		
0.3	23		
0.212	10		
0.15	6		
0.063	4		

Dry Mass of sample, g	210

Sample Proportions	% dry mass
Cobbles	0
Gravel	11
Sand	85
Fines <0.063mm	4

Grading Analysis		
D100	mm	
D60	mm	0.696
D30	mm	0.343
D10	mm	0.209
Uniformity Coefficient		3.3
Curvature Coefficient		0.81

Remarks

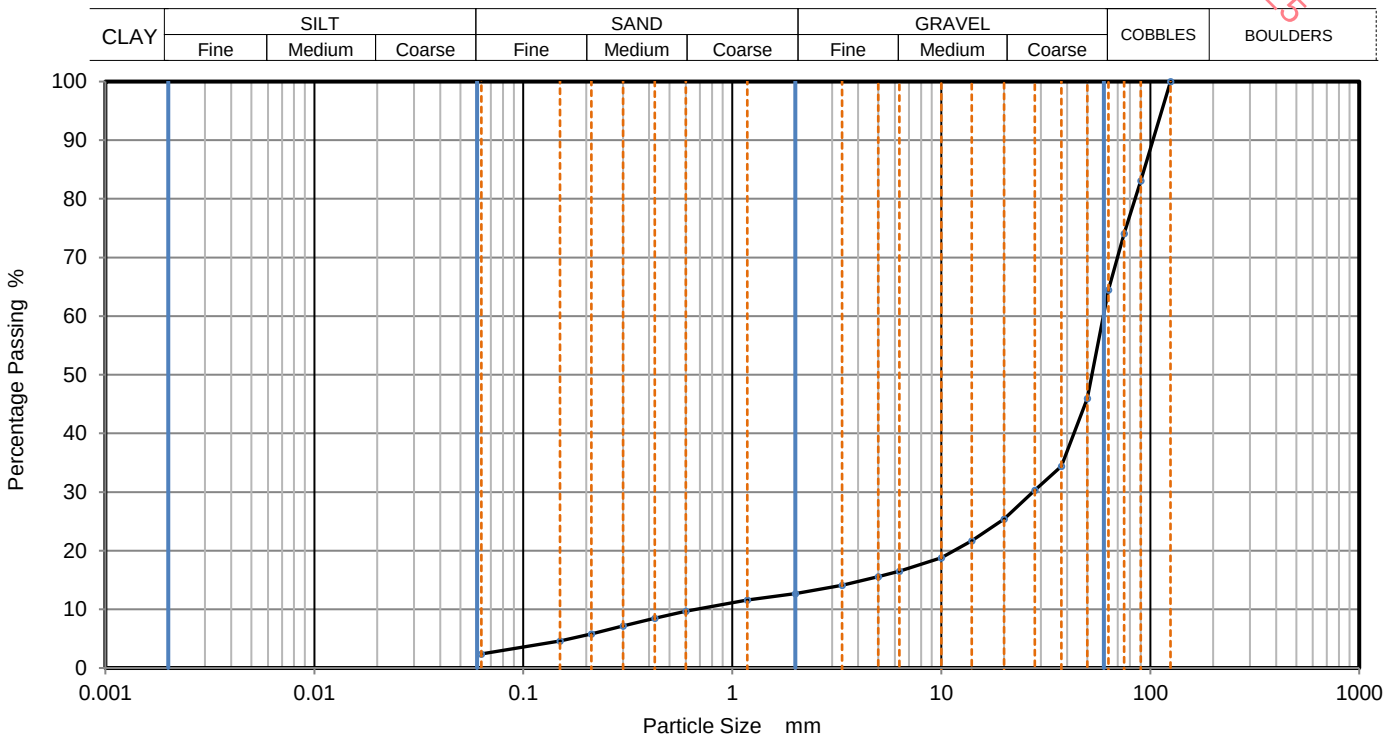
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

LAB 05R Version 4

UKAS TESTING
10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0472**
				Borehole/Pit No.	TP01
Site Name	Kingston, Galway			Sample No.	2
Soil Description	Brown slightly sandy subangular fine to coarse GRAVEL with medium cobble content.			Depth, m	0.40
Specimen Reference	2	Specimen Depth	0.4 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019051710



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	83		
75	74		
63	65		
50	46		
37.5	34		
28	30		
20	25		
14	22		
10	19		
6.3	17		
5	16		
3.35	14		
2	13		
1.18	12		
0.6	10		
0.425	9		
0.3	7		
0.212	6		
0.15	5		
0.063	2		

Dry Mass of sample, g	20320

Sample Proportions	% dry mass
Cobbles	36
Gravel	52
Sand	10
Fines <0.063mm	2

Grading Analysis		
D100	mm	125
D60	mm	59.6
D30	mm	27.5
D10	mm	0.677
Uniformity Coefficient		88
Curvature Coefficient		19

Remarks

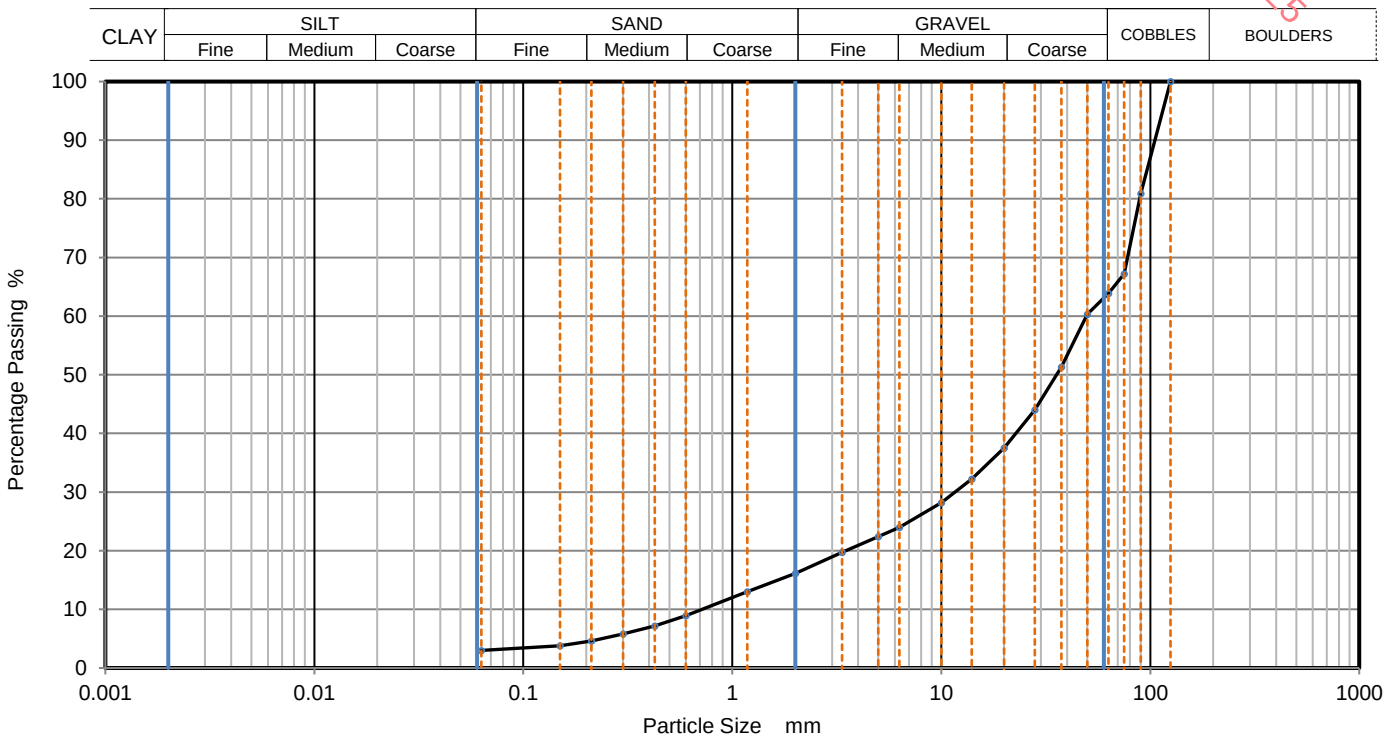
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

PARTICLE SIZE DISTRIBUTION

CAUSEWAY GEOTECH				Job Ref	**19-0472**
				Borehole/Pit No.	TP04
Site Name	Kingston, Galway			Sample No.	1
Soil Description	Brown slightly sandy slightly silty subangular fine to coarse GRAVEL with medium cobble content.			Depth, m	0.50
Specimen Reference	2	Specimen Depth	0.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019051712



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	81		
75	67		
63	64		
50	60		
37.5	51		
28	44		
20	38		
14	32		
10	28		
6.3	24		
5	22		
3.35	20		
2	16		
1.18	13		
0.6	9		
0.425	7		
0.3	6		
0.212	5		
0.15	4		
0.063	3		

Dry Mass of sample, g	24974

Sample Proportions	% dry mass
Cobbles	36
Gravel	48
Sand	13
Fines <0.063mm	3

Grading Analysis		
D100	mm	125
D60	mm	49.6
D30	mm	11.6
D10	mm	0.715
Uniformity Coefficient		69
Curvature Coefficient		3.8

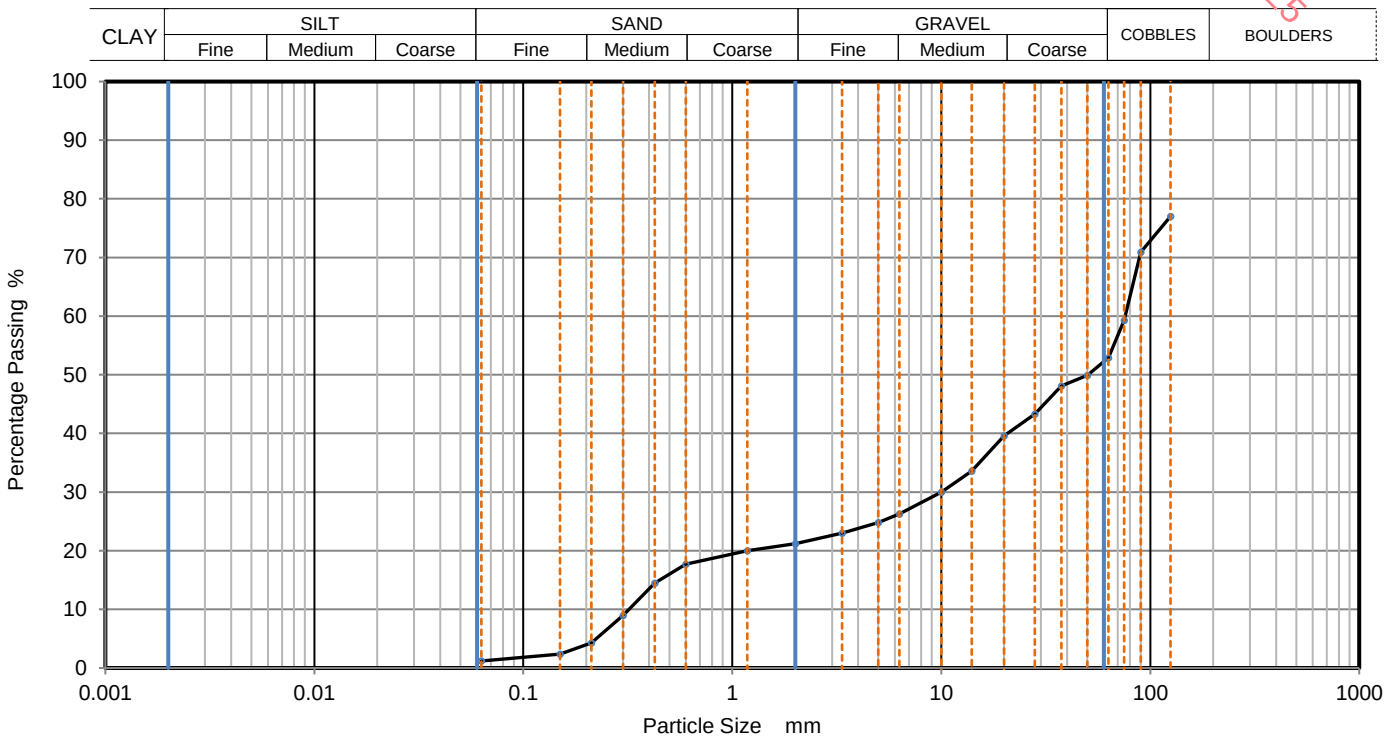
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0472**
				Borehole/Pit No.	TP05
Site Name	Kingston, Galway			Sample No.	4
Soil Description	Greyish brown sandy subangular fine to coarse GRAVEL with medium to high cobble content.			Depth, m	2.20
Specimen Reference	2	Specimen Depth	2.2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019051713



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	77		
90	71		
75	59		
63	53		
50	50		
37.5	48		
28	43		
20	40		
14	34		
10	30		
6.3	26		
5	25		
3.35	23		
2	21		
1.18	20		
0.6	18		
0.425	15		
0.3	9		
0.212	4		
0.15	2		
0.063	1		

Dry Mass of sample, g	24588

Sample Proportions	% dry mass
Cobbles	47
Gravel	32
Sand	20
Fines <0.063mm	1

Grading Analysis		
D100	mm	
D60	mm	75.9
D30	mm	10
D10	mm	0.319
Uniformity Coefficient		240
Curvature Coefficient		4.1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

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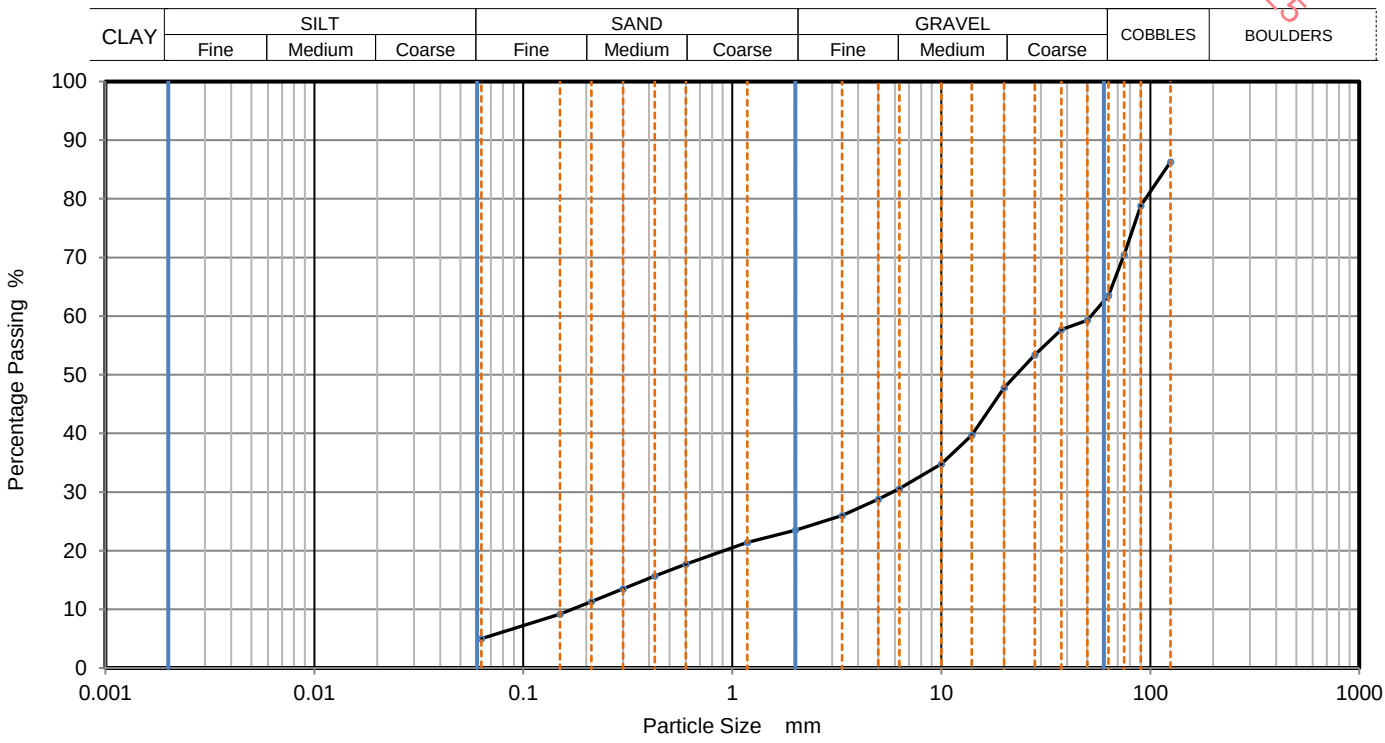
PARTICLE SIZE DISTRIBUTION

				Job Ref	**19-0472**
				Borehole/Pit No.	TP06
Site Name	Kingston, Galway			Sample No.	2
Soil Description	Greyish brown slightly sandy subangular fine to coarse GRAVEL with medium cobble content.			Depth, m	0.60
Specimen Reference	2	Specimen Depth	0.6 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019051714



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	86		
90	79		
75	71		
63	64		
50	59		
37.5	58		
28	53		
20	48		
14	40		
10	35		
6.3	31		
5	29		
3.35	26		
2	24		
1.18	21		
0.6	18		
0.425	16		
0.3	14		
0.212	11		
0.15	9		
0.063	5		

Dry Mass of sample, g: 20350

Sample Proportions	% dry mass
Cobbles	37
Gravel	40
Sand	19
Fines <0.063mm	5

Grading Analysis		
D100	mm	
D60	mm	52
D30	mm	5.84
D10	mm	0.171
Uniformity Coefficient		300
Curvature Coefficient		3.8

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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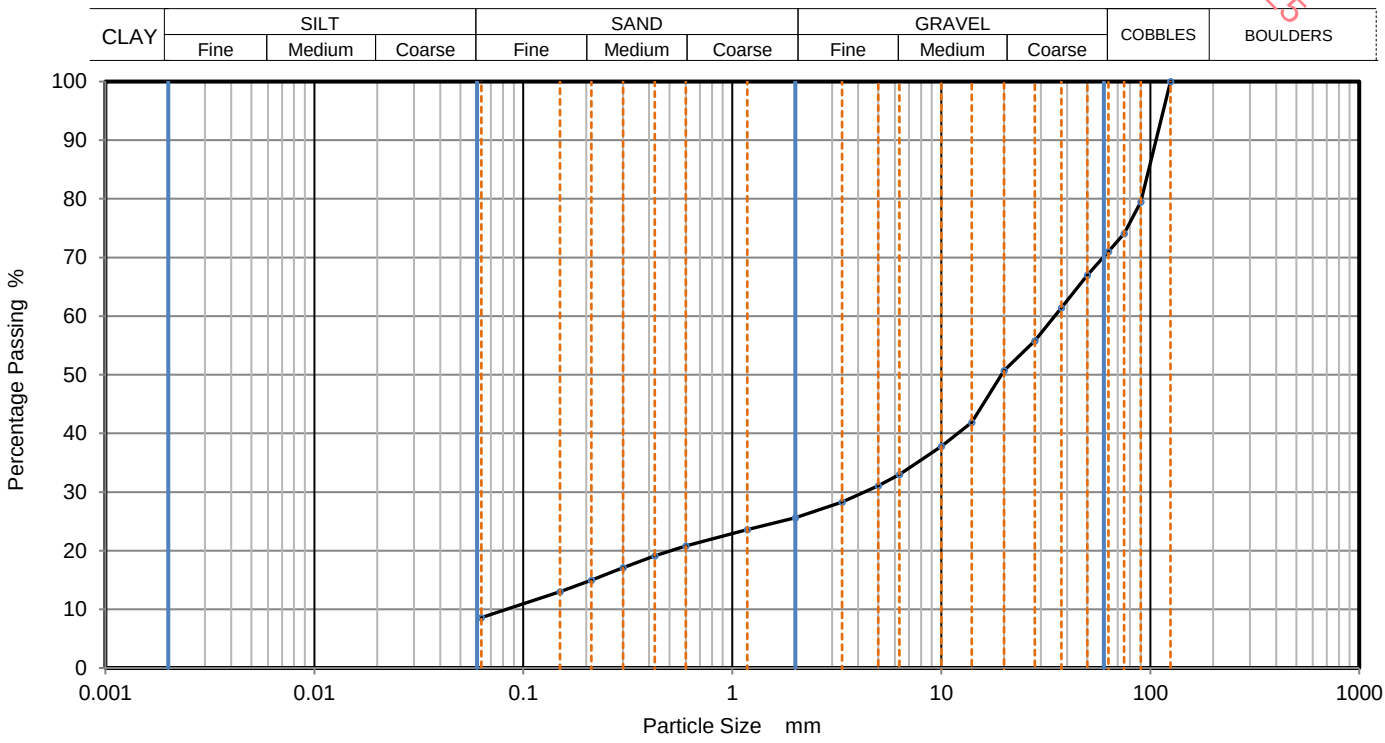
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0472
				Borehole/Pit No.	TP07
Site Name	Kingston, Galway			Sample No.	2
Soil Description	Brown sandy gravelly SILT with medium cobble content.			Depth, m	0.60
Specimen Reference	5	Specimen Depth	0.6 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2019051715



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	80		
75	74		
63	71		
50	67		
37.5	61		
28	56		
20	51		
14	42		
10	38		
6.3	33		
5	31		
3.35	28		
2	26		
1.18	24		
0.6	21		
0.425	19		
0.3	17		
0.212	15		
0.15	13		
0.063	9		

Dry Mass of sample, g	14535

Sample Proportions	% dry mass
Cobbles	29
Gravel	45
Sand	17
Fines <0.063mm	9

Grading Analysis		
D100	mm	125
D60	mm	34.9
D30	mm	4.28
D10	mm	0.0833
Uniformity Coefficient		420
Curvature Coefficient		6.3

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

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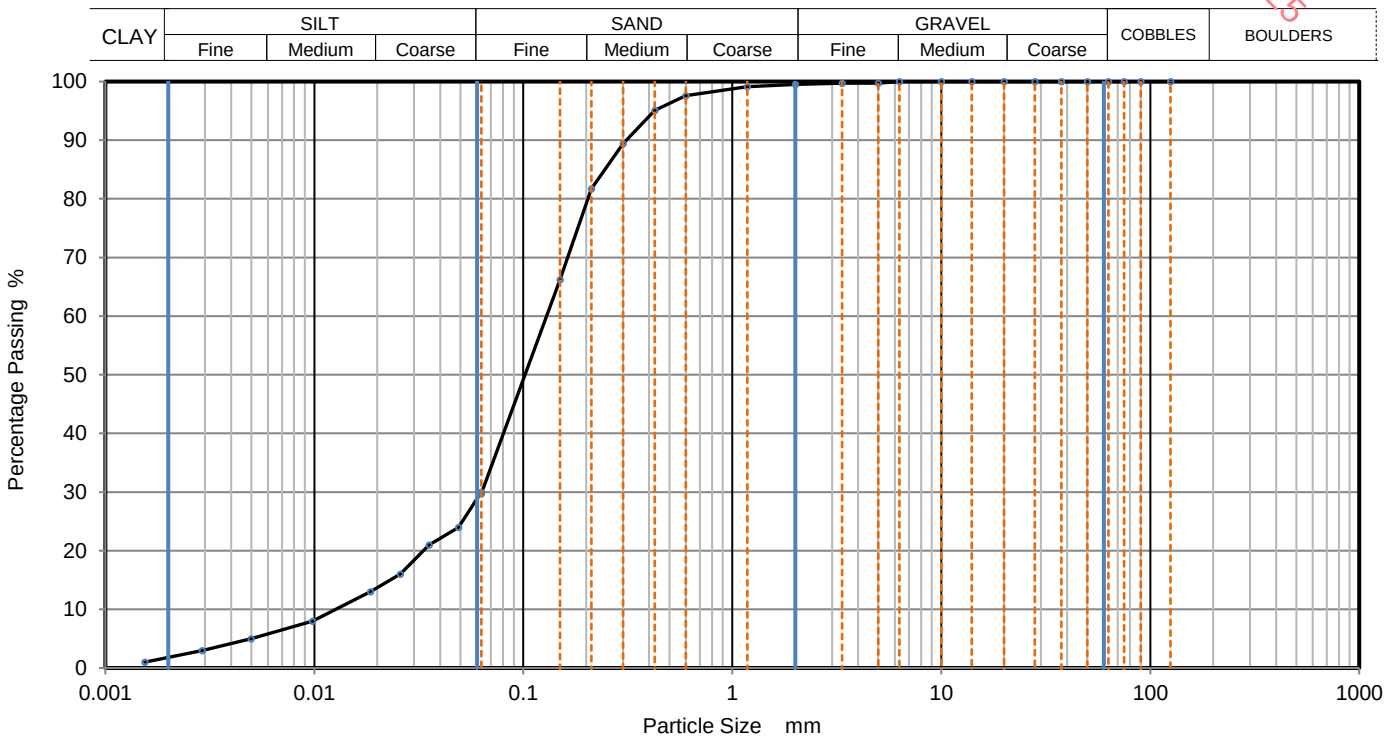
PARTICLE SIZE DISTRIBUTION

				Job Ref	**19-0472**
				Borehole/Pit No.	TP09
Site Name	Kingston, Galway			Sample No.	3
Soil Description	Greyish brown silty fine to coarse SAND.			Depth, m	0.90
Specimen Reference	2	Specimen Depth	0.9 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019051716



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	30
90	100	0.0491	24
75	100	0.0354	21
63	100	0.0258	16
50	100	0.0185	13
37.5	100	0.0098	8
28	100	0.0050	5
20	100	0.0029	3
14	100	0.0015	1
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	98	Particle density	(assumed)
0.425	95	2.65	Mg/m3
0.3	89		
0.212	82		
0.15	66		
0.063	30		

Dry Mass of sample, g: 216

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	70
Silt	28
Clay	2

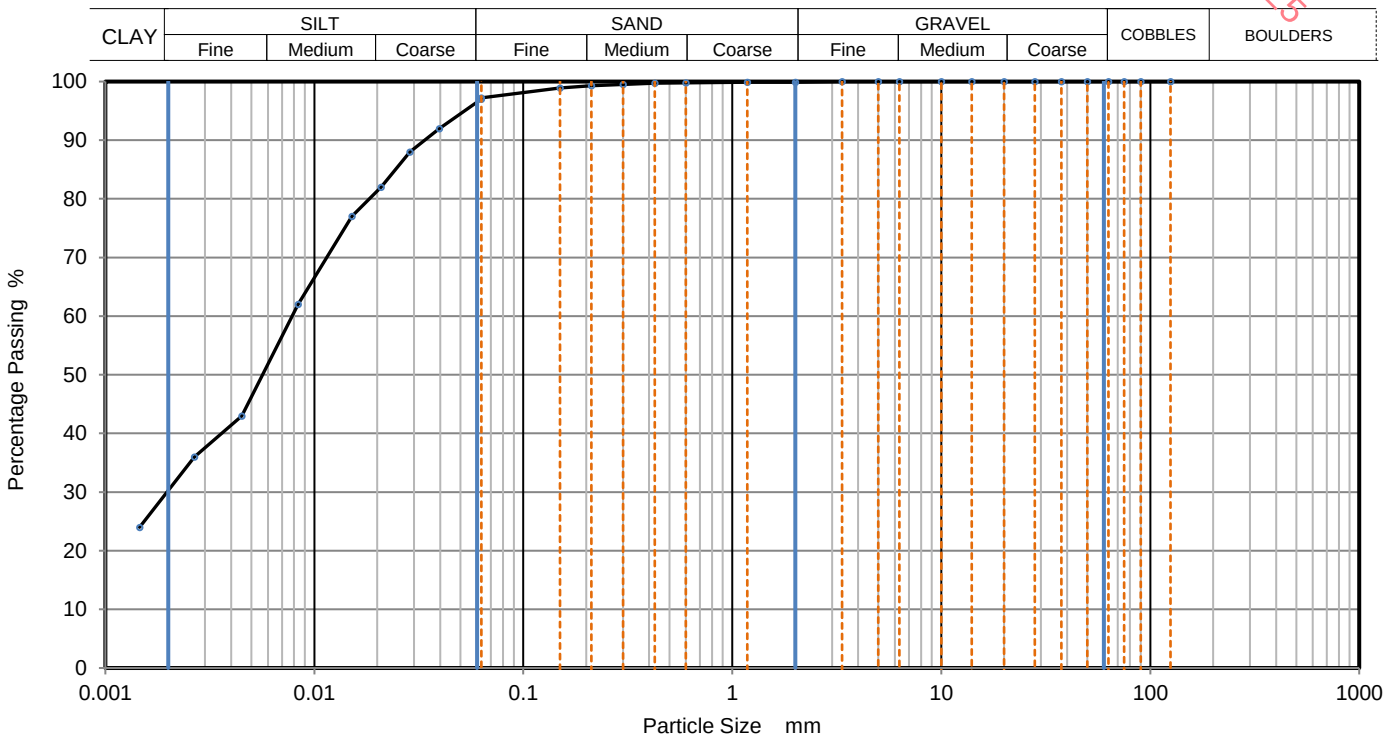
Grading Analysis		
D100	mm	
D60	mm	0.129
D30	mm	0.0634
D10	mm	0.0123
Uniformity Coefficient		11
Curvature Coefficient		2.5

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**19-0472**
				Borehole/Pit No.	TP09
Site Name	Kingston, Galway			Sample No.	4
Soil Description	Brown slightly sandy silty CLAY.			Depth, m	2.40
Specimen Reference	5	Specimen Depth	2.4 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019051717



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	97
90	100	0.0396	92
75	100	0.0286	88
63	100	0.0208	82
50	100	0.0151	77
37.5	100	0.0084	62
28	100	0.0045	43
20	100	0.0027	36
14	100	0.0015	24
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	100	2.65	Mg/m3
0.3	100		
0.212	99		
0.15	99		
0.063	97		

Dry Mass of sample, g	210

Sample Proportions	% dry mass
Cobbles	0
Gravel	0
Sand	3
Silt	67
Clay	30

Grading Analysis		
D100	mm	
D60	mm	0.00791
D30	mm	0.00198
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

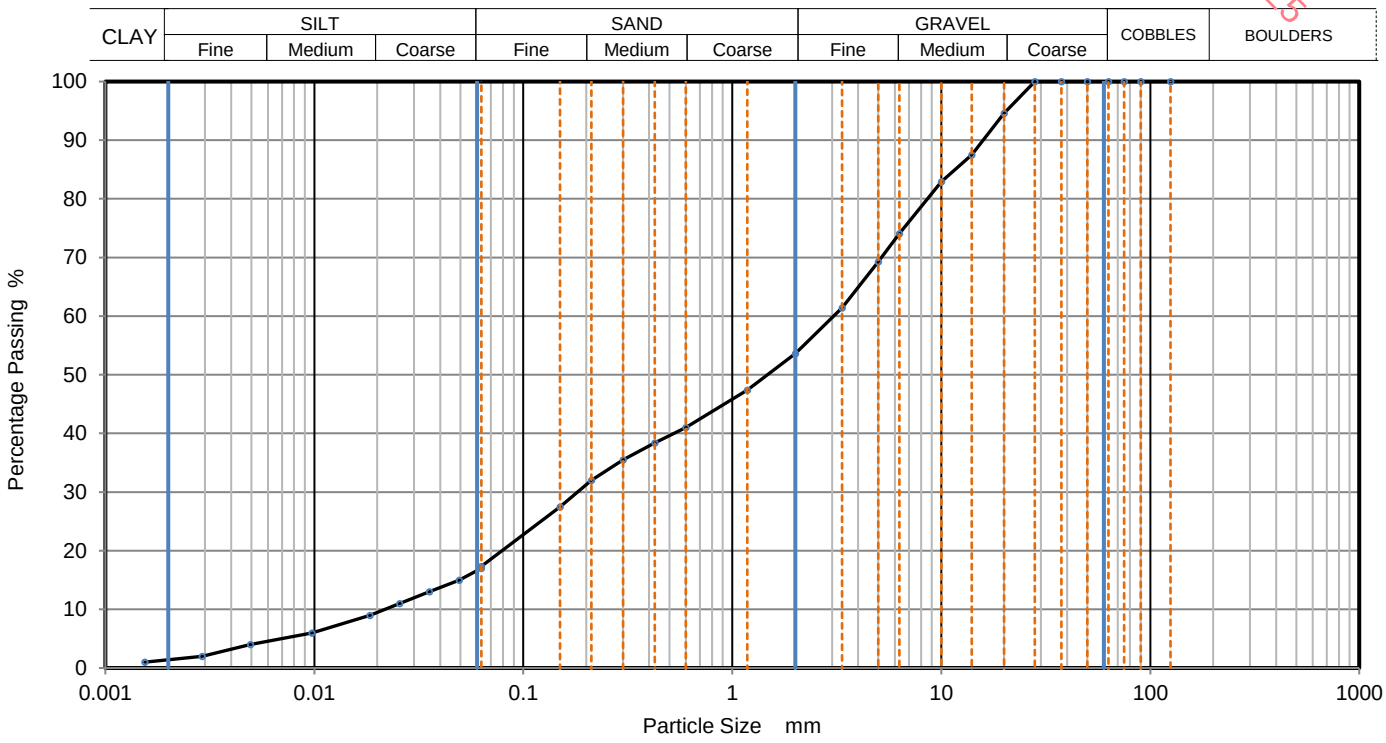
Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	19-0472
				Borehole/Pit No.	TP12
Site Name	Kingston, Galway			Sample No.	4
Soil Description	Greyish brown gravelly silty fine to coarse SAND.			Depth, m	1.60
Specimen Reference	2	Specimen Depth	1.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2019051719



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	17
90	100	0.0494	15
75	100	0.0356	13
63	100	0.0256	11
50	100	0.0184	9
37.5	100	0.0097	6
28	100	0.0050	4
20	95	0.0029	2
14	88	0.0015	1
10	83		
6.3	74		
5	69		
3.35	61		
2	54		
1.18	47		
0.6	41	Particle density	(assumed)
0.425	38	2.65	Mg/m3
0.3	36		
0.212	32		
0.15	28		
0.063	17		

Dry Mass of sample, g	2331

Sample Proportions	% dry mass
Cobbles	0
Gravel	46
Sand	36
Silt	16
Clay	1

Grading Analysis		
D100	mm	
D60	mm	3.06
D30	mm	0.182
D10	mm	0.0216
Uniformity Coefficient		140
Curvature Coefficient		0.5

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING 10122

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

UKAS TESTING
2183

Final Report

Report No.:	19-18433-1
Initial Date of Issue:	07-Jun-2019
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham
Project	19-0472 Kingston, Galway

Quotation No.:		**Date Received:**	31-May-2019
Order No.:		**Date Instructed:**	31-May-2019
No. of Samples:	5		
Turnaround (Wkdays):	5	**Results Due:**	06-Jun-2019
Date Approved:	07-Jun-2019		

Approved By:

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Chemtest
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Results - Soil

Project: 19-0472 Kingston, Galway

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			19-18433	19-18433	19-18433	19-18433	19-18433
Quotation No.:		**Chemtest Sample ID.:**			835523	835524	835525	835526	835527
Order No.:		Client Sample Ref.:			2	5	2	5	2
		Sample Location:			BH01B	BH04	BH05	BH10	BH12
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			1.00	1.00	1.10	2.00	1.00
		Date Sampled:			30-May-2019	30-May-2019	30-May-2019	30-May-2019	30-May-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Moisture	N	2030	%	0.020	3.6	20	5.2	6.4	48
pH	U	2010		N/A	8.7		8.3	9.0	
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.010		< 0.010	< 0.010	
Organic Matter	U	2625	%	0.40		3.3			33

Chemtest
The right chemistry to deliver results

Report Information

Key

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

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

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

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

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

CAUSEWAY GEOTECH

10122

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info@causewaygeotech.com
www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

Project Name:	Kingston, Galway –Ground Investigation
Project No.:	19-0472
Client:	Lioncor Developments Limited
Engineer:	Tobin Consulting Engineers
Date:	14/06/19

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s).

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Approved Signatory

Stephen Watson
Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

CAUSEWAY GEOTECH

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www.causewaygeotech.com

10122

Project Name: Kingston, Galway –Ground Investigation

Report Reference: Schedule 2

The table below details the tests carried out, the specifications used, and the number of tests included in this report.

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
ROCK	Point load index	ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985	12

CAUSEWAY GEOTECH

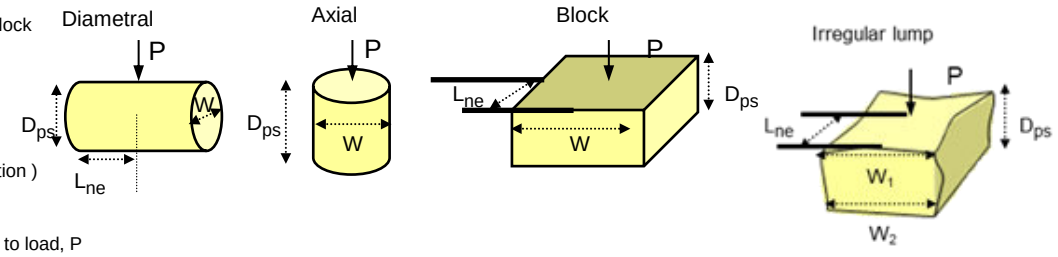
Point Load Strength Index Tests
Summary of Results

Project No.: 19-0472

Project Name: Kingston, Galway

Borehole No.	Sample			Specimen		Rock Type	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Depth	Ref.	Type	Ref.	Depth		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m				m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH01B	5.30		C	1	5.30	GRANITE	D	U	YES	69.4	78.9	78.9	76.0	17.0	77.4	2.8	3.5	
BH02	6.40		C	2	6.40	GRANITE	D	U	NO	92.2	79.1	79.1	76.0	44.6	77.5	7.4	9.0	
BH03A	5.40		C	3	5.40	GRANITE	D	U	NO	90.8	83.8	83.8	82.0	25.7	82.9	3.7	4.7	
BH04	6.00		C	4	6.00	GRANITE	D	U	YES	57.2	79.2	79.2	74.0	61.7	76.6	10.5	12.8	
BH05	4.90		C	5	4.90	GRANITE	D	U	NO	87.3	83.8	83.8	81.0	22.5	82.4	3.3	4.2	
BH06	5.00		C	6	5.00	GRANITE	D	U	YES	73.6	84.0	84.0	81.0	19.1	82.5	2.8	3.5	
BH07	5.80		C	7	5.80	GRANITE	D	U	YES	82.4	83.9	83.9	81.0	11.4	82.4	1.7	2.1	
BH08	8.10		C	8	8.10	GRANITE	D	U	NO	55.6	83.7	83.7	82.0	47.6	82.8	6.9	8.7	
BH09	5.90		C	9	5.90	GRANITE	D	U	NO	60.5	84.0	84.0	81.0	30.5	82.5	4.5	5.6	
BH10	3.80		C	10	3.80	GRANITE	D	U	YES	62.7	83.9	83.9	81.0	6.1	82.4	0.9	1.1	
BH11	3.30		C	11	3.30	GRANITE	D	U	YES	62.2	84.1	84.1	81.0	9.7	82.5	1.4	1.8	
BH12	6.50		C	12	6.50	GRANITE	D	U	YES	80.9	83.9	83.9	79.0	51.8	81.4	7.8	9.7	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise

Detailed legend for test and dimensions, based on ISRM, is shown above.

Size factor, F = (De/50)0.45 for all tests.

LAB 17R Version 4

Date Printed: 14/06/2019

Approved By: Stephen.Watson

UKAS TESTING
10122

CAUSEWAY GEOTECH

RECEIVED: 16/10/2025

APPENDIX H

ENVIRONMENTAL LABORATORY TEST RESULTS

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

UKAS TESTING
2183

Final Report

Report No.:	19-16635-1
Initial Date of Issue:	23-May-2019
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan John Cameron Lucy Newland Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham
Project	19-0472 Kingston Galway

Quotation No.:		**Date Received:**	16-May-2019
Order No.:		**Date Instructed:**	16-May-2019
No. of Samples:	3		
Turnaround (Wkdays):	5	**Results Due:**	22-May-2019
Date Approved:	23-May-2019		

Approved By:

Details: Robert Monk, Technical Manager

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 19-0472 Kingston Galway

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-16635	19-16635	19-16635
Quotation No.:			**Chemtest Sample ID.:**		827612	827617	827624
			Sample Location:		TP01	TP07	TP12
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		0.4	0.6	0.6
			Date Sampled:		13-May-2019	13-May-2019	13-May-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-
Moisture	N	2030	%	0.020	8.6	8.3	24
pH	U	2010		N/A	8.1	7.6	7.7
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	0.019
Cyanide (Free)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	0.50
Thiocyanate	U	2300	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	2.9	1.7	0.91
Sulphate (Total)	U	2430	%	0.010	0.063	0.021	0.30
Arsenic	U	2450	mg/kg	1.0	5.3	6.3	12
Cadmium	U	2450	mg/kg	0.10	0.10	< 0.10	0.27
Chromium	U	2450	mg/kg	1.0	6.9	8.1	17
Copper	U	2450	mg/kg	0.50	17	17	24
Mercury	U	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	5.2	7.8	5.3
Lead	U	2450	mg/kg	0.50	18	25	49
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20	0.79
Zinc	U	2450	mg/kg	0.50	22	32	51
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	2.2	< 0.40	11
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	1.8
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	74
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	76
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 19-0472 Kingston Galway

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-16635	19-16635	19-16635
Quotation No.:			**Chemtest Sample ID.:**		827612	827617	827624
			Sample Location:		TP01	TP07	TP12
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		0.4	0.6	0.6
			Date Sampled:		13-May-2019	13-May-2019	13-May-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	50
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	2.4
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	52
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	130
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30	1.4	< 0.30

Chemtest
The right chemistry to deliver results

Report Information

Key

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

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

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

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

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

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

UKAS TESTING
2183

Final Report

Report No.:	19-16652-1
Initial Date of Issue:	24-May-2019
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan John Cameron Lucy Newland Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham
Project	19-0472 Kingston Galway

Quotation No.:		**Date Received:**	16-May-2019
Order No.:		**Date Instructed:**	16-May-2019
No. of Samples:	3		
Turnaround (Wkdays):	7	**Results Due:**	24-May-2019
Date Approved:	24-May-2019		

Approved By:

Details: Martin Dyer, Laboratory Manager

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - 2 Stage WAC

Project: 19-0472 Kingston Galway

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-16652								
Chemtest Sample ID:	827657								
Sample Ref:									
Sample ID:									
Sample Location:	TP01								
Top Depth(m):	0.4								
Bottom Depth(m):									
Sampling Date:	13-May-2019								
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%			2.0	3	5	6
Loss On Ignition	2610	U	%			2.7	--	--	10
Total BTEX	2760	U	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	U				8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0050	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.011	0.0079	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0010	0.0013	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0022	0.0026	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0082	0.0033	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	0.0042	< 0.010	0.038	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	0.0010	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.0010	< 0.50	< 0.50	4	50	200
Chloride	1220	U	4.4	1.7	< 10	20	800	15000	25000
Fluoride	1220	U	0.29	0.28	< 1.0	2.8	10	150	500
Sulphate	1220	U	5.2	< 1.0	10	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	170	98	340	1000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	18	20	< 50	190	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	13

Leachate Test Information	
Leachant volume 1st extract/l	0.323
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.181

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 19-0472 Kingston Galway

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-16652								
Chemtest Sample ID:	827658								
Sample Ref:									
Sample ID:									
Sample Location:	TP07								
Top Depth(m):	0.6								
Bottom Depth(m):									
Sampling Date:	13-May-2019								
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%			0.30	3	5	6
Loss On Ignition	2610	U	%			2.4	--	--	10
Total BTEX	2760	U	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	U				7.9	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0050	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.0047	0.0068	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0028	0.0032	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0068	0.0084	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0018	< 0.0010	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	0.012	0.024	0.024	0.23	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	0.0010	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0011	0.0016	< 0.50	< 0.50	4	50	200
Chloride	1220	U	5.9	2.1	12	23	800	15000	25000
Fluoride	1220	U	0.16	0.20	< 1.0	2.0	10	150	500
Sulphate	1220	U	4.7	2.9	< 10	30	1000	20000	50000
Total Dissolved Solids	1020	N	47	29	93	300	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	20	27	< 50	260	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	13

Leachate Test Information	
Leachant volume 1st extract/l	0.324
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.117

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 19-0472 Kingston Galway

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-16652								
Chemtest Sample ID:	827659								
Sample Ref:									
Sample ID:									
Sample Location:	TP12								
Top Depth(m):	0.6								
Bottom Depth(m):									
Sampling Date:	13-May-2019								
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%			9.4	3	5	6
Loss On Ignition	2610	U	%			18	--	--	10
Total BTEX	2760	U	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	U				7.6	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0040	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.0098	0.0073	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0019	0.0016	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.015	0.0075	< 0.050	0.084	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	0.0012	0.0052	< 0.010	0.047	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0034	< 0.0010	< 0.50	< 0.50	4	50	200
Chloride	1220	U	3.1	1.2	< 10	14	800	15000	25000
Fluoride	1220	U	0.17	0.18	< 1.0	1.8	10	150	500
Sulphate	1220	U	8.5	< 1.0	17	10	1000	20000	50000
Total Dissolved Solids	1020	N	160	110	320	1200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	29	24	56	250	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	17

Leachate Test Information	
Leachant volume 1st extract/l	0.315
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.215

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Chemtest
The right chemistry to deliver results

Report Information

Key

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

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

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

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

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

CAUSEWAY GEOTECH

RECEIVED: 16/10/2025

APPENDIX I

SPT HAMMER ENERGY MEASUREMENT REPORT

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Neil Burrows
Southern Testing Laboratories
Unit 11
Charlwoods Road
East Grinstead
RH19 2HU

SPT Hammer Ref:	0193
Test Date:	23/02/2019
Report Date:	26/02/2019
File Name:	0193.spt
Test Operator:	NPB

Instrumented Rod Data

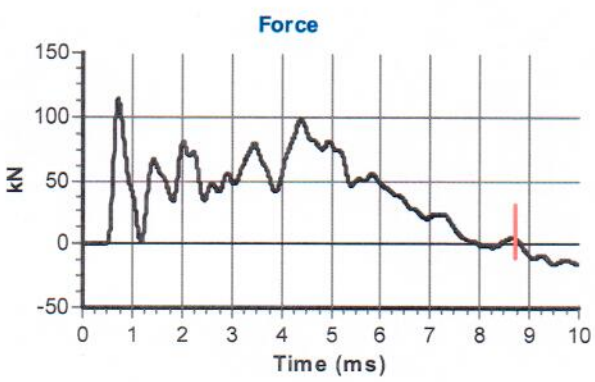
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	6458
Accelerometer No.2:	9607

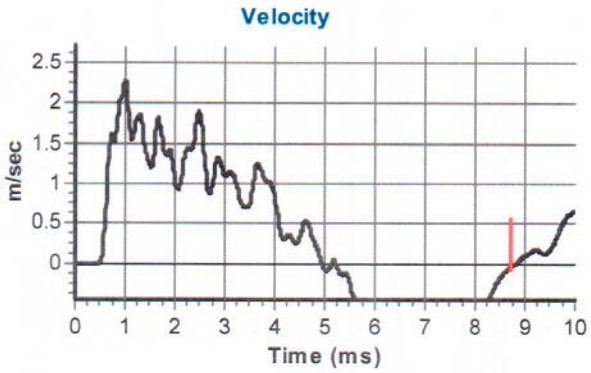
SPT Hammer Information

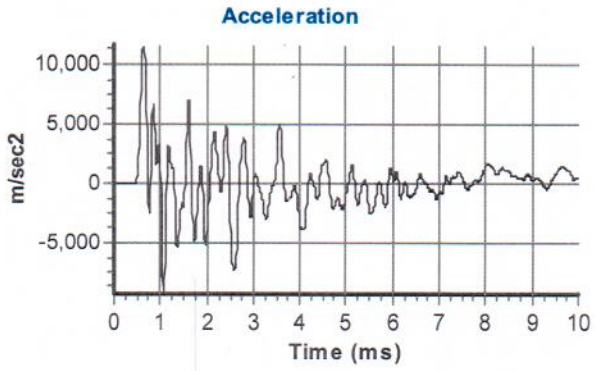
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location

CAUSEWAY







Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	296

Energy Ratio E_r (%): **63**

The recommended calibration interval is 12 months

Signed: N P Burrows

Title: Field Operations Manager

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Neil Burrows
Southern Testing Laboratories
Unit 11
Charlwoods Road
East Grinstead
RH19 2HU

SPT Hammer Ref:	0267
Test Date:	23/02/2019
Report Date:	26/02/2019
File Name:	0267.spt
Test Operator:	NPB

Instrumented Rod Data

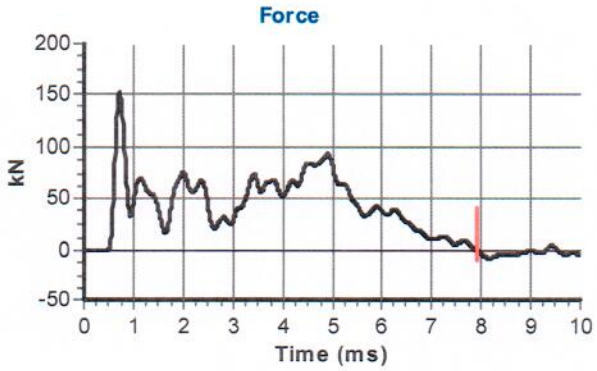
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	6458
Accelerometer No.2:	9607

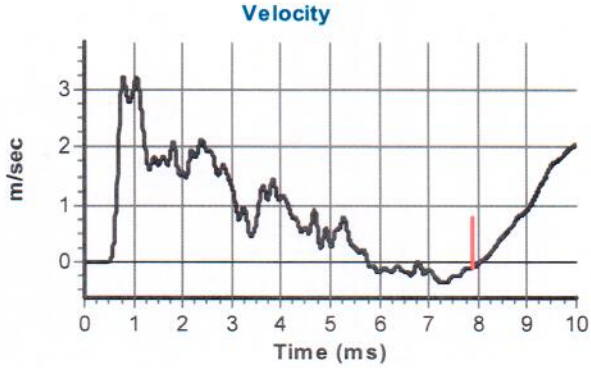
SPT Hammer Information

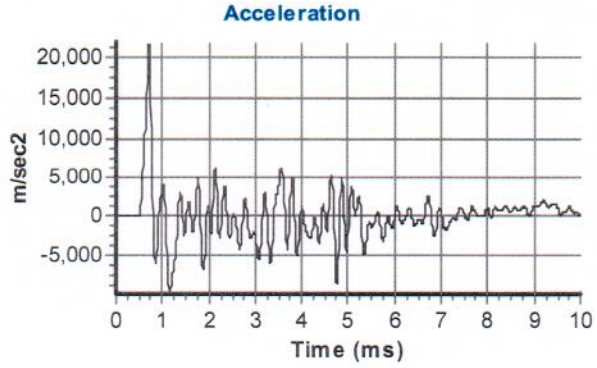
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

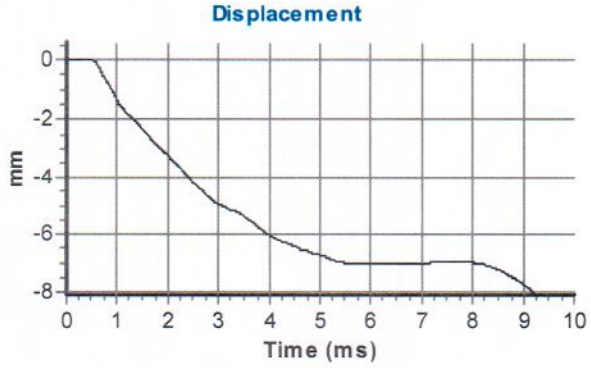
Comments / Location

CAUSEWAY









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	407

Energy Ratio E_r (%): **86**

Signed: N P Burrows

Title: Field Operations Manager

The recommended calibration interval is 12 months