West Offaly Power Station and the Ash Disposal Facility – Site Investigation: Interpretative Report

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Client's Representative:	Bord na Móna
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CONTENTS

Document Control Sheet

Note on: Methods of describing soils and rocks & abbreviations used on exploratory hole logs

1 AUTHORITY 5

2 SCOPE 5

3 DESCRIPTION OF SITE 5

4 SITE OPERATIONS 6
4.1 Summary of site works 6
4.2 Boreholes 6
4.2.1 Boreholes by combined percussion boring and rotary follow-on drilling 7
4.2.2 Rotary drilled boreholes 7
4.3 Standpipe installations 8
4.4 Trial pits 8
4.5 Slit trenches 8
4.6 Dynamic probes 9
4.7 Surveying 9
4.8 Ground water and ground gas monitoring 9

5 LABORATORY WORK 9
5.1 Geotechnical laboratory testing of soils 9
5.2 Geotechnical laboratory testing of rock 10
5.3 Environmental laboratory testing of soils 10

6 GROUND CONDITIONS 11
6.1 General geology of the area 11
6.2 Ground types encountered during investigation of the site: WOP Station 11
6.3 Ground types encountered during investigation of the site: WOP ADF 12
6.4 Groundwater 12

7 DISCUSSION 14
7.1 Proposed construction 14
7.2 Recommendations for construction 14
7.2.1 Foundations and ground floor construction: Power Station Site 14
7.2.2 Foundations slab construction: Power Station Site – Laydown Area 16
7.2.3 West Offaly Power Station - Ash Disposal Facility 19
7.2.4 Soil aggressivity 20
7.3 Material re-usability 21

8 REFERENCES 22

APPENDICES

Appendix A	Site and exploratory hole location plans
Appendix B	WOP borehole logs
Appendix C	WOA borehole logs
Appendix D	WOP probe logs
Appendix E	WOA probe logs
Appendix F	WOP core photographs
Appendix G	WOP trial pit logs
Appendix H	WOA trial pit logs
Appendix I	WOP trial pit photographs
Appendix J	WOA trial pit photographs
Appendix K	WOP slit trench logs and drawings
Appendix L	WOP slit trench photographs
Appendix M	Geotechnical laboratory test results
Appendix N	SPT hammer energy measurement report

Document Control Sheet

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The works were conducted in accordance with:

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

IS 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 1377-2:1990, BS EN ISO 17892-1:2014, and BS EN ISO 17892-2:2014

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
D	Small disturbed sample
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT	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
Abbreviations relating to rock core – reference Clause 44.4.4 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.

West Offaly Power Station and The Ash Disposal Facility

1 AUTHORITY

On the instructions of Bord na Móna ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical information for input to the design of an upgrade to the existing Power Station and the construction of bunding and storage facilities at the Ash Disposal Facility.

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 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, included boreholes by cable percussion boring and rotary drilling, trial pits, slit trenches, soil 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 on the site of West Offaly Power Station and Ash Disposal Facility near Shannonbridge, Co. Offaly.

The Power Station is bordered to the north, east and south by farmland and to the southwest by the River Shannon. The works were conducted in the northern end of the site, both inside the perimeter fence and also in a rough area of ground to the north.

The Ash Disposal Facility is located 6.30km to the east of the power station. Access is by railway or via gravel road. The site is bordered on all sides by bog land.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 23rd of January and 10th of March 2017, included:

- six light cable percussion boreholes with rotary follow on drilling in two of the boreholes in the power station
- six boreholes by rotary open hole drilling in the power station
- three light cable percussion boreholes in the ash disposal facility
- two boreholes by rotary open hole drilling in the ash disposal facility
- a standpipe installation in six boreholes in the power station
- a standpipe installation in two boreholes in the ash disposal facility
- eight machine dug trial pits in the power station
- ten machine dug trial puts in the ash disposal facility
- two machine dug slit trenches in the power station
- twenty-seven dynamic probes in the power station
- twenty dynamic probes in the ash disposal facility

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 twelve boreholes were put down through soils and rock strata to their completion depths by a combination of methods, including light cable percussion boring by Dando 2000 rigs, and rotary drilling by a Beretta T44 tracked rotary drilling rig.

The borehole logs state the methodology and plant used for each location, as well as the appropriate depth ranges.

A summary of the boreholes, subdivided by category in accordance with the methods employed for their completion, is presented in the following sub-sections.

4.2.1 Boreholes by combined percussion boring and rotary follow-on drilling

Six boreholes were put down initially by light cable percussion boring. Two of the boreholes were subsequently continued to their completion by rotary follow on techniques with core recovery in bedrock.

Where the cable percussion borehole had not been advanced onto bedrock, rotary percussive methods were employed to advance the borehole to completion/bedrock. Symmetrix cased full-hole drilling was used, with SPTs carried out at standard intervals as required.

Hand dug inspection pits were carried out between ground level and 1.2m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Standard penetration tests were carried out in accordance with EC7 at standard depth intervals throughout the overburden using the split spoon sampler (SPT) or solid cone attachment (SPT(C)). 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.

Where coring was carried out within bedrock strata, conventional coring methods were used with a metric T2-101 core barrel. This produced core of nominal 84mm diameter, which was placed in triple 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 borehole logs, with core photographs presented in Appendix D.

4.2.2 Rotary drilled boreholes

Six boreholes were put to their completion by rotary drilling techniques only. The boreholes were completed using a Beretta T44 tracked rotary drilling rig.

Symmetrix-cased full hole rotary percussive drilling techniques were employed to advance the boreholes to bedrock or completion. Rotary coring was employed to recover core samples of the bedrock in five of the boreholes.

The core was extracted in up to 1.5m lengths using a metric T2-101 core barrel, which produced core of nominal 84mm diameter, and was placed in triple 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 borehole logs, with core photographs presented in Appendix D.

4.3 Standpipe installations

A groundwater monitoring standpipe was installed in six boreholes.

Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

Following the completion of the intrusive investigation work groundwater monitoring was undertaken at the site on three occasions.

4.4 Trial pits

Eighteen trial pits were excavated using a 11t tracked excavator fitted with a 600mm wide bucket, to depths of up to 4.00m.

Environmental samples were taken in each trial pit. Disturbed (small jar and bulk bag) samples were taken at standard depth intervals and at change of strata for geotechnical purposes.

Any water strikes encountered during excavation were recorded with details shown in the trial pit logs. The stability of the trial pit walls was noted on completion.

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

4.5 Slit trenches

Two slit trenches were excavated using a combination of hand digging and mechanical excavation using a compact 3t tracked excavator fitted with a 600mm wide toothless bucket, to locate and identify buried services at the site.

Drawing of the trenches and the locations of services encountered during excavation are shown on the slit trench logs in Appendix G, with photographs presented in Appendix H.

4.6 Dynamic probes

Forty-seven dynamic probes were conducted using the DPSH-B method as described in BSEN ISO 22476-2. The method entails a 63.5kg hammer falling 0.75m onto a 90° cone of 50.5mm diameter.

Appendix C provides the dynamic probe logs in the form of plots, against depth, of the number of blows per 100mm penetration.

4.7 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 Transverse Mercator) 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.

4.8 Ground water and ground gas monitoring

Following completion of site works, ground water monitoring was conducted in three rounds. Ground water monitoring was carried out using a water interface probe.

Groundwater monitoring records are presented in Section 6.3.

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.
- **shear strength** (total stress): unconsolidated undrained triaxial tests and lab vanes
- **compaction related:** Moisture Condition Value and MCV relationship, California bearing ratio tests

- **soil chemistry:** pH, water soluble sulphate content and organic matter content

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

The test results are presented in Appendix I.

5.2 Geotechnical laboratory testing of rock

Laboratory testing of rock sub-samples comprised:

- point load index
- unconfined compressive strength (UCS) tests

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
Uniaxial compression strength tests	ISRM Suggested Methods (1981) Suggested method for determining deformability of rock materials in uniaxial compression, Part 2 and ISRM (2007) Ulusay R, Hudson JA (eds) The complete ISRM suggested methods for rock characterization, testing and monitoring, 2007

The test results are presented in Appendix I.

5.3 Environmental laboratory testing of soils

In addition, environmental testing was conducted on selected environmental soil and water samples.

Results of environmental laboratory testing are presented in a separate environmental report.

6 GROUND CONDITIONS

6.1 General geology of the area

According to the published geological records for the power station site, superficial deposits in the area consist of glacial tills overlain by peat. There are also areas of alluvium associated with the River Shannon. The underlying bedrock is composed of argillaceous limestones of the Lucan Formation and Waulsortian Formation.

The site at the ash disposal facility is overlain again by glacial tills overlain by peat. The predominant bedrock is composed of massive unbedded lime-mudstone of the Waulsortian Formation.

6.2 Ground types encountered during investigation of the site: WOP Station

A summary of the ground types encountered in the exploratory holes at the power station are listed below, in approximate stratigraphic order:

- **Topsoil:** encountered in up to 0.50m thickness
- **Made Ground (sub-base):** approximately 1.00m to 2.00m of aggregate fill over ash deposits in numerous boreholes
- **Made Ground (fill):** ash rich deposits varying in colour and stiffness, described on the individual exploratory hole logs
- **Recent deposits:** spongy peat deposits overlaying both tills derived from bedrock and more recent fluvioglacial deposits
- **Fluvioglacial deposits:** typically medium dense sands and gravels with localised pockets of firm sandy gravelly clays interspersed throughout.
- **Glacial Till:** sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.
- **Bedrock (Limestone):** Rockhead was encountered at depths ranging from 3.70m in WOP-BH03/17 to 11.30m in borehole WOP-BH03/17

6.3 Ground types encountered during investigation of the site: WOP ADF

A summary of the ground types encountered in the exploratory holes at the ash disposal facility are listed below, in approximate stratigraphic order:

- **Recent deposits:** spongy peat deposits overlaying both tills derived from bedrock and more recent fluvioglacial deposits
- **Glacial Till:** sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.

6.4 Groundwater

At the West Offaly Power Station groundwater was encountered during boring through soil as water strikes in six boreholes. None of the water strikes were coincident with rockhead with the exception of WOP-BH05/17 where a water strike was recorded at 6.80m. Groundwater was encountered as seepage in two trial pits ranging from 1.50m in WOPTP02 to 3.50m in WOPTP01.

At the Ash Disposal Facility groundwater was encountered in two out of five boreholes and were not coincident with rockhead. Groundwater strikes were also recorded in six of the trial pits at a range of depths.

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.

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

Subsequent groundwater monitoring of the standpipe installations recorded water levels as shown in Table 2 for the Power Station and in Table 3 for the Ash Disposal Facility.

Table 1: Groundwater monitoring (WOP Station)

Date	Water level					
	WOP-BH02/17	WOP-BH04/17	WOP-BH05/17	WOP-BH06/17	WOP-BH09/17	WOP-BH11/17
07/03/2017	4.12	3.87		4.52	4.83	2.82
20/03/2017	4.45	4.00	3.95	4.70	5.25	3.00
28/03/2017	4.67	4.00	4.03	4.90	5.30	3.15

Table 3: Groundwater monitoring (WOP ADF)

Date	Water level		
	WOA-BH01/17	WOA-BH02A/17	WOA-BH03/17
07/03/2017	0.62	0.58	
20/03/2017	0.65	0.62	3.12
28/03/2017	0.71	0.74	3.07

7 DISCUSSION

7.1 Proposed construction

It is proposed to construct an upgrade to the existing Power Station, and also construct bunding and storage facilities at the Ash Disposal Facility.

No further details were available to Causeway Geotech at the time of preparing this report.

7.2 Recommendations for construction

7.2.1 Foundations and ground floor construction: Power Station Site

Foundations should transfer loading to below any Made Ground or subsoil. The recommended foundation construction and estimated allowable bearing pressure (ABP) at the six borehole locations within the area of the Power Station Site are presented in Table 4 below.

The thickness of peat and heterogenous Made Ground deposits makes the implementation of traditional shallow (spread) foundations unsuitable. Consequently the most practicable foundation solution across the site involves the transfer of loading to depth by piling. However, if the site levels were to be reduced, then spread foundations may be considered a viable option on the site.

Table 4: Construction recommendations for power station building units/structures

Borehole	Depth Below EGL* to Suitable Bearing Stratum	Estimated ABP (kPa)	Strata description	Foundation type	Ground floor construction	Groundwater
WOP-BH07/17	3.7	>500	Limestone bedrock	Piled	Suspended	Not encountered during drilling
WOP-BH08/17	5.3	>500	Limestone bedrock	Piled	Suspended	Not encountered during drilling

Borehole	Depth Below EGL* to Suitable Bearing Stratum	Estimated ABP (kPa)	Strata description	Foundation type	Ground floor construction	Groundwater
WOP-BH09/17	3.70	>500	Limestone bedrock	Piled	Suspended	Water strike at 14.2m during drilling. SWL in standpipe ranging between 4.8-5.2mBGL
WOP-BH10/17	3.80	>500	Limestone bedrock	Piled	Suspended	Not encountered during drilling
WOP-BH11/17	3.80	>500	Limestone bedrock	Piled	Suspended	Not encountered during drilling. SWL in standpipe ranging between 2.8-3.2mBGL
WOP-BH12/17	5.30	>500	Limestone bedrock	Piled	Suspended	Not encountered during drilling.

7.2.1.1 Piled foundations

Piling to transfer loadings to depth is suggested to be the most practicable and applicable option given the variation in depth to a consistent bearing stratum across the site, coupled with the relatively shallow water table which would be problematic for any open trench shallow foundation systems.

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 glacial deposits where present in significant thickness, and end bearing on the limestone 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 – such as the peat.

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.

7.2.1.2 Spread foundations

Where site levels are being reduced, the implementation of spread foundations will be possible. For a consistent bearing stratum, it is suggested that any spread foundations (strip/pad/trench) should bear onto the limestone bedrock. Without cognisance of the proposed formation levels, the depths of excavation for foundations are unknown.

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 generally fine grained/cohesive nature of the soils beneath the overlying recent/made ground deposits, excavations for foundations through the Glacial Till deposits are likely to be relatively stable. However, any 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.

The use of ground bearing floor slabs is 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.

Where excavation of the limestone bedrock is required to achieve formation levels, the excavatibility of the rock must be considered. In following the guidance of Pettifer and Fookes, an assessment on excavatibility using the parameters of point load strength Is(50) and fracture spacing has been used. In applying these principles, it can be seen that the "excavation envelope" derived from the point load test data and fracture spacing suggests that the majority of rock will be excavated by hard ripping with some areas possibly requiring hydraulic breaking, where the formation levels are extending well below the uppermost weathered rockhead zone..

7.2.2 Foundations slab construction: Power Station Site – Laydown Area

Foundations should transfer loading to below any Made Ground or subsoil. The recommended foundation construction and estimated allowable bearing pressure (ABP) at the six borehole locations within the area of the proposed laydown area are presented in Table 5 below.

The thickness of peat and low strength, heterogenous Made Ground deposits makes the implementation of traditional shallow (spread) foundations unsuitable, further bolstered by the presence of shallow groundwater. Consequently, the most practicable foundation solution to support the slab is to transfer loading to depth, either by piling or by ground improvement methods such as vibro-compaction.

Table 5: Construction recommendations for slab

Borehole	Depth Below EGL* to Suitable Bearing Stratum	Estimated ABP (kPa)	Strata description	Foundation type	Slab construction	Groundwater
WOP-BH01/17	~6.6 – 7.6	500	Possible bedrock	Piled	Suspended	Not encountered during drilling
WOP-BH02/17	9.6	500	Possible Limestone bedrock	Piled	Suspended	Water strike at 7.5m during drilling
WOP-BH03/17	11.30	500	Limestone bedrock	Piled	Suspended	Water strikes at 1.8m, 7.1m and 14.3m during drilling
WOP-BH04/17	>7.2	500	Possible Limestone bedrock	Piled	Suspended	Water strike at 5.5m during drilling
WOP-BH05/17	6.8	500	Limestone bedrock	Piled	Suspended	Water strike at 6.8m during drilling
WOP-BH06/17	11.2	500	Possible Limestone bedrock	Piled	Suspended	Water strikes at 5.9m and 7.7m during drilling

Piling to transfer loadings to depth is suggested to be the most practicable and applicable option given the variation in depth to a consistent bearing stratum across the site, coupled with the relatively shallow and variable groundwater which would be problematic for any spread foundation systems. The variability of the overburden and the presence of low strength anthropogenic and recent deposits is likely to render any ground improvement, such as vibro-stone columns, unsuitable at the site.

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 some capacity from shaft friction through the the glacial deposits, where present in reasonable thickness, and end bearing on the weathered limestone 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, such as the peat deposits.

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.

7.2.2.1 Excavations and stockpiling

The excavation of existing placed ash material should make provisions for side wall instability. The heterogenous nature of the placed material, coupled with the underlying peat, renders the stability unpredictable. As noted from the trial pit excavations carried out across the area, some locations were stable throughout excavation, while others collapsed in prior to reaching their scheduled depths. As such, any open cut excavations should make allowance for limiting the duration of being open, battering back side slopes at 2 vertical to 1 horizontal, and for control of groundwater by sump and pumping. Shoring may also be required, especially where planning to excavate through significant thickness of very soft Made Ground / recent deposits and where shallow groundwater is likely to be encountered.

If stockpiling excavated ash material and recent deposits, the following recommendations for good construction practices are suggested:

- A free-draining granular retaining berm should be constructed on the downslope side of the stockpiles using suitable granular fill material, nominal 100mm diameter, maximum diameter 300mm (grading Class 1A or similar approved grading). This will prevent oversaturation of the peat, allow consolidation and prevent build-up of pore pressure behind the berm.
- The berm should be constructed with a maximum outer slope of 1 in 1 to prevent instability.
- Silt fencing should be provided around the toe of the berms and check drains will be provided along outflow channels.
- A minimum freeboard of 0.5m should be constructed to prevent overtopping of the berm.
- Regular checks should be undertaken with additional surface profiling and/or extra drainage channels being provided as required to prevent surface ponding.

Ongoing monitoring of the stockpiles should include the following:

- Movement monitoring posts shall be placed at regular intervals along the crest of the stability berms and along the toe of the berms immediately after construction.
- A weekly site walkover should be undertaken during construction and monthly surveys post-construction by the geotechnical/drainage clerk-of-works to check for signs of movement along the monitoring posts, evidence of ponding or seepage, cracking, erosion or bulging within the berms.
- Monthly ground level surveys of the stockpiled material surface, berm and monitoring posts should be undertaken to check for evidence of peat or other ground movement and to check for consolidation of the peat and berms.

7.2.3 West Offaly Power Station - Ash Disposal Facility

It is understood that it is proposed to construct five additional cells in the area of the existing Ash Disposal Facility. The likely construction methods will involve the excavation of the peat for removal, the construction of an earthen bund around each cell to a height of circa 3m above ground level, with the cells then lined with a geotextile membrane.

Once the peat has been removed, any bunds may be constructed bearing onto the underlying glacial till, which is typically very stiff, with an allowable bearing pressure in excess of 300kPa, as derived from the SPT N values.

Refer to section 7.3 of this report for a discussion on the suitability of the glacial till for usability in earthworks.

7.2.3.1 Excavations in peat

The peat contouring plan presented in Appendix I shows that there is a blanket covering of peat across the extent of the site, ranging in thickness from less than 0.5m up to 3.8m. Its thickness is quite variable, as derived from the borehole, trial pit and inferred from the dynamic probing logs.

Generally speaking, where peat is present in excess of 2.5m thickness, it is known to pose problems in excavations. The thickness of peat present across the site typically falls above this threshold, and as such there exists a risk with regard to peat slide potential.

7.2.3.1.1 Mitigation measures

To further reduce the risk for peat slide potential, a number of mitigation measures may be adopted:

- Spoil heaps should not be spread over existing peat layers in thickness >0.5m, and should not be placed downslope of adjacent peat. Instead, it should be deposited on the flanks of the excavation

and spread out to limit the surcharge pressure on sensitive peat

- Maintain vigilance of open excavations during and after periods of prolonged precipitation, where risk of mobility of peat is greatest
- Trench support systems should be employed – locally trench boxes should suffice, in regions of laterally extensive peat then a more fixed shoring system should be installed.
- The duration that the excavation is open should be limited
- A comprehensive monitoring regime should be set up during construction works such that ground movement and groundwater conditions are being constantly monitored by a qualified, competent and experienced professional.

7.2.4 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 (2005).

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 development and not perceived as containing pyrite;
- Sites not subjected to previous 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 having been subject to previous 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.

7.3 Material re-usability

In assessing the reusability of soil several approaches may be considered. Most commonly, the following parameters are used:

a) moisture content and the plastic limit / moisture content ratio of potential Cohesive Fill: an upper bound ratio of 1.2 is often adopted.

b) undrained shear strength (undisturbed and remoulded) of potential Cohesive Fill: a lower bound strength of 50kPa is often adopted.

c) Moisture Condition Value (MCV) of potential Cohesive Fill: a lower bound MCV of 8 is often adopted.

d) California Bearing Ratio (CBR) of potential Cohesive Fill: a lower bound CBR of 2% is often adopted.

e) measured SPT *N*-value of potential Cohesive Fill: a lower bound value of 12 is often adopted, using the published relationships between *N*-value and c_u, Clayton (1995). However, the individual blow counts need to be examined to allow assessment of whether *N*-values have been elevated by the presence of coarse gravel or cobbles.

f) particle size distribution, in particular the fines content, of potential Granular Fill.

g) moisture content of potential Granular Fill as reflected by laboratory test results and the records of groundwater strikes in coarse grained soils

h) coefficient of uniformity, C_u, of granular material.

Allowance will also have to be made of construction expedients and their impact on the proportion of reusable soil, including:

- the effects of weathering of the near surface soils
- the presence of moisture susceptible soils
- the difficulties of separating layers and lenses of potential Granular and Cohesive Fill
- the presence of groundwater in lenses and layers of coarse grained soils.

Note that not all the aforementioned parameters are applicable in each case, more so a combination of those most applicable.

In assessing its suitability for use as fill, reference is made to the in-situ test results and the laboratory testing conducted on representative disturbed samples obtained from the trial pits and boreholes during the ground investigation.

It is likely given the low strength, high natural moisture content and occasional organic nature of the upper soils, coupled with the low MCV value that the recent deposits or anthropogenic deposits will not be suitable for re-use as fill.

The above assessment is based on the information gleaned from the investigation points. When carrying out excavation works, further on site testing should be conducted to verify the type/classification and suitability of fill material.

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: 2002: Geotechnical investigation and testing - Identification and classification of soil - Part 1 Identification and description. British Standards Institution.

BS EN ISO 22282-2: 2012: Geotechnical investigation and testing – Geohydraulic testing – Part 2: Water permeability tests in a borehole using open systems.

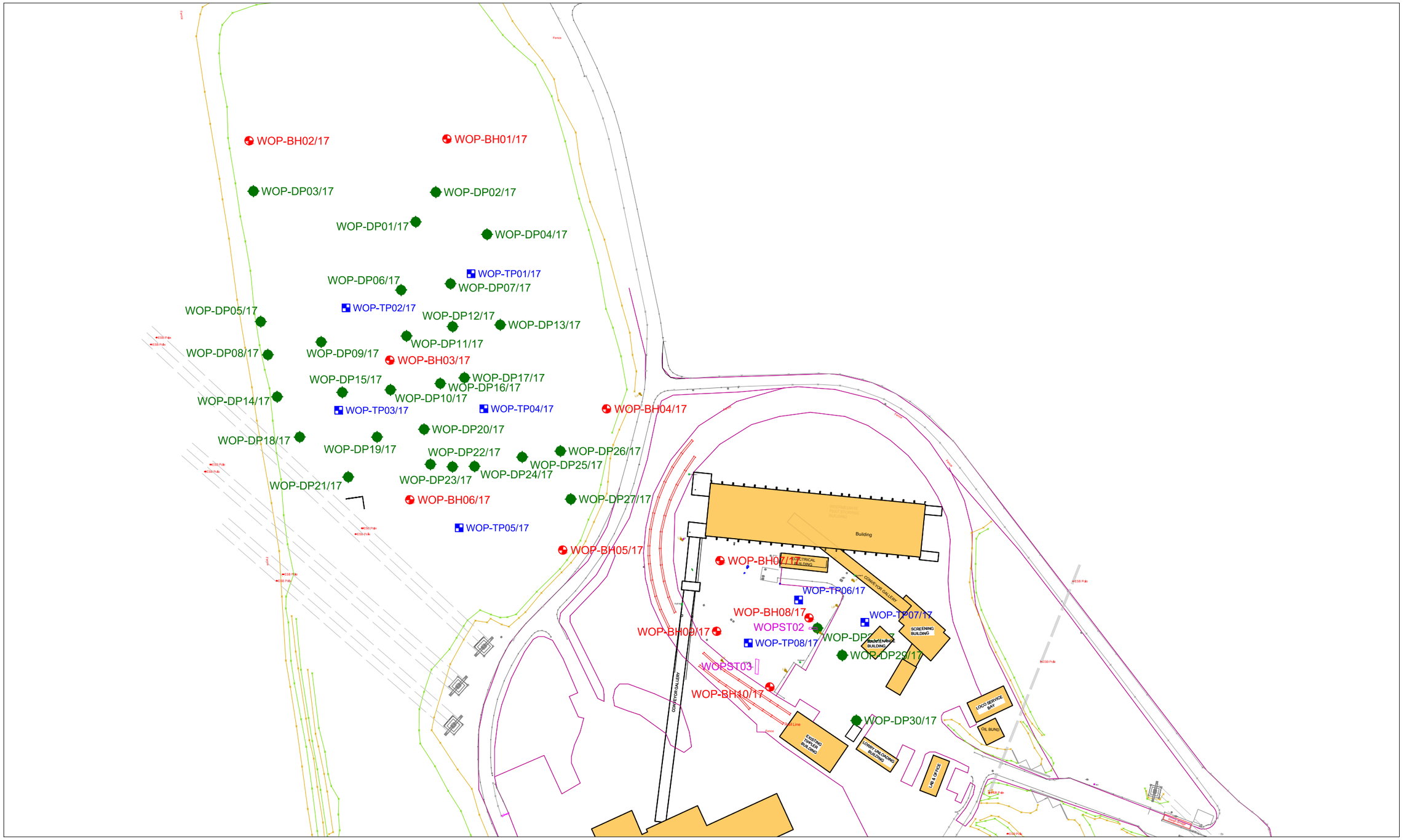
Construction Industry Research and Information Association (CIRIA). 1993. Research Project 369. The Standard Penetration Test (SPT): Methods and Use. CIRIA. London.

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

CAUSEWAY GEOTECH

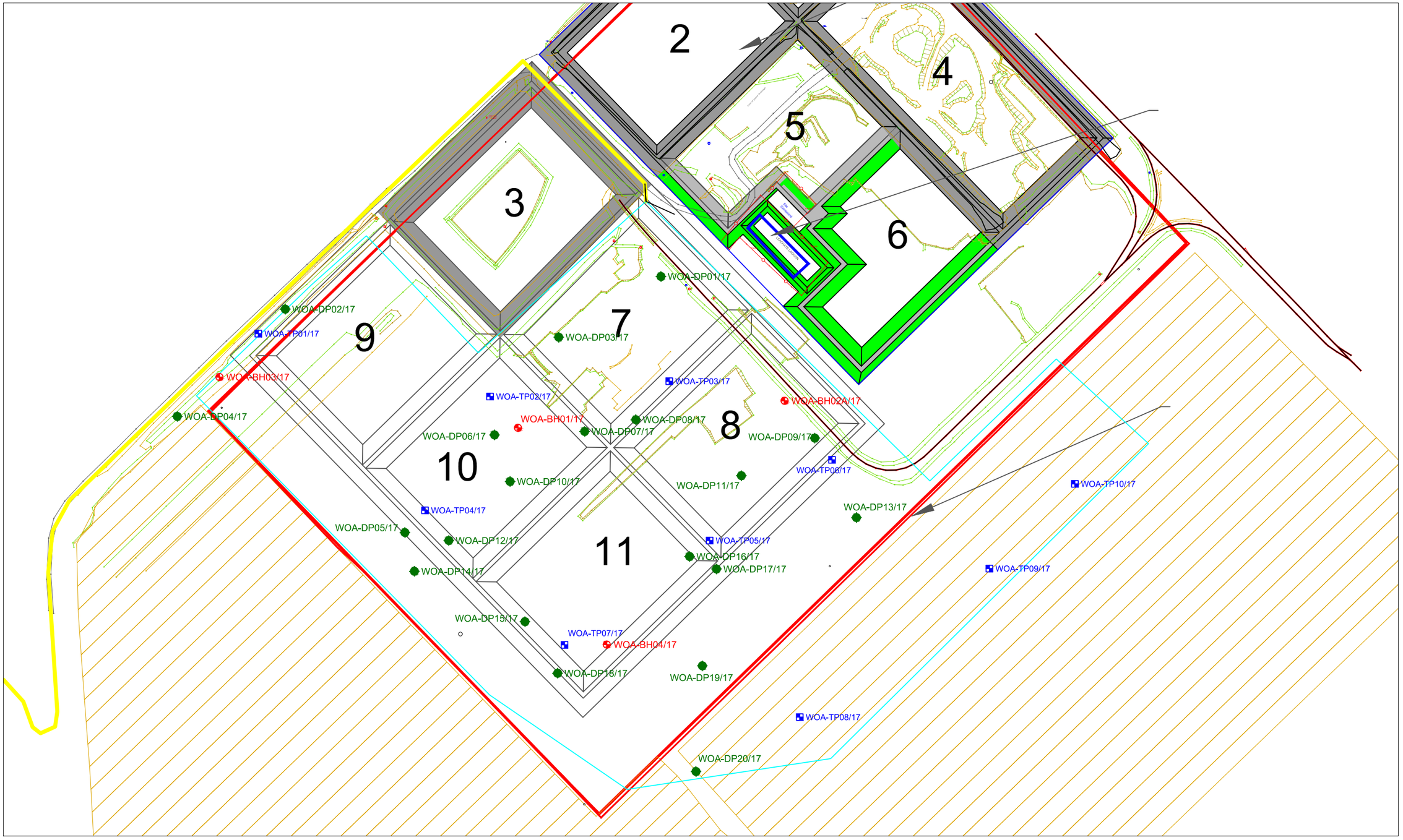
APPENDIX A

Site and exploratory hole location plans



PROJECT: West Offaly Power Station and the Ash Disposal Facility		TITLE: Exploratory hole location plan			
CLIENT: Bord Na Mona	KEY: Borehole; Dynamic Probe; Trial Pit	CAUSEWAY GEOTECH	SCALE: NTS@A3	DATE: 20/04/2017	
ENGINEER: Bord Na Mona			DRWN: BS CHCK: CH	SERIES: 1 of 3	DWG No: 16-1239-EHL-001

PROJECT: West Offaly Power Station and the Ash Disposal Facility		TITLE: Exploratory hole location plan			
CLIENT: Bord Na Mona	KEY: Borehole; Dynamic Probe; Trial Pit	CAUSEWAY GEOTECH	SCALE: NTS@A3	DATE: 20/04/2017	
ENGINEER: Bord Na Mona			DRWN: BS CHCK: CH	SERIES: 2 of 3	DWG No: 16-1239-EHL-002



PROJECT: West Offaly Power Station and the Ash Disposal Facility		TITLE: Exploratory hole location plan			
CLIENT: Bord Na Mona	KEY: Borehole; Dynamic Probe; Trial Pit	CAUSEWAY GEOTECH	SCALE: NTS@A3	DATE: 20/04/2017	
ENGINEER: Bord Na Mona			DRWN: BS; CHCK: CH	SERIES: 3 of 3	DWG No: 16-1239-EHL-003

CAUSEWAY GEOTECH

APPENDIX B

WOP borehole logs

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH01/17
Coordinates: 597116.78 E 725198.78 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Cable Percussion	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Dando 2000	**Ground Level:** 40.13 mOD	**Dates:** 22/02/2017 - 22/02/2017	**Driller:** IS **Logger:** CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					39.93	(0.20) 0.20		TOPSOIL		
0.50 - 1.00	B1					(1.50)		MADE GROUND - Very stiff, locally firm thinly laminated dark grey and pinkish grey SILT (ash)		
1.20 - 1.70	U2			Ublow=18 100%						
1.70 - 1.90	B3				38.43	1.70 (0.50)		MADE GROUND - Dark grey slightly silty sandy subangular fine to coarse GRAVEL. Sand is fine to coarse.		
2.20 - 2.70	B4				37.93	2.20		MADE GROUND - Soft to firm thinly laminated dark grey and grey SILT (ash)		
2.20 - 2.65	SPT (C) N=10	2.20	Dry	N=10 (1,4/3,2,2,3)						
3.20 - 3.70	U5			Ublow=21 100%		(3.00)				
4.20 - 4.70	B6									
4.20 - 4.65	SPT (C) N=5	4.20	Dry	N=5 (1,2/1,1,2,1)						
5.20 - 5.70	B7				34.93	5.20		MADE GROUND - Stiff dark grey SILT (ash)		
5.20 - 5.65	SPT (C) N=23	4.20	Dry	N=23 (2,3/3,4,7,9)		(0.70)				
6.00 - 6.50	B8				34.23	5.90		Very dense dark grey clayey subangular to subrounded fine to coarse GRAVEL with high cobble content.		
6.00 - 6.45	SPT (C) N=52	6.00	Dry	N=52 (10,10/11,11,13,17)		(0.70)				
					33.53	6.60		End of Borehole at 6.60m		

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
6.60	150	6.60	1.70	01:00

CAUSEWAY GEOTECH	Project No.: 16-1239	Project Name: West Offaly Power station and the Ash Disposal Facility	Borehole No.: WOP-BH02/17
	Coordinates: 597008.21 E 725197.80 N	Client: Bord Na Mona	Sheet 1 of 1
Method: Cable Percussion		Client's Representative: Bord Na Mona	Scale: 1:50
			Driller: IS
Plant: Dando 2000	Ground Level: 39.63 mOD	Dates: 22/02/2017 - 22/02/2017	Logger: CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					39.43	(0.20) 0.20		TOPSOIL		
0.50 - 1.00	B1					(0.80)		MADE GROUND - Soft dark grey slightly sandy slightly gravelly CLAY with many rootlets. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium.		
1.00 - 1.45	SPT (C) N=13			N=13 (1,4/3,4,3,3)	38.63	1.00		MADE GROUND - Firm to stiff dark grey slightly sandy slightly gravelly CLAY with many rootlets. Sand is fine. Gravel is subangular to subrounded fine to medium.		
1.20 - 1.70	B11									
2.00 - 2.50	U2			Ublow=12 100%		(2.20)				
2.50 - 2.70	D3									
3.20 - 3.65	SPT (C) N=6			N=6 (2,3/2,1,2,1)	36.43	3.20		MADE GROUND- Very soft to soft ark grey slightly sandy slightly gravelly CLAY with many rootlets. Sand is fine. Gravel is subangular to subrounded fine to medium.		
4.00 - 4.50	U4			Ublow=14 100%		(1.30)				
					35.13	4.50		MADE GROUND - Very soft brown CLAY with closely spaced thick laminations of fine to coarse sand.		
5.00 - 5.50	B5									
5.00 - 5.45	SPT (C) N=3			N=3 (1,1/0,1,1,1)		(1.30)				
5.80 - 6.30	B6				33.83	5.80		Plastic dark brown amorphous PEAT		
						(1.20)				
7.00 - 7.50	B7				32.63	7.00		Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse.		
						(0.50)				
7.50 - 7.95	SPT (C) N=36			N=36 (8,7/6,10,9,11) Water strike at 7.50m	32.13	7.50		Dense dark grey sandy silty subangular to subrounded fine to coarse GRAVEL with high cobble content. Sand is fine to coarse.		
8.50 - 9.00	B8					(2.10)				
9.00 - 9.45	SPT (C) N=54			N=54 (10,10/12,12,13,17)						
9.30 - 9.50	B9									
9.60	B10				30.03 30.03	(0.00) 9.60		BOULDER/Possible BEDROCK		
								End of Borehole at 9.60m		

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		7.50	7.50	20	6.90

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
		9.60		01:00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH03/17
Coordinates: 597084.93 E 725079.17 N	**Client:** Bord Na Mona		Sheet 1 of 2
Method: Cable Percussion+Rotary Drilling+Rotary Coring	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Dando 2000+Beretta T44	**Ground Level:** 40.23 mOD	**Dates:** - 07/03/2017	**Driller:** IS+JR **Logger:** CH+LP

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.30)		TOPSOIL		
					39.93	0.30				
0.50 - 1.00	B1							MADE GROUND - Soft dark grey slightly sandy slightly gravelly CLAY with rootlets. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
						(0.90)				
1.20 - 1.70	B2				39.03	1.20				
1.20 - 1.65	SPT (C) N=8	1.20		N=8 (1,0/1,1,2,4)				MADE GROUND - Firm thinly laminated dark grey and grey sandy SILT (ash) Sand is fine to coarse.		
				Water strike at 1.80m					▼	
2.20 - 2.70	B3									
2.20 - 2.65	SPT (C) N=14	1.20		N=14 (2,1/2,2,6,4)						
						(3.00)				
3.20 - 3.70	B4									
3.20 - 3.65	SPT (C) N=14	1.20		N=14 (1,6/4,3,4,3)						
4.20 - 4.70	B5				36.03	4.20				
4.20 - 4.65	SPT (C) N=21	1.20		N=21 (4,3/6,3,6,6)				MADE GROUND - Firm to stiff thinly laminated dark grey slightly gravelly sandy SILT (ash).		
5.20 - 5.70	B6									
5.20 - 5.65	SPT (C) N=11	5.20		N=11 (3,2/3,3,2,3)		(2.30)				
6.50 - 7.00	B7				33.73	6.50			▼	
						(0.60)		Plastic dark brown amorphous PEAT		
7.10	B8				33.13	7.10				
7.10 - 7.55	SPT (C) N=49	7.10		N=49 (11,10/12,10,11,16)		(0.50)		Dense grey clayey subangular to subrounded fine to coarse GRAVEL with medium cobble content.		
						7.60				
				Water strike at 7.10m	32.63			Spongy dark brown amorphous PEAT		
						(3.70)				
10.10 - 10.26	SPT (C)			50 (25 for 85mm/50 for 80mm)						

Remarks

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		1.80	1.80	20	1.80
		7.10	7.10	20	6.60
		14.30	14.30	0	0.00

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
7.60	150			

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH03/17
Coordinates: 597084.93 E 725079.17 N	**Client:** Bord Na Mona		Sheet 2 of 2
Method: Cable Percussion+Rotary Drilling+Rotary Coring	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Dando 2000+Beretta T44	**Ground Level:** 40.23 mOD	**Dates:** - 07/03/2017	**Driller:** IS+JR **Logger:** CH+LP

Depth (m)	Sample / Tests		Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									Spongy dark brown amorphous PEAT		
	100	100	100	10		28.93			Strong dark grey to black argillaceous LIMESTONE. Largely unweathered. Discontinuities: 1. 0 to 10 degree bedding fractures closely to medium spaced (30/230/500) planar, smooth. 2. 70 to 90 degree fractures from 13.10m to 14.10m, medium spaced, undulating, rough, closed, occasionally with light brown and white staining.		
12.30	100	100	86	3			(3.00)				
13.30	100	87	87	6							
14.30					Water strike at 14.3m	25.93	14.30		End of Borehole at 14.30m		
	TCR	SCR	RQD	FI							

Remarks

Water Added	
From (m)	To (m)

Water Strike - General			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.80	1.80	20	1.80
7.10	7.10	20	6.60
14.30	14.30	0	0.00

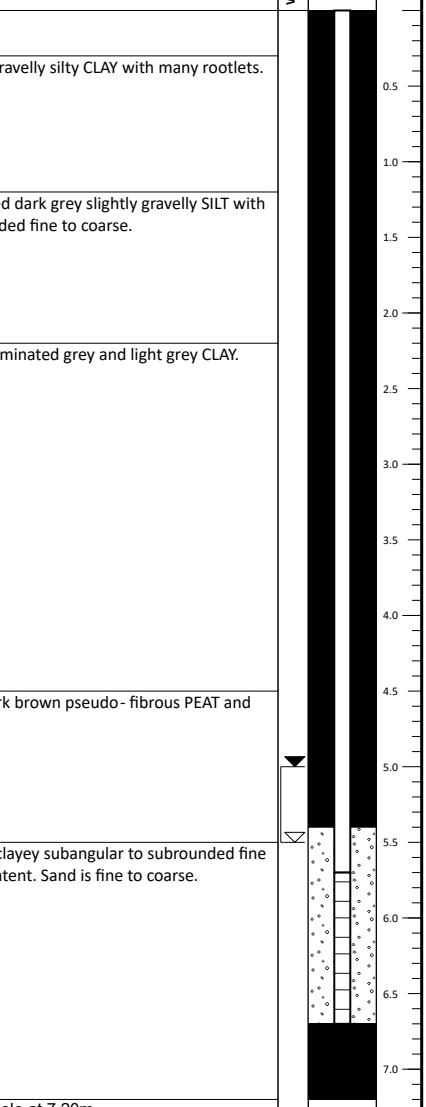
Casing Details	
To (m)	Diam (mm)
7.60	150

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility	**Borehole No.:** WOP-BH04/17
Coordinates: 597204.36 E 725050.75 N	**Client:** Bord Na Mona	Sheet 1 of 1
Method: Cable Percussion	**Client's Representative:** Bord Na Mona	**Scale:** 1:50
Plant: Dando 2000	**Ground Level:** 39.81 mOD	**Dates:** 22/02/2017 - 22/02/2017	**Driller:** IS
			Logger: CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(0.30)		TOPSOIL
					39.51	0.30		MADE GROUND - Soft slightly sandy gravelly silty CLAY with many rootlets. Gravel is subangular fine to coarse
0.50 - 1.20	B1							
						(0.90)		
1.20 - 1.70	B3				38.61	1.20		MADE GROUND - Firm thinly laminated dark grey slightly gravelly SILT with low cobble content. Gravel is subrounded fine to coarse.
	D2							
1.20 - 1.65	SPT (C) N=19	1.20	Dry	N=19 (1,2/4,6,6,3)				
						(1.00)		
2.20 - 2.70	B5				37.61	2.20		MADE GROUND - Soft to firm thinly laminated grey and light grey CLAY.
	D4							
2.20 - 2.65	SPT () N=9	2.20	Dry	N=9 (4,4/3,2,2,2)				
3.20 - 3.70	B6							
3.20 - 3.65	SPT () N=9	3.20		N=9 (2,1/2,2,3,2)		(2.30)		
4.00 - 5.00	B8							
4.20 - 4.70	B7							
4.20 - 4.65	SPT (C) N=4			N=4 (3,1/2,1,1,0)				
					35.31	4.50		MADE GROUND: Mixed pockets of dark brown pseudo- fibrous PEAT and very soft dark grey SILT (ash)
5.00	ES11					(1.00)		
5.50	ES12				34.31	5.50		Dense to very dense dark grey sandy clayey subangular to subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse.
5.50 - 6.00	B9							
5.50 - 5.79	SPT (C)	5.50		50 (25 for 86mm/50 for 200mm) Water strike at 5.50m				
						(1.70)		
6.50 - 7.00	B10							
6.50 - 6.88	SPT (C)			48 (8,8/48 for 225mm)				
7.20 - 7.50	SPT (C)			60 (50 for 75mm/60 for 225mm)	32.61	7.20		End of Borehole at 7.20m



Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		5.50	5.50	20	5.00

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
7.20	150			

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH05/17
Coordinates: 597180.50 E 724973.32 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Cable Percussion+Roatry Drilling+Rotary Coring	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Dando 2000+Beretta T44	**Ground Level:** 39.69 mOD	**Dates:** 22/02/2017 - 22/02/2017	**Driller:** IS+JR **Logger:** CH+LP

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(0.30)		TOPSOIL		
					39.39	0.30		MADE GROUND: Soft grey SILT (ash)		
0.50 - 1.00	B1					(0.70)				
					38.69	1.00		Stiff to very stiff bluish grey slightly sandy slightly gravelly CLAY with high cobble content. Gravel is subangular to subrounded fine to coarse of limestone.		
1.20 - 1.70 1.20 - 1.65	B2 SPT (C) N=40	1.20	Dry	N=40 (11,10/8,11,11,10)						
2.00 - 2.50 2.00 - 2.45	B3 SPT (C) N=30			N=30 (6,6/7,7,8,8)		(2.00)				
3.00 - 3.50 3.00 - 3.45	B4 SPT (C) N=9	3.00	Dry	N=9 (2,1/2,2,3,2)	36.69	3.00		Firm bluish grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine. Gravel is subangular fine to coarse.		
4.00 - 4.50 4.00 - 4.45	B5 SPT (C) N=10			N=10 (4,3/2,2,3,3)		(2.00)				
5.00 - 5.50 5.00 - 5.45	B6 SPT (C) N=33	5.00	Dry	N=33 (3,6/7,8,9,9)	34.69	5.00		Very stiff bluish grey slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse.		
						(1.50)				
5.90 5.90 - 5.95	B7 SPT (C)			50 (25 for 50mm/50 for 0mm)						
				Water strike at 6.8m Water strike at 6.8m	33.19	6.50 (0.30)		Weathered LIMESTONE recovered as angular fine to coarse gravel.		
					32.89	6.80		Strong dark grey to black argillaceous LIMESTONE. Largely unweathered. Discontinuities: 1. 0 to 10 degree bedding fractures typically medium spaced occasionally closely spaced (100/300/700) planar, smooth, closed. 2. Subvertical fractures, [planar, rough, closed with light brown and white staining.		
	100 52 47			2 NI						
7.80	100 95 95			8		(3.00)				
8.80	87 87 87			2 1						
9.80					29.89	9.80		End of Borehole at 9.80m		
	TCR SCR RQD			FI						

Remarks

Terminated at scheduled depth

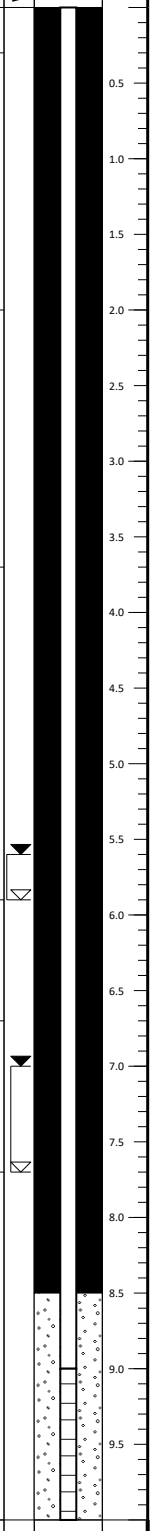
Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		6.80	6.80	0	0.00

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
		5.90		01:00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility	**Borehole No.:** WOP-BH06/17
Coordinates: 597096.41 E 725000.89 N	**Client:** Bord Na Mona	Sheet 1 of 2
Method: Cable Percussion	**Client's Representative:** Bord Na Mona	**Scale:** 1:50
Plant: Dando 2000	**Ground Level:** 40.46 mOD	**Driller:** IS
	Dates: 22/02/2017 - 22/02/2017	**Logger:** CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(0.30)		TOPSOIL
					40.16	0.30		MADE GROUND: Soft to firm thinly laminated dark grey and light grey SILT (ash)
0.50	B1							
1.00 - 1.50	B2							
1.00 - 1.45	SPT (C) N=8	1.00		N=8 (1,2/2,2,2,2)		(1.70)		
2.00 - 2.50	B3				38.46	2.00		MADE GROUND: Firm to stiff thinly laminated dark grey and grey SILT (ash).
2.00 - 2.45	SPT (S) N=18	2.00		N=18 (3,4/4,4,4,6)				
						(1.70)		
3.20 - 3.70	U4			Ublow=33 100%				
3.70 - 3.90	D5				36.76	3.70		MADE GROUND: Very soft to soft thinly laminated dark grey and grey SILT (ash).
4.00 - 4.45	SPT (S) N=3			N=3 (2,1/0,1,1,1)				
						(2.20)		
5.00 - 5.45	SPT (S) N=7			N=7 (1,1/2,2,1,2)				
				Water strike at 5.9m	34.56	5.90		
6.00 - 6.45	SPT (S) N=10			N=10 (3,2/3,2,2,3)				MADE GROUND: Loose to medium dense dark grey very sandy subangular to subrounded fine to coarse GRAVEL. Sand is fine to coarse.
						(0.80)		
6.70 - 6.90	D6				33.76	6.70		Spongy dark brown pseudo-fibrous PEAT.
7.00 - 7.50	U7			Ublow=6 100%				
						(1.00)		
7.50 - 7.70	D8							
				Water strike at 7.70	32.76	7.70		Dense dark grey sandy subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse.
8.50 - 9.00	B9							
8.50 - 8.95	SPT (C)			45 (11,11/12,17,16,)				
						(3.50)		
~~10.00 - 10.50~~	B10							



Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		5.90 7.70	5.90 7.70	20 20	5.60 7.00

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
10.50	200			

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH06/17
Coordinates: 597096.41 E 725000.89 N	**Client:** Bord Na Mona		Sheet 2 of 2
Method: Cable Percussion	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Dando 2000	**Ground Level:** 40.46 mOD	**Dates:** 22/02/2017 - 22/02/2017	**Driller:** IS
			Logger: CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.00 - 10.30	SPT (C)			50 (6,13/50 for 150mm)				Dense dark grey sandy subrounded fine to coarse GRAVEL with low cobble content. Sand is fine to coarse.		
					29.26	11.20		End of Borehole at 11.20m		

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		5.90 7.70	5.90 7.70	20 20	5.60 7.00

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
10.50	200			

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH07/17
Coordinates: 597266.62 E 724967.50 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Rotary Drilling+Rotary Coring	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 40.25 mOD	**Dates:** 01/03/2017 - 01/03/2017	**Driller:** JR **Logger:** CH+LP

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
							(1.20)		MADE GROUND (Drillers description)
						39.04	1.20		PEAT (Drillers description)
							(1.40)		
						37.65	2.60		Grey sandy gravelly CLAY (Drillers description)
							(1.10)		
				9		36.54	3.70		Medium strong dark grey and black argillaceous LIMESTONE. Partially weathered from 3.70m to 5.40m with light brown sand and white staining on fracture surfaces. Discontinuities: 1. 0 to 10 degree bedding fractures closely spaced becoming medium spaced below 5.40m, (60/120/360) planar, smooth, closed with light brown and white staining from 3.70m to 5.40m. 2. 70 to 90 degree fractures at 3.85m, 4.95m and 9.60m, undulating, rough, closed with light brown and white staining.
	100	93	84	2					
4.70				7					
	90	84	60	NI			(3.00)		
5.70									
	100	100	100	3					
6.70						33.54	6.70		End of Borehole at 6.70m
	TCR	SCR	RQD	FI					

Water: Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5

Remarks

Terminated at scheduled depth

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH08/17
Coordinates: 597315.47 E 724936.10 N	**Client:** Bord Na Mona		Sheet 1 of 2
Method: Rotary Coring	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 40.15 mOD	**Dates:** 28/02/2017 - 28/02/2017	**Driller:** JR
			Logger: LP

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
									MADE GROUD: Hardcore fill (Drillers description)		
							(1.20)				
						38.95	1.20		Gravelly CLAY (Drillers description)		
							(2.90)				
						36.05	4.10		Gravelly PEAT (Drillers description)		
							(1.20)				
				10		34.85	5.30		Strong medium bedded dark grey argillaceous LIMESTONE. Largely unweathered: unstained, film of grey clay on some fracture and joint surfaces. Discontinuities: 1. 0 to 30 degree fractures medium spaced (10/220/560) mostly planar but occasionally undulating, smooth, unstained film of grey clay on some fracture surfaces. 2. One 85 t 90 degree joint at 5.40 to 5.50m, planar, smooth, unstained.		
				20							
				5							
				20							
				7							
	100	94	76	3							
				10							
				4							
				7							
6.90				10							
				4							
				10							
	100	99	94	4			(6.00)				
8.40				20							
				2							
	100	97	95	4							
				10							
				7							
				3							
10.00	TCR	SCR	RQD	FI							

Remarks

Terminated at scheduled depth

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility	**Borehole No.:** WOP-BH08/17
Coordinates: 597315.47 E 724936.10 N	**Client:** Bord Na Mona	Sheet 2 of 2
Method: Rotary Coring	**Client's Representative:** Bord Na Mona	**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 40.15 mOD	**Driller:** JR
	Dates: 28/02/2017 - 28/02/2017	**Logger:** LP

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
	100	96	89	12 2 3					Strong medium bedded dark grey argillaceous LIMESTONE. Largely unweathered: unstained, film of grey clay on some fracture and joint surfaces. Discontinuities: 1. 0 to 30 degree fractures medium spaced (10/220/560) mostly planar but occasionally undulating, smooth, unstained film of grey clay on some fracture surfaces. 2. One 85 t 90 degree joint at 5.40 to 5.50m, planar, smooth, unstained.		
11.30						28.85	11.30		End of Borehole at 11.30m		

TCR	SCR	RQD	FI

Remarks

Terminated at scheduled depth

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH09/17
Coordinates: 597264.68 E 724928.83 N	**Client:** Bord Na Mona		Sheet 1 of 2
Method: Rotary Drilling	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 40.78 mOD	**Dates:** 01/03/2017 - 01/03/2017	**Driller:** JR **Logger:** CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(1.20)		MADE GROUND (Drillers description)
					39.58	1.20		
						(1.40)		MADE GROUND: Hardcore fill (Drillers description)
					38.18	2.60		
						(1.10)		MADE GROUND: Hardcore fill with red brick(Drillers description)
					37.08	3.70		LIMESTONE (Drillers description) Open hole drilling
						(11.30)		

Water | Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5

Remarks

Terminated at scheduled depth

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		14.20	3.70	0	0.00

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH09/17
Coordinates: 597264.68 E 724928.83 N	**Client:** Bord Na Mona		Sheet 2 of 2
Method: Rotary Drilling	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 40.78 mOD	**Dates:** 01/03/2017 - 01/03/2017	**Driller:** JR **Logger:** CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
								LIMESTONE (Drillers description) Open hole drilling
				Water strike at 14.2m				
					25.78	15.00		End of Borehole at 15.00m

Water

Backfill

10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5

Remarks

Terminated at scheduled depth

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		14.20	3.70	0	0.00

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH10/17
Coordinates: 597293.96 E 724898.22 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Roatry Drilling+Rotary Coring	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 40.43 mOD	**Dates:** 02/03/2017 - 02/03/2017	**Driller:** JR **Logger:** CH+LP

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
							(1.20)		MADE GROUND: Hardcore fill (Drillers description)		
						39.23	1.20		Wet silty CLAY with cobbles (Drillers description)		
							(1.40)				
						37.83	2.60		Sandy gravelly CLAY (Drillers description)		
							(1.20)				
	100	54	26	NI		36.63	3.80		Medium strong dark grey argillaceous LIMESTONE. Partially weathered from 3.80m to 4.30m with slightly reduced strength and staining on fracture surfaces. Discontinuities: 1. 0 to 10 degree bedding fractures closely spaced becoming medium spaced below 5.20m (50/100/350) planar, smooth, closed with light brown staining on some surfaces. 2. One subvertical fracture from 4.90m to 5.20m, undulating, rough, closed with patchy light brown staining.		
4.80				7							
	100	100	100				(2.50)				
5.80				2							
	54	54	54								
6.30						34.13	6.30		End of Borehole at 6.30m		
	TCR	SCR	RQD	FI							

Remarks

Terminated at scheduled depth

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH11/17
Coordinates: 597534.45 E 724779.30 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Rotary Drilling+Rotary Coring	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 43.72 mOD	**Dates:** 06/03/2017 - 06/03/2017	**Driller:** JR **Logger:** CH+LP

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
							(1.20)		MADE GROUND: Hardcore fill (Drillers description)
						42.52	1.20		Sandy gravelly CLAY (Drillers description)
							(1.10)		
						41.42	2.30		Sandy gravelly CLAY (Drillers description)
							(1.50)		
	100	100	92	2		39.92	3.80		Medium strong black argillaceous LIMESTONE. Largely unweathered. Discontinuities: 1. 0 to 10 degree bedding fractures typically medium spaced, occasionally closely spaced (50/200/450) planar, smooth, closed occasionally with faint orangey brown staining. 2. 70 to 90 degree fractures at 4.15m, 4.40m and 4.60m, undulating, rough, closed with orange brown staining.
4.80									
	100	100	87	5			(3.10)		
5.80									
	100	100	100	1					
				5					
6.90						36.82	6.90		End of Borehole at 6.90m
	TCR	SCR	RQD	FI					

Water | Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5

Remarks

Terminated at scheduled depth

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOP-BH12/17
Coordinates: 597574.62 E 724739.83 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Rotary Drilling+Rotary Coring	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 44.22 mOD	**Dates:** 06/03/2017 - 06/03/2017	**Driller:** JR **Logger:** CH+LP

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
							(1.20)		MADE GROUND: Hardcore fill (Drillers description)		
						43.02	1.20		Sandy gravelly CLAY (Drillers description)		
							(4.10)				
	100	100	68	7		38.92	5.30		Medium strong becoming strong from 6.20m to 7.50m black argillaceous LIMESTONE. Unweathered. Discontinuities: 1. 0 to 10 degree bedding fractures closely spaced becoming medium spaced below 6.20m (70/290/600) planar, smooth, closed.		
6.40				2							
	95	95	95	1			(3.00)				
7.50				2							
	100	59	59								
				NI							
8.30						35.92	8.30		End of Borehole at 8.30m		
	TCR	SCR	RQD	FI							

Remarks

Terminated at scheduled depth

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

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

CAUSEWAY GEOTECH

APPENDIX C

WOA borehole logs

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility	**Borehole No.:** WOA-BH01/17
Coordinates: 602693.58 E 727221.59 N	**Client:** Bord Na Mona	Sheet 1 of 1
Method: Cable Percussion	**Client's Representative:** Bord Na Mona	**Scale:** 1:50
Plant: Dando 2000	**Ground Level:** 37.83 mOD	**Driller:** AH
	Dates: 23/02/2017 - 23/02/2017	**Logger:** CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
0.50 - 1.50	D6							Spongy brown fibrous PEAT		
0.80 - 1.20	B1									
1.00 - 1.45	SPT (S) N=1			N=1 (1,0/1,0,0,0)						
1.80 - 2.20	B2					(3.80)				
2.00 - 2.45	SPT (S)			N=0 (1,0/0,0,0,0)						
2.50 - 3.40	D7									
2.80 - 3.20	B3									
3.00 - 3.45	SPT (S) N=1			N=1 (1,0/0,1,0,0)						
3.80 - 4.20	B4			Water strike at 3.80m	34.03	3.80		Very stiff grey slightly gravelly sandy SILT with high cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse.		
4.00 - 4.45	SPT (C) N=35			N=35 (5,7/7,8,10,10)						
4.50 - 5.40	D8					(1.60)				
4.80 - 5.20	B5									
5.00 - 5.45	SPT (C) N=36			N=36 (8,8/7,8,9,12)						
5.40 - 5.41	SPT (C)			50 (25 for 10mm/50 for 0mm)	32.43	5.40		End of Borehole at 5.40m		

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		3.80	3.80	20	3.50

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
		5.40		01:00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOA-BH02/17
Coordinates: 602931.48 E 727242.53 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Cable Percussion	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Dando 2000	**Ground Level:** 38.92 mOD	**Dates:** 23/02/2017 - 23/02/2017	**Driller:** AH
			Logger: CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(0.70)		Spongy brown fibrous PEAT
0.50	D4				38.22	0.70		
0.80 - 1.20	B1							Stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine.
1.00 - 1.45	SPT (S) N=21			N=21 (4,4/5,5,6,5)				
1.50	D5					(1.80)		
1.80	B7							
1.80 - 2.20	B2							
2.00 - 2.45	SPT (S) N=24			N=24 (5,6/6,5,7,6)				
2.50	D6				36.42	2.50		Very stiff grey slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse.
2.80 - 3.20	B3					(0.80)		
3.00 - 3.30	SPT (C)			33 (8,8/33 for 150mm)				
3.30 - 3.35	SPT (C)			50 (25 for 50mm/50 for 0mm)	35.62	3.30		End of Borehole at 3.30m

Water | Backfill

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
		3.30		01:00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOA-BH02A/17
Coordinates: 602929.24 E 727245.49 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Cable Percussion	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Dando 2000	**Ground Level:** 38.93 mOD	**Dates:** 23/02/2017 - 23/02/2017	**Driller:** AH / **Logger:** CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(0.40)		Spongy brown fibrous PEAT
					38.53	0.40		
0.50 - 1.50	D6							Stiff grey slightly sandy gravelly CLAY with low cobble content and occasional thin lenses of clayey gravel. Sand is fine to coarse. Gravel is subangular fine to coarse.
0.80 - 1.20	B1							
1.00 - 1.45	SPT (S) N=18			N=18 (4,5/4,4,5,5)				
1.80 - 2.20	B2							
2.00 - 2.45	SPT (S) N=21			N=21 (5,6/5,6,5,5)		(3.60)		
2.50 - 3.50	D7							
2.80 - 3.20	B3							
3.00 - 3.45	SPT (S) N=25			N=25 (5,6/6,7,6,6)				
4.00 - 4.45	SPT (S) N=33			N=33 (7,6/7,8,8,10)	34.93	4.00		Very stiff grey slightly sandy gravelly CLAY with high cobble content and occasional thin lenses of sandy clayey gravel. Sand is fine to coarse. Gravel is subangular fine to coarse.
4.50 - 5.50	D8							
4.80 - 5.10	B4							
5.00 - 5.45	SPT (C) N=38			N=38 (10,11/9,10,9,10)		(2.20)		
5.80 - 6.20	B5							
6.00 - 6.22	SPT (C)			25 (8,8/25 for 75mm)				
6.20 - 6.28	SPT (C)			50 (25 for 75mm/50 for 0mm)	32.73	6.20		End of Borehole at 6.20m

Water / Backfill

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details		Chiselling Details		
To (m)	Diam (mm)	From (m)	To (m)	Time (hh:mm)
		6.20		01:00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOA-BH03/17
Coordinates: 602431.20 E 727269.18 N	**Client:** Bord Na Mona		Sheet 1 of 2
Method: Rotary Drilling	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 39.43 mOD	**Dates:** 08/03/2017 - 08/03/2017	**Driller:** JR **Logger:** CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(4.10)		Spongy brown fibrous PEAT		
					35.33	4.10		Very stiff grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse.		
5.60 - 5.86	SPT (C)			50 (10,14/50 for 105mm)						
7.10 - 7.28	SPT (C)			50 (25 for 95mm/50 for 90mm)		(7.50)				
8.60 - 8.80	SPT (C)			50 (25 for 125mm/50 for 75mm)						

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility	**Borehole No.:** WOA-BH03/17
Coordinates: 602431.20 E 727269.18 N	**Client:** Bord Na Mona	Sheet 2 of 2
Method: Rotary Drilling	**Client's Representative:** Bord Na Mona	**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 39.43 mOD	**Dates:** 08/03/2017 - 08/03/2017	**Driller:** JR
			Logger: CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.10 - 10.40	SPT (C)			50 (25 for 135mm/50 for 160mm)				Very stiff grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse.		
11.60 - 11.88	SPT (C)			50 (12,43/50 for 125mm)	27.82	11.60		End of Borehole at 11.60m		

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOA-BH04/17
Coordinates: 602772.09 E 727029.99 N	**Client:** Bord Na Mona		Sheet 1 of 2
Method: Rotary Drilling	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 39.34 mOD	**Dates:** 09/03/2017 - 09/03/2017	**Driller:** JR **Logger:** CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
						(2.60)		Spongy brown fibrous PEAT		
2.60 - 3.05	SPT (C) N=2			N=2 (0,0/0,1,0,1)	36.74	2.60		Very stiff grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse.		
4.10 - 4.38	SPT (C)			50 (10,14/50 for 135mm)						
5.60 - 5.88	SPT (C)			50 (11,13/50 for 125mm)		(7.50)				
7.10 - 7.35	SPT (C)			Water strike at 7.0m 50 (25 for 130mm/50 for 120mm)					▼	
8.60 - 8.98	SPT (C)			50 (10,13/50 for 230mm)						

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		7.00	10.10	0	0.00

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

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Borehole No.:** WOA-BH04/17
Coordinates: 602772.09 E 727029.99 N	**Client:** Bord Na Mona		Sheet 2 of 2
Method: Rotary Drilling	**Client's Representative:** Bord Na Mona		**Scale:** 1:50
Plant: Beretta T44	**Ground Level:** 39.34 mOD	**Dates:** 09/03/2017 - 09/03/2017	**Driller:** JR **Logger:** CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.10 - 10.40	SPT (C)			50 (11,14/50 for 155mm)	29.24	10.10		Very stiff grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse.		
								End of Borehole at 10.10m		

Remarks

Terminated at refusal on boulders/possible bedrock

Water Added		Water Strike - General			
From (m)	To (m)	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
		7.00	10.10	0	0.00

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

CAUSEWAY GEOTECH

APPENDIX D

WOP probe logs

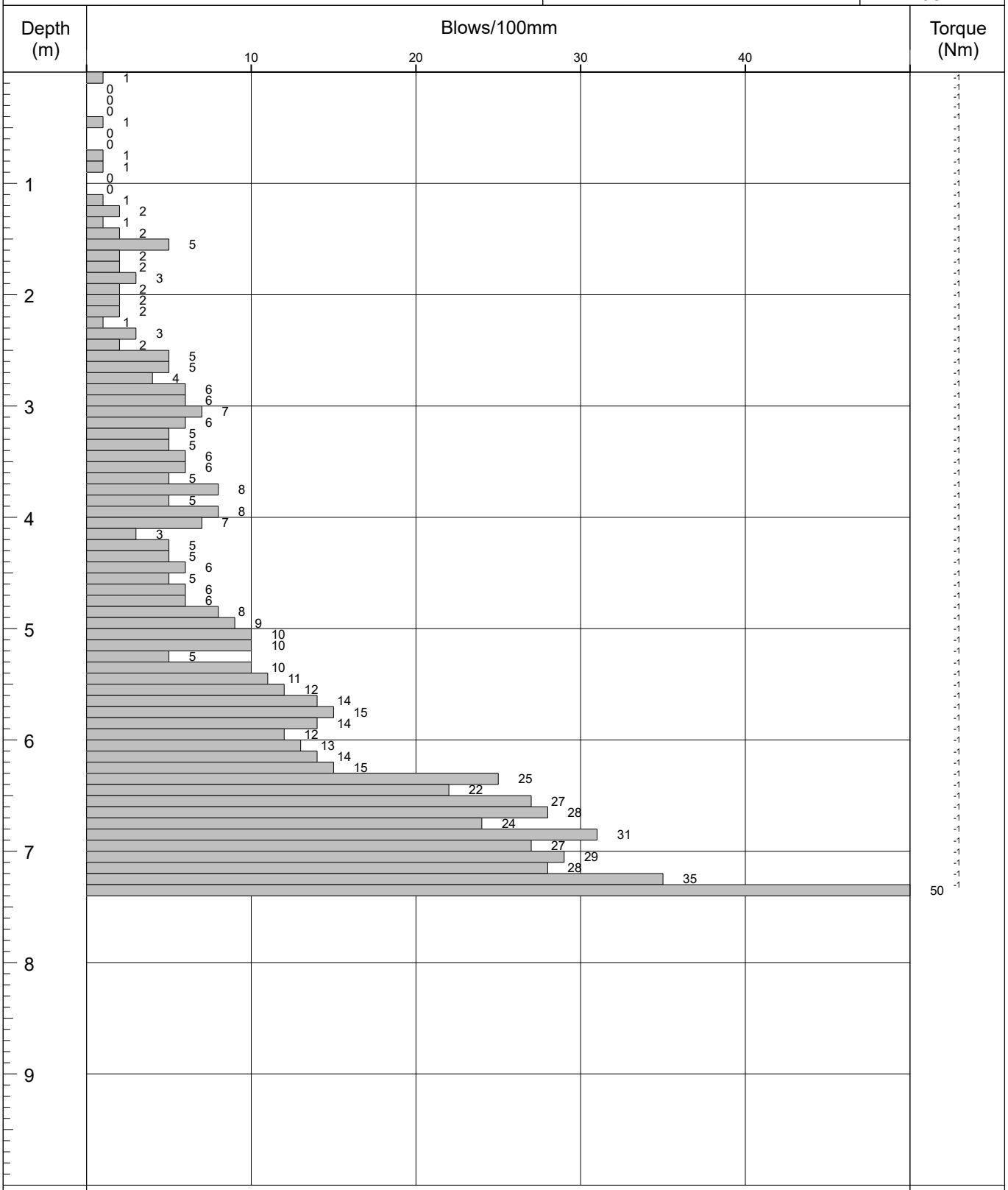
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-01/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597099.68 - 725153.32	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.20	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 7.40m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	7.40	
	Probe Type	DPSH-A			

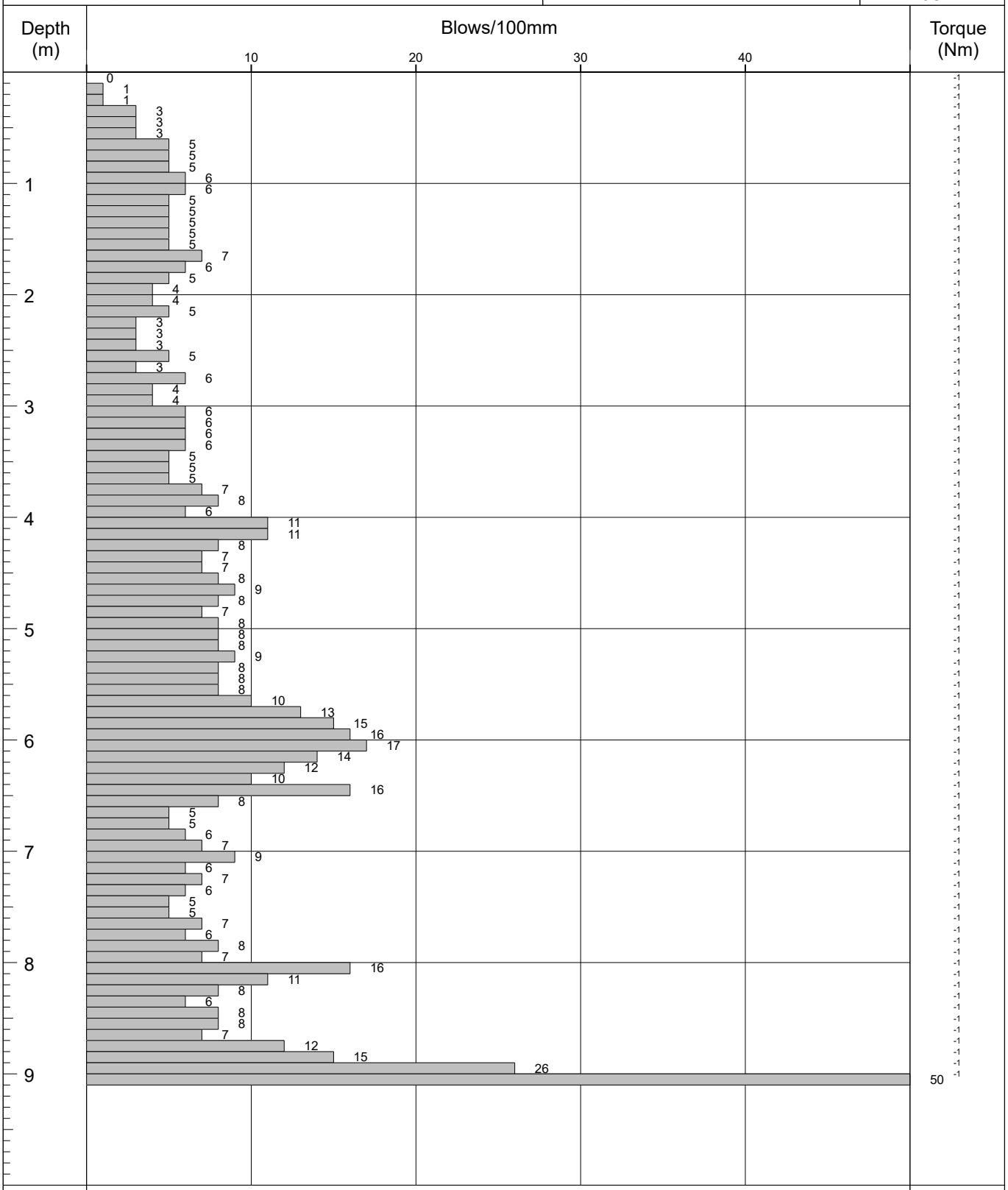
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-02/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597110.72 - 725169.62	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.18	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 9.10m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	9.10	
	Probe Type	DPSH-A			

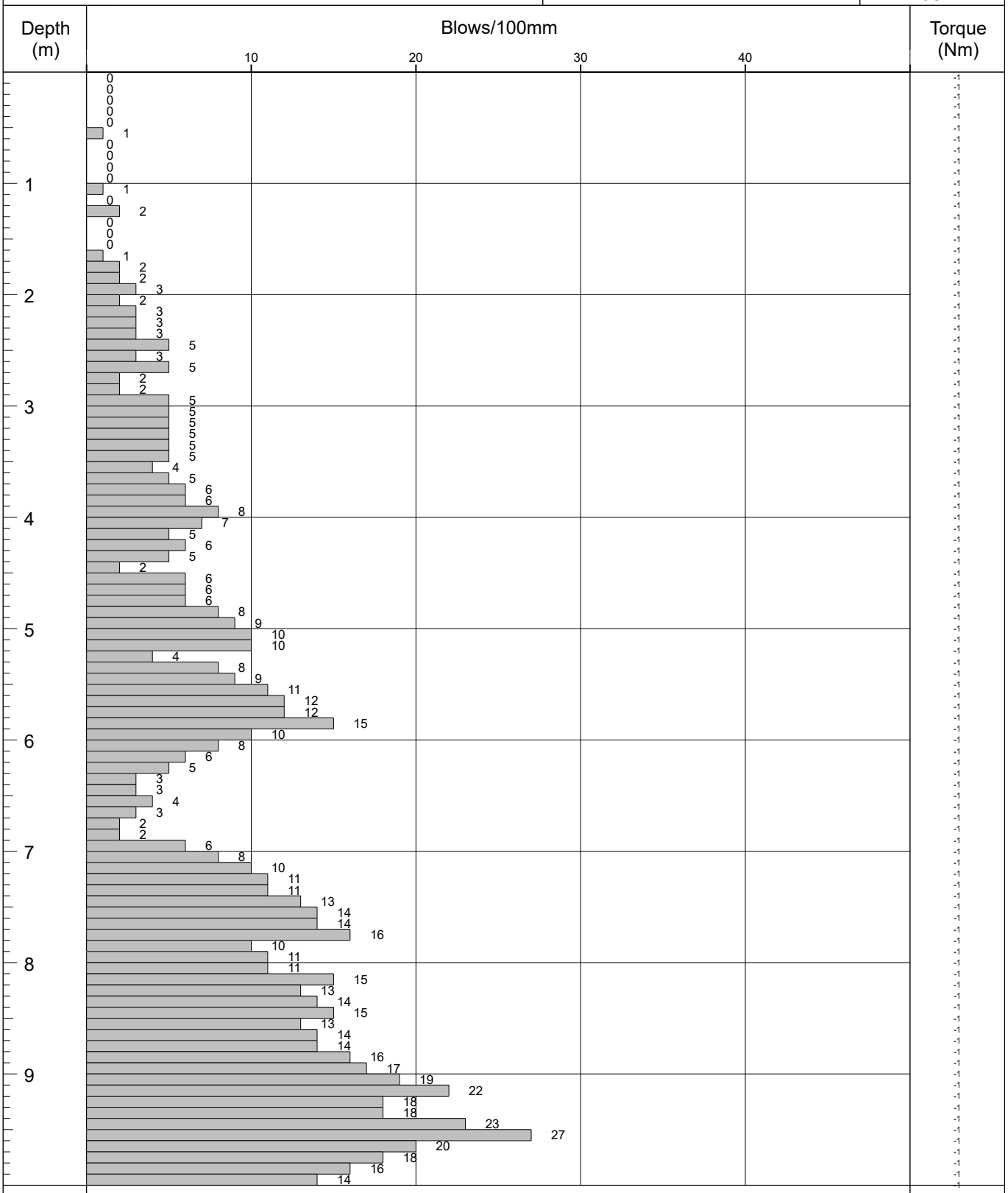
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-03/17

Sheet 1 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597010.64 - 725170.16	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.58	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 10.10m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	10.10	
	Probe Type	DPSH-A			

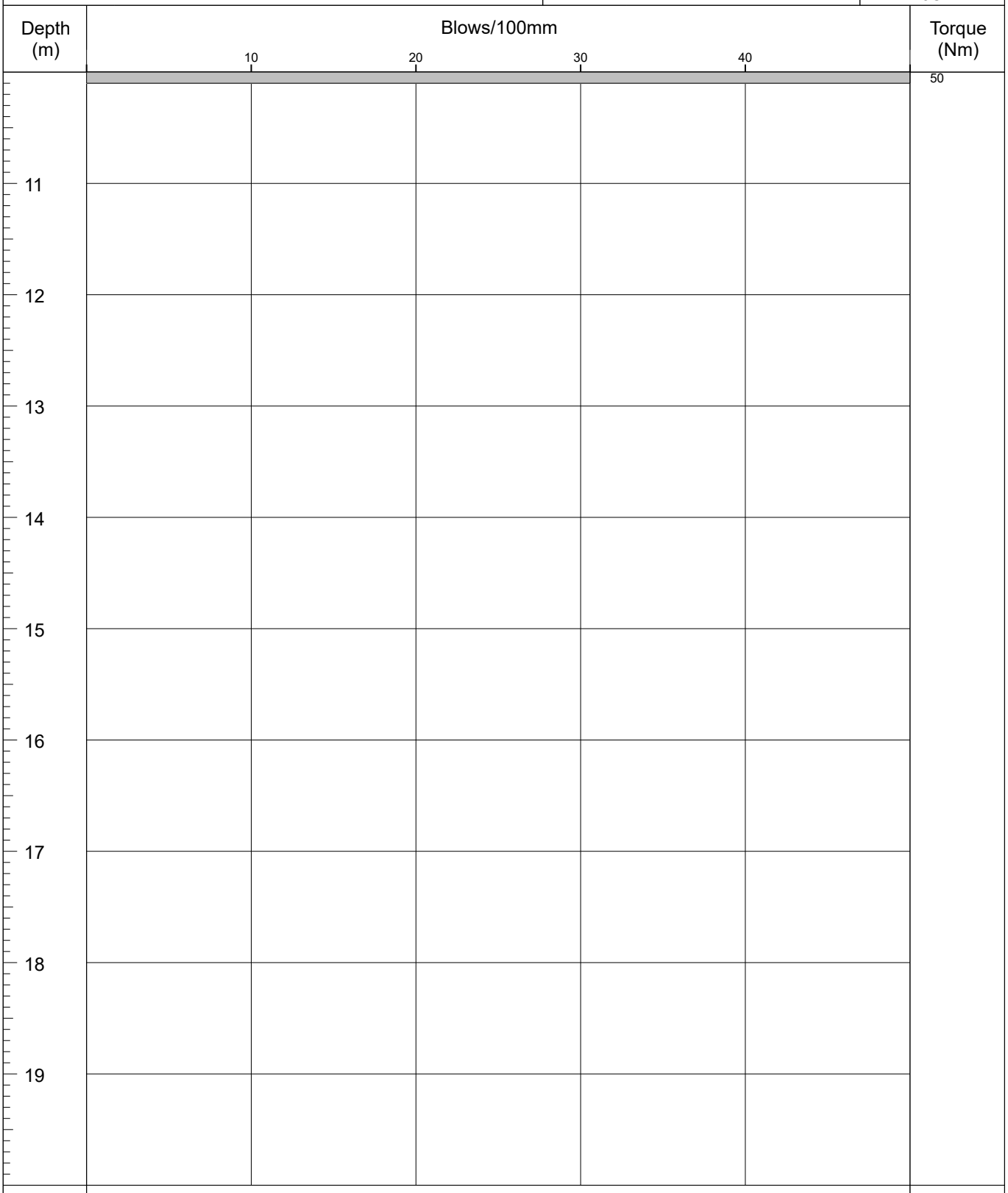
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-03/17

Sheet 2 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597010.64 - 725170.16	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.58	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



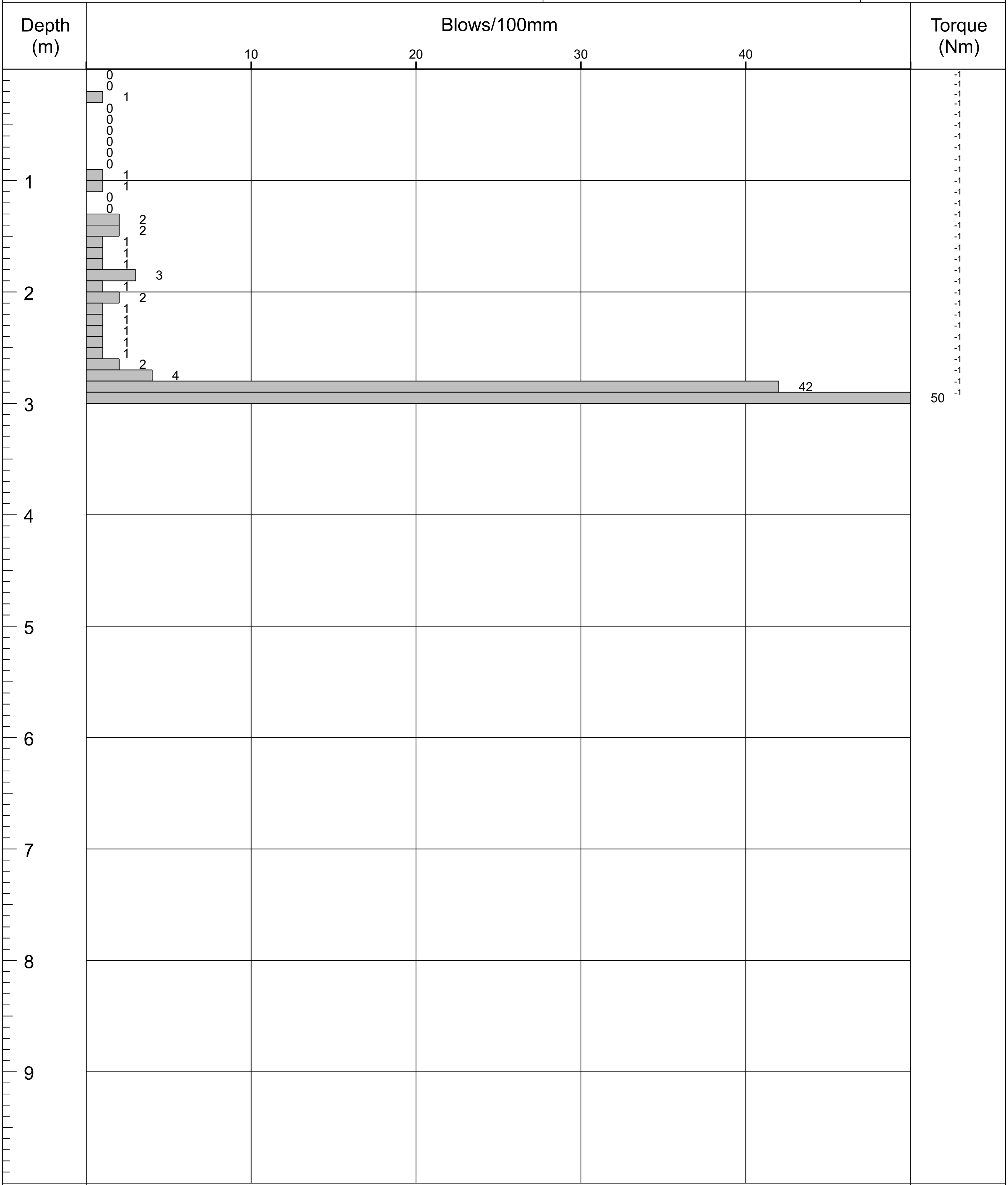
Remarks:
General; 10.10m

Fall Height	750	Cone Base Diameter	45
Hammer Wt	64	Final Depth	10.10
Probe Type	DPSH-A		

AGS

CAUSEWAY GEOTECH	# Probe Log	Probe No: **WOP-DP-04/17** Sheet 1 of 1

Project Name:	West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597138.83 - 725146.46	**Hole Type:** DP
Client:	Bord Na Mona		**Level:**	40.35	**Scale:** 1:50
Client's Rep:	Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 3.00m	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	3.00
	Probe Type	DPSH-A		

AGS

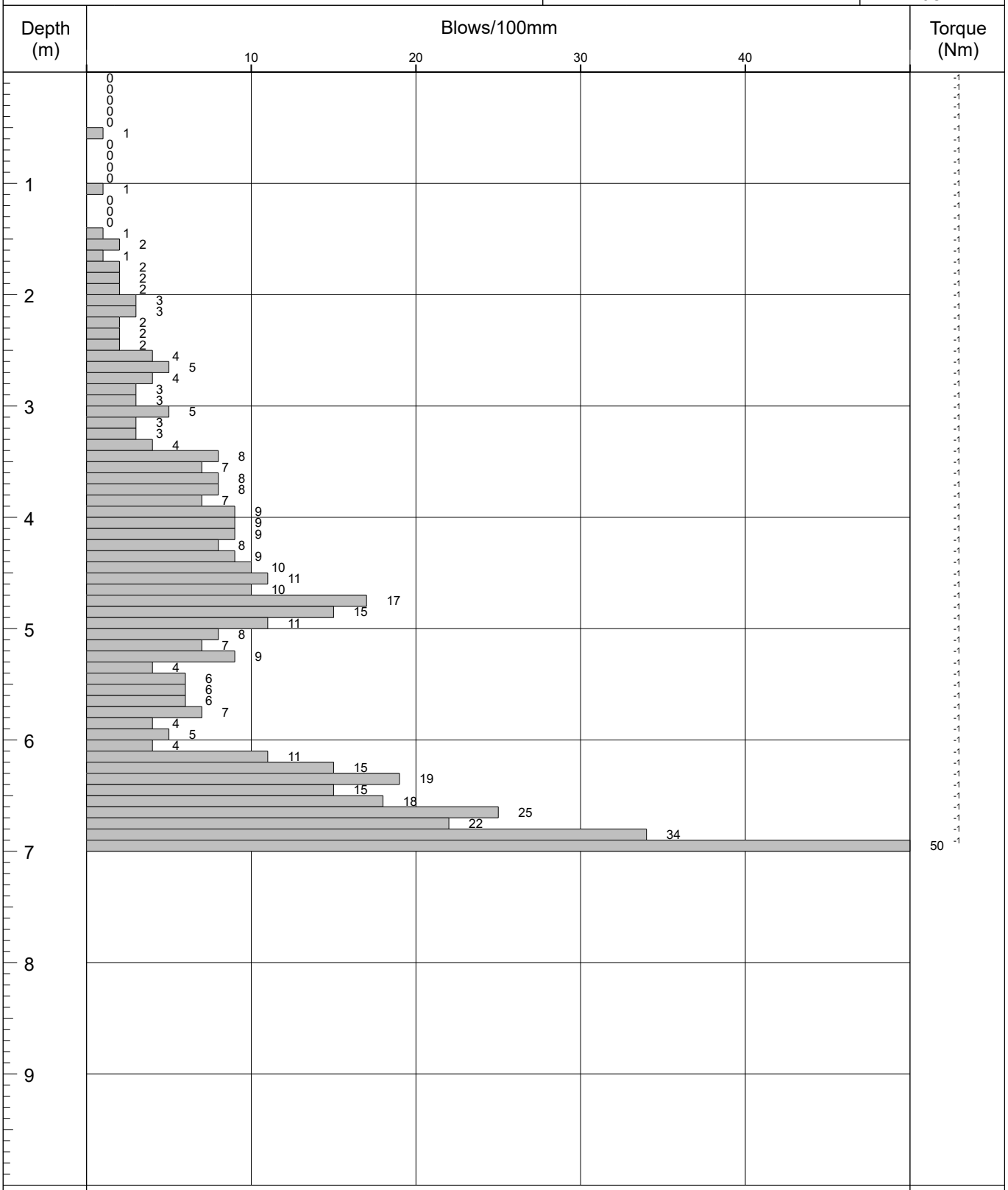
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-05/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597014.63 - 725098.60	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.00	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 7.00m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	7.00	
	Probe Type	DPSH-A			

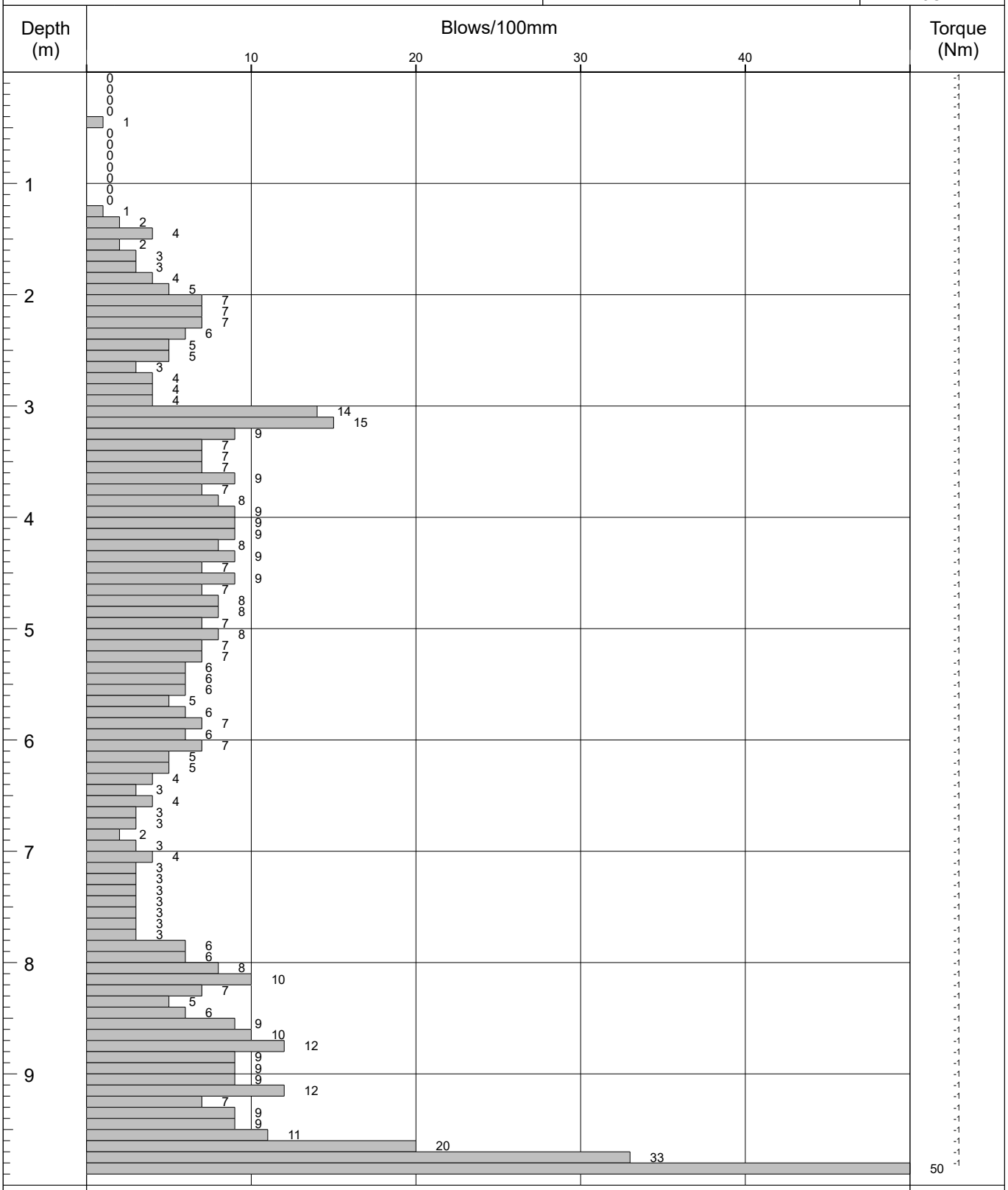
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-06/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597091.68 - 725115.94	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.15	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 9.90m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	9.90	
	Probe Type	DPSH-A			

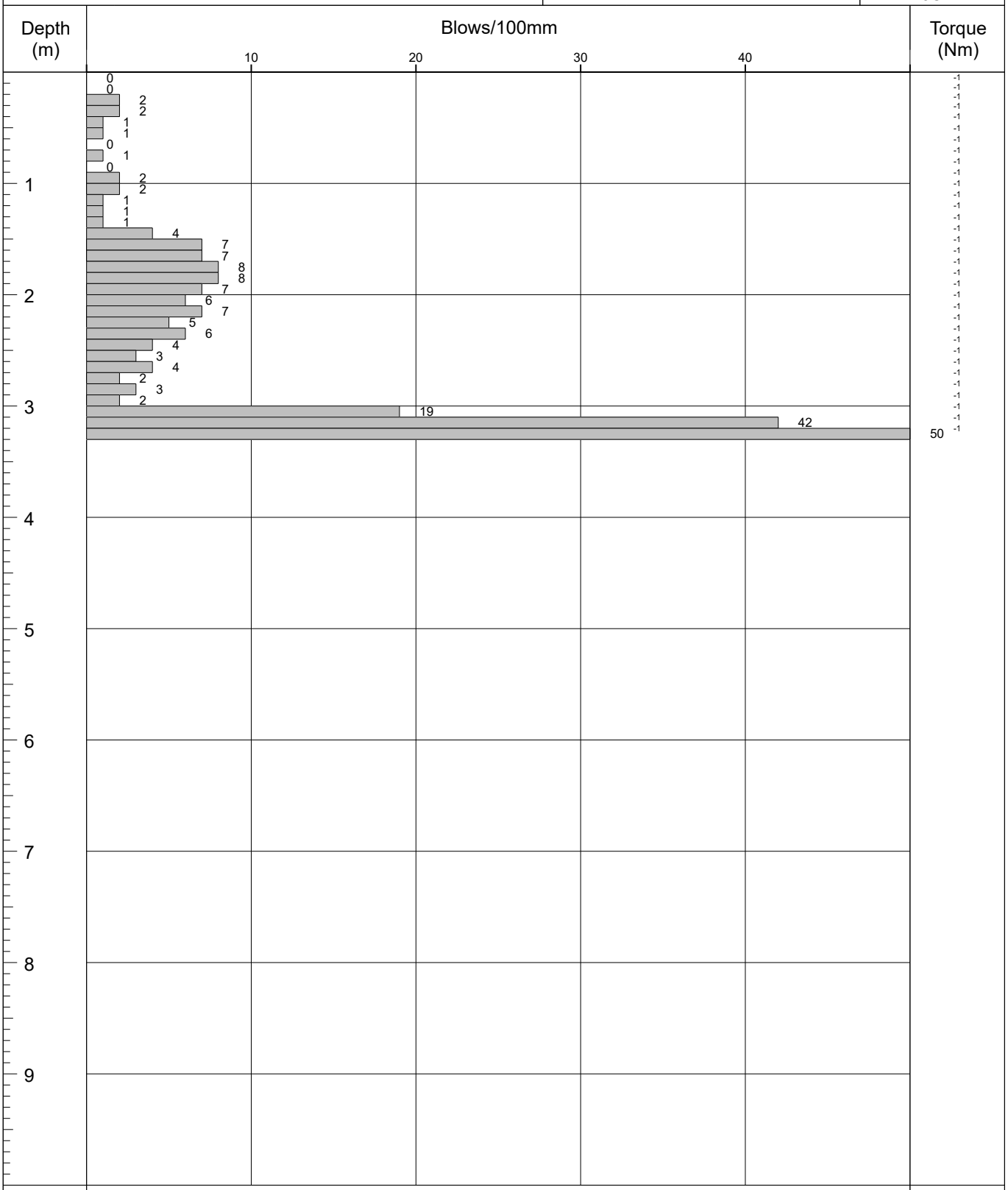
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-07/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597118.81 - 725119.39	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.51	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 3.30m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	3.30	
	Probe Type	DPSH-A			

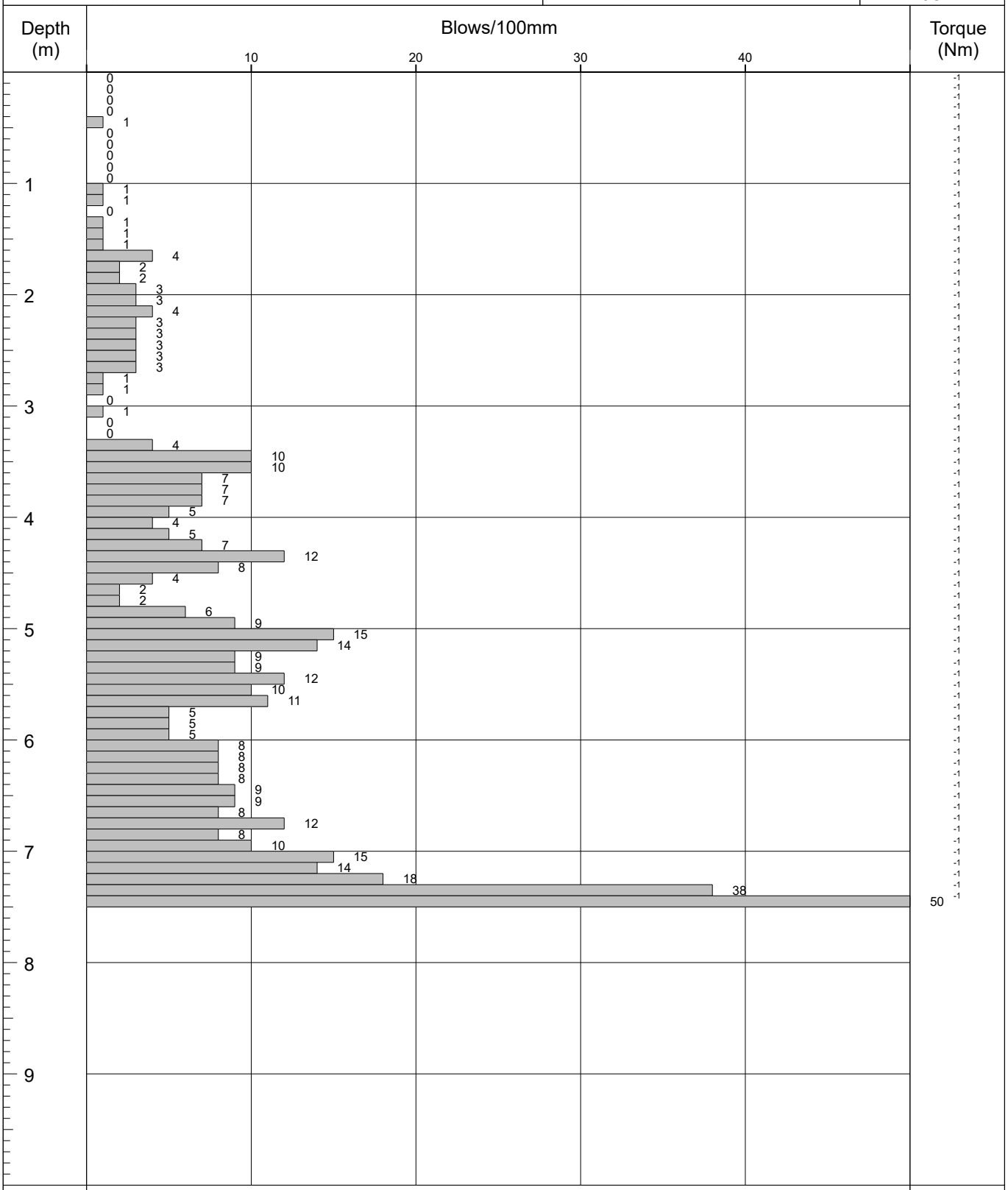
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-08/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597018.56 - 725080.42	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	38.76	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 7.50m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	7.50	
	Probe Type	DPSH-A			

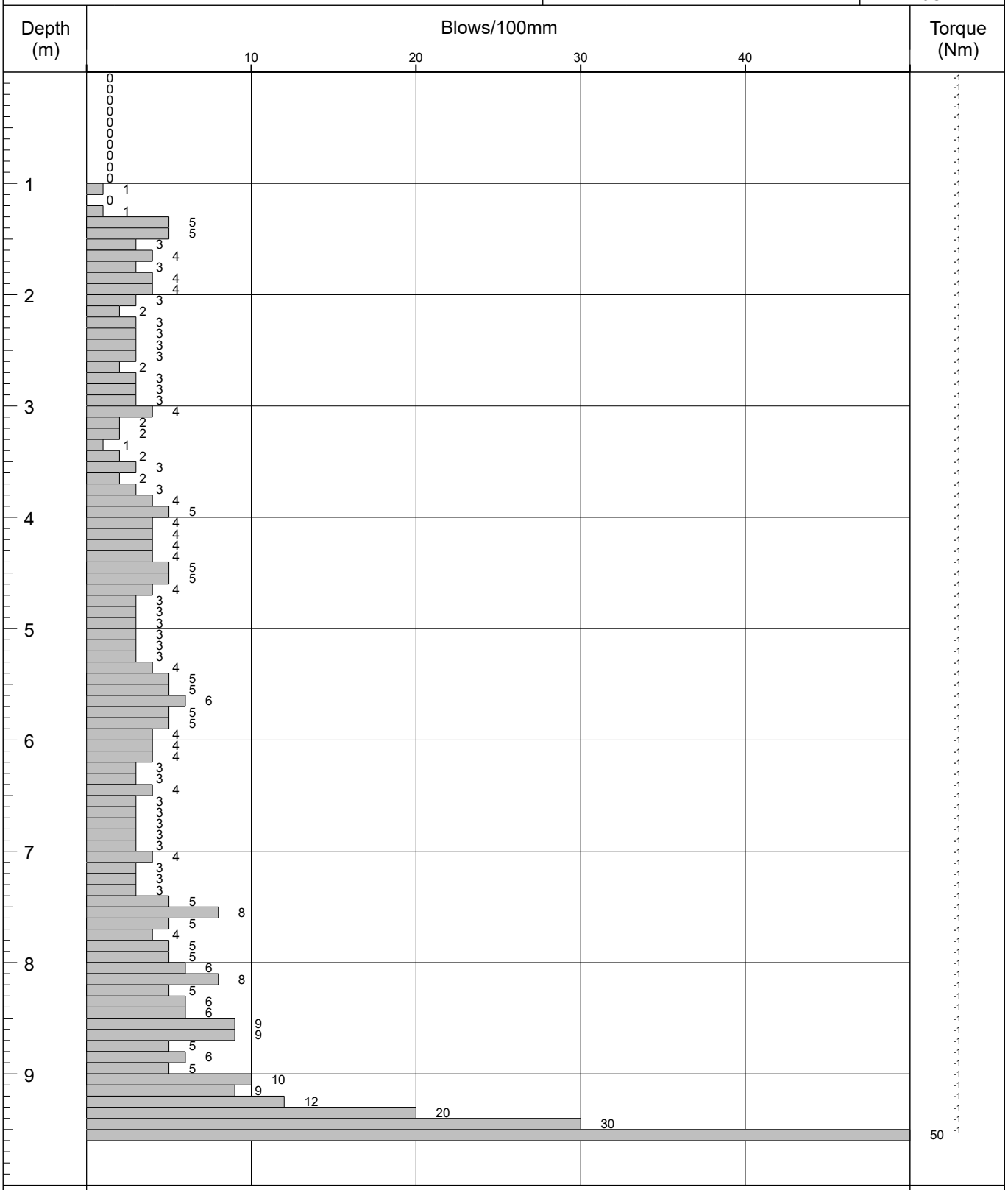
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-09/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597047.82 - 725087.43	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.66	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 9.60m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	9.60	
	Probe Type	DPSH-A			

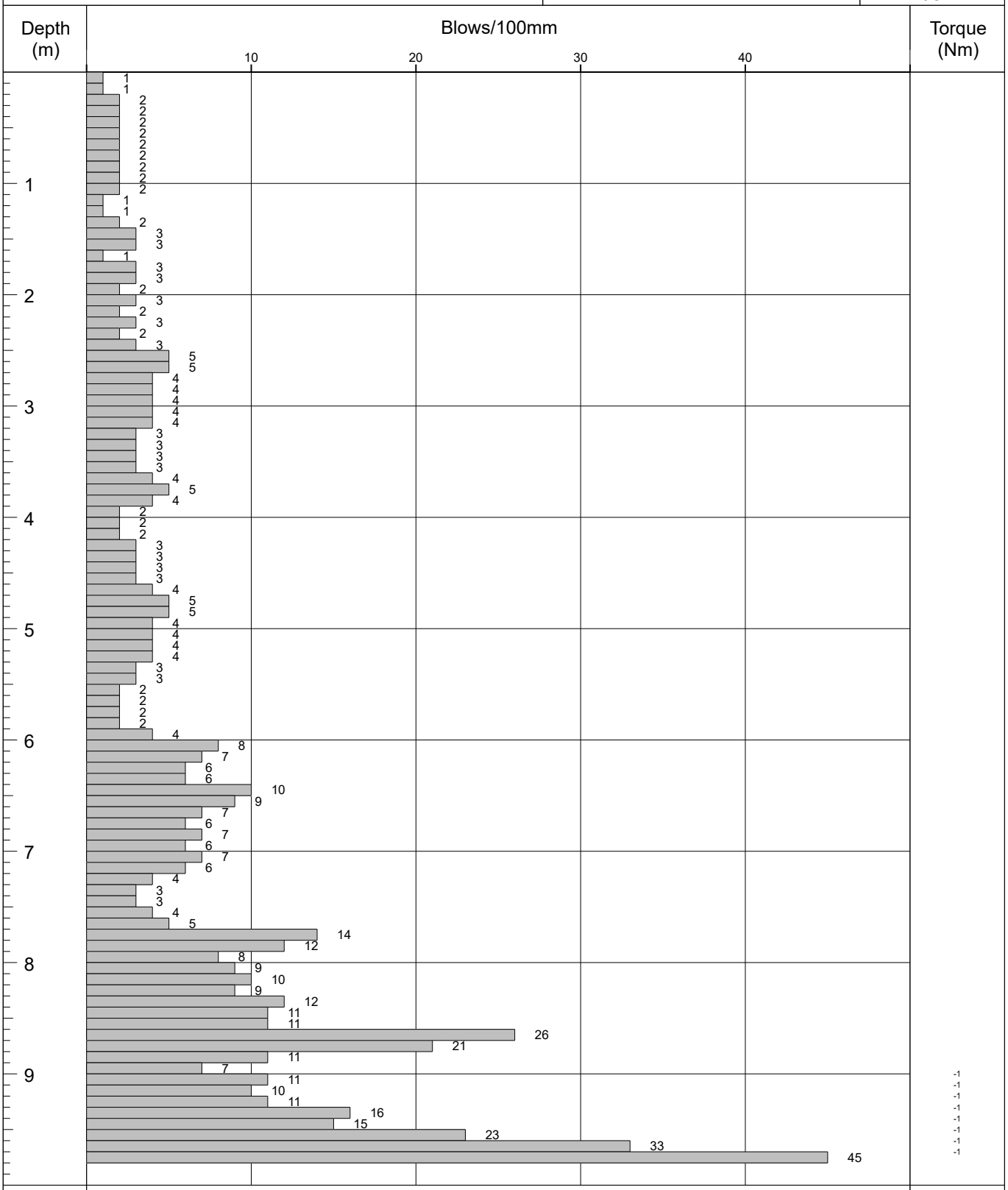
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-10/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597085.86 - 725061.20	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.48	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 9.80m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	9.60	
	Probe Type	DPSH-A			

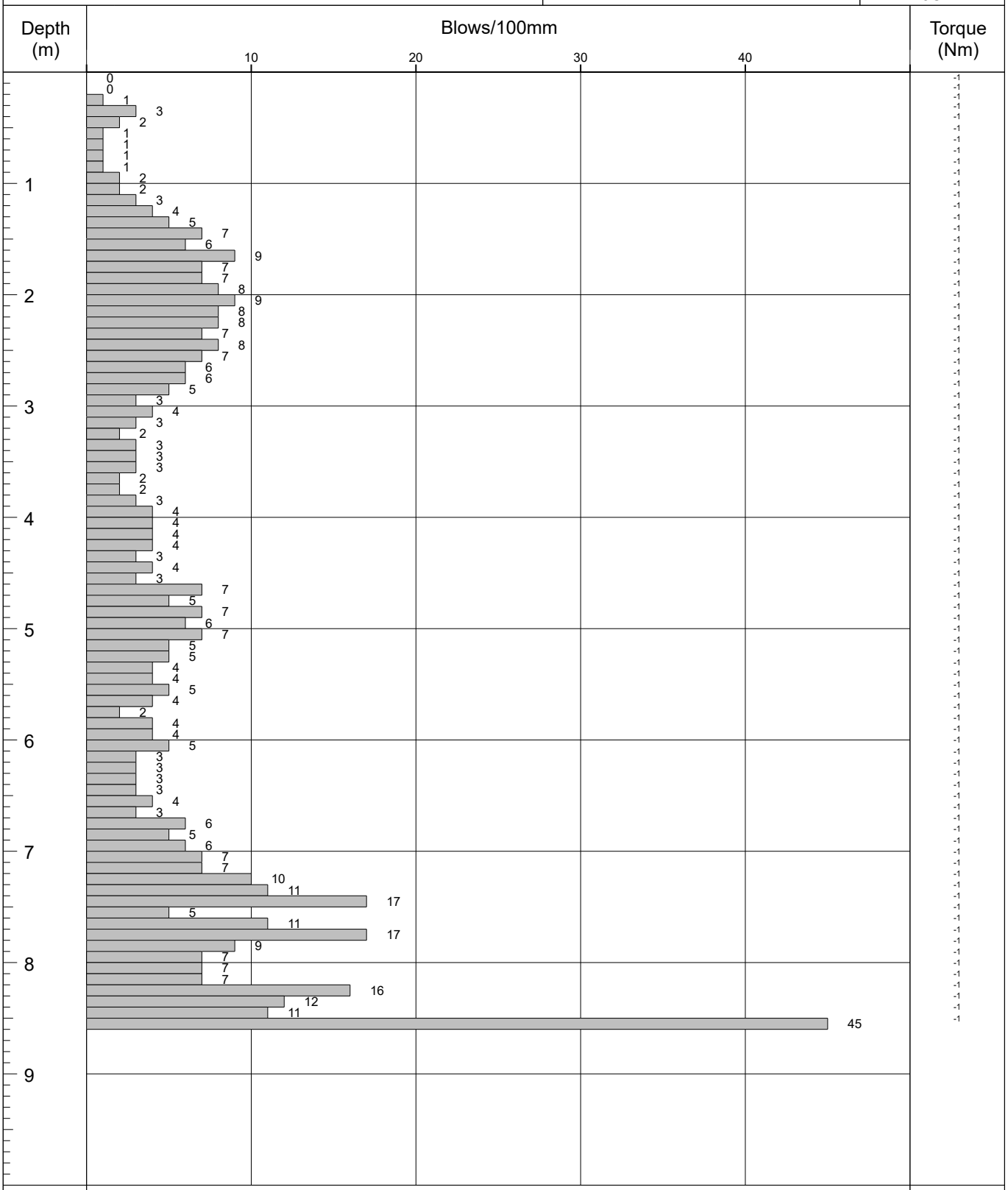
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-11/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597094.64 - 725090.73	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.21	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 8.60m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	8.60	
	Probe Type	DPSH-A			

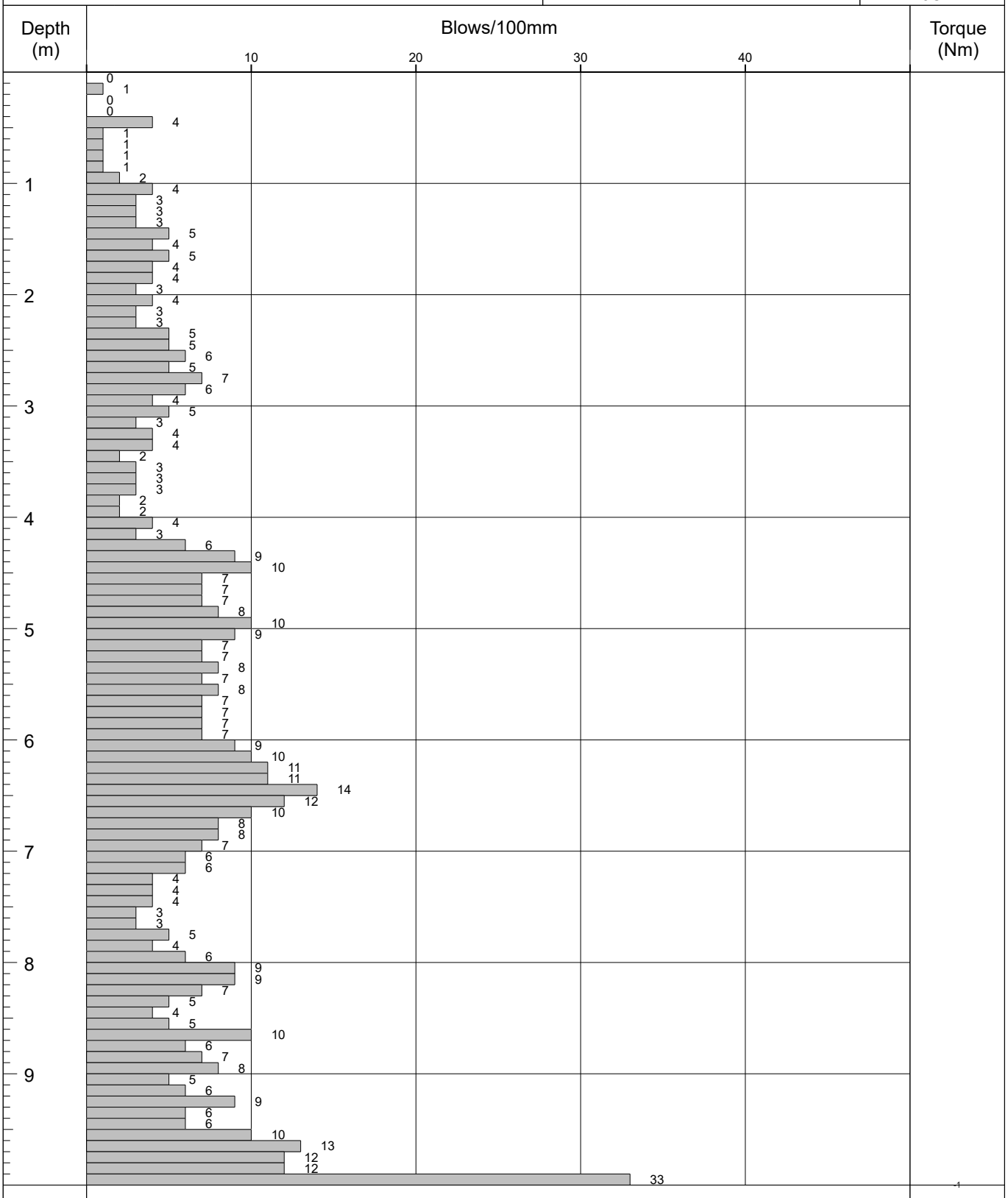
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-12/17

Sheet 1 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597119.94 - 725095.89	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.66	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 10.20m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	10.20	
	Probe Type	DPSH-A			

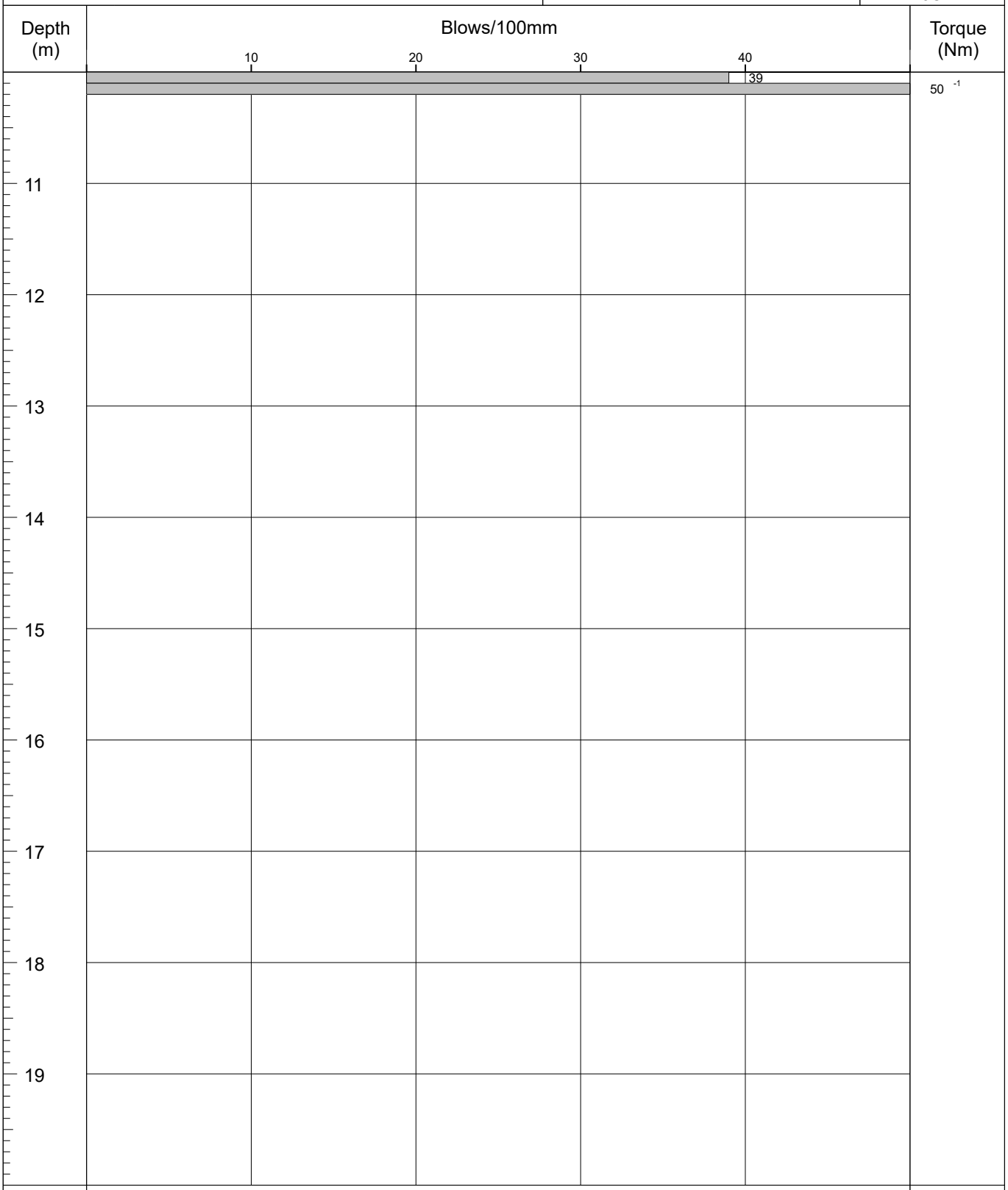
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-12/17

Sheet 2 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597119.94 - 725095.89	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.66	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks:
General; 10.20m

Fall Height	750	Cone Base Diameter	45
Hammer Wt	64	Final Depth	10.20
Probe Type	DPSH-A		

AGS

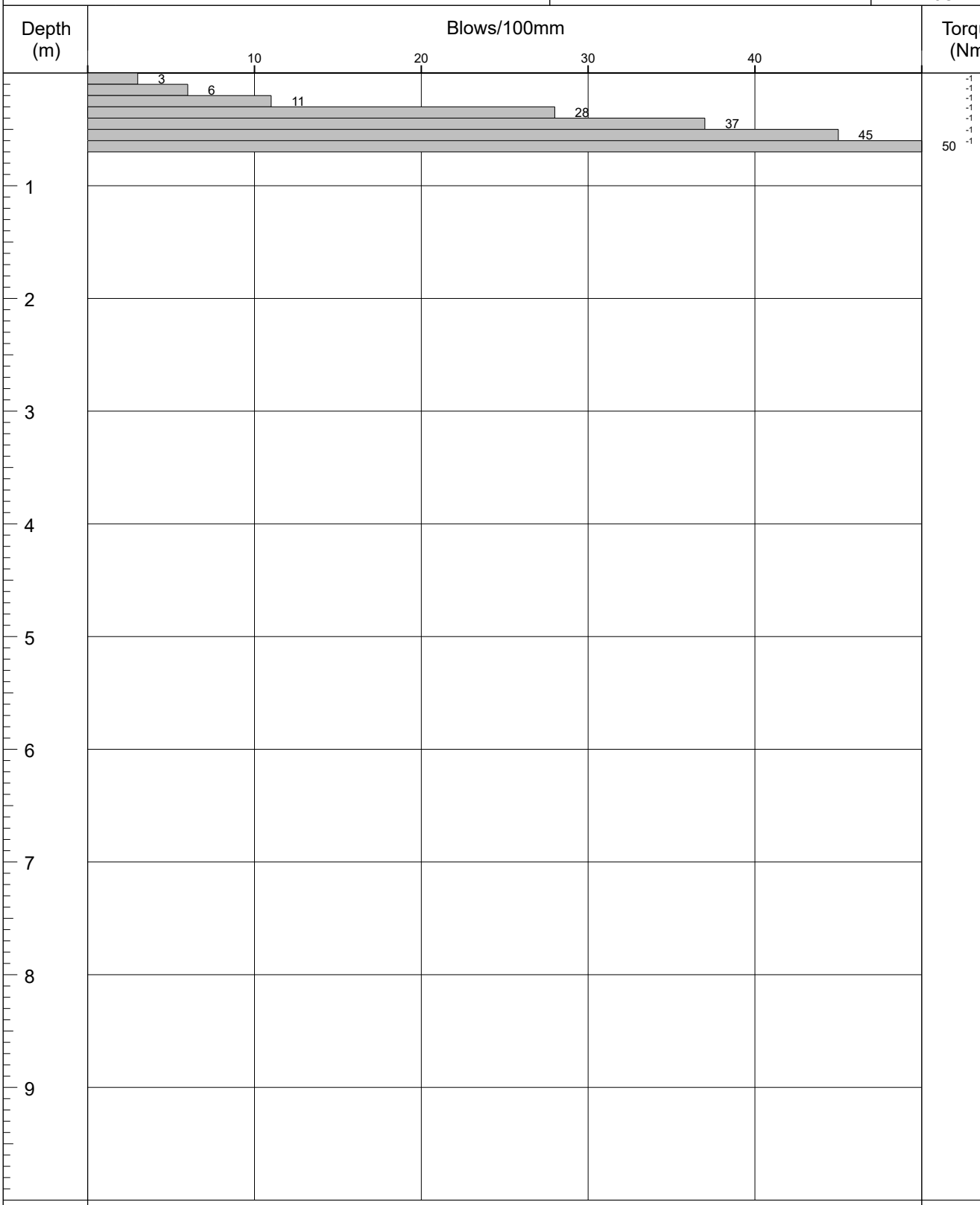
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-13/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597146.09 - 725096.84	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.81	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks:
General; 0.7m 3 attempts made @ 1.0m from original location all with same result

Fall Height	750	Cone Base Diameter	45
Hammer Wt	64	Final Depth	0.70
Probe Type	DPSH-A		

AGS

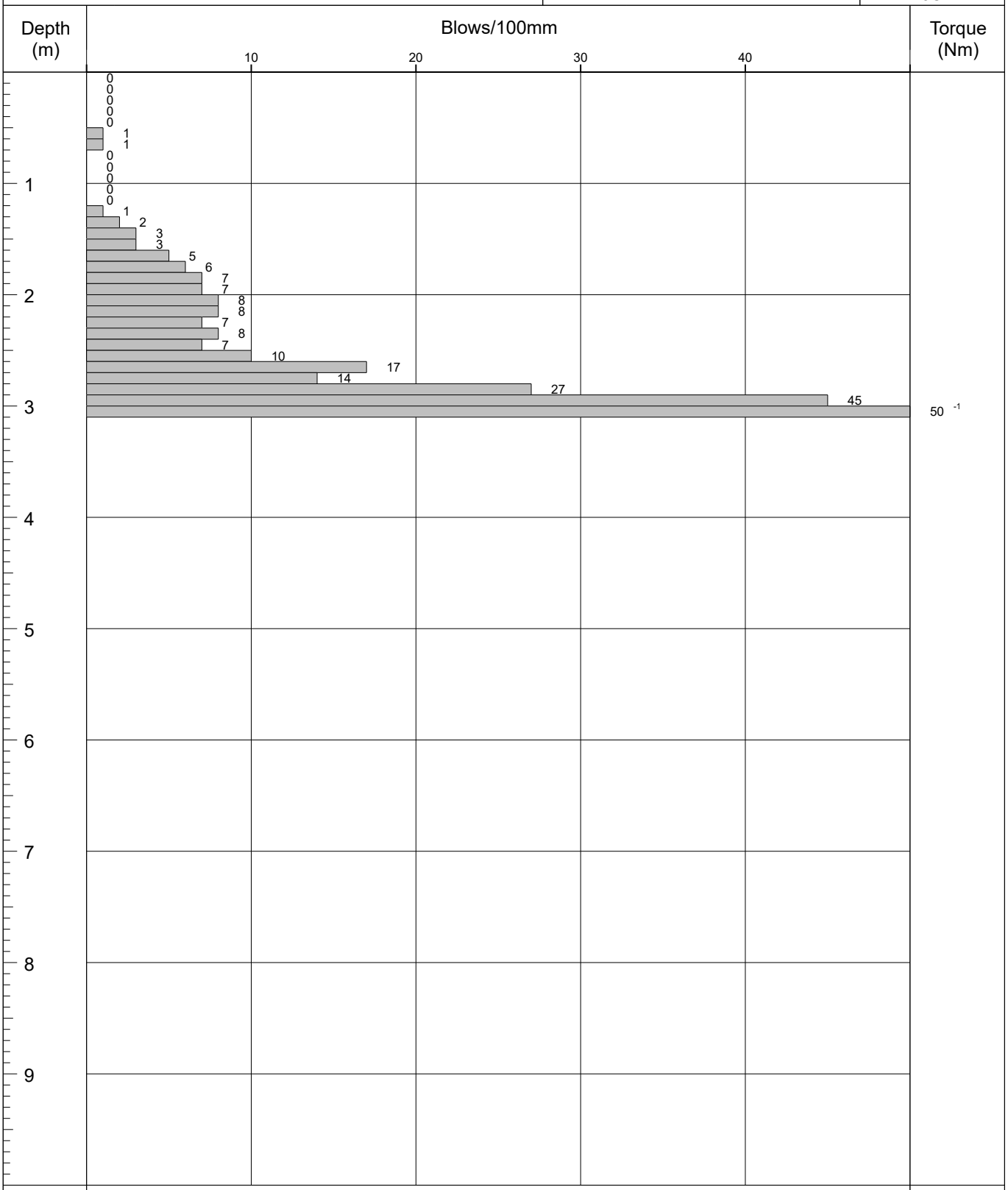
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-14/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597023.64 - 725057.40	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	38.08	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 3.10m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	3.10	
	Probe Type	DPSH-A			

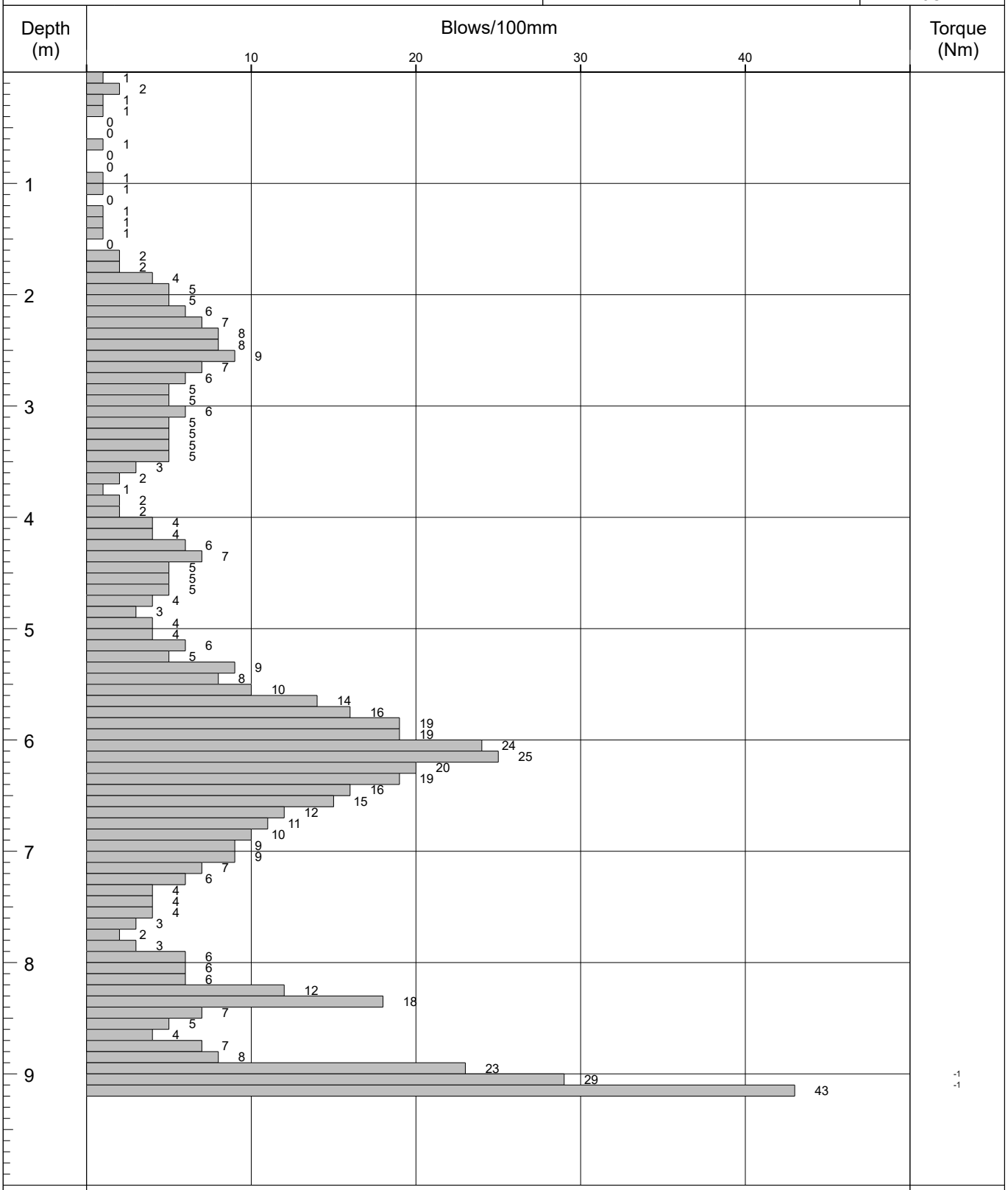
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-15/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597059.38 - 725059.84	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.03	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 9.20m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	9.20	
	Probe Type	DPSH-A			

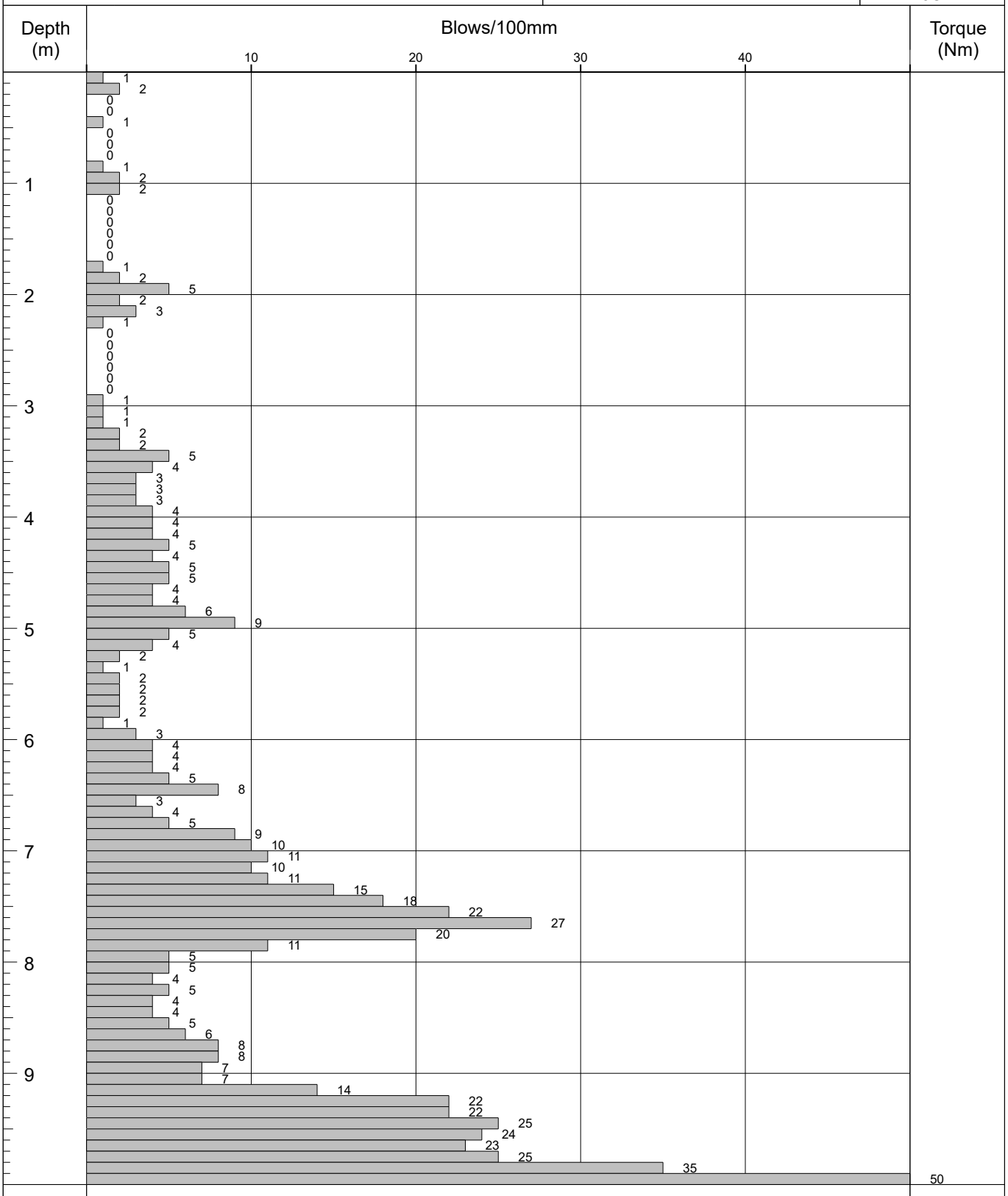
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-16/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597113.18 - 725064.66	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.58	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 10.00m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	10.00	
	Probe Type	DPSH-A			

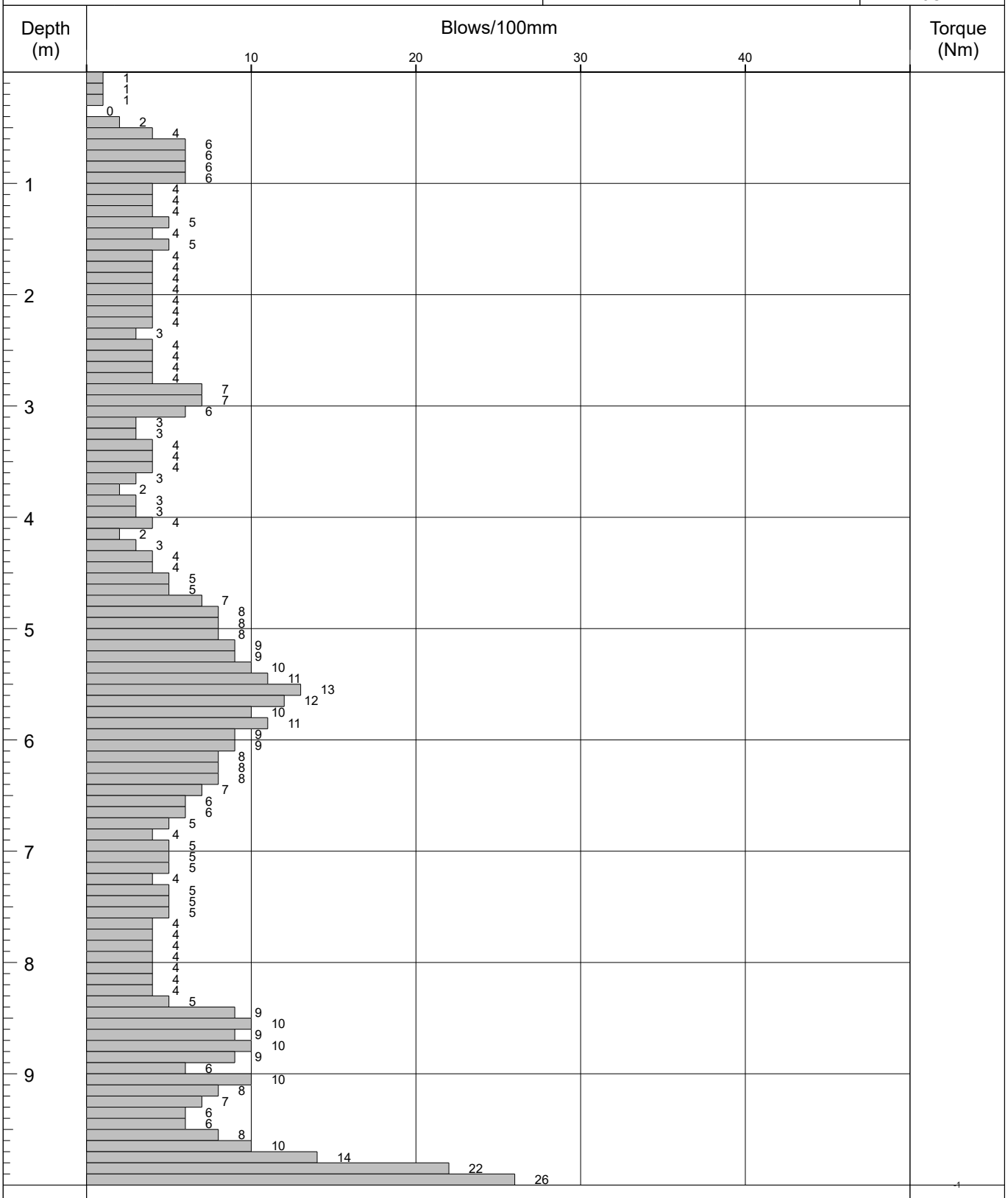
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-17/17

Sheet 1 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597126.42 - 725067.81	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.76	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 10.20m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	10.20	
	Probe Type	DPSH-A			

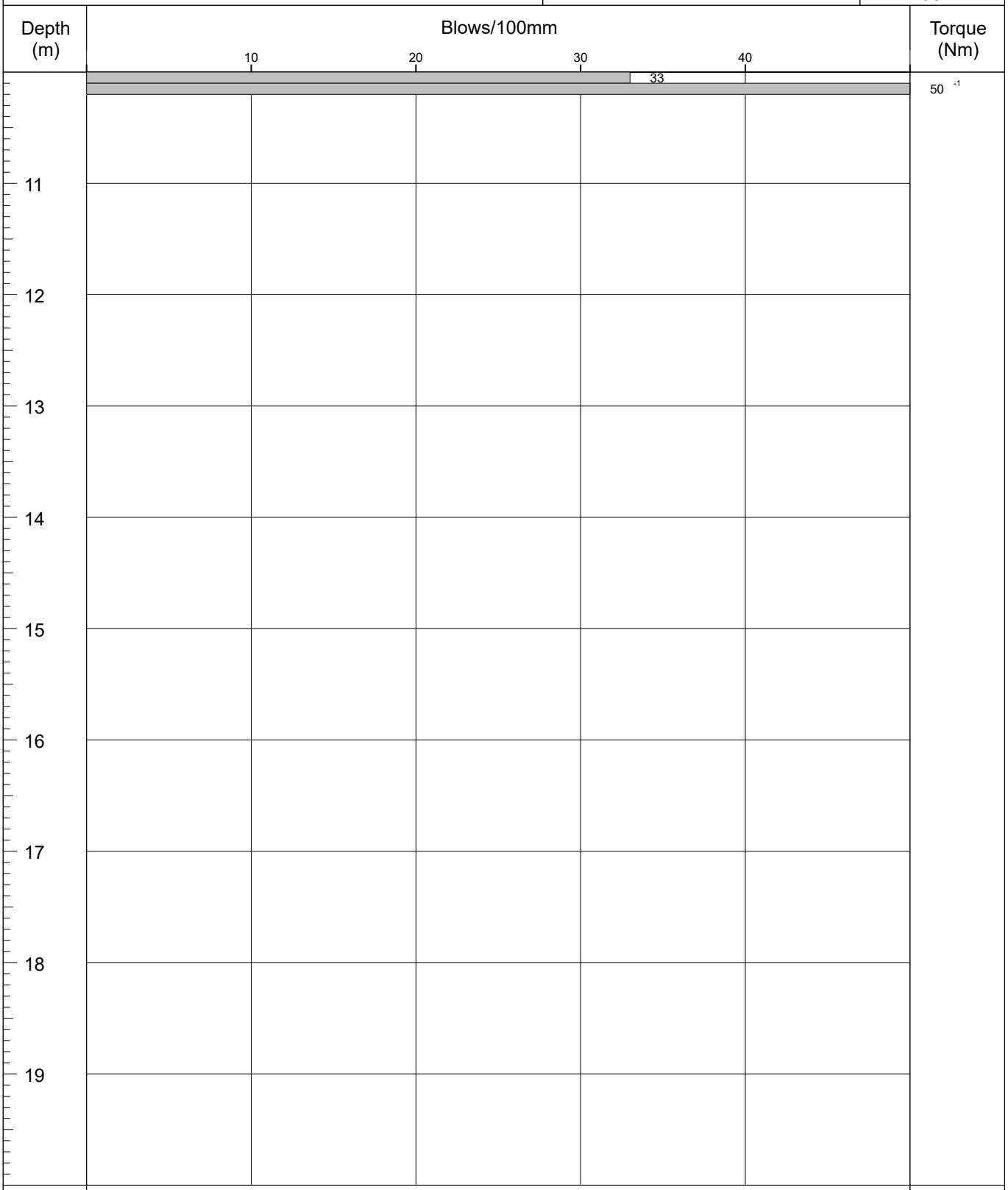
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-17/17

Sheet 2 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597126.42 - 725067.81	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.76	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks:
General; 10.20m

Fall Height	750	Cone Base Diameter	45
Hammer Wt	64	Final Depth	10.20
Probe Type	DPSH-A		

AGS

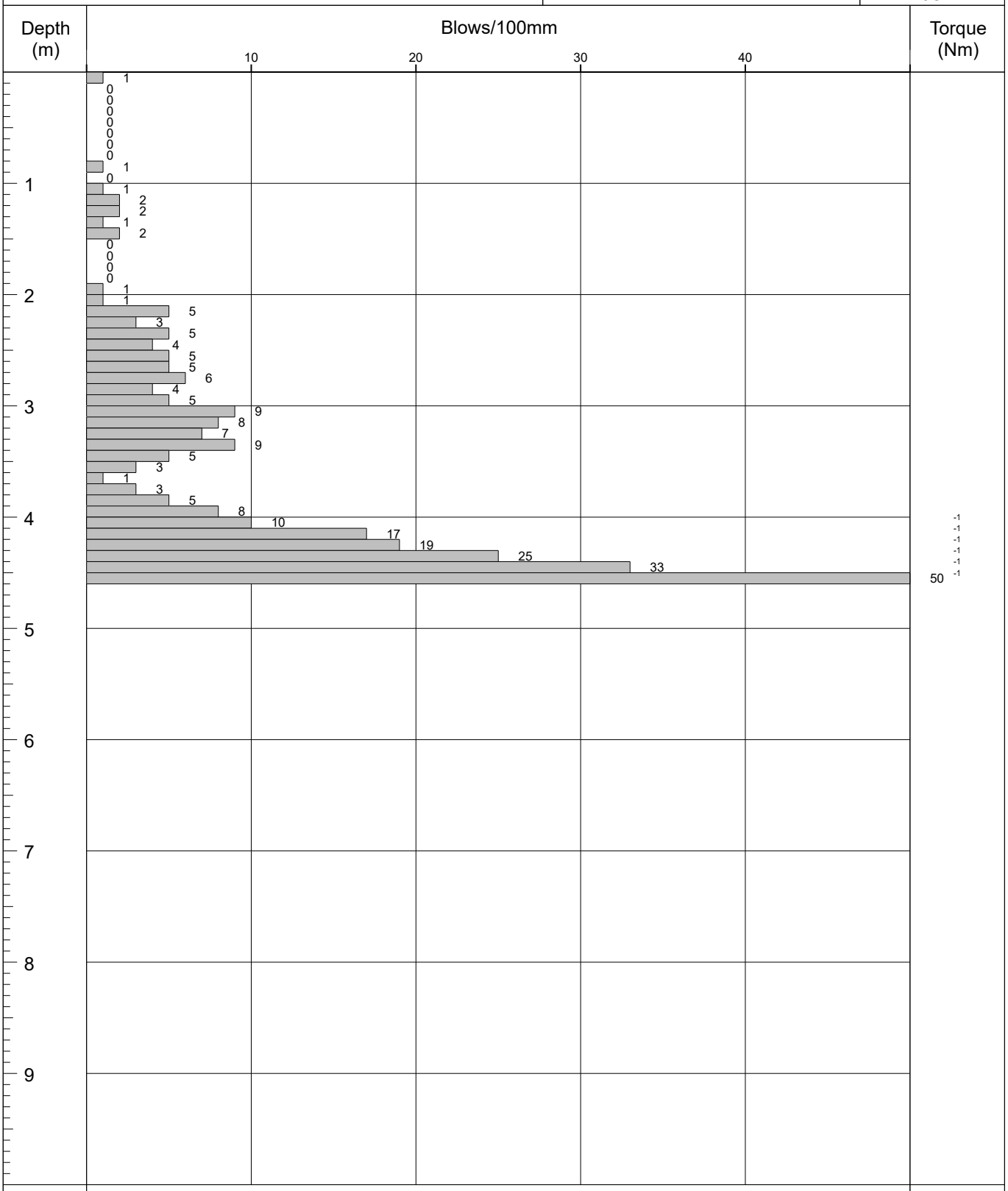
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-18/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597036.05 - 725035.31	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	38.13	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	22/02/2017	**Operator:** JC



Remarks: General; 4.60m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	4.60	
	Probe Type	DPSH-A			

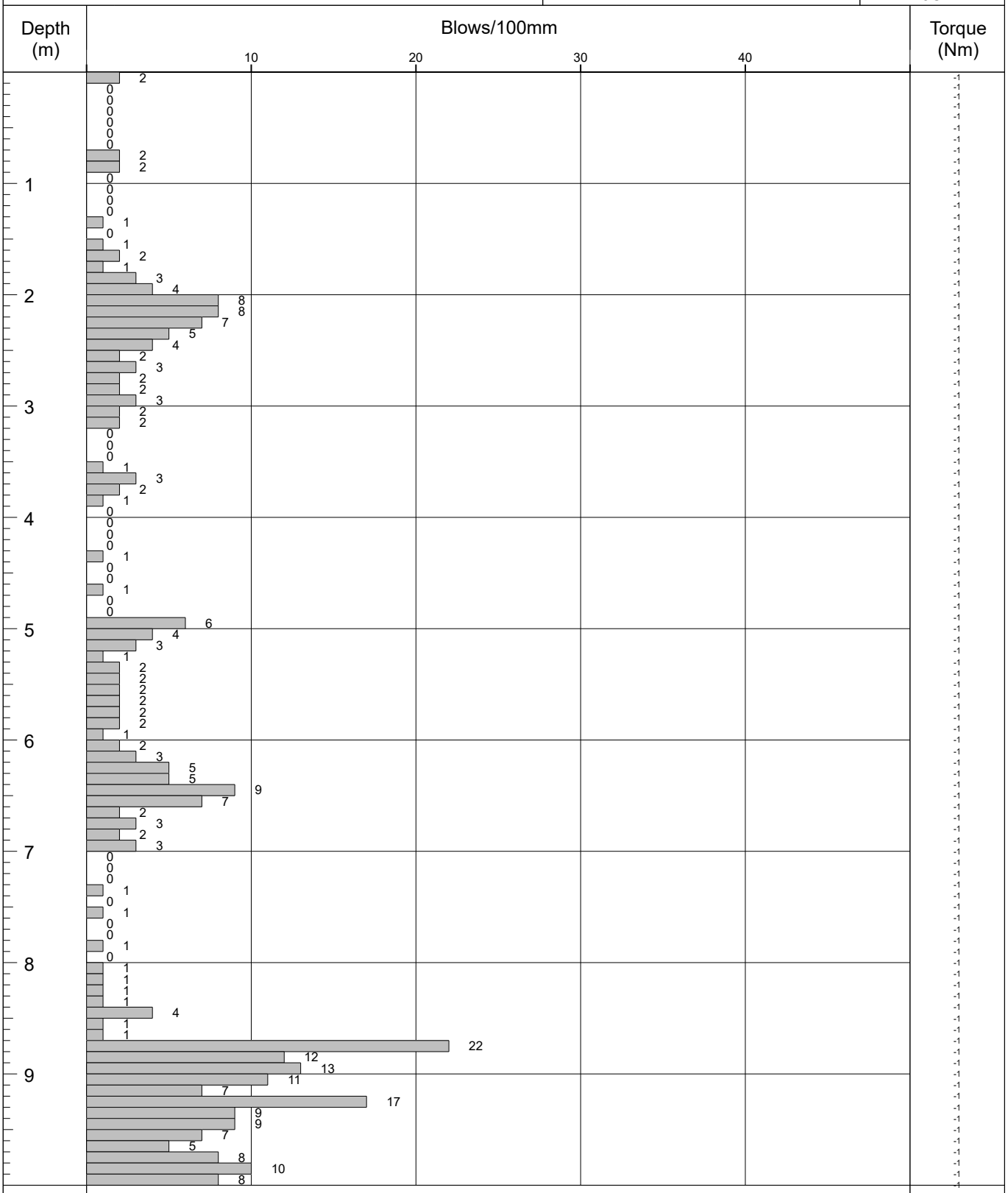
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-19/17

Sheet 1 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597078.48 - 725035.30	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.32	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks: General; 10.40M	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	10.40	
	Probe Type	DPSH-A			

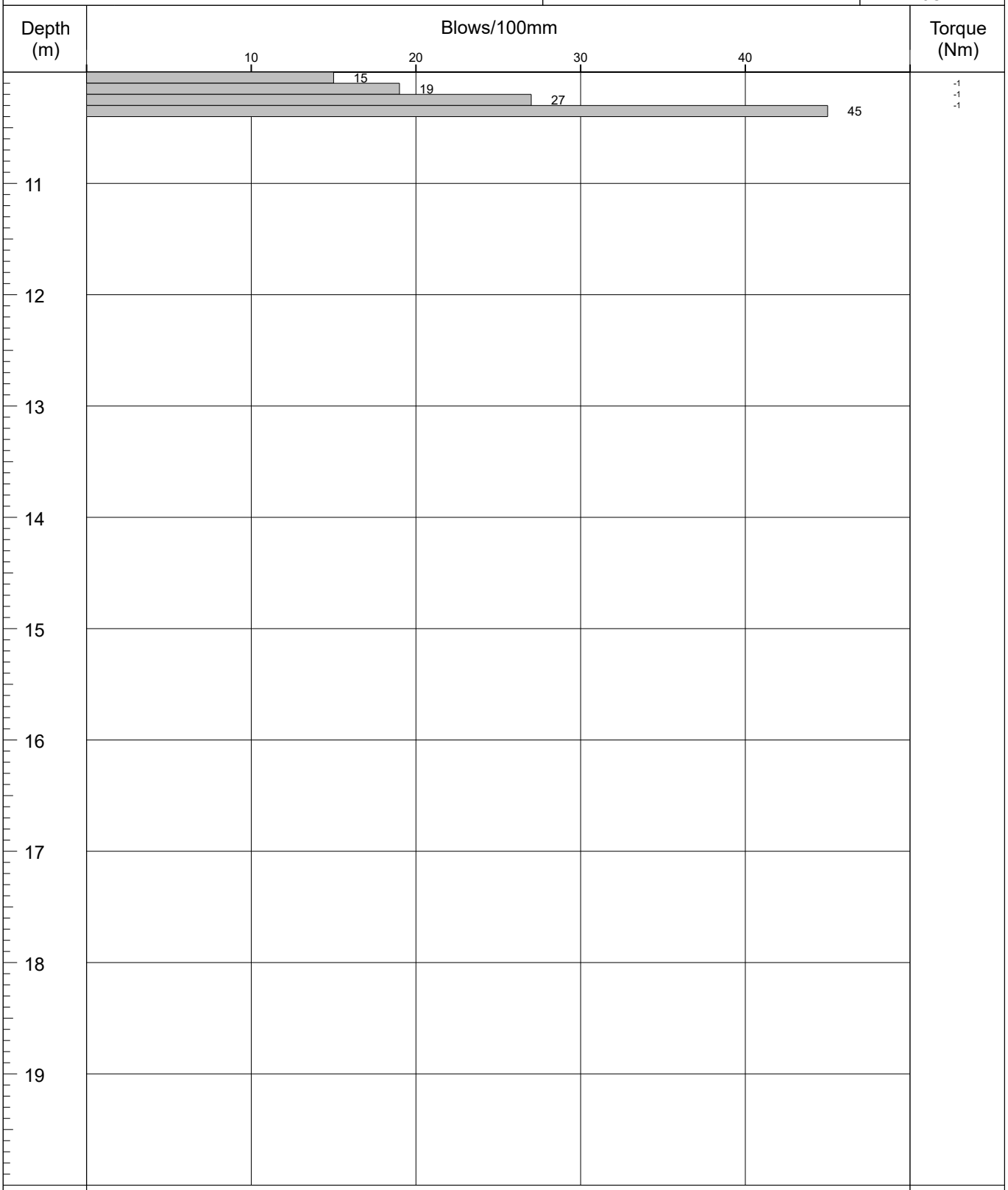
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-19/17

Sheet 2 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597078.48 - 725035.30	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.32	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks: General; 10.40M	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	10.40	
	Probe Type	DPSH-A			

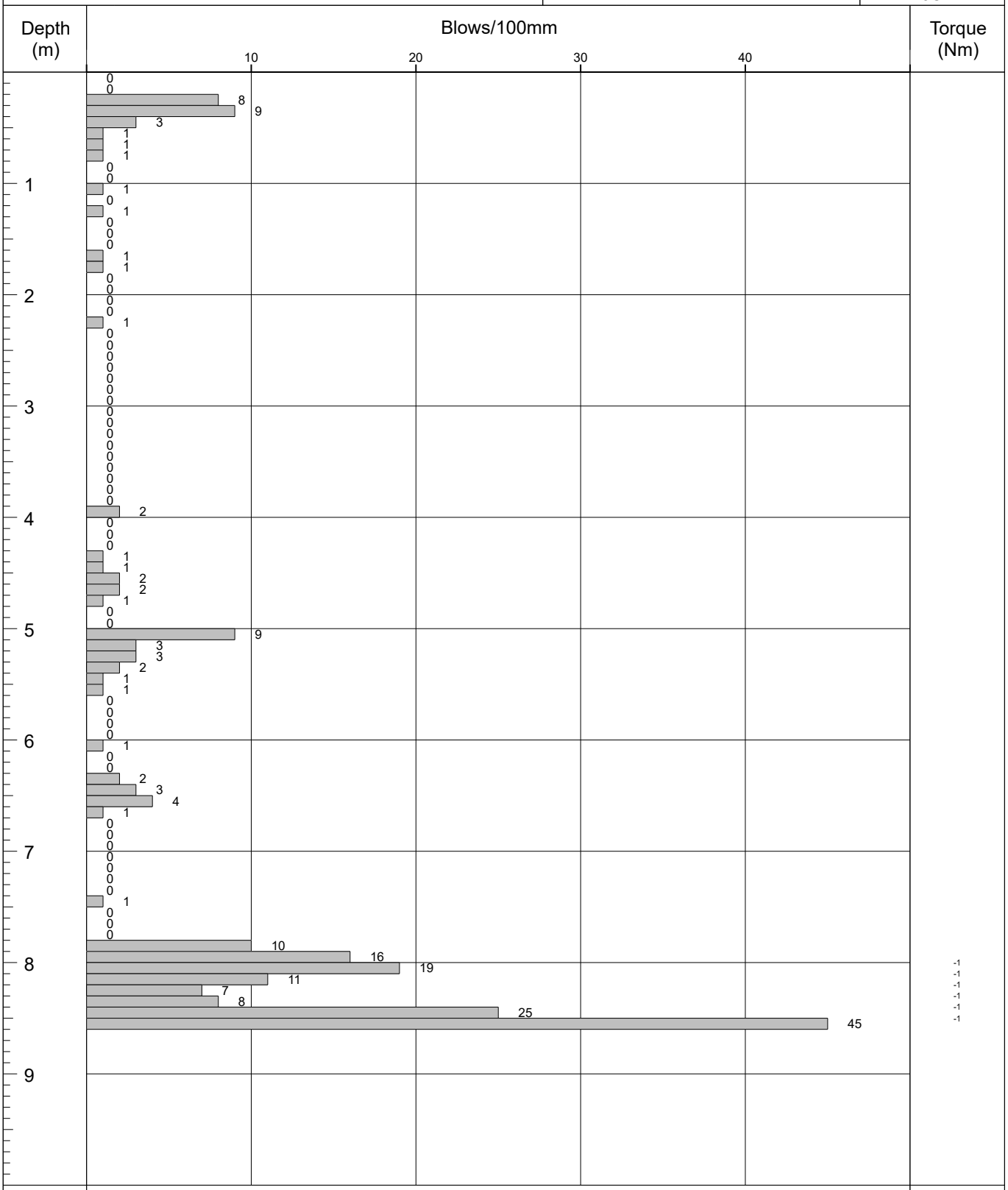
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-20/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597104.27 - 725039.57	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.53	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks: General; 8.60M	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	8.60	
	Probe Type	DPSH-A			

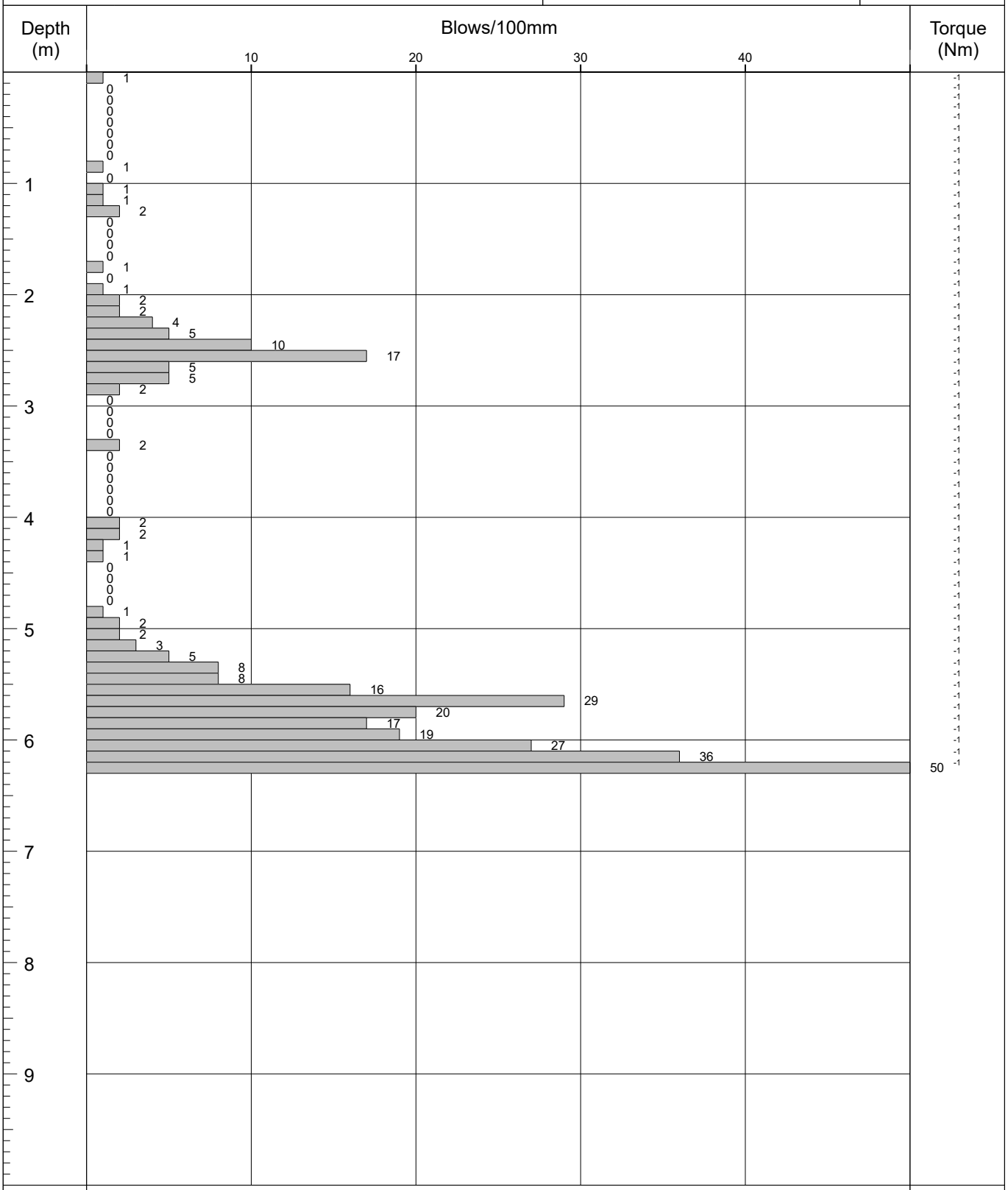
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-21/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597062.66 - 725013.38	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.20	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:**



Remarks: General; 6.30M	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	6.30	
	Probe Type	DPSH-A			

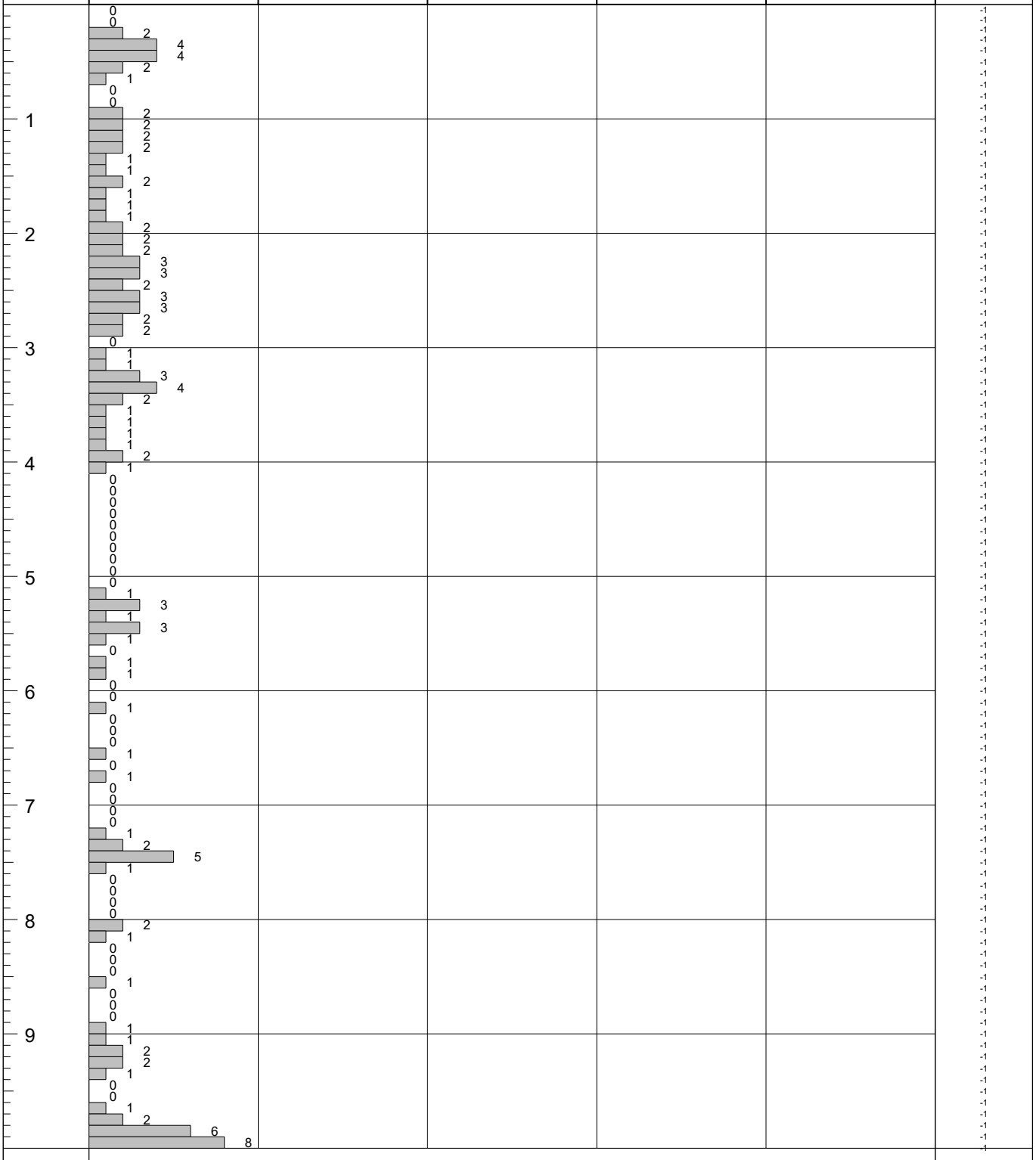
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-22/17

Sheet 1 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597107.77 - 725020.34	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.51	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks: General; 10.30M	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	10.30	
	Probe Type	DPSH-A			

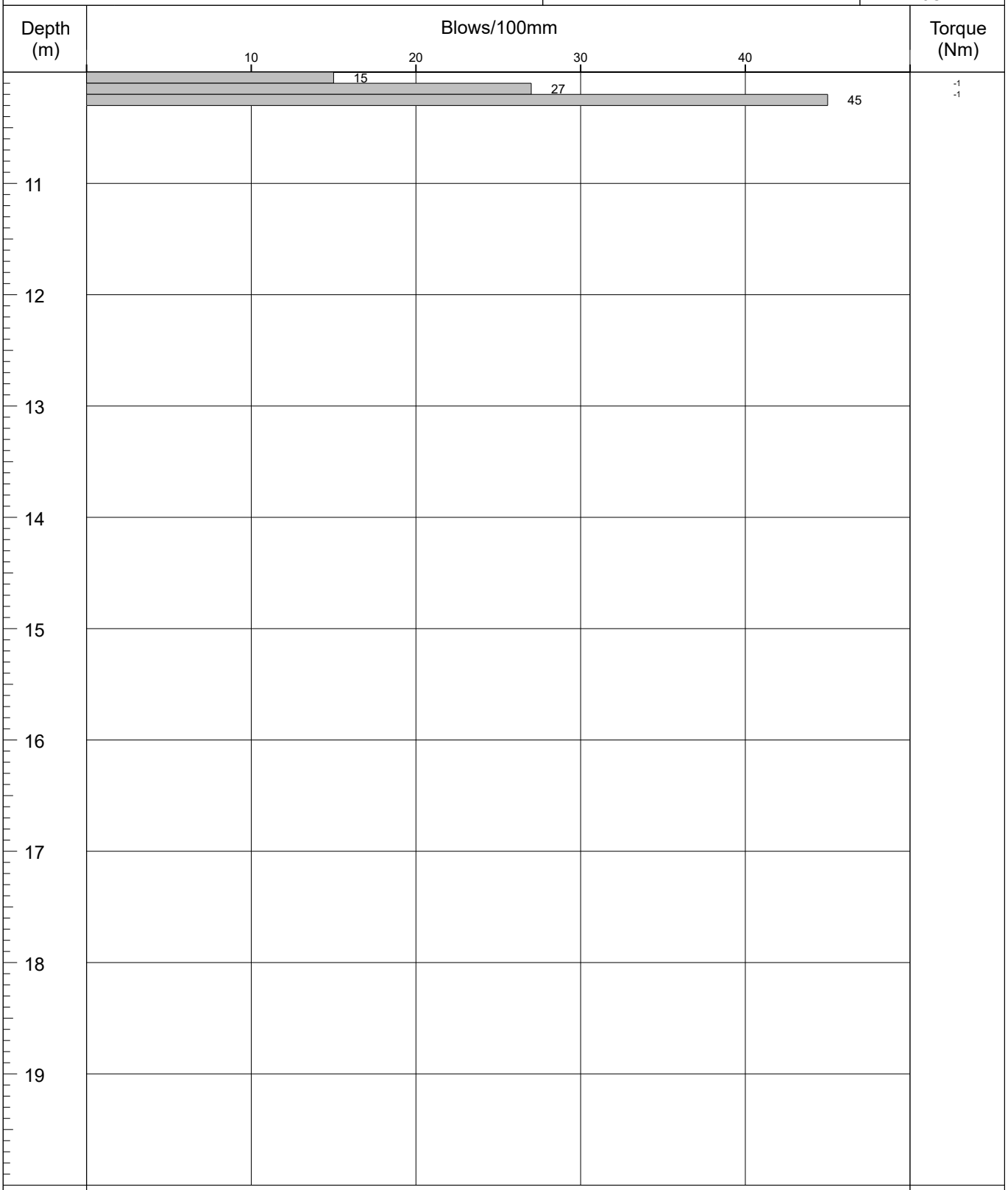
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-22/17

Sheet 2 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597107.77 - 725020.34	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.51	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks:
General; 10.30M

Fall Height	750	Cone Base Diameter	45
Hammer Wt	64	Final Depth	10.30
Probe Type	DPSH-A		

AGS

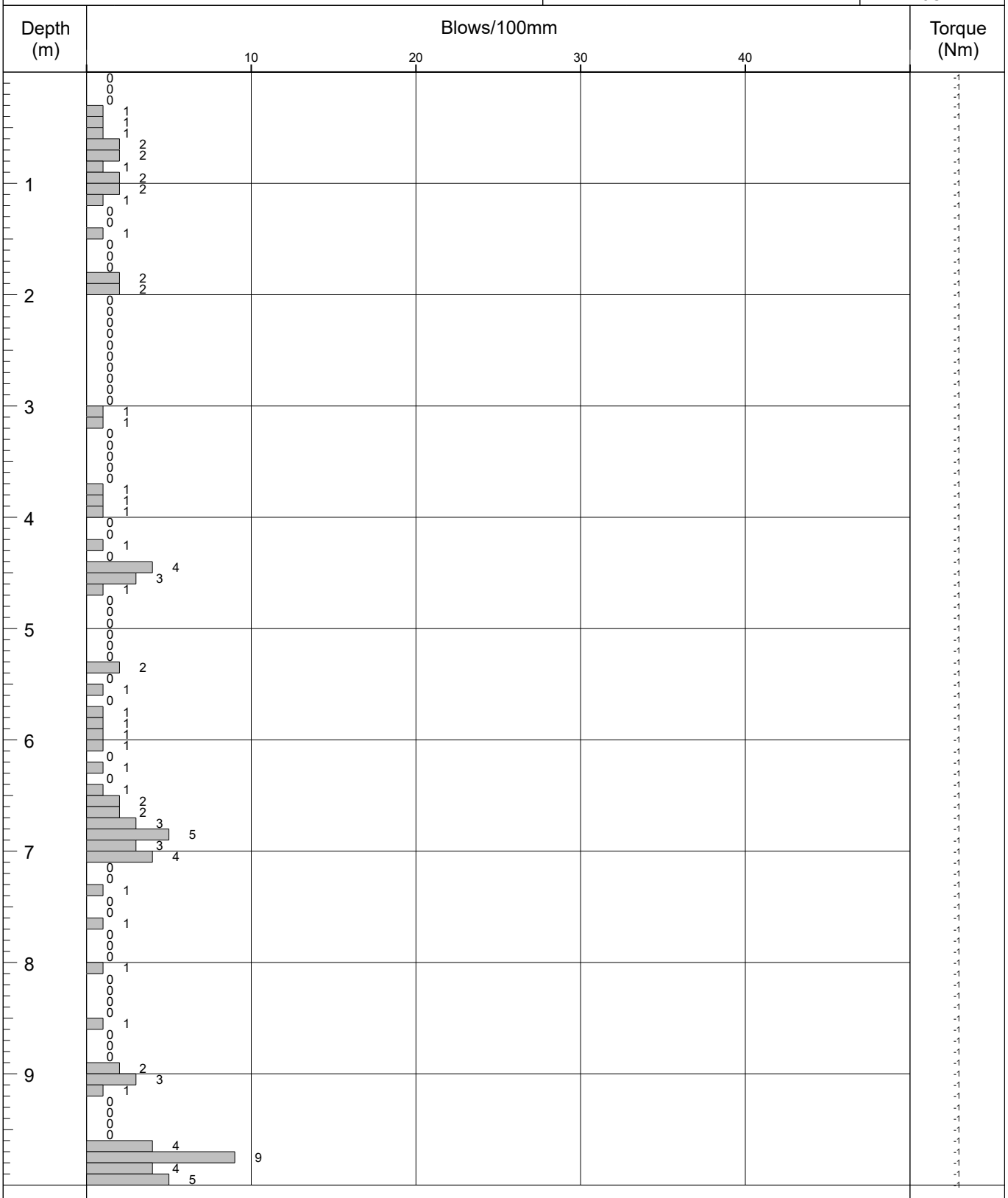
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-23/17

Sheet 1 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597119.86 - 725019.00	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.65	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks: General; 11.00m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	11.00	
	Probe Type	DPSH-A			

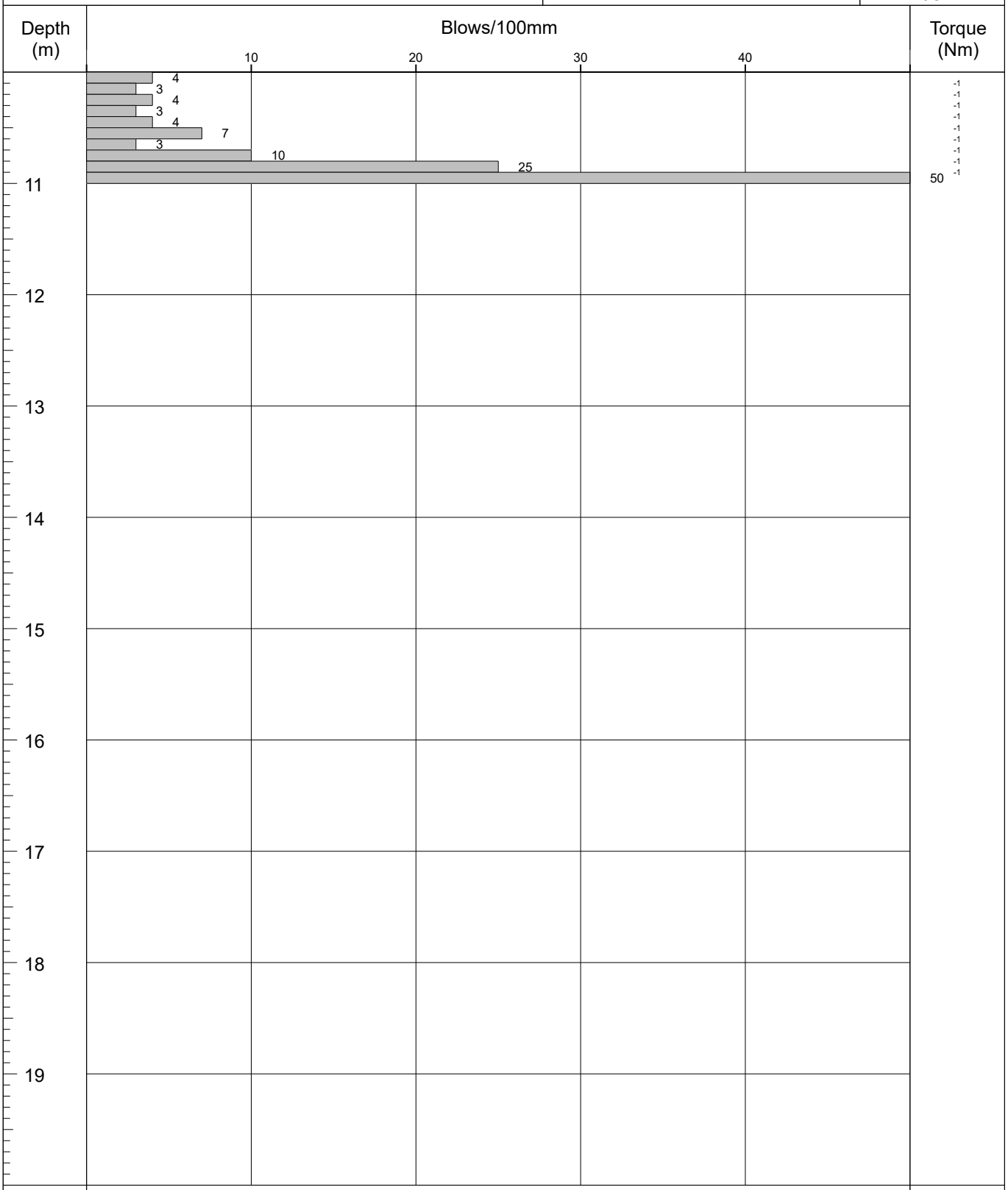
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-23/17

Sheet 2 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597119.86 - 725019.00	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.65	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks: General; 11.00m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	11.00	
	Probe Type	DPSH-A			

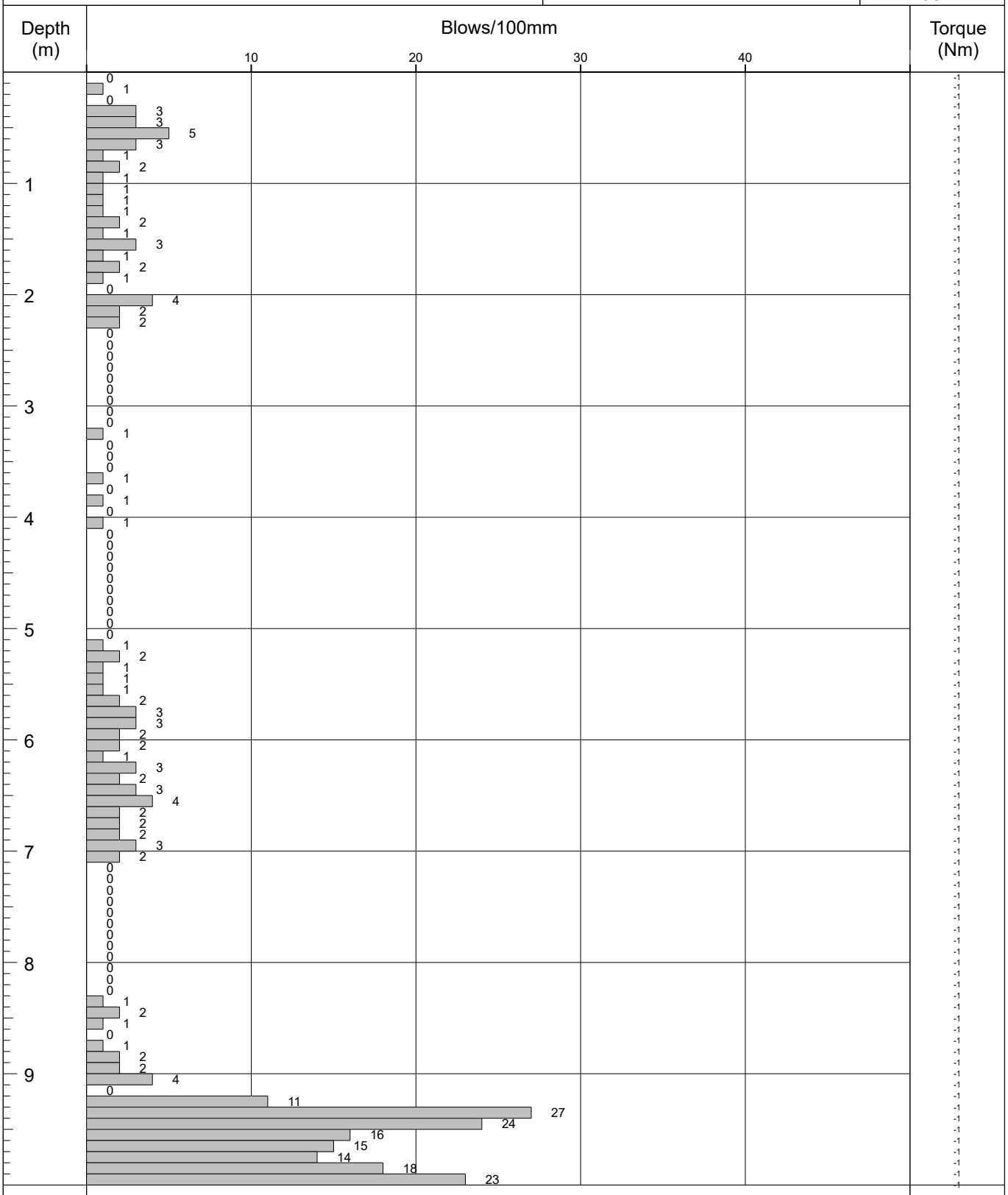
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-24/17

Sheet 1 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597131.96 - 725019.23	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.78	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks: General; 10.10m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	10.10	
	Probe Type	DPSH-A			

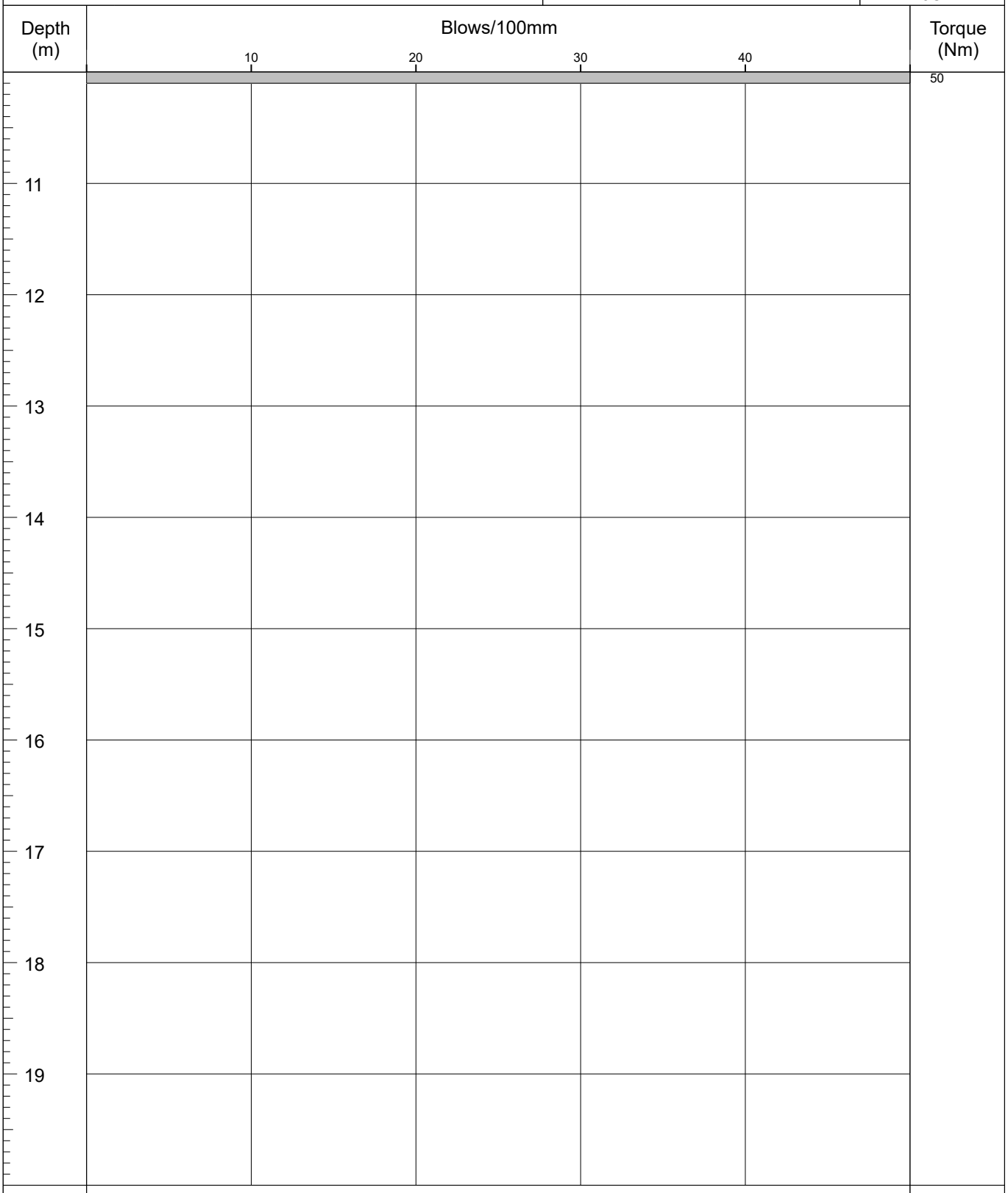
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-24/17

Sheet 2 of 2

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597131.96 - 725019.23	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.78	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks:
General; 10.10m

Fall Height	750	Cone Base Diameter	45
Hammer Wt	64	Final Depth	10.10
Probe Type	DPSH-A		

AGS

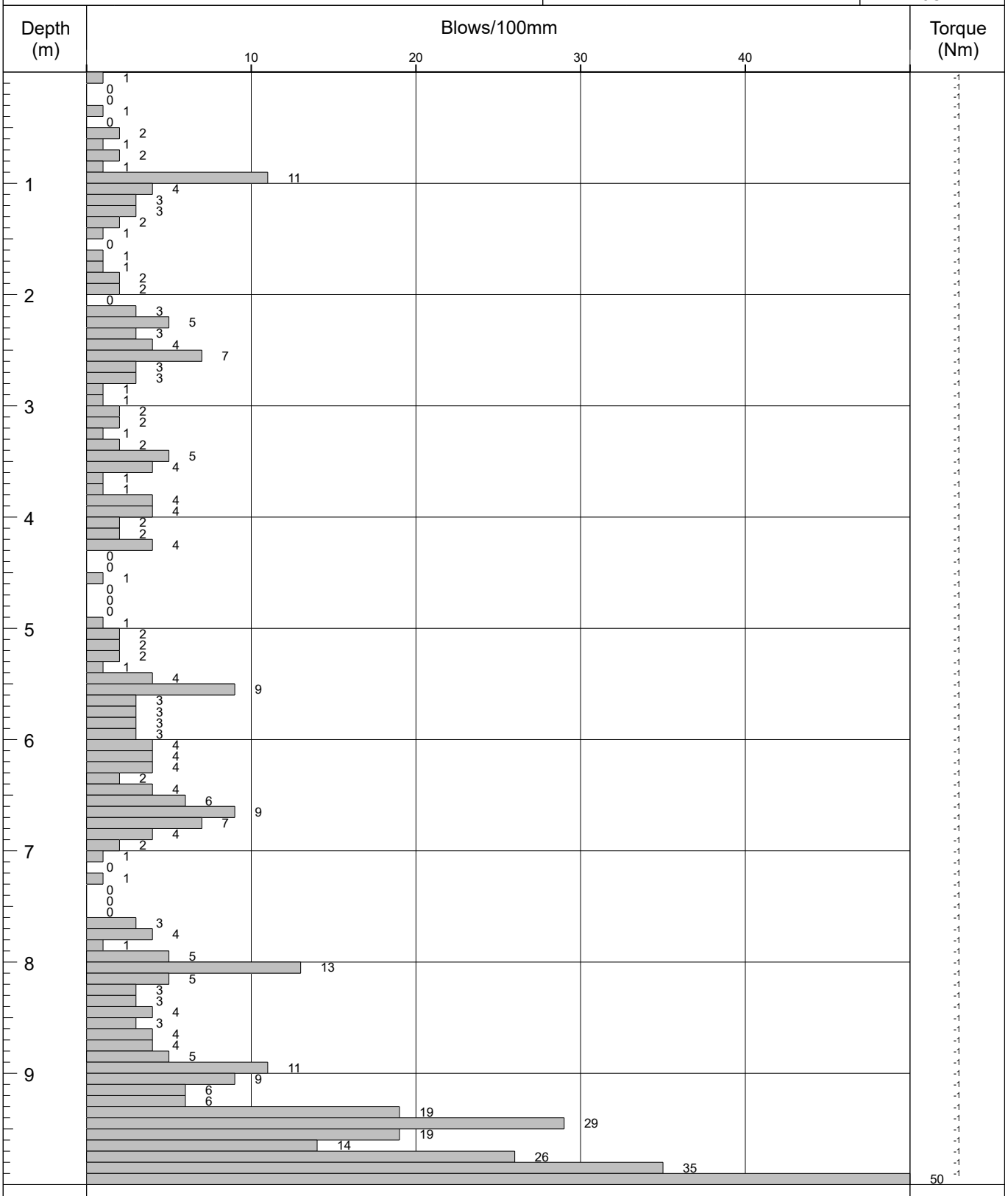
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-25/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597158.12 - 725024.33	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	41.08	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	21/02/2017	**Operator:** JC



Remarks: General; 10.00M	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	10.00	
	Probe Type	DPSH-A			

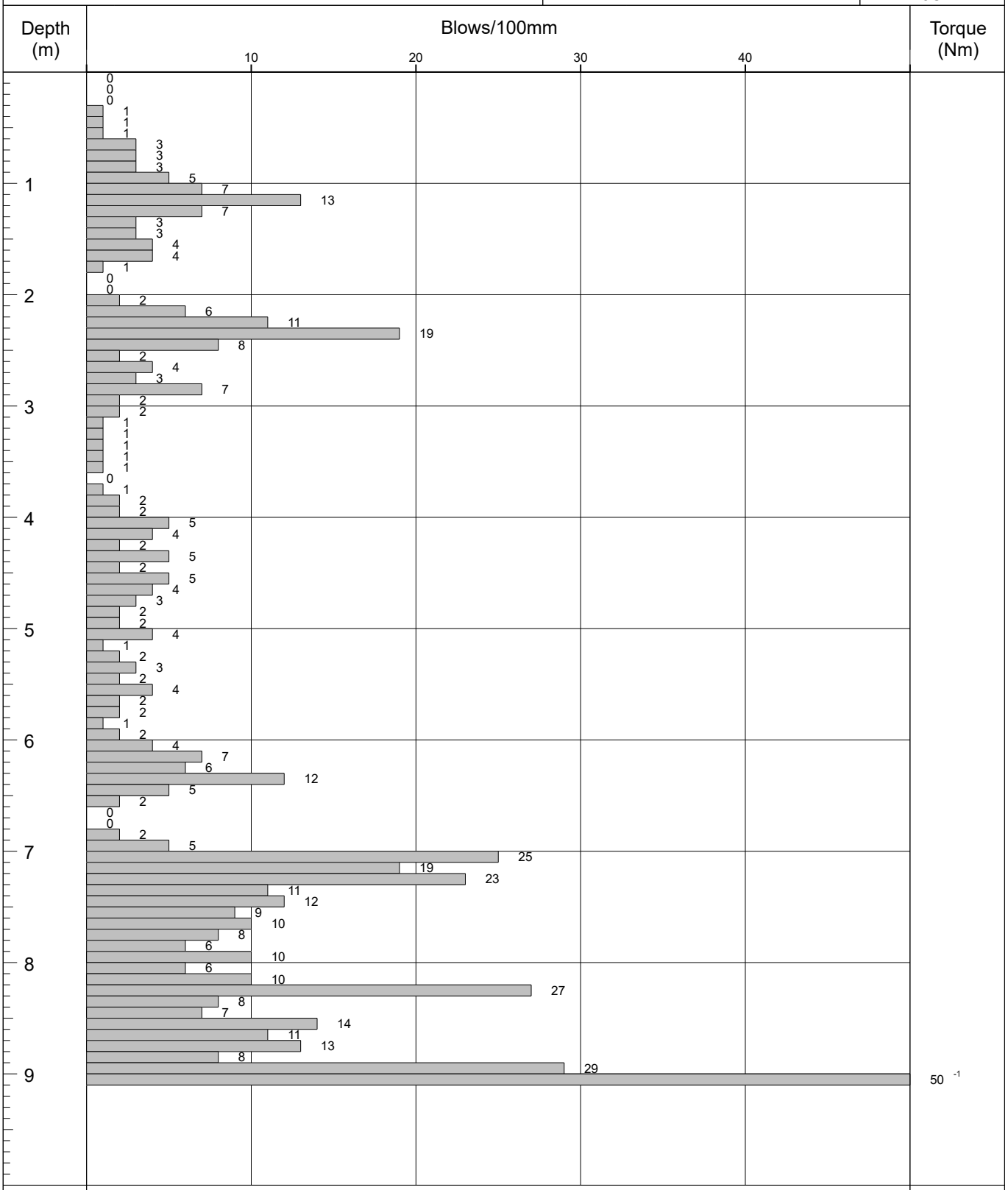
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-26/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597179.11 - 725027.59	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.79	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	20/02/2017	**Operator:** JC



Remarks: General; 9.10M	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	9.10	
	Probe Type	DPSH-A			

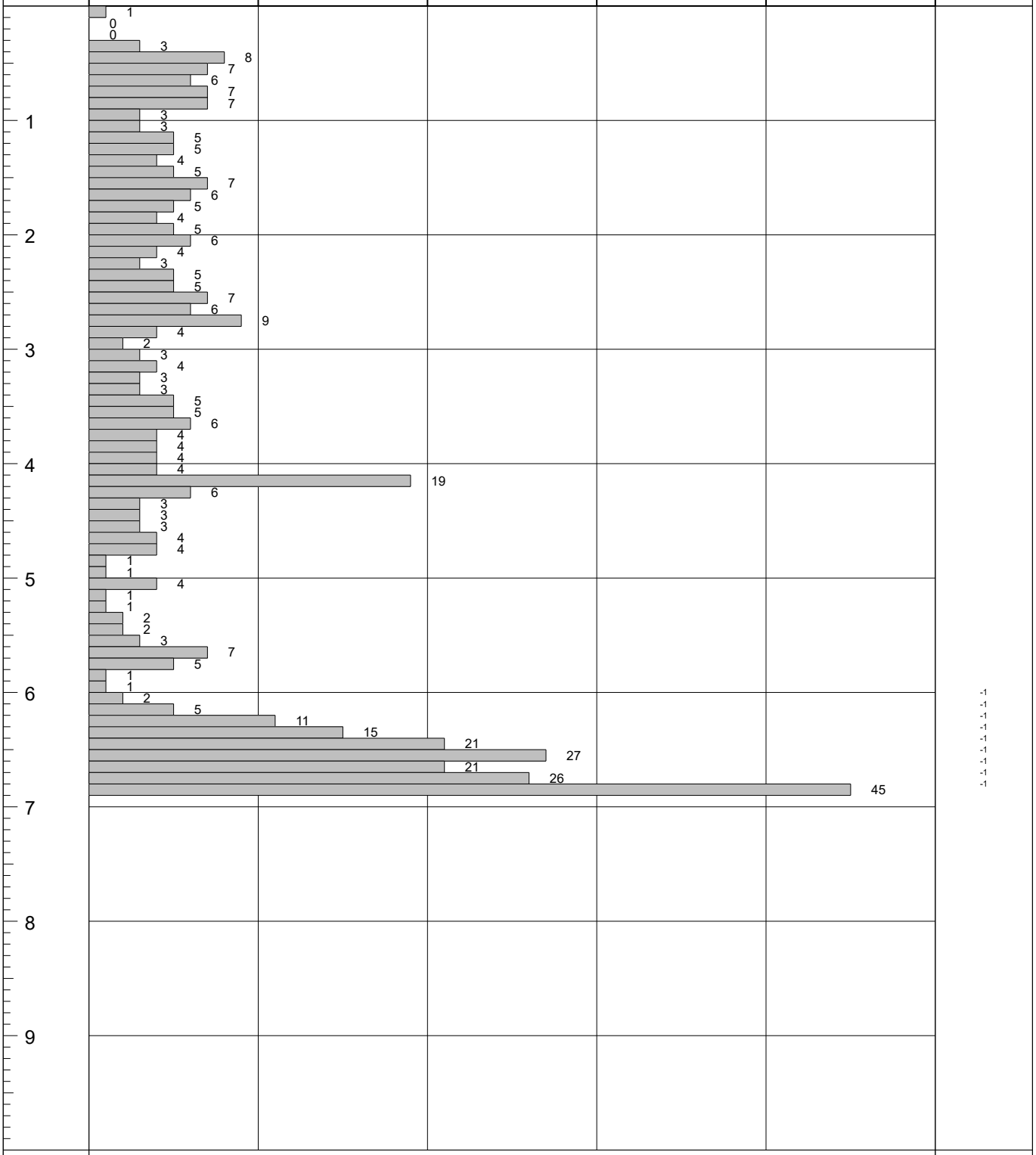
CAUSEWAY GEOTECH

Probe Log

Probe No: WOP-DP-27/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	597184.78 - 725001.26	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	40.33	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	20/02/2017	**Operator:** JC



Remarks: General; 6.9	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	6.90	
	Probe Type	DPSH-A			

CAUSEWAY GEOTECH

APPENDIX E

WOA probe logs

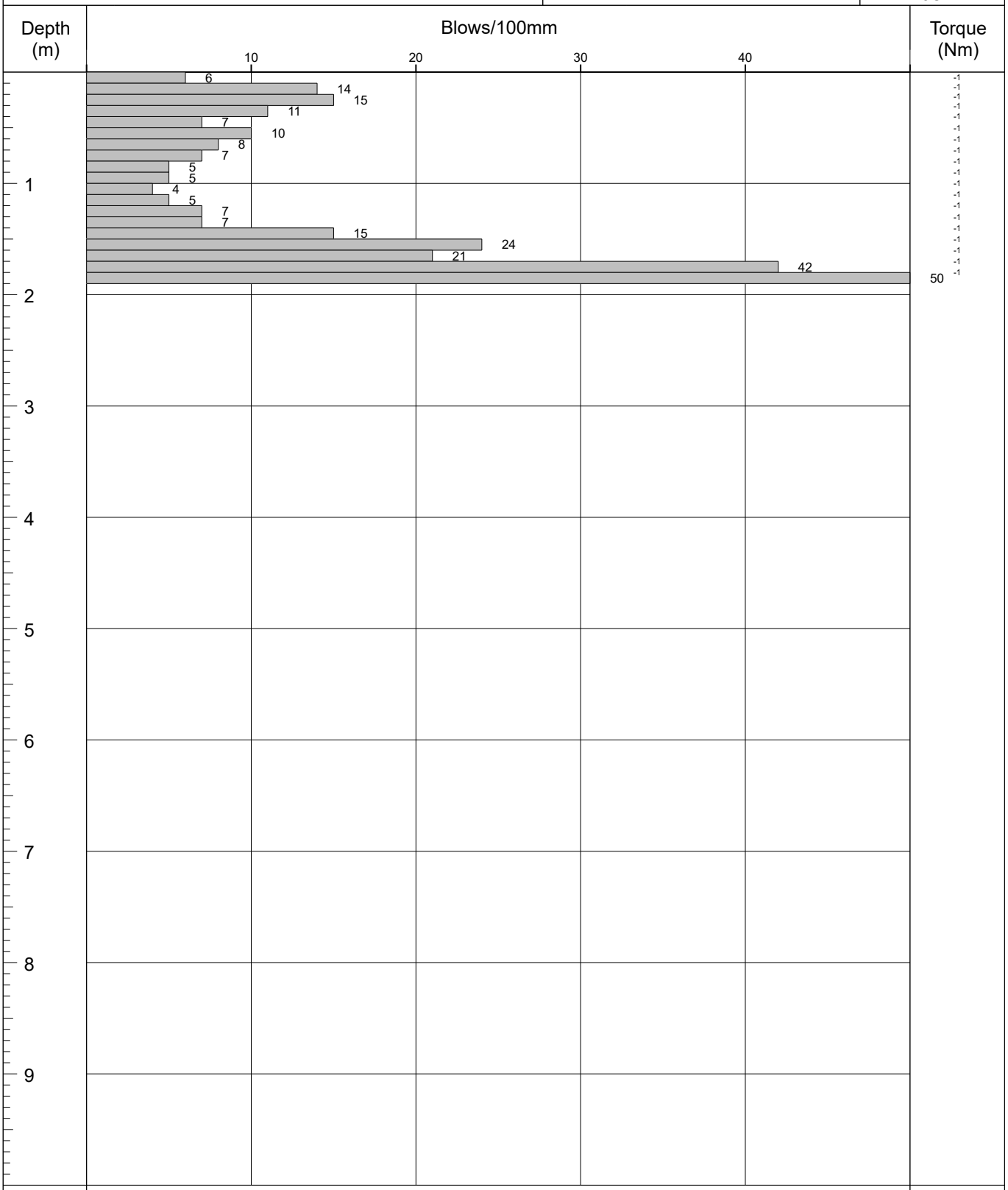
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-01/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602819.99 - 727355.38	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	37.71	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	14/02/2017	**Operator:** JC



Remarks:	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	0.00	
	Probe Type	DPSH-A			

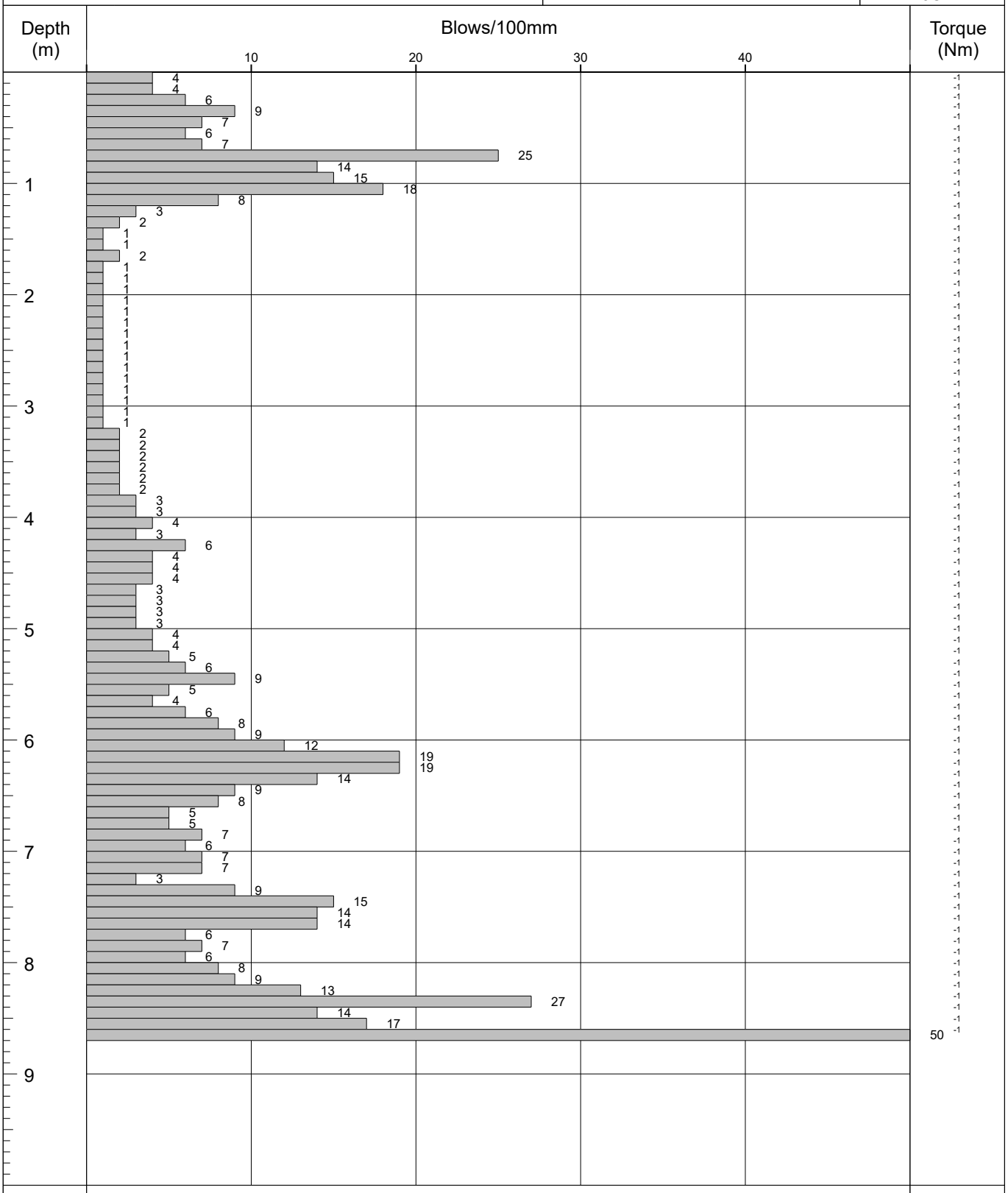
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-02/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602487.93 - 727326.48	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.19	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	14/02/2017	**Operator:** JC



Remarks:	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	0.00	
	Probe Type	DPSH-A			

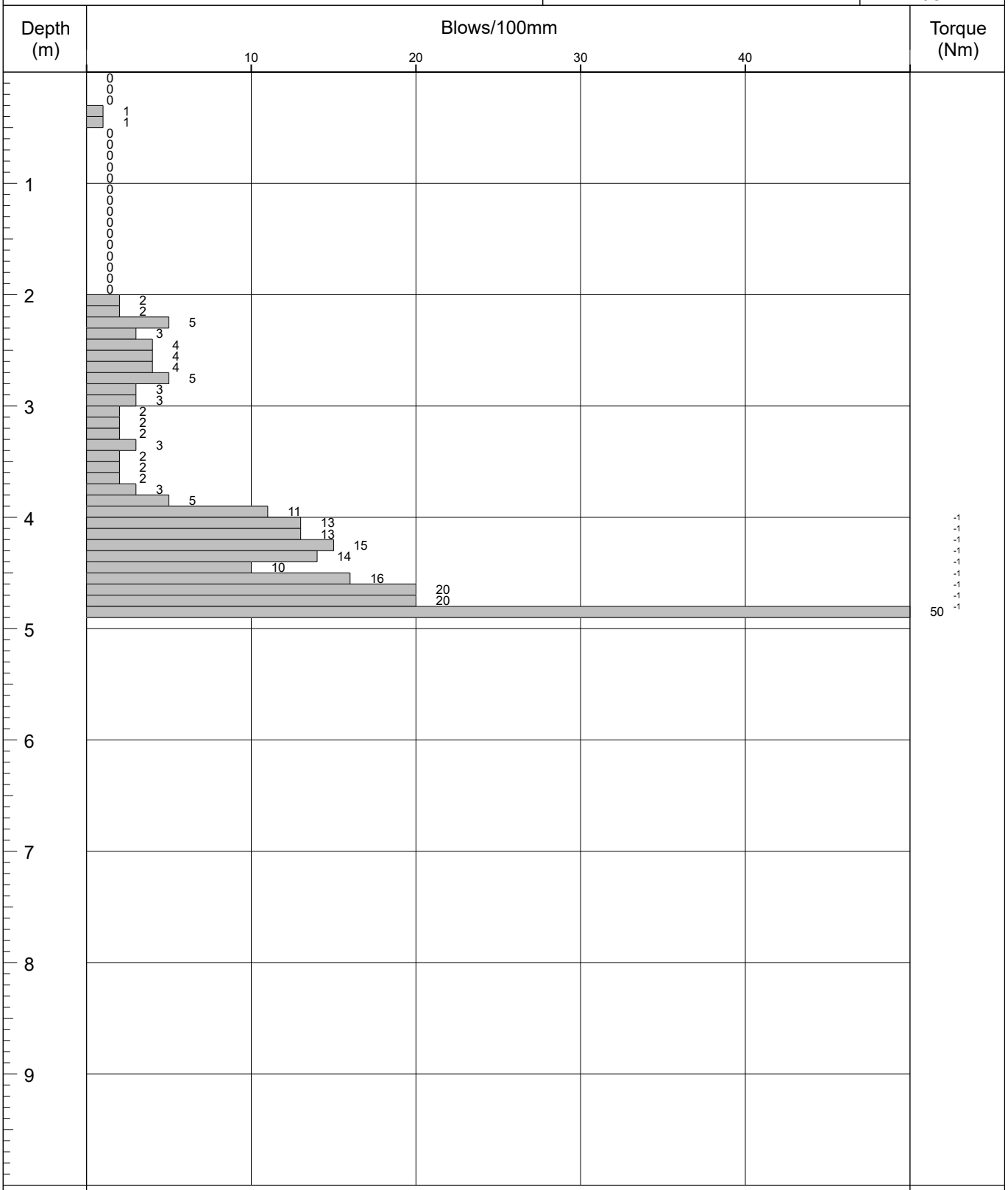
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-03/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602729.67 - 727301.69	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	37.06	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	15/02/2017	**Operator:** JC

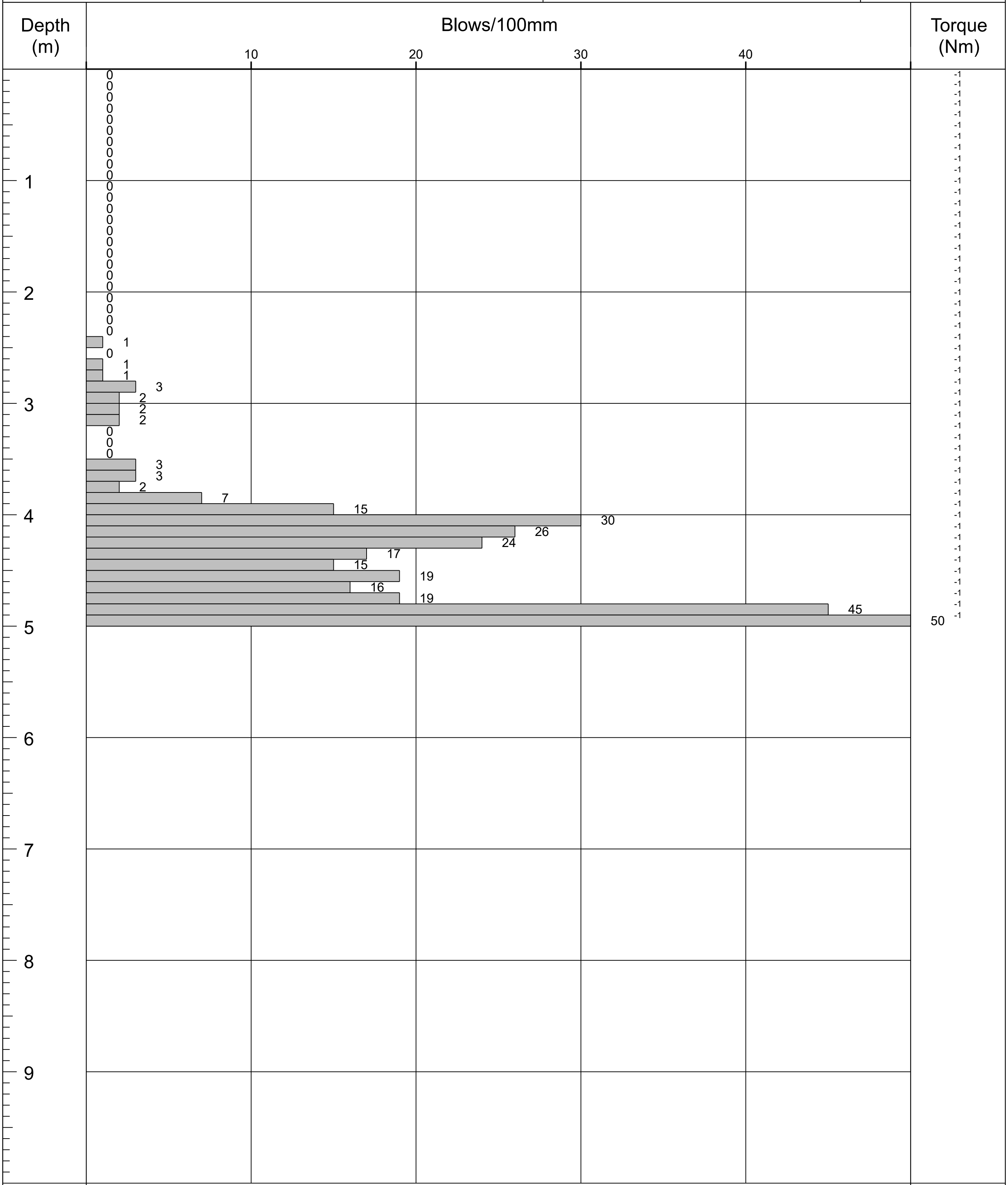


Remarks:				
	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	4.90
	Probe Type	DPSH-A		

AGS

Probe Log

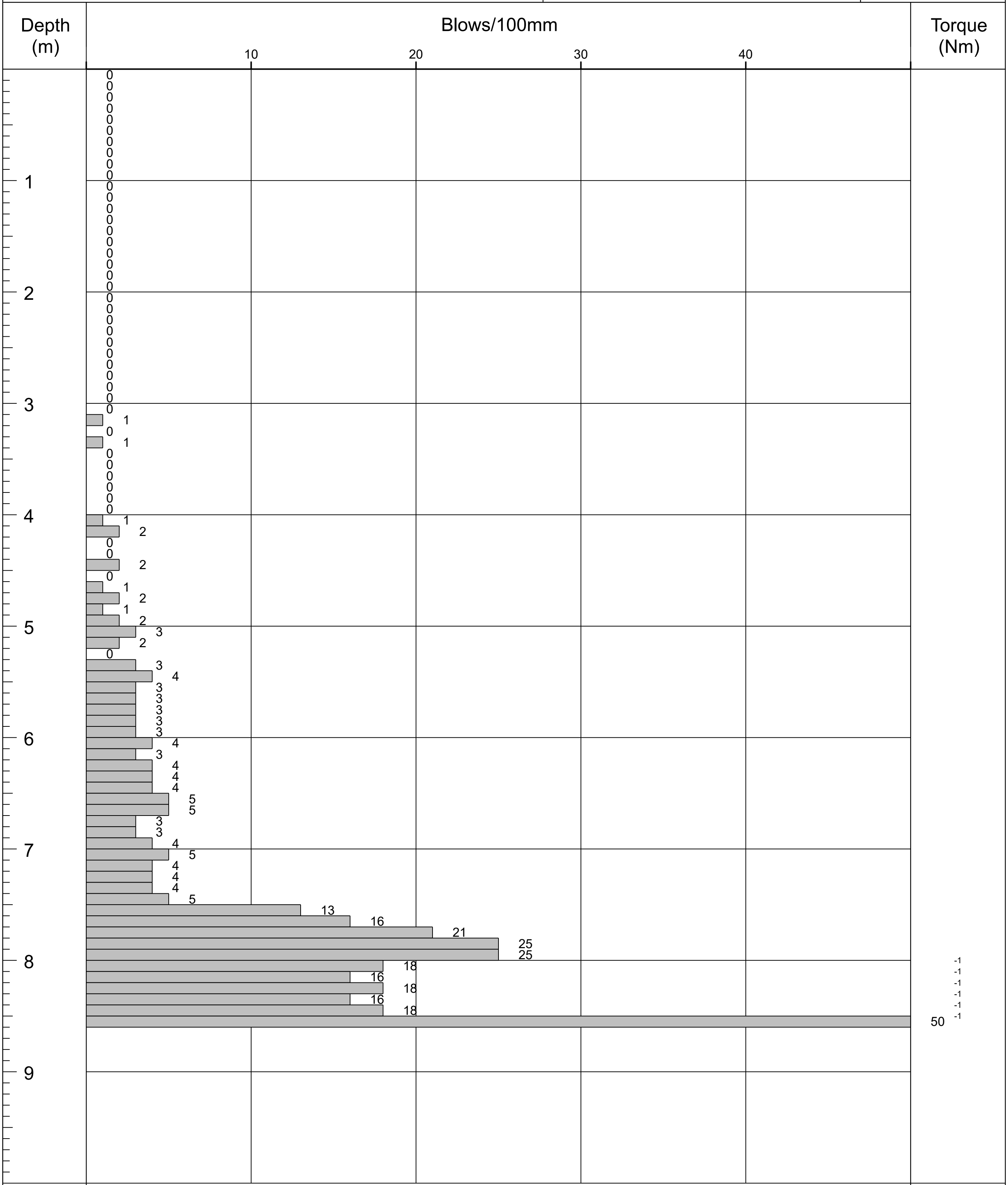
Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:** 602392.49 - 727231.68	**Probe No:** WOA-DP-04/17 Sheet 1 of 1
			Hole Type: DP
Client: Bord Na Mona		**Level:** 37.93	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:** 14/02/2017	**Operator:** JC



Remarks:				
	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	0.00
	Probe Type	DPSH-A		

CAUSEWAY GEOTECH	# Probe Log	**Probe No:** **WOA-DP-05/17** Sheet 1 of 1

Project Name:	West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602593.67 - 727129.02	**Hole Type:** DP
Client:	Bord Na Mona		**Level:**	37.44	**Scale:** 1:50
Client's Rep:	Bord Na Mona		**Date:**	15/02/2017	**Operator:** JC



Remarks:	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	8.60
	Probe Type	DPSH-A		

AGS

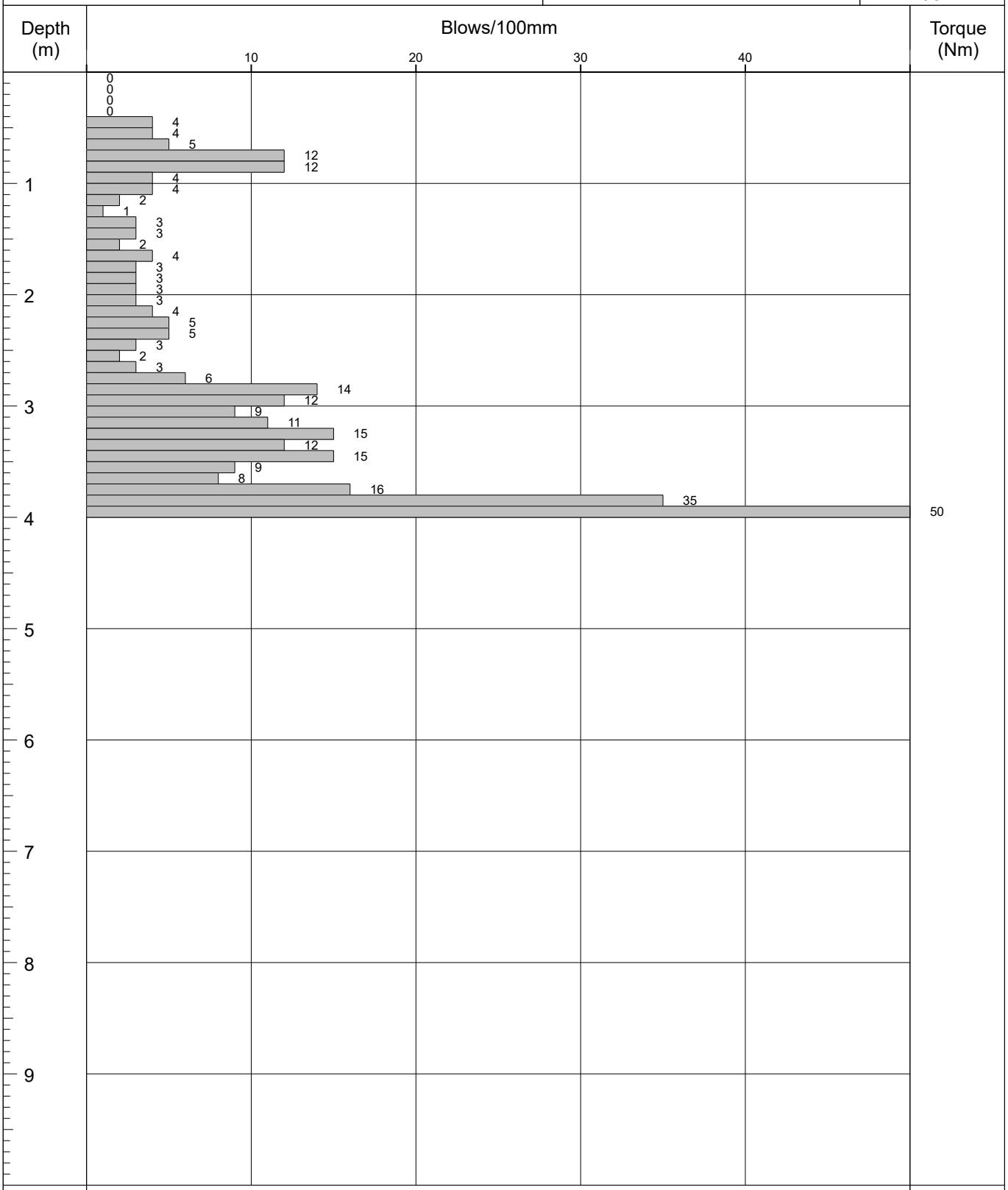
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-06/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602672.88 - 727215.32	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	37.39	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	15/02/2017	**Operator:** JC



Remarks:				
	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	4.00
	Probe Type	DPSH-A		

AGS

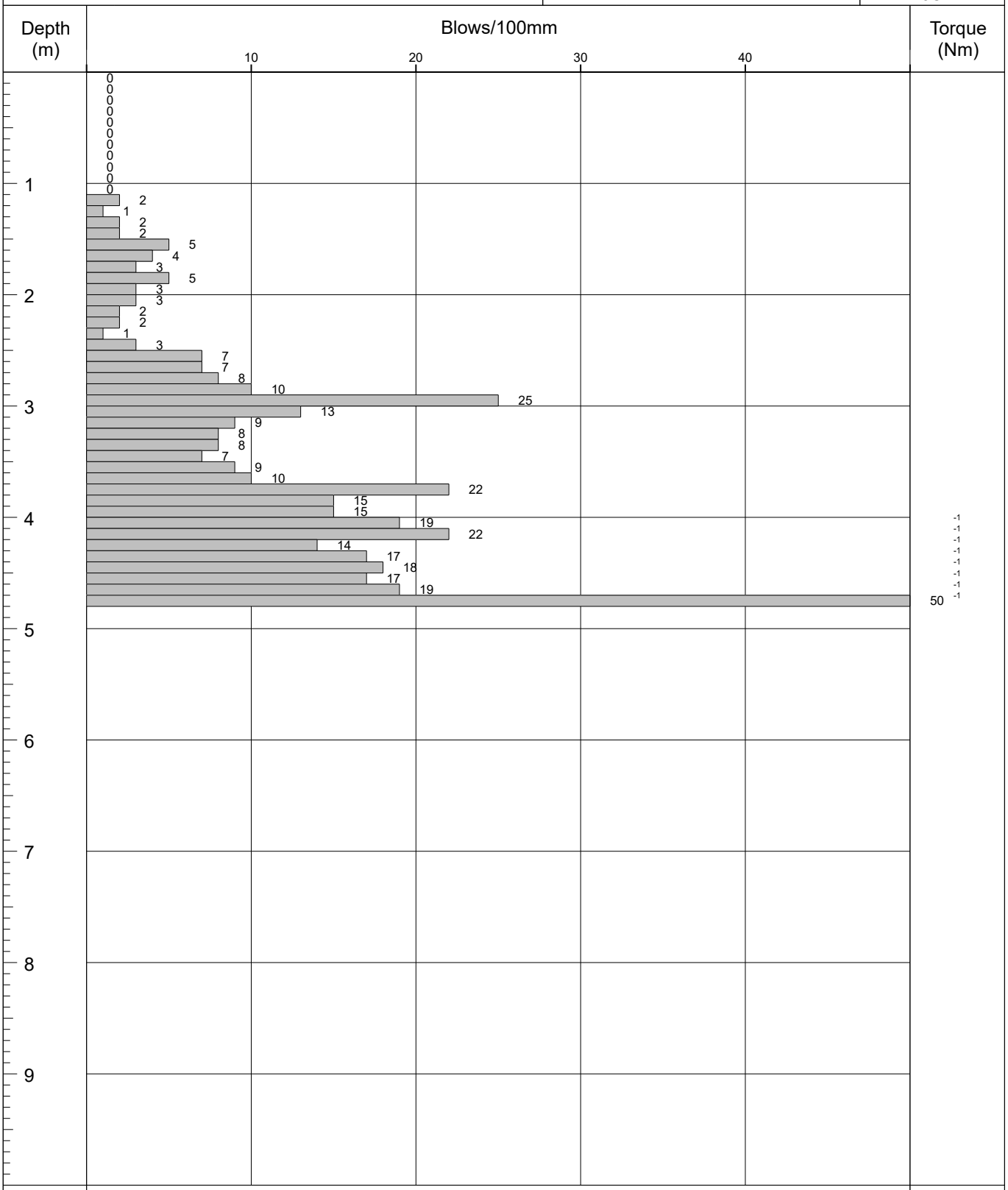
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-07/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602752.56 - 727218.39	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	38.28	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	15/02/2017	**Operator:** JC



Remarks:				
	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	4.80
	Probe Type	DPSH-A		

AGS

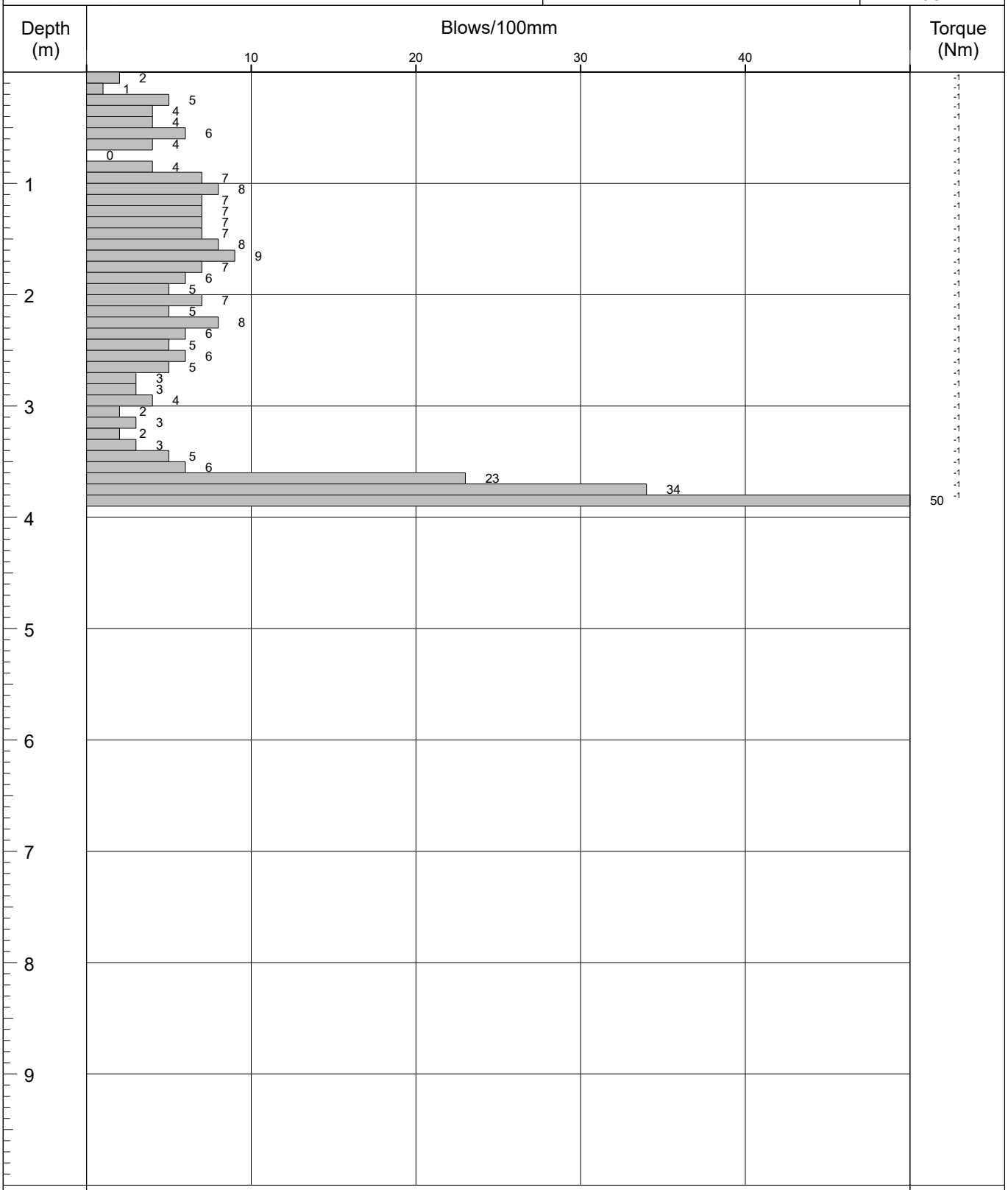
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-08/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602797.80 - 727228.77	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	38.40	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	16/02/2017	**Operator:** JC



Remarks: General; 3.90m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	3.90	
	Probe Type	DPSH-A			

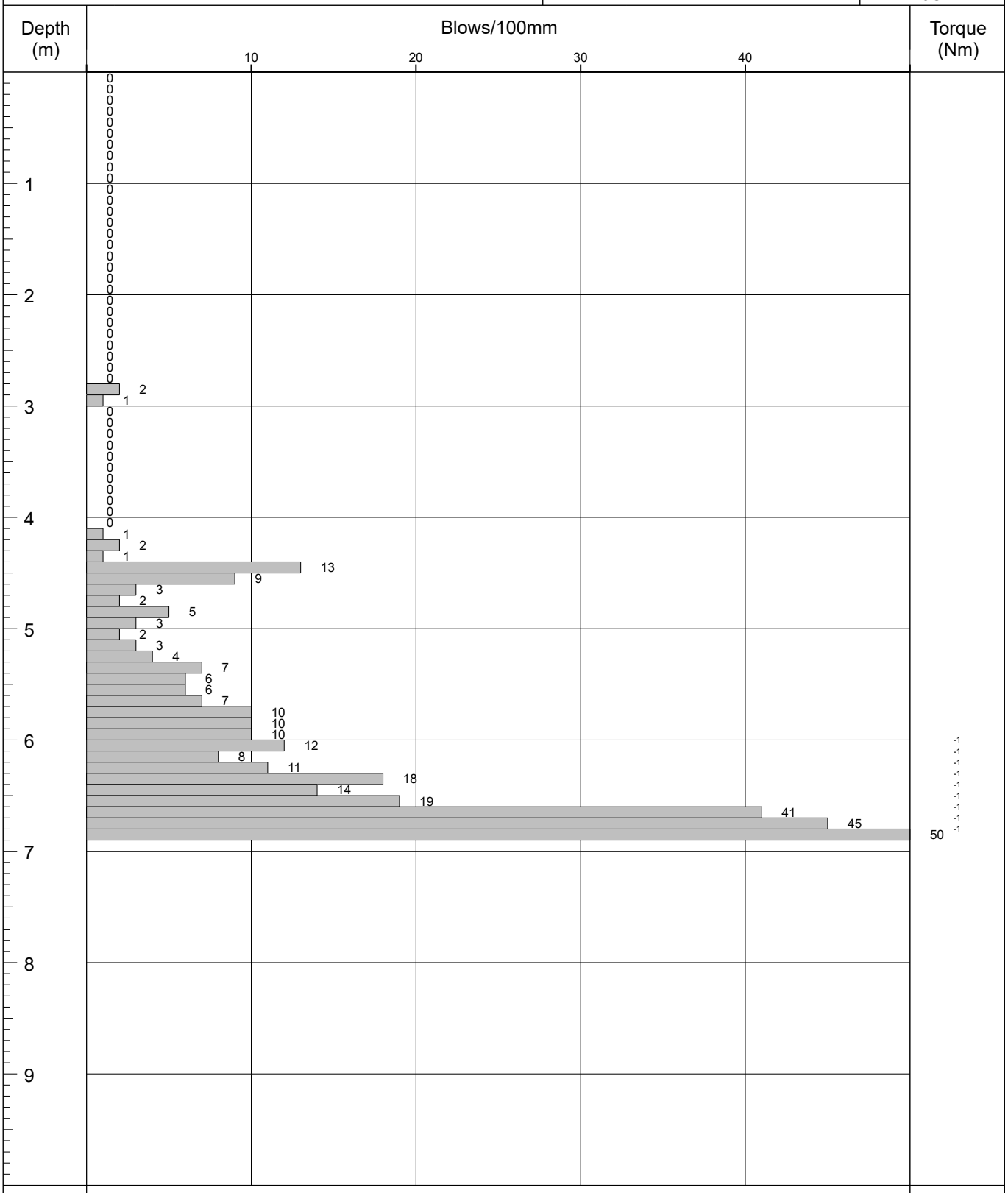
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-09/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602955.99 - 727212.52	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.45	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	15/02/2017	**Operator:** JC



Remarks:				
	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	6.90
	Probe Type	DPSH-A		

AGS

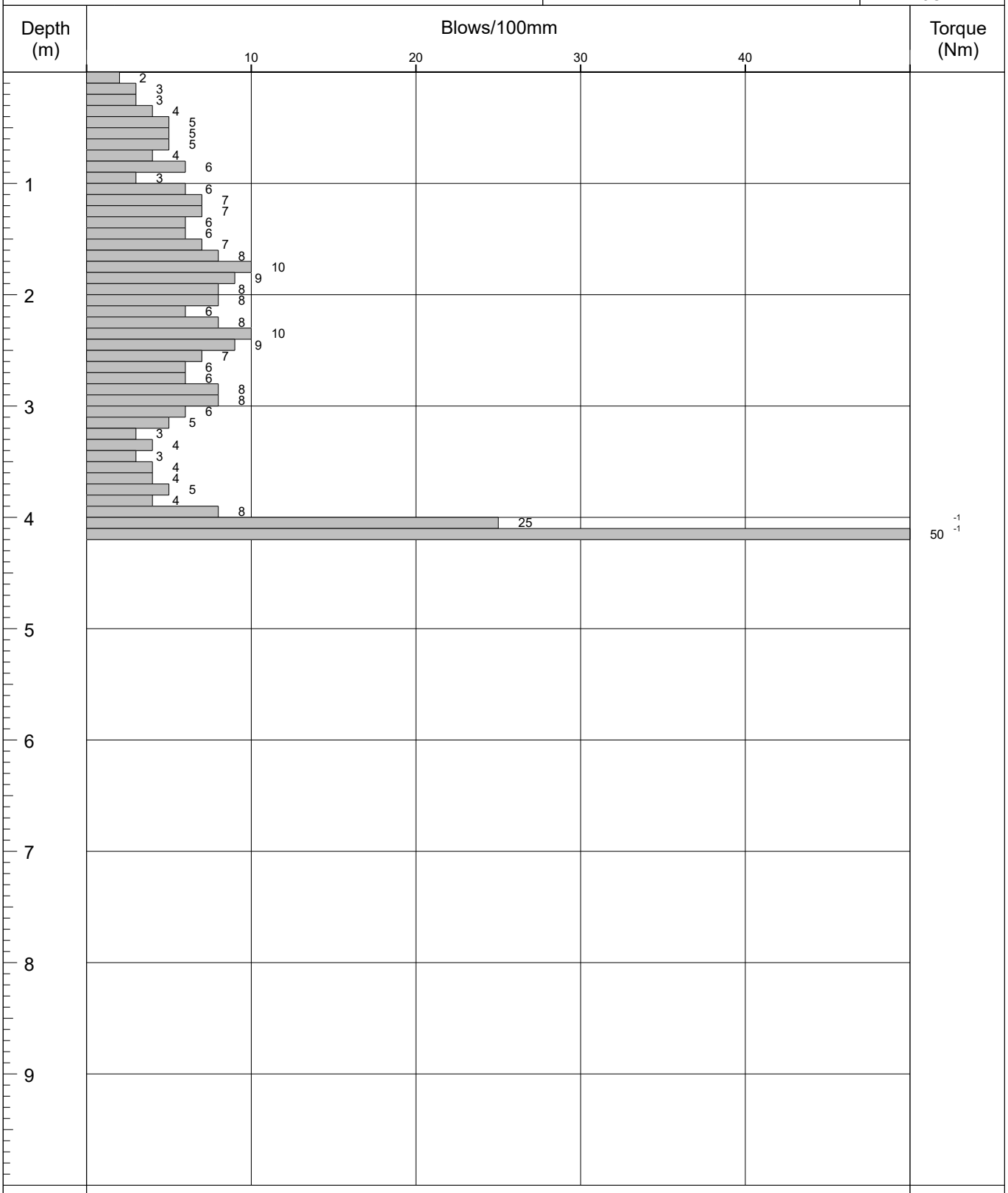
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-10/17

Sheet 1 of 1

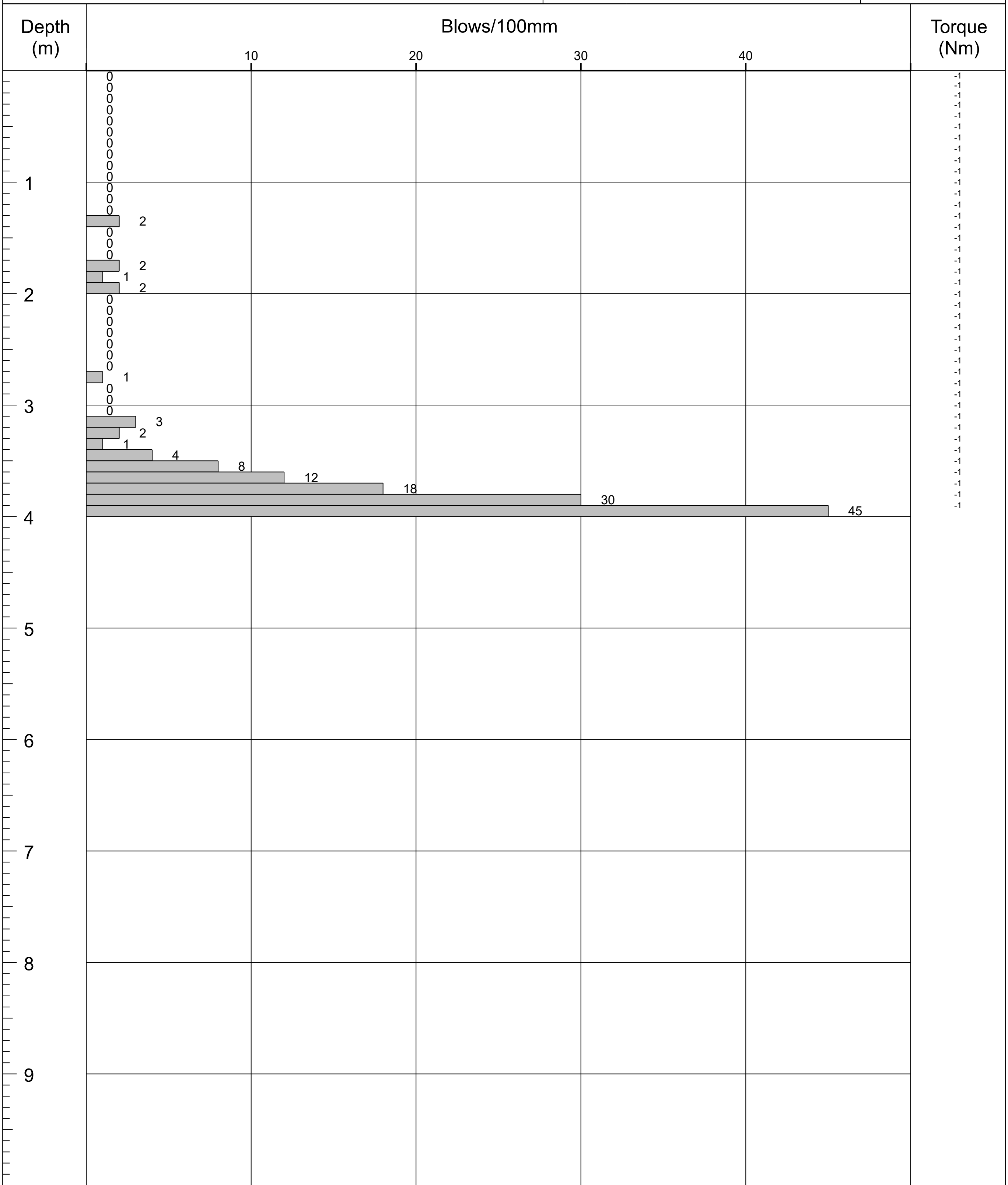
Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602686.66 - 727174.11	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	38.67	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	16/02/2017	**Operator:** JC



Remarks: General; 4.20m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	4.20	
	Probe Type	DPSH-A			

CAUSEWAY GEOTECH	Probe Log	Probe No: **WOA-DP-11/17** Sheet 1 of 1

Project Name:	West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602891.09 - 727179.29	**Hole Type:** DP
Client:	Bord Na Mona		**Level:**	38.74	**Scale:** 1:50
Client's Rep:	Bord Na Mona		**Date:**	16/02/2017	**Operator:** JC

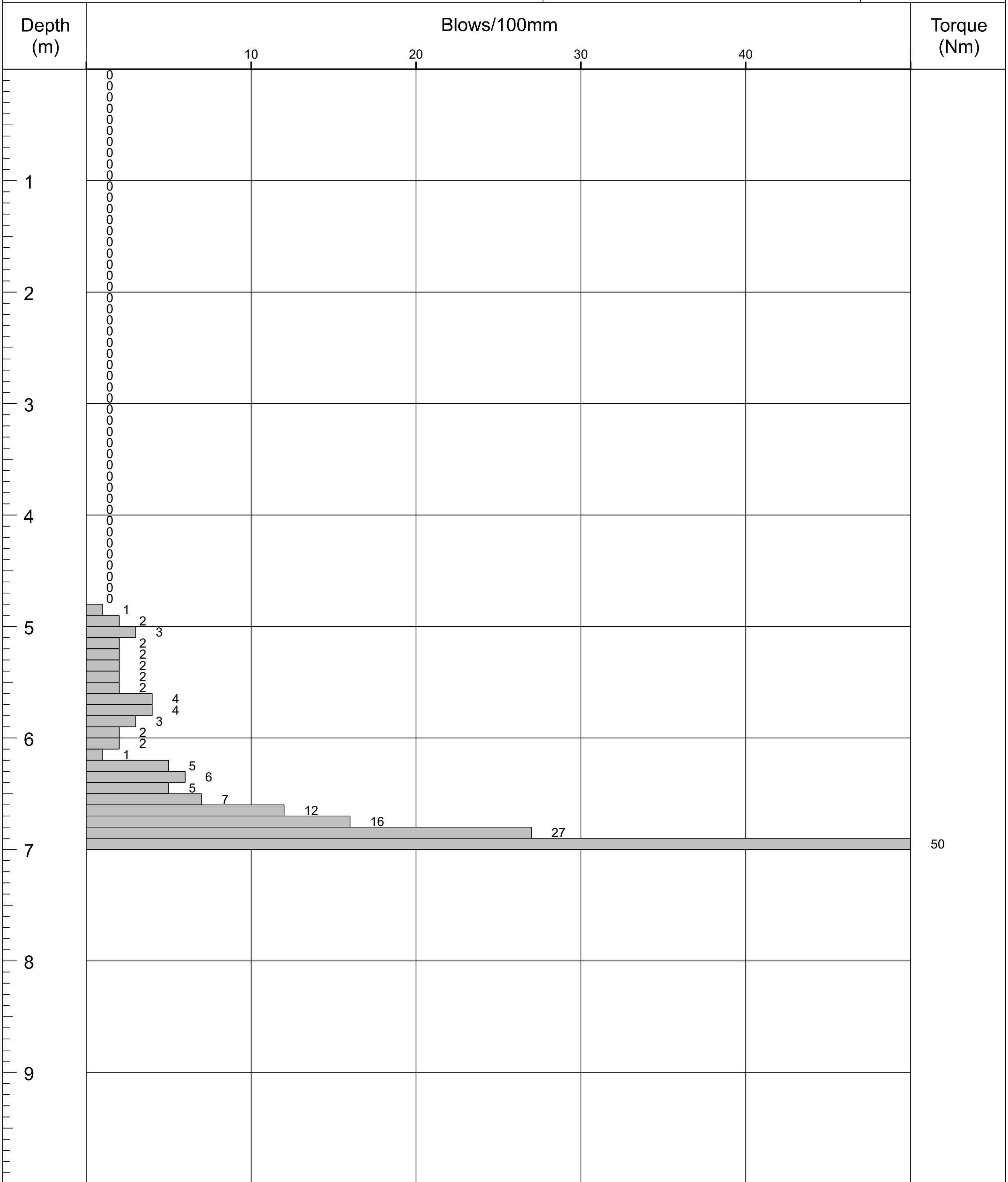


Remarks: General; 4.00M	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	4.00
	Probe Type	DPSH-A		

AGS

CAUSEWAY GEOTECH	Probe Log	Probe No: **WOA-DP-12/17** Sheet 1 of 1

Project Name:	West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602632.46 - 727121.97	**Hole Type:** DP
Client:	Bord Na Mona		**Level:**	38.46	**Scale:** 1:50
Client's Rep:	Bord Na Mona		**Date:**	15/02/2017	**Operator:** JC



Remarks:	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	7.00
	Probe Type	DPSH-A		

AGS

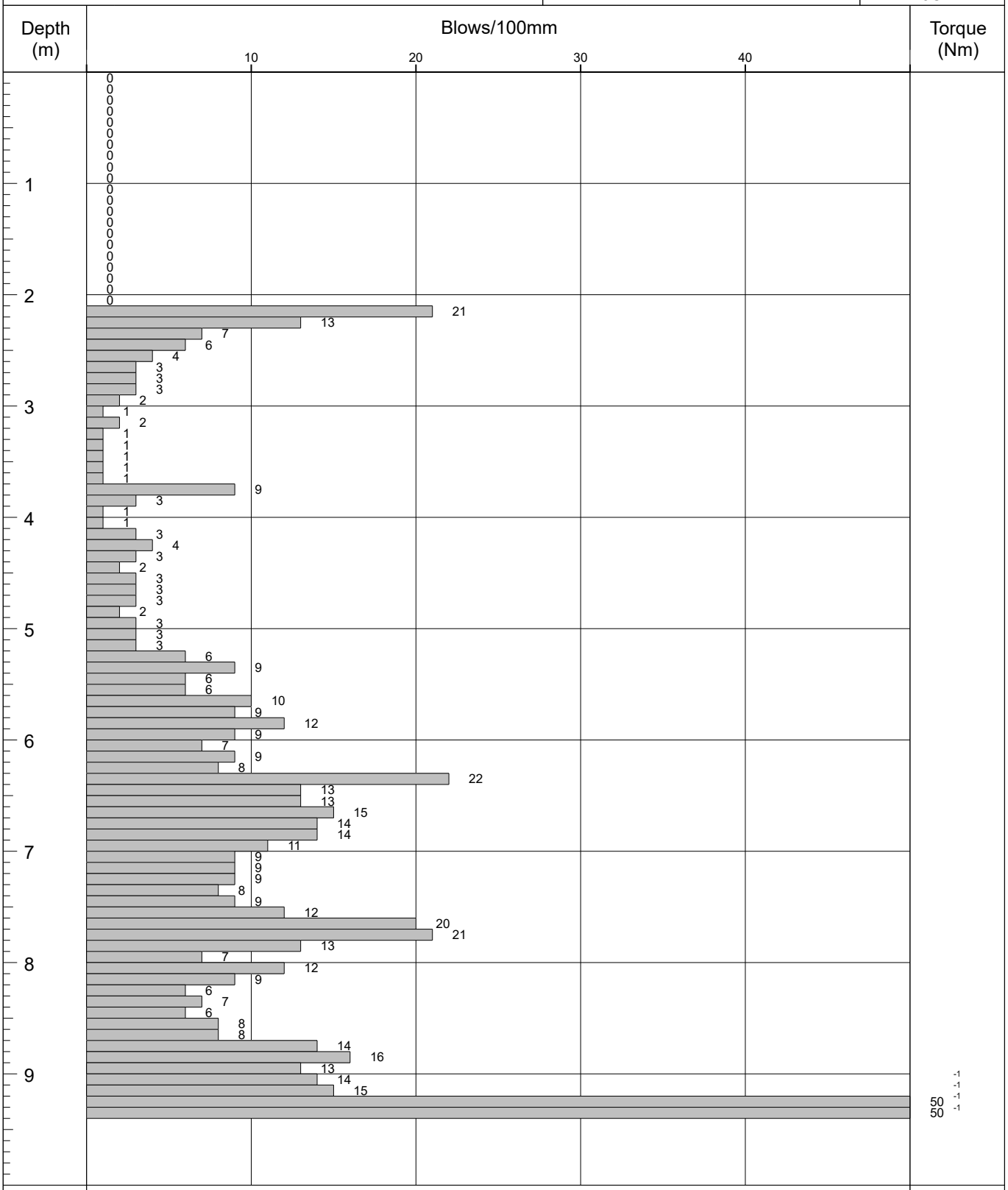
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-13/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602992.80 - 727142.24	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.67	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	15/02/2017	**Operator:** JC



Remarks:	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	9.40	
	Probe Type	DPSH-A			

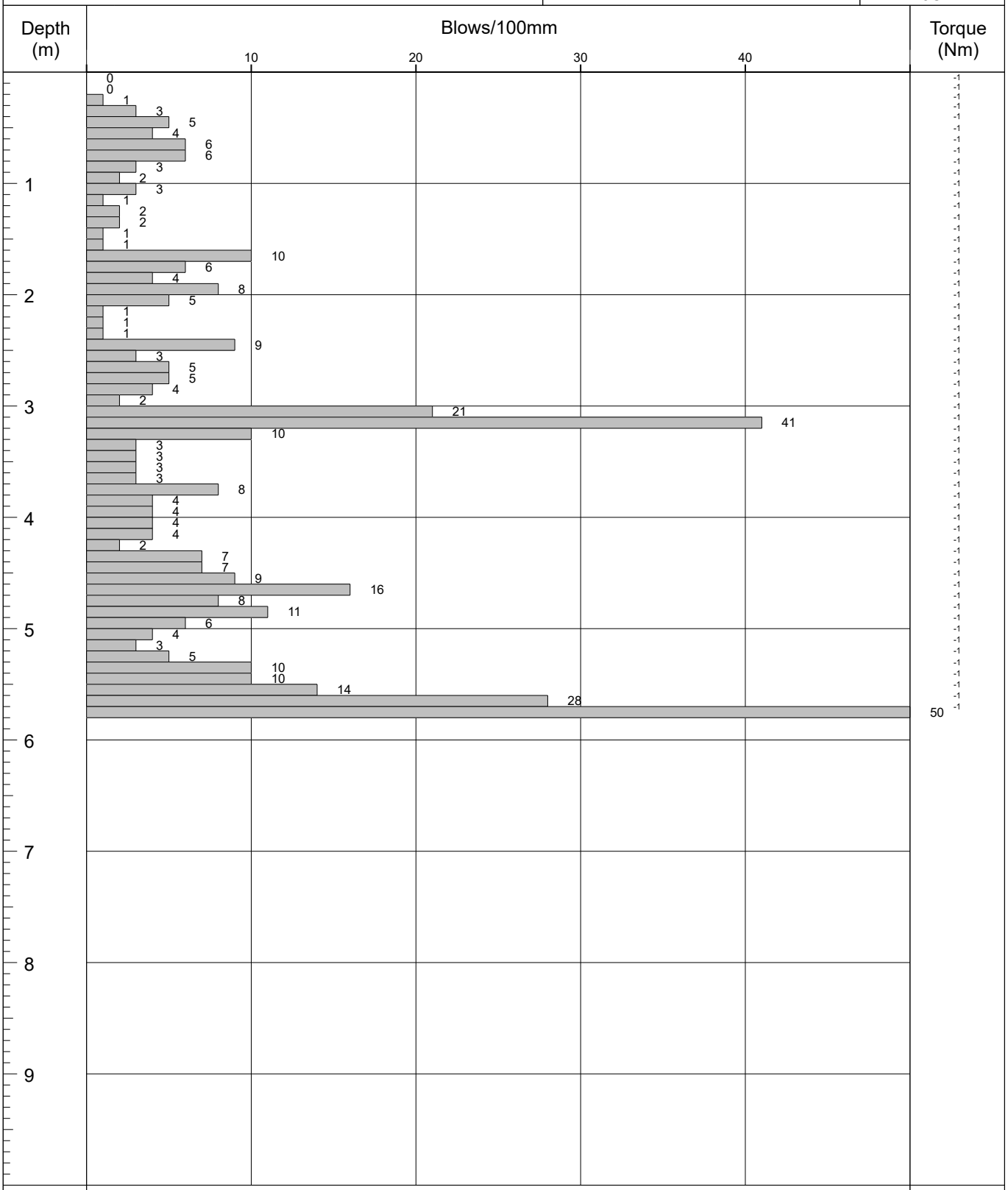
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-14/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602602.07 - 727094.76	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	38.38	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	16/02/2017	**Operator:** JC



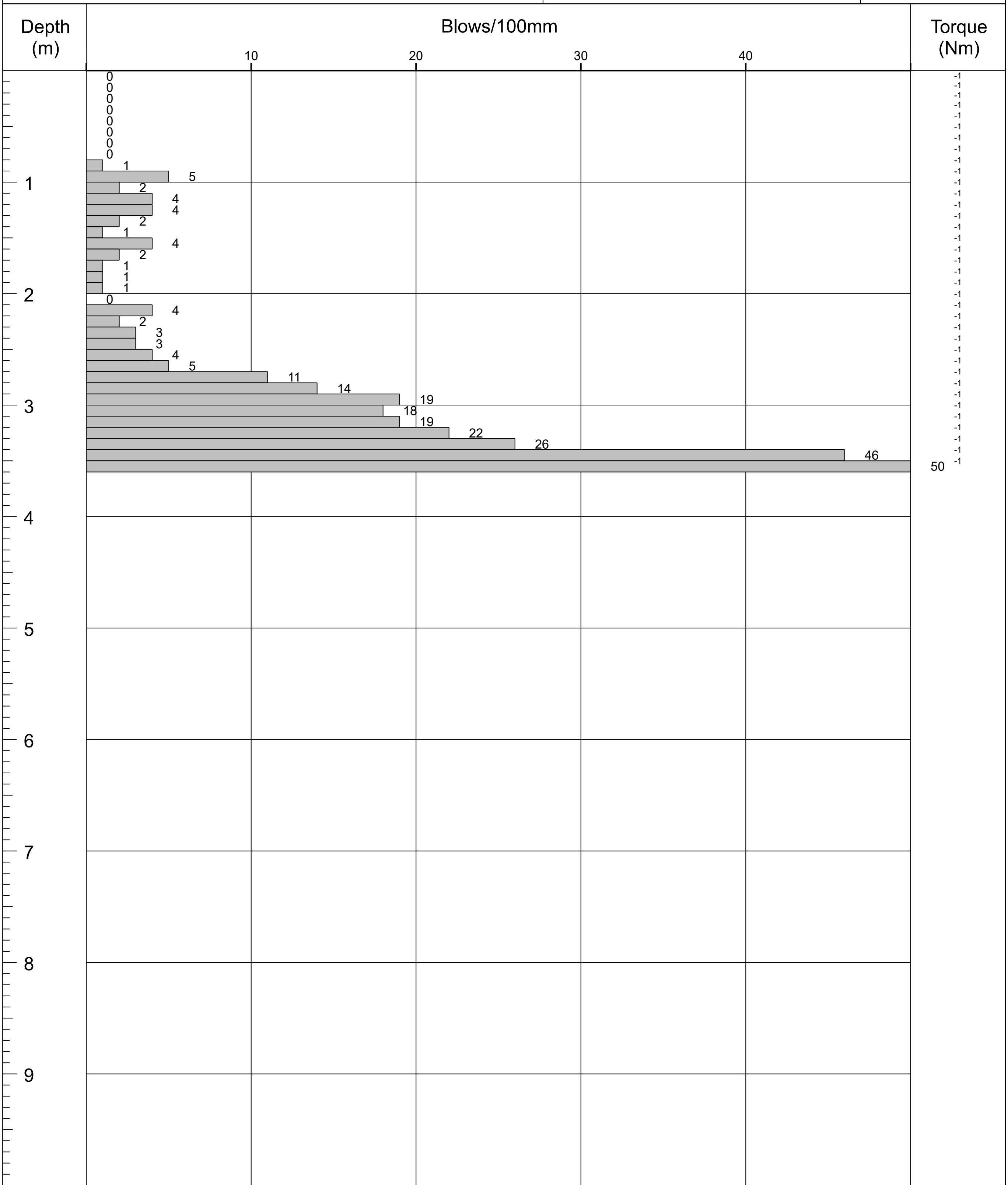
Remarks:
General; 5.80m

Fall Height	750	Cone Base Diameter	45
Hammer Wt	64	Final Depth	5.80
Probe Type	DPSH-A		

AGS

CAUSEWAY GEOTECH	Probe Log	Probe No: WOA-DP-15/17 Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602699.78 - 727050.24	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.20	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	16/02/2017	**Operator:** JC



Remarks: General; 3.60m	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	3.60
	Probe Type	DPSH-A		

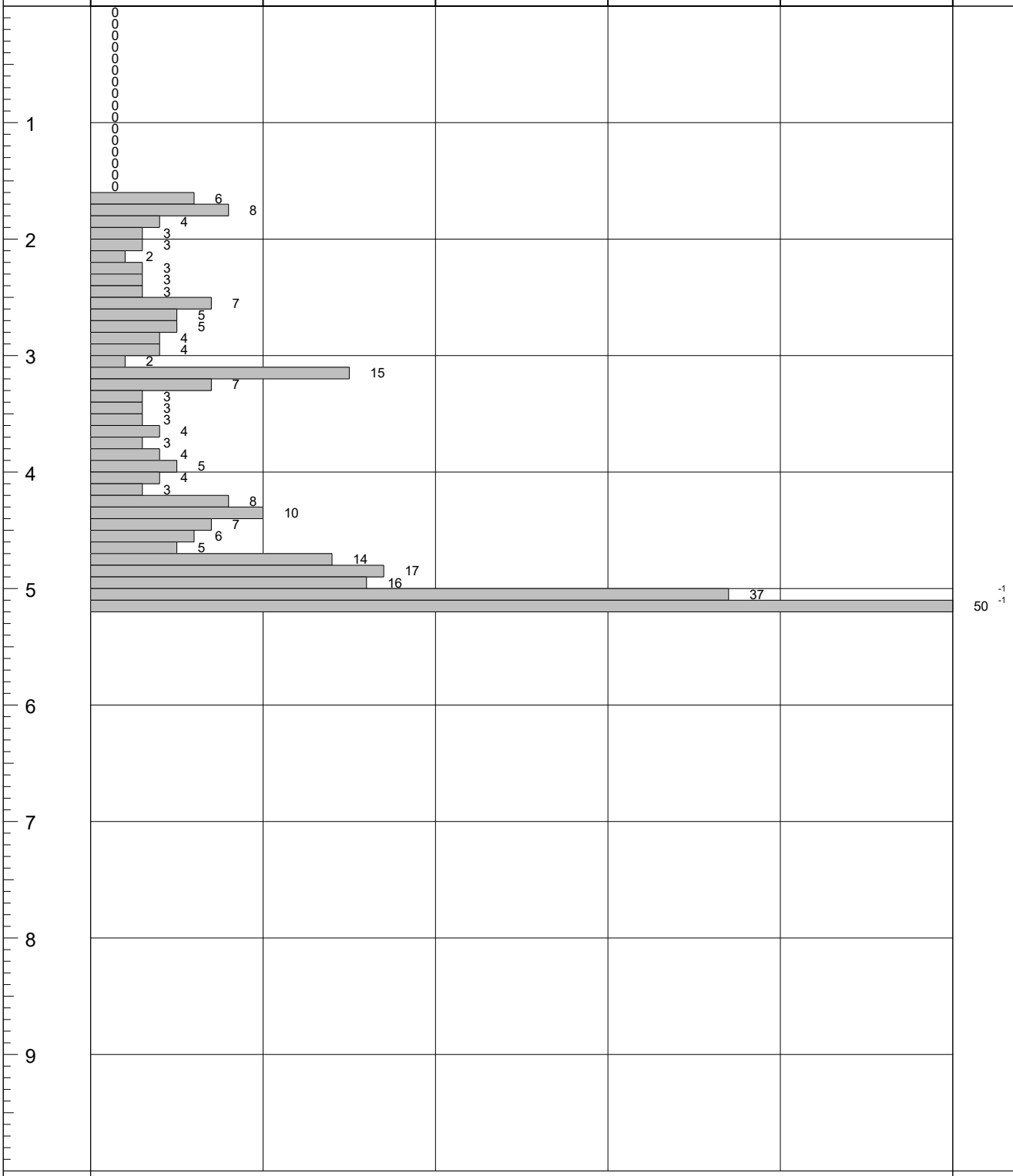
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-16/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602845.31 - 727107.88	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.38	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	15/02/2017	**Operator:** JC



Remarks:				
	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	5.20
	Probe Type	DPSH-A		

AGS

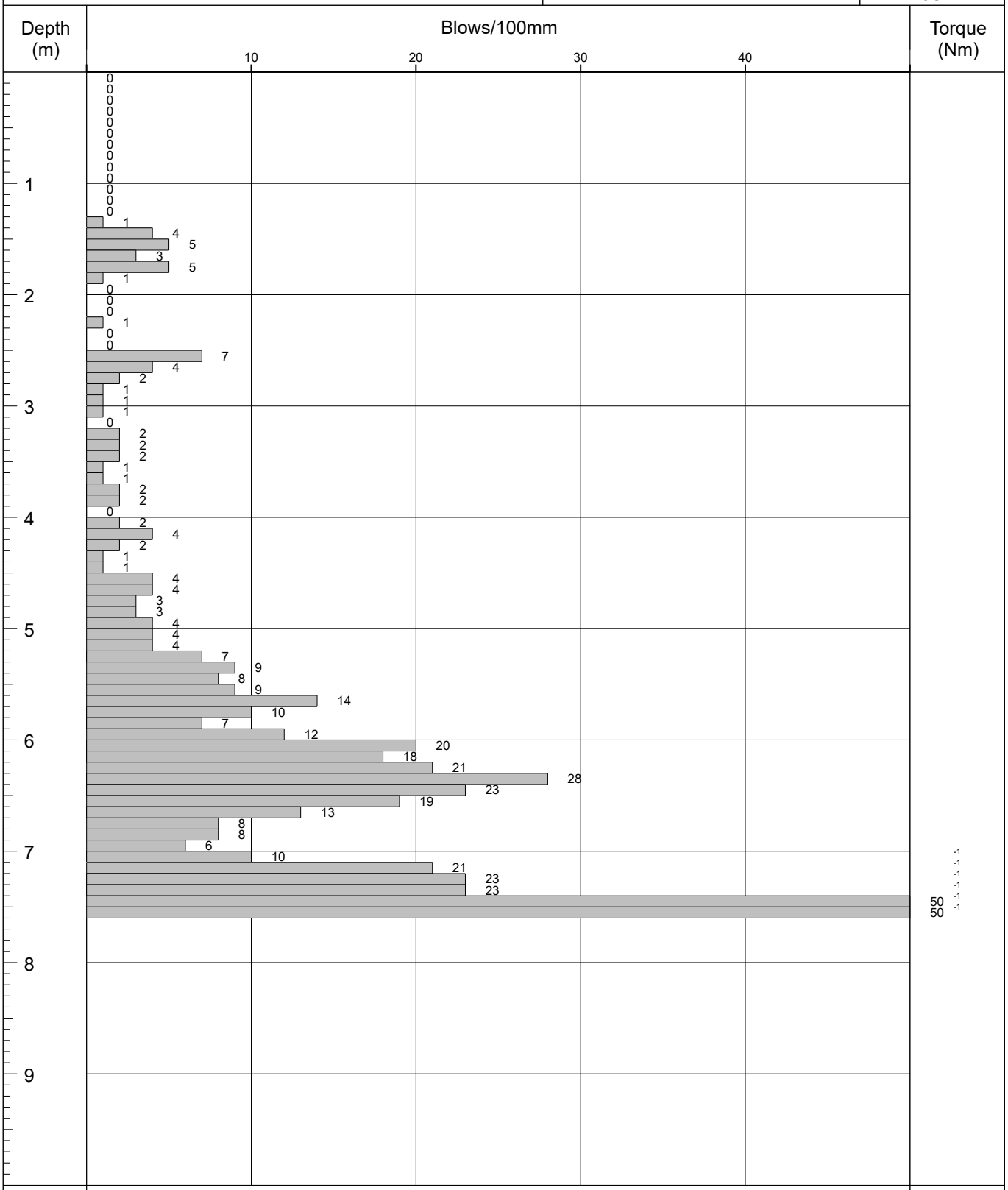
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-17/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602869.07 - 727096.81	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.09	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	15/02/2017	**Operator:** JC



Remarks:				
	Fall Height	750	Cone Base Diameter	45
	Hammer Wt	64	Final Depth	7.60
	Probe Type	DPSH-A		

AGS

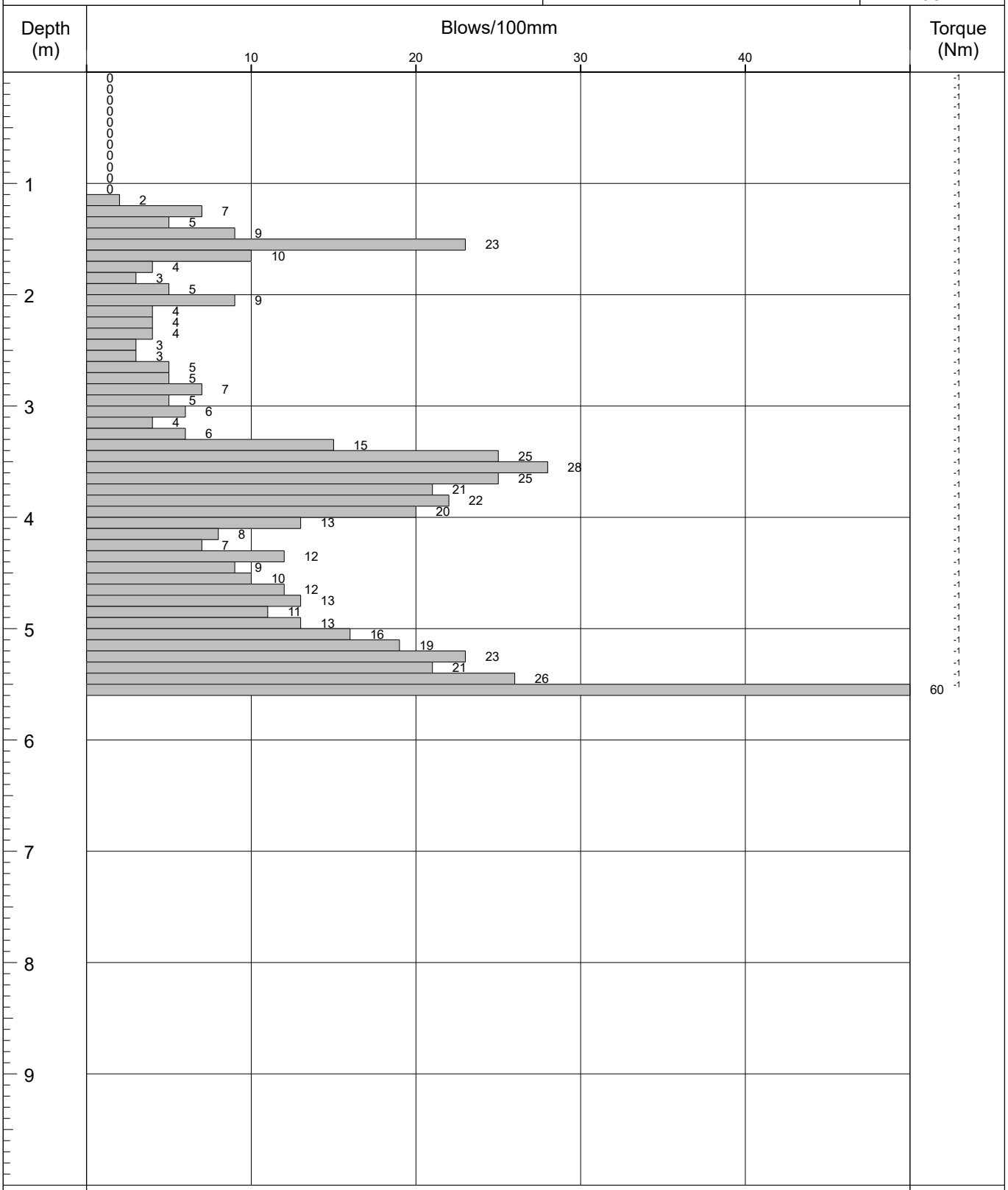
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-18/17

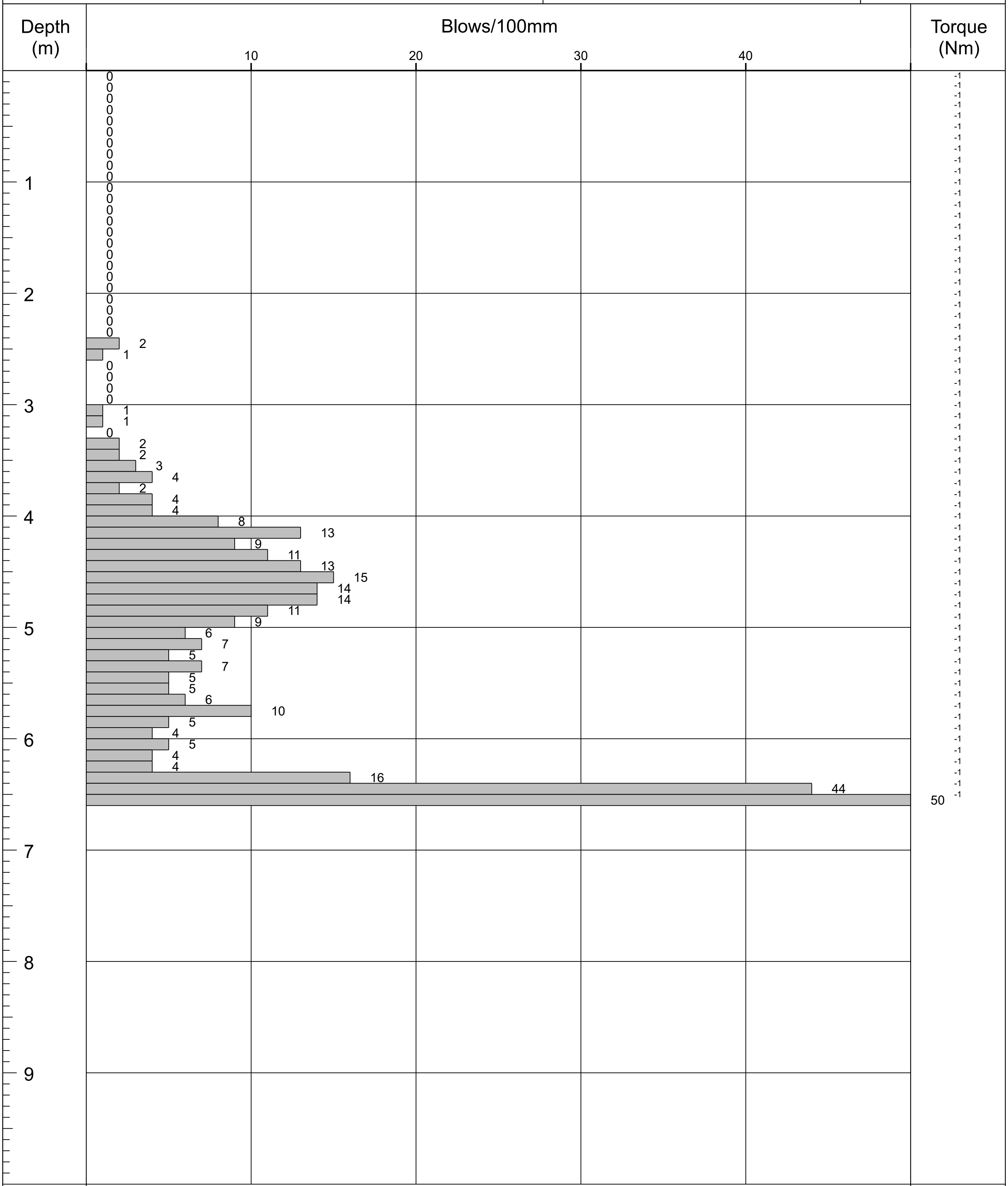
Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602728.66 - 727004.66	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.23	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	16/02/2017	**Operator:** JC



Remarks: General; 5.60M	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	5.60	
	Probe Type	DPSH-A			

CAUSEWAY GEOTECH	Probe Log			Probe No: WOA-DP-19/17 Sheet 1 of 1
Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602856.57 - 727011.20	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	39.52	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	16/02/2017	**Operator:** JC



Remarks: General; 6.60m				
Fall Height	750	Cone Base Diameter	45	AGS
Hammer Wt	64	Final Depth	6.60	
Probe Type	DPSH-A			

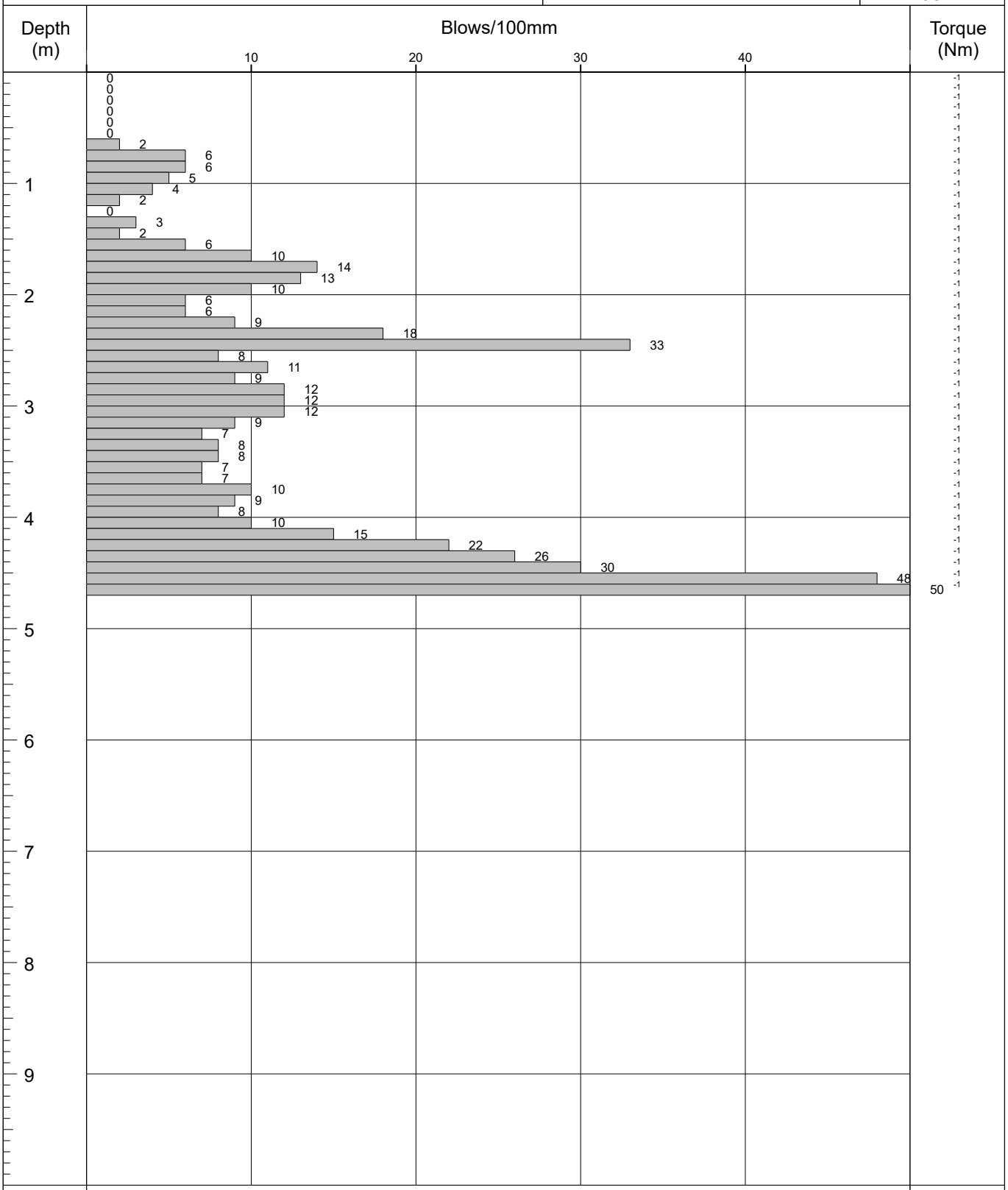
CAUSEWAY GEOTECH

Probe Log

Probe No: WOA-DP-20/17

Sheet 1 of 1

Project Name: West Offaly Power station and the Ash Disposal Facility	**Project No.** 16-1239	**Co-ords:**	602850.97 - 726917.79	**Hole Type:** DP
Client: Bord Na Mona		**Level:**	38.74	**Scale:** 1:50
Client's Rep: Bord Na Mona		**Date:**	16/02/2017	**Operator:** JC



Remarks: General; 4.70m	Fall Height	750	Cone Base Diameter	45	AGS
	Hammer Wt	64	Final Depth	4.70	
	Probe Type	DPSH-A			

CAUSEWAY GEOTECH

APPENDIX F

WOP core photographs

WOP-BH03/17

WOP-BH05/17


Job no: 16-1239
CAUSEWAY GEOTECH
Job Name: SHANNONBRIDGE
BH: 05
Date: 29/3/17
Box no: 1
of: 2
Starts (m): 6.80
Ends (m): 8.80
6.8m
8.3m
8.8m

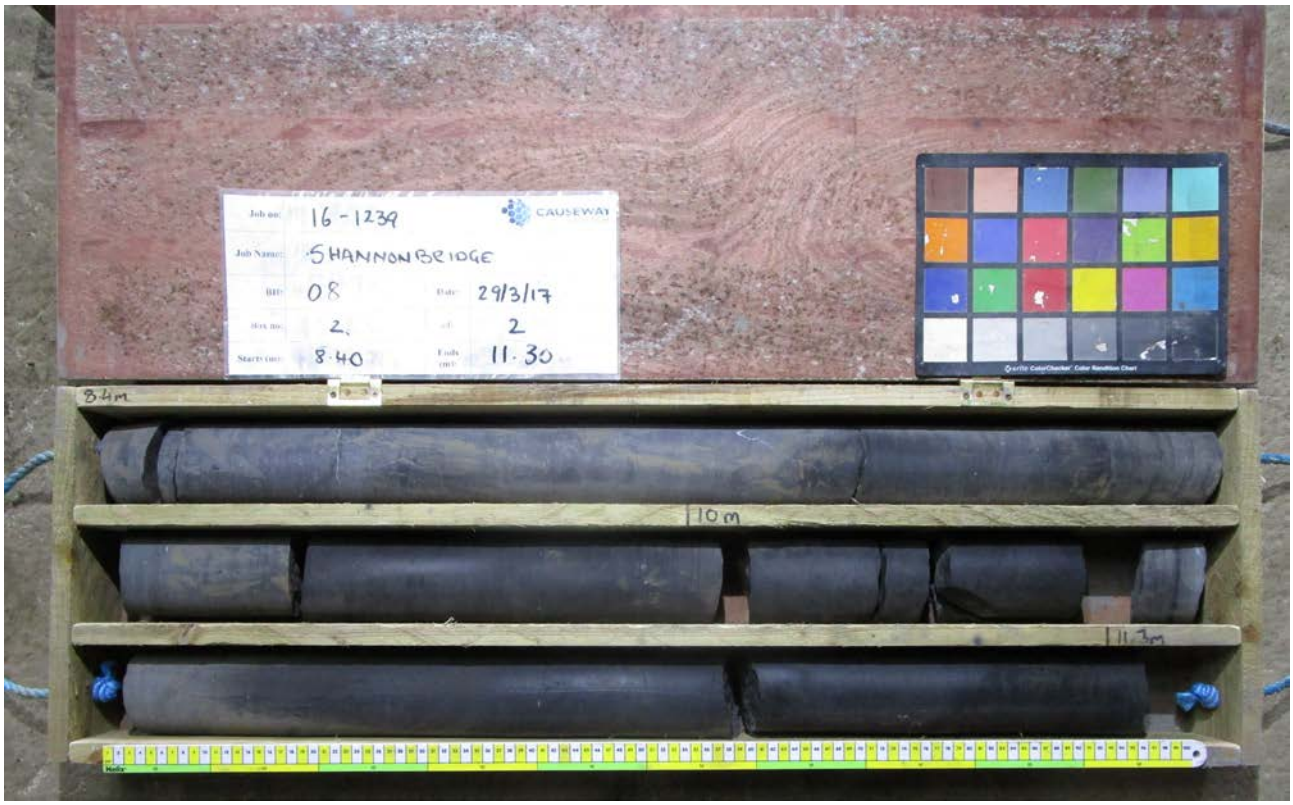

Job no: 16-1239
CAUSEWAY GEOTECH
Job Name: SHANNONBRIDGE
BH: 05
Date: 29/3/17
Box no: 2
of: 2
Starts (m): 8.80
Ends (m): 9.80
8.8m
9.8m

WOP-BH07/17


Job no: 16-1239
CAUSEWAY GEOTECH
Job Name: SHANNON BRIDGE
BH: 07
Date: 29/3/17
Box no: 1.
of: 1
Starts (m): 3.70
Ends (m): 6-70
3.7m.
5.1m

WOP-BH08/17


16-1239
SHANNONBRIDGE
08
29/3/17
1
2
5-30
8.40
5.3m
6.9m
8.4m


16-1239
CAUSEWAY
SHANNONBRIDGE
08
29/3/17
2
2
8.40
11.30
8.4m
10m

WOP-BH10/17


Job no: 16-1239
CAUSEWAY
Job Name: SHANNON BRIDGE
BH: 10
Date: 29/3/17
Box no: 1
of: 1
Starts (m): 3.80
Ends (m): 6.30

WOP-BH11/17


Job no: 16-1239
CAUSEWAY
Job Name: SHANNONBRIDGE
BH: 11
Date: 29/3/17
Box no: 1
of: 1
Starts (m): 3.80
Ends (m): 6.90
6.9m

WOP-BH12/17


Job no: 16-1239
CAUSEWAY
Job Name: SHANNON BRIDGE
BH: 12
Date: 29/3/17
Box no: 1.
of: 2
Starts (m): 5.30
Ends (m): 7.50
5.3m
6.8m


Job no: 16-1239
CAUSEWAY
Job Name: SHANNON BRIDGE
BH: 12
Date: 29/3/17
Box no: 2.
of: 2
Starts (m): 7.50
Ends (m): 8.30

CAUSEWAY GEOTECH

APPENDIX G

WOP trial pit logs

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WOPTP-01**
Co-ordinates: 597130.08 E 725124.90 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 40.58 mOD	**Date:** 24/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.30)		Black peaty TOPSOIL	
			40.28	0.30		MADE GROUND: Very stiff thinly laminated grey slightly sandy CLAY (ash). Sand is fine to coarse.	
0.50	ES7			(0.40)			
0.50 - 1.50	W9	PID = 0.10ppm					
			39.88	0.70		MADE GROUND: Soft locally stiff thinly laminated grey slightly gravelly sandy CLAY (ash) Sand is fine to coarse. Gravel is fine.	
1.00	B1						
1.00	D2	PID = 0.20ppm					
		PID = 0.20ppm					
2.00	B3						
2.00	D4	PID = 0.30ppm		(2.80)			
		PID = 0.30ppm					
3.00	B5						
3.00	D6						
3.00	ES8	PID = 0.40ppm					
		Water strike at 3.5m PID = 0.40ppm	37.08	3.50		End of trial pit at 3.50m	▼

Remarks

Water Strikes:

Struck at (m):	Remarks:
3.50	Water strike at 3.5m

Stability: Stable

Width: 0.80

Length: 3.50

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WOPTP-02**
Co-ordinates: 597061.46 E 725106.16 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 39.62 mOD	**Date:** 24/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.50)		Black peaty TOPSOIL	
		PID = 0.10ppm	39.12	0.50		MADE GROUND: Soft locally stiff thinly laminated grey slightly sandy SILT (ash). Sand is fine to coarse.	
1.00	B1						
1.00	D2						
1.00	ES9						
		PID = 0.10ppm					
		Water strike at 1.5m					▼
		PID = 0.20ppm					
2.00	B3						
2.00	D4						
2.00	ES10						
		PID = 0.40ppm					
		PID = 0.20ppm		(3.50)			
3.00	B5						
3.00	D6						
		PID = 0.20ppm					
		PID = 0.30ppm					
4.00	B7		35.62	4.00		End of trial pit at 4.00m	
4.00	D8						
		PID = 0.20ppm					

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks

Water Strikes:

Struck at (m):	Remarks:
1.50	Water strike at 1.5m

Stability: Stable

Width: 0.80

Length: 3.50

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WOPTP-03**
Co-ordinates: 597955.33 E 725037.29 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 40.07 mOD	**Date:** 24/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.25)		Very soft to soft blueish brown slightly sandy gravelly CLAY. Sand is fine to coarse. gravel is fine to medium subrounded of mixed lithologies.	
			39.82	0.25		MADE GROUND: Stiff thinly laminated blueish grey slightly gravelly sandy SILT (ash) Sand is fine to coarse. Gravel is fine.	
0.50	ES9	PID = 0.10ppm					
1.00	B1						
1.00	D2	PID = 0.20ppm					
		PID = 0.10ppm		(2.65)			
2.00	B3						
2.00	D4	PID = 0.10ppm					
2.50	ES10	PID = 0.20ppm					
			37.17	2.90		MADE GROUND: Soft locally stiff thinly laminated blueish grey slightly sandy SILT (ash). Sand is fine to coarse.	
3.00	B5						
3.00	D6	PID = 0.20ppm		(0.60)			
		PID = 0.20ppm	36.57	3.50		MADE GROUND: Soft locally stiff thinly laminated pinkish grey slightly sandy CLAY (ash). Sand is fine to coarse.	
4.00	B7						
4.00	D8	PID = 0.10ppm		(1.10)			
			35.47	4.60		End of trial pit at 4.60m	

Remarks
No groundwater encountered

Terminated at scheduled depth

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 0.70

Length: 3.50

CAUSEWAY GEOTECH	**Project No.:** 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility	**Trial Pit No.:** **WOPTP-04**
	Co-ordinates: 597137.08 E	**Client:** Bord Na Mona	Sheet 1 of 1
Method: Trial Pitting	725050.83 N	**Client's Representative:** Bord Na Mona	**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 40.83 mOD	**Date:** 24/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.45)		MADE GROUND: Very soft to soft bluish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded of mixed lithologies.	
			40.38	0.45			
0.50	B1					MADE GROUND: Soft to locally stiff thinly laminated grey slightly gravelly sandy SILT (ash). Gravel is fine.	
0.50	D2						
0.50 - 2.00	EW13						
		PID = 1.00ppm					
1.00	B3			(1.15)			
1.00	D4						
		PID = 0.20ppm					
		PID = 0.20ppm					
			39.23	1.60		MADE GROUND: Very soft thinly laminated interlayered grey and pink CLAY (ash).	
				(0.60)			
2.00	ES11						
2.20	B5		38.63	2.20		MADE GROUND: Black slightly silty fine to coarse SAND (ash).	
2.20	D6						
		PID = 0.40ppm		(0.30)			
		PID = 0.10ppm	38.33	2.50		MADE GROUND: Very soft locally very stiff thinly laminated grey CLAY (ash).	
				(1.50)			
3.50	B7						
3.50	D8						
3.50	ES12						
		PID = 0.10ppm					
4.00	B9		36.83	4.00		End of trial pit at 4.00m	
4.00	D10						
		PID = 0.10ppm					

Remarks

Terminated at scheduled depth

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.60

Length: 3.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WOPTP-05**
Co-ordinates: 597123.53 E 724985.51 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 40.61 mOD	**Date:** 23/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.24)		MADE GROUND: Soft blackish brown slightly sandy slightly gravelly CLAY (ash). Sand is fine to coarse. Gravel is fine to medium subrounded of mixed lithologies.	
			40.37	0.24		MADE GROUND: Very stiff thinly laminated grey SILT (ash).	
0.50	B1						
0.50	D2	PID = 0.00ppm					
1.00	B3						
1.00	D4						
1.00	ES5	PID = 0.00ppm					
		PID = 0.00ppm					
2.00	B6						
2.00	D7			(3.76)			
		PID = 0.00ppm					
3.00	B8						
3.00	D9						
		PID = 0.00ppm					
4.00	B10		36.61	4.00		End of trial pit at 4.00m	
4.00	D11						
4.00	ES12	PID = 0.00ppm					

Remarks

Terminated at scheduled depth

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width:

Length:

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WOPTP-06**
Co-ordinates: 597309.76 E 724945.92 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 40.13 mOD	**Date:** 27/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.48)		MADE GROUND: Grey slightly clayey sandy fine to coarse subrounded to subangular GRAVEL with red brick and wood fragments. Sand is fine to coarse.	
0.50 - 1.50	EW5	PID = 0.00ppm	39.65	0.48 (0.12)		MADE GROUND: Lean mix concrete	
0.75	ES3		39.52	0.60 (0.25)		Dark blueish grey sandy fine to coarse subangular GRAVEL. Sand is fine to coarse.	
1.00	B1		39.28	0.85		Brownish grey very sandy silty fine to coarse subangular to subrounded GRAVEL of mixed lithologies with high cobble content. Sand is fine to coarse.	
1.00	D2	PID = 0.00ppm		(0.65)			
1.50	ES4	PID = 0.10ppm	38.62	1.50		End of trial pit at 1.50m	

Remarks
No groundwater encountered

Terminated on boulders at 1.50m

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 1.00

Length: 4.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WOPTP-07**
Co-ordinates: 597346.14 E 724933.69 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T tarcked Excavator	**Ground Level:** 40.11 mOD	**Date:** 27/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.20)		MADE GROUND: Grey slightly silty sandy fine to coarse subangular GRAVEL of limestone. Sand is fine to coarse.	
			39.91	0.20			
				(0.15)		Dark grey slightly silty sandy fine to coarse subangular GRAVEL of shale with low cobble and boulder content. Sand is fine to coarse.	
			39.76	0.35			
0.50	ES3	PID = 0.00ppm		(0.60)		Brown sandy fine to coarse subangular GRAVEL of limestone with medium boulder and cobble content. Sand is fine to coarse.	
			39.16	0.95			
1.00	B1			(0.20)		Dark brown sandy clayey fine to coarse subangular GRAVEL of limestone with high boulder and cobble content. Sand is fine to coarse.	
1.00	D2	PID = 0.10ppm	38.96	1.15		End of trial pit at 1.15m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated on boulders at 1.15m

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.90

Length: 4.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WOPTP-08**
Co-ordinates: 597282.17 E 724922.36 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 40.24 mOD	**Date:** 27/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			40.14	(0.10) 0.10		MADE GROUND: Grey slightly sandy fine to coarse subangular GRAVEL of limestone. Sand is fine to coarse.	
				(0.50)		MADE GROUND: Brownish grey slightly sandy clayey fine to coarse subangular GRAVEL of mixed lithologies. Sand is fine to coarse.	
		PID = 0.10ppm	39.64	0.60			
			39.54	(0.10) 0.70		MADE GROUND: Lean mix	
				(0.15)		Dark grey slightly silty sandy fine to coarse subangular GRAVEL of shale. Sand is fine to coarse.	
			39.39	0.85			
				(0.17)		Brown slightly sandy clayey fine to coarse subangular GRAVEL of limestone. Sand is fine to coarse.	
1.00	B1		39.22	1.02			
1.00	D2					End of trial pit at 1.02m	
1.00	ES3						
		PID = 0.10ppm					

Remarks
No groundwater encountered

Terminated on boulders 1.02m

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 4.00

CAUSEWAY GEOTECH

APPENDIX H

WOA trial pit logs

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** WPATP-01/17
Co-ordinates: 602464.13 E 727304.85 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 39.40 mOD	**Date:** 31/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
		PID = 0.40ppm		(0.90)		Spongy dark brown pseudo-fibrous PEAT.	
			38.50	0.90			
1.00	B1					Spongy brown fibrous PEAT	
1.00	D2	PID = 0.60ppm					
1.50	ES7	PID = 0.40ppm					
				(1.90)			
2.00	B3						
2.00	D4	PID = 0.10ppm					
		PID = 0.00ppm					
			36.60	2.80		Firm grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse angular of limestone.	
3.00	B5						
3.00	D6						
3.00	ES8	PID = 0.00ppm					
				(1.00)			
		PID = 0.00ppm					
			35.60	3.80		End of trial pit at 3.80m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated at scheduled depth

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 0.90

Length: 4.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WPATP-02/17**
Co-ordinates: 602668.92 E 727249.28 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavtor	**Ground Level:** 37.27 mOD	**Date:** 30/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.80)		Yellowish grey slightly sandy clayey fine to coarse subangular GRAVEL of mixed lithologies. Sand is fine to coarse .	
		PID = 0.50ppm					
			36.47	0.80		Spongy dark brown fibrous PEAT	
1.00	B1						
1.00	D2	PID = 0.70ppm					
				(1.30)			
1.50	ES7	PID = 0.90ppm					
2.00	B3						
2.00	D4	PID = 0.50ppm	35.16	2.10		Soft grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded of mixed lithologies.	
2.50	ES8	PID = 0.10ppm		(0.90)			
3.00	B5		34.26	3.00		End of trial pit at 3.00m	
3.00	D6	PID = 0.10ppm					

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:

Stability: Stable

Width: 0.90

Length: 3.00

CAUSEWAY GEOTECH	**Project No.:** 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility	**Trial Pit No.:** **WPATP-03/17**
	Co-ordinates: 602827.35 E	**Client:** Bord Na Mona	Sheet 1 of 1
Method: Trial Pitting	727262.79 N	**Client's Representative:** Bord Na Mona	**Scale:** 1:25
Plant: 11T Tracked Excavtor	**Ground Level:** 38.70 mOD	**Date:** 30/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.25)		Spongy dark brown pseudo-fibrous PEAT	
			38.45	0.25		Very soft grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded of mixed lithologies.	
0.50	ES1	PID = 1.00ppm		(0.65)			
			37.80	0.90		Blueish grey gravelly very silty fine to coarse SAND with high cobble and boulder content. Gravel is fine to coarse subrounded of mixed lithologies .	
1.00	B3						
1.00	D4						
1.00		HVP=20, HVR=20					
1.00		HVP=28, HVR=28					
1.00		HVP=39, HVR=39					
				(1.10)			
1.50	ES2	PID = 0.10ppm Slow					▼
		Fast	36.70	2.00		End of trial pit at 2.00m	▼

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks

Terminated due to collapsing pit walls

Water Strikes:

Struck at (m):	Remarks:
1.54	Slow
2.00	Fast

Stability: Unstable

Width: 0.65

Length: 3.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WPATP-04/17**
Co-ordinates: 602611.41 E 727148.65 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavtor	**Ground Level:** 37.46 mOD	**Date:** 30/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
		PID = 0.10ppm		(1.30)		Spongy dark brown fibrous PEAT	
		Slow					▼
1.00	B1						
1.00	D2						
1.00	ES7						
		PID = 0.10ppm					
			36.16	1.30		Soft grey slightly sandy CLAY. Sand is fine to coarse.	
1.50	ES8						
		PID = 0.10ppm		(0.80)			
2.00	B3						
2.00	D4						
2.00		HVP=12, HVR=1	35.36	2.10		Very soft blueish grey CLAY.	
		PID = 0.10ppm					
		PID = 0.10ppm		(0.90)			
3.00	B5		34.46	3.00		End of trial pit at 3.00m	
3.00	D6						
		PID = 0.10ppm					

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:
0.90	Slow

Stability: Stable

Width: 0.90

Length: 4.00

CAUSEWAY GEOTECH	**Project No.:** 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility	**Trial Pit No.:** WPATP-05/17
	Co-ordinates: 602863.04 E 727121.95 N	**Client:** Bord Na Mona	Sheet 1 of 1
Method: Trial Pitting		**Client's Representative:** Bord Na Mona	**Scale:** 1:25
Plant: 11T Tracked Excavtor	**Ground Level:** 39.36 mOD	**Date:** 30/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.25)		Spongy dark brown amorphous PEAT	
			39.11	0.25		Spongy brown fibrous PEAT	
		PID = 0.40ppm					
1.00	B1			(1.60)			
1.00	D2	PID = 0.40ppm					
1.50	ES7	PID = 0.40ppm					
			37.51	1.85		Very soft grey slightly sandy gravelly CLAY with medium cobble and boulder content. Gravel is fine to coarse subangular of mixed lithologies. Sand is fine to coarse.	
2.00	B3						
2.00	D4						
2.00	ES8	PID = 0.10ppm					
		PID = 0.00ppm		(1.15)			
3.00	B5		36.36	3.00		End of trial pit at 3.00m	
3.00	D6	PID = 0.00ppm					

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated due to pit walls collapsing

Water Strikes:	
Struck at (m):	Remarks:

Stability: Unstable

Width: 0.90

Length: 4.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WPATP-06/17**
Co-ordinates: 602971.22 E 727193.30 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavtor	**Ground Level:** 38.99 mOD	**Date:** 30/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.20)		Spongy dark brown amorphous PEAT	
			38.78	0.20		Spongy brown fibrous PEAT	
		PID = 0.30ppm					
				(1.20)			
1.00	B1						
1.00	D2						
1.00	ES3						
		PID = 0.30ppm Fast					▼
			37.58	1.40		Very soft grey slightly sandy CLAY	
			37.53	(0.05) 1.45		End of trial pit at 1.45m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks

Terminated on confining layer

Water Strikes:

Struck at (m):	Remarks:
1.30	Fast

Stability: Unstable

Width: 1.00

Length: 5.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WPATP-07/17**
Co-ordinates: 602734.75 E 727029.73 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 38.98 mOD	**Date:** 30/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.55)		Spongy dark brown fibrous PEAT	
0.50	ES5	PID = 0.00ppm	38.43	0.55		Very soft grey slightly sandy gravelly CLAY with high cobble and boulder content. Gravel is fine to coarse subangular of mixed lithologies.	
1.00	B1						
1.00	D2	PID = 0.10ppm		(1.25)			
1.50	ES6	PID = 0.00ppm					
		Slow	37.18	1.80		End of trial pit at 1.80m	▼
2.00	B3						
2.00	D4						

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks

Terminated due to pit walls collapsing

Water Strikes:

Struck at (m):	Remarks:
1.80	Slow

Stability: Unstable

Width: 0.90

Length: 4.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** WPATP-08/17
Co-ordinates: 602942.70 E 726965.85 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 39.70 mOD	**Date:** 31/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			39.60	(0.10) 0.10		Spongy dark brown pseudo fibrous PEAT	
						Spongy brown fibrous PEAT	
		PID = 2.40ppm					
				(1.70)			
1.00	B1						
1.00	D2	PID = 0.50ppm					
1.50	ES7	PID = 0.10ppm					
			37.90	1.80		Grey sandy clayey subangular fine to coarse GRAVEL of mixed lithologies with high cobble content. Sand is fine to coarse.	
2.00	B3						
2.00	D4	PID = 0.00ppm					
				(1.20)			
2.50	ES8	PID = 0.00ppm Fast					▼
3.00	B5		36.70	3.00		End of trial pit at 3.00m	
3.00	D6	PID = 0.00ppm					

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks

Terminated due to pit walls collapsing

Water Strikes:

Struck at (m):	Remarks:
2.58	Fast

Stability: Unstbale

Width: 0.90

Length: 5.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WPATP-09/17**
Co-ordinates: 603110.35 E 727097.17 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 41.90 mOD	**Date:** 31/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
						Grey very sandy very clayey fine to coarse subangular GRAVEL of mixed lithologies. Sand is fine to coarse.	
		PID = 0.00ppm					
1.00	B1			(2.00)			
1.00	D2						
1.00	ES5						
		PID = 0.00ppm					
		PID = 0.00ppm					
2.00	B3		39.90	2.00			
2.00	D4					Grey very sandy clayey subangular fine to coarse GRAVEL of mixed lithologies with high cobble content. Sand is fine to coarse. Cobbles are subrounded.	
		PID = 0.00ppm		(0.40)			
		Fast	39.50	2.40			▼
						End of trial pit at 2.40m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks

Terminated due to pit walls collapsing

Water Strikes:

Struck at (m):	Remarks:
2.40	Fast

Stability: Unstable

Width: 1.80

Length: 4.00

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WPATP-10/17**
Co-ordinates: 603185.90 E 727172.05 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 40.90 mOD	**Date:** 31/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.60)		Spongy dark brown amorphous PEAT	
0.50	ES5	PID = 0.00ppm	40.30	0.60		Very soft grey slightly sandy gravelly CLAY with high cobble and boulder content. Gravel is fine to coarse subangular of mixed lithologies.	
1.00	B1						
1.00	D2						
1.00	ES6	PID = 0.00ppm		(1.55)			
		PID = 0.00ppm					
2.00	B3						
2.00	D4	PID = 0.00ppm	38.75	2.15		End of trial pit at 2.15m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks

Terminated due to pit walls collapsing

Water Strikes:	
Struck at (m):	Remarks:

Stability: Unstable

Width: 0.90

Length: 3.00

CAUSEWAY GEOTECH

APPENDIX I

WOP trial pit photographs

WOPTP01

WOPTP01

WOPTP02

WOPTP02

WOPTP03

WOPTP03

WOPTP04

WOPTP04

WOPTP05

WOPTP05

WOPTP06

WOPTP06

WOPTP07

WOPTP07

WOPTP08

WOPTP08

CAUSEWAY GEOTECH

APPENDIX J

WOA trial pit photographs

WPATP-01/17

WPATP-01/17

WPATP-02/17

WPATP-02/17

WPATP-03/17

WPATP-03/17

WPATP-04/17

WPATP-04/17

WPATP-05/17

WPATP-05/17

WPATP-06/17

WPATP-06/17

WPATP-07/17

WPATP-07/17

WPATP-08/17

WPATP-08/17

WPATP-09/17

WPATP-09/17

WPATP-10/17

WPATP-10/17

CAUSEWAY GEOTECH

APPENDIX K

WOP slit trench logs and drawings

CAUSEWAY GEOTECH

Project No.: 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility		**Trial Pit No.:** **WOPST-02**
Co-ordinates: 597315.59 E 724930.90 N	**Client:** Bord Na Mona		Sheet 1 of 1
Method: Slit Trenching	**Client's Representative:** Bord Na Mona		**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 40.26 mOD	**Date:** 26/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.30)		TOPSOIL	
			39.96	0.30		MADE GROUND: Concrete	
				(0.30)			
			39.66	0.60		MADE GROUND: Grey slightly clayey sandy fine to coarse angular to subangular GRAVEL. Sand is fine to coarse (CL804)	
				(0.20)			
			39.46	0.80		MADE GROUND: Brown slightly gravelly slightly clayey fine to coarse SAND. Gravel is subangular to subrounded fine to coarse.	
				(0.55)			
			38.90	1.35		End of trial pit at 1.35m	

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:

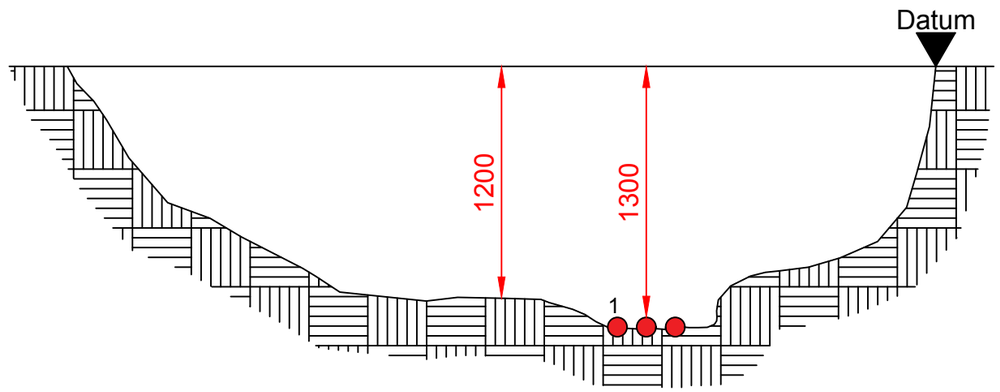
Stability:

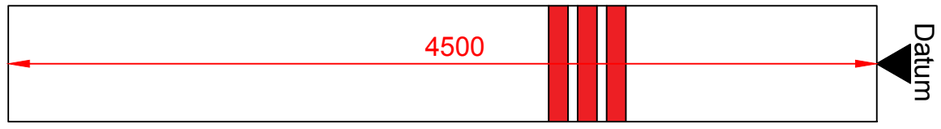
Width: 0.60

Length: 4.50

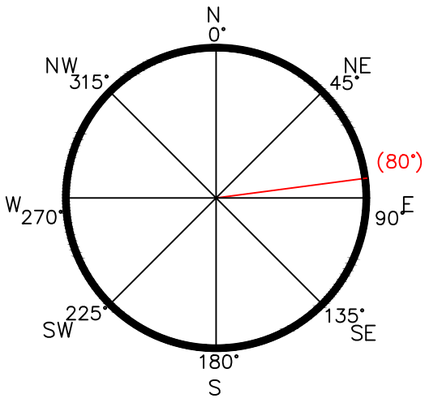
JOB NUMBER: 16-1239	JOB NAME: West Offaly Power Station and Ash Disposal Facility		LOCATION: ST-02/17
CLIENT: Bord Na Mona	CLIENTS REPRESENTATIVE: Bord Na Mona	CREW: RS	PLANT & EQUIPMENT 3 Tonne Excavator & Hand Tools

TRENCH: (SECTION & PLAN)





TRENCH – ORIENTATION



TRENCH ORIENTATED: 80° FROM NORTH

COORDINATES

EASTING: -

NORTHING: -

ELEVATION: -

No:	Type of Service:	Diameter (in mm)	Depth to Top of Service (m)	Distance to Centre of Service (m)	Details/Comments
01	Electric	100	1.30	1.35 - 1.50 - 1.65	3x 100mm Red plastic pipe possible electric
02					
03					
04					
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					

TRENCH LENGHT (M): 4.50

TRENCH DEPTH (M): 1.35

TRENCH WIDTH (M): 0.60

STABILITY: Good

GROUNDWATER: None

SCALE: NTS@A3

DRAWN: BS

CHECKED: CH

DATE EXCAVATED: 26/01/2017

CAUSEWAY GEOTECH

CAUSEWAY GEOTECH	**Project No.:** 16-1239	**Project Name:** West Offaly Power station and the Ash Disposal Facility	**Trial Pit No.:** **WOPST-03**
	Co-ordinates: 597287.58 E	**Client:** Bord Na Mona	Sheet 1 of 1
Method: Slit Trenching	724905.15 N	**Client's Representative:** Bord Na Mona	**Scale:** 1:25
Plant: 11T Tracked Excavator	**Ground Level:** 40.30 mOD	**Date:** 26/01/2017	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.30)		MADE GROUND: Concrete	
			40.00	0.30		MADE GROUND: Brown very sandy fine to coarse subangular to subrounded GRAVEL. Sand is fine to coarse.	
				(1.10)			
			38.90	1.40		End of trial pit at 1.40m	

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:

Stability:

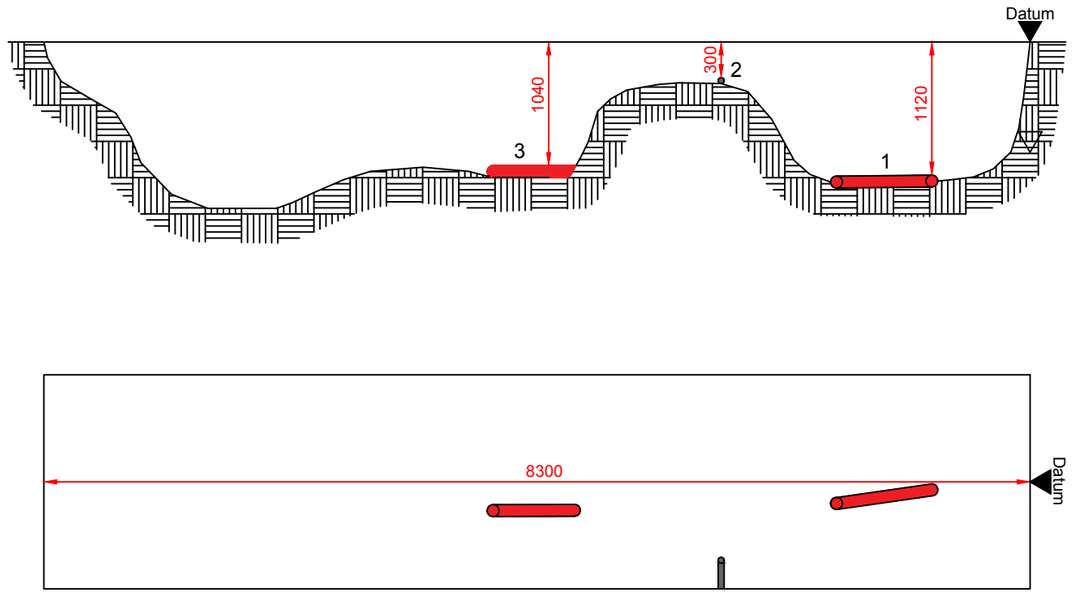
Width: 1.80

Length: 8.30

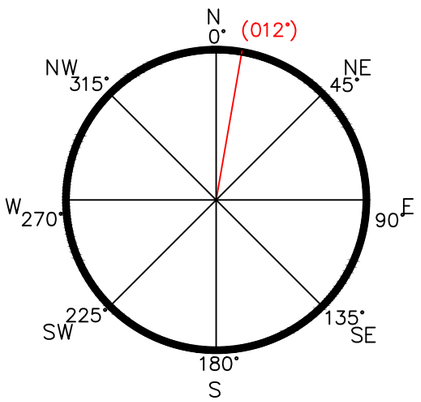
JOB NUMBER: 16-1239	JOB NAME: West Offaly Power Station and Ash Disposal Facility	LOCATION: ST-03/17

CLIENT: Bord Na Mona	CLIENTS REPRESENTATIVE: Bord Na Mona	CREW: RS	PLANT & EQUIPMENT 3 Tonne Excavator & Hand Tools

TRENCH: (SECTION & PLAN)



TRENCH – ORIENTATION



TRENCH ORIENTATED: 012° FROM NORTH

COORDINATES

EASTING: -

NORTHING: -

ELEVATION: -

No:	Type of Service:	Diameter (in mm)	Depth to Top of Service (m)	Distance to Centre of Service (m)	Details/Comments
01	Electric	100	1.12	1.30	100mm Red plastic possible electric (possible joined to service 3)
02	Unknown	50	0.30	2.60	50mm Unknown service possible electric
03	Electric	100	1.04	4.05	100mm Red plastic pipe possible electric (possible joined to service 1)
04					
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					

TRENCH LENGHT (M): 8.30

TRENCH DEPTH (M): 1.40

TRENCH WIDTH (M): 1.80

STABILITY: Good

GROUNDWATER: None

SCALE: NTS@A3

DRAWN: BS

CHECKED: CH

DATE EXCAVATED: 26/01/2017

CAUSEWAY GEOTECH

CAUSEWAY GEOTECH

APPENDIX L

WOP slit trench photographs

WOPST-02/17

WOPST-02/17

WOPST-03/17

WOPST-03/17

CAUSEWAY GEOTECH

APPENDIX M

Geotechnical laboratory test results

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SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

Client:	**Bord Na Mona**
From:	**Stephen Watson** **Laboratory Manager** **Causeway Geotech Ltd**
Tel:	**+44(0)2827666640**
E-mail:	**stephen.watson@causewaygeotech.com**
Date:	**29/03/17**
Ref:	**16-1239 – Schedule 1**

West Offaly Power Station and the Ash Disposal Facility

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 60 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

CAUSEWAY GEOTECH

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Project Name **West Offaly Power Station and the Ash Disposal Facility**

Report Reference. **16-1239 – Schedule 1**

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

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	Number of test results included in the report
SOIL	Moisture content - oven drying method	BS 1377-2:1990	36
SOIL	Liquid limit - cone penetrometer	BS 1377-2:1990	27
SOIL	Liquid limit - cone penetrometer - one point	BS 1377-2:1990	27
SOIL	Plastic limit	BS 1377-2:1990	27
SOIL	Plasticity index and liquidity index	BS 1377-2:1990	27
SOIL	Particle size distribution - wet sieving	BS 1377-2:1990	10
SOIL	Particle size distribution - dry sieving	BS 1377-2:1990	10
SOIL	Particle size distribution -sedimentation hydrometer method	BS 1377-2:1990	6
SOIL	MCV	BS 1377-4:1990	5
SOIL	MCV relationship	BS 1377-4:1990	2
SOIL	California Bearing Ratio (CBR)	BS 1377-4:1990	7
SOIL	Laboratory vane	BS 1377- 7:1990	5
SOIL	Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377- 7:1990	3
SOIL	pH Value of Soil		13
SOIL	Sulphate Content water extract		13
SOIL	Organic Matter		2

Summary of Classification Test Results

Project No.	Project Name
16-1239	West Offaly Power station and the Ash Disposal Facility

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
WOPTP-01	1	1.00		B	MADE GROUND: Grey sandy slightly gravelly organic CLAY.			194.0	74	21 -1pt	14	7		CL
WOPTP-01	3	2.00		B	MADE GROUND: Grey sandy slightly gravelly organic CLAY.			156.0	100	21 -1pt	13	8		CL
WOPTP-01	5	3.00		B	MADE GROUND: Grey sandy slightly gravelly organic CLAY.			156.0	56	20 -1pt	9	11		CL
WOPTP-02	2	1.00		D	MADE GROUND: Grey sandy organic SILT.			149.0	100	101 -1pt	89	12		ME
WOPTP-02	3	2.00		B	MADE GROUND: Grey sandy organic SILT.			42.0	100	103 -1pt	81	22		ME
WOPTP-02	5	3.00		B	MADE GROUND: Grey sandy slightly organic SILT.			198.0	100	102 -1pt	47	55		ME
WOPTP-03	1	1.00		B	MADE GROUND: Grey sandy organic SILT.			132.0	100	107 -1pt	63	44		ME
WOPTP-03	3	2.00		B	MADE GROUND: Grey sandy organic SILT.			153.0	100	137 -1pt	105	32		ME
WOPTP-03	6	3.00		D	MADE GROUND: Grey sandy organic SILT.			84.0	100	139 -1pt	110	29		ME
WOPTP-04	1	0.50		B	MADE GROUND: Grey sandy slightly gravelly organic SILT.			151.0	59	131 -1pt	100	31		ME
WOPTP-04	2	0.50		D	MADE GROUND: Grey sandy slightly gravelly organic SILT.			129.0	100	143 -1pt	89	54		ME
WOPTP-04	3	1.00		B	MADE GROUND: Grey sandy organic SILT.			181.0	100	143 -1pt	89	54		ME
WOPTP-04	5	2.20		B	MADE GROUND: Grey sandy organic SILT..			187.0	100	151 -1pt	NP			

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

Key

Density test — Linear measurement unless : wd - water displacement; wi - immersion in water

Liquid Limit — 4pt cone unless : cas - Casagrande method; 1pt - single point test

Particle density — sp - small pyknometer; gj - gas jar

Date Printed: 29/03/2017

Approved By: Stephen.Watson

Table 1

sheet 1

Summary of Classification Test Results

Project No.	Project Name
16-1239	West Offaly Power station and the Ash Disposal Facility

Hole No.	Sample				Soil Description	Density bulk Mg/m3	Density dry Mg/m3	*w* %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type										
WOPTP-04	7	3.50		B	MADE GROUND: Grey sandy organic SILT.			141.0	100	137 -1pt	92	45		ME
WOPTP-05	4	1.00		D	MADE GROUND: Grey sandy organic SILT.			102.0	100	123 -1pt	103	20		ME
WOPTP-05	6	2.00		B	MADE GROUND: Grey sandy organic SILT.			130.0	100	125 -1pt	105	20		ME
WOPTP-05	8	3.00		B	MADE GROUND: Grey sandy organic SILT.			153.0	100	124 -1pt	103	21		ME
WOPTP-05	10	4.00		B	MADE GROUND: Grey sandy slightly gravelly organic SILT.			128.0	100	124 -1pt	103	21		ME
WOPTP-06	1	1.00		B	Brownish grey silty sandy fine to coarse sandy GRAVEL with low cobble content.			4.5						
WOPTP-07	1	1.00		B	Dark brown sandy fine to coarse subangular GRAVEL with medium cobble content.			5.3						
WPATP-01/17	4	2.00		D	Brown fibrous PEAT.			437.0						
WPATP-01/17	5	3.00		B	Grey slightly sandy slightly gravelly CLAY.			19.0	93	30 -1pt	18	12		CL
WPATP-02/17	5	3.00		B	Grey slightly sandy very gravelly CLAY.			31.0	94	38 -1pt	23	15		CI
WPATP-02/17	6	3.00		D	Grey slightly sandy very gravelly CLAY.			32.0	100	39 -1pt	23	16		CI
WPATP-03/17	3	1.00		B	Blueish grey sandy slightly gravelly CLAY.			21.0						
WPATP-04/17	2	1.00		D	Dark brown fibrous PEAT.			707.0						

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

Key

Density test
Linear measurement unless :
wd - water displacement
wi - immersion in water

Liquid Limit
4pt cone unless :
cas - Casagrande method
1pt - single point test

Particle density
sp - small pyknometer
gj - gas jar

Date Printed: 29/03/2017

Approved By: Stephen.Watson

Table 1

sheet 2

Summary of Classification Test Results

Project No.	Project Name
16-1239	West Offaly Power station and the Ash Disposal Facility

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
WPATP-04/17	3	2.00		B	Grey slightly sandy CLAY.			47.0	100	40 -1pt	23	17		CI
WPATP-04/17	5	3.00		B	Blueish grey slightly sandy CLAY.			31.0	100	40 -1pt	22	18		CI
WPATP-05/17	2	1.00		D	Brown fibrous PEAT.			686.0						
WPATP-05/17	3	2.00		B	Grey sandy gravelly CLAY.			17.0	83	25 -1pt	15	10		CL
WPATP-05/17	5	3.00		B	Grey sandy gravelly CLAY.			8.8	73	21 -1pt	11	10		CL
WPATP-07/17	4	2.00		D	Grey slightly sandy gravelly CLAY.			11.0	52	22 -1pt	12	10		CL
WPATP-08/17	5	3.00		B	Grey slightly sandy fine to coarse GRAVEL with medium to high cobble content.			3.1						
WPATP-09/17	1	1.00		B	Grey sandy gravelly CLAY.			11.0						
WPATP-09/17	3	2.00		B	Grey sandy fine to coarse subangular GRAVEL.			8.0						
WPATP-10/17	3	2.00		B	Grey sandy very gravelly CLAY.			9.3	42	22 -1pt	14	8		CL

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

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	

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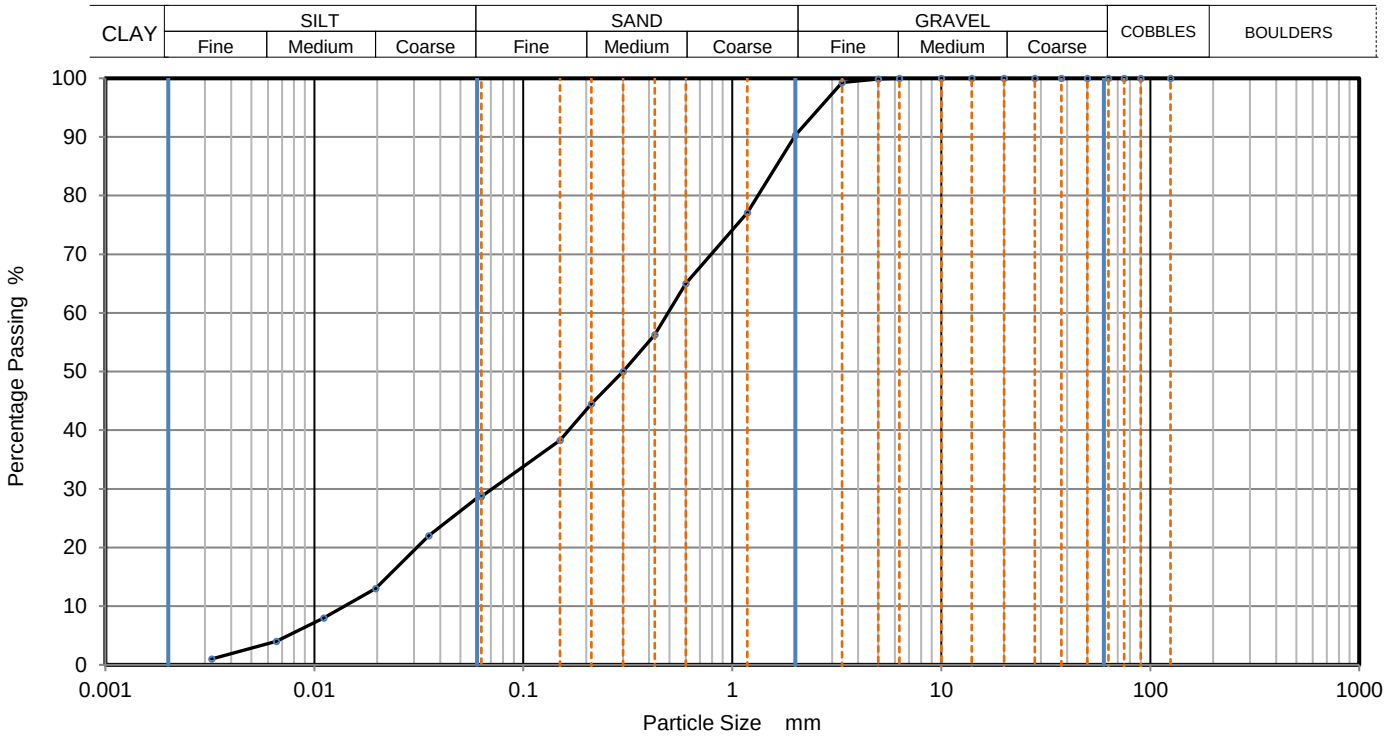
Table 1

sheet 3

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOPTP-01
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	1
Soil Description	MADE GROUND: Grey sandy slightly gravelly organic CLAY.			Depth, m	1.00
Specimen Reference	7	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201702240



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	29
90	100	0.0353	22
75	100	0.0196	13
63	100	0.0111	8
50	100	0.0066	4
37.5	100	0.0032	1
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	90		
1.18	77		
0.6	65	Particle density	(assumed)
0.425	56	1.40	Mg/m3
0.3	50		
0.212	45		
0.15	38		
0.063	29		

Dry Mass of sample, g	602

Sample Proportions	% dry mass
Cobbles	0
Gravel	10
Sand	62
Fines <0.063mm	29

Grading Analysis		
D100	mm	
D60	mm	0.492
D30	mm	0.0706
D10	mm	0.0141
Uniformity Coefficient		35
Curvature Coefficient		0.72

Remarks

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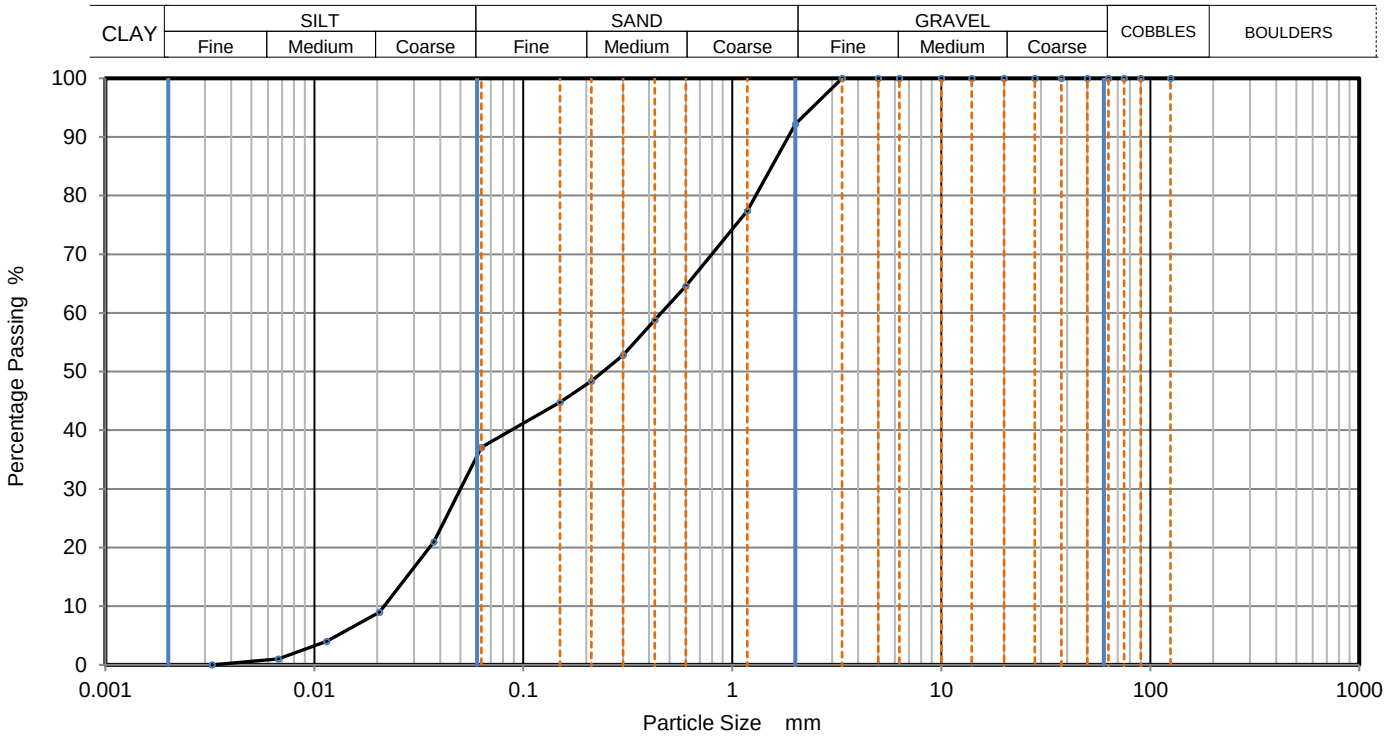
Approved	Sheet printed	**Fig** 1
Stephen.Watson	29/03/2017 15:52	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOPTP-01
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	5
Soil Description	MADE GROUND: Grey sandy slightly gravelly organic CLAY.			Depth, m	3.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201702242



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	37
90	100	0.0373	21
75	100	0.0205	9
63	100	0.0115	4
50	100	0.0067	1
37.5	100	0.0032	0
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	92		
1.18	77		
0.6	65	Particle density	(assumed)
0.425	59	1.40	Mg/m3
0.3	53		
0.212	48		
0.15	45		
0.063	37		

Dry Mass of sample, g	1139

Sample Proportions	% dry mass
Cobbles	0
Gravel	8
Sand	55
Fines <0.063mm	37

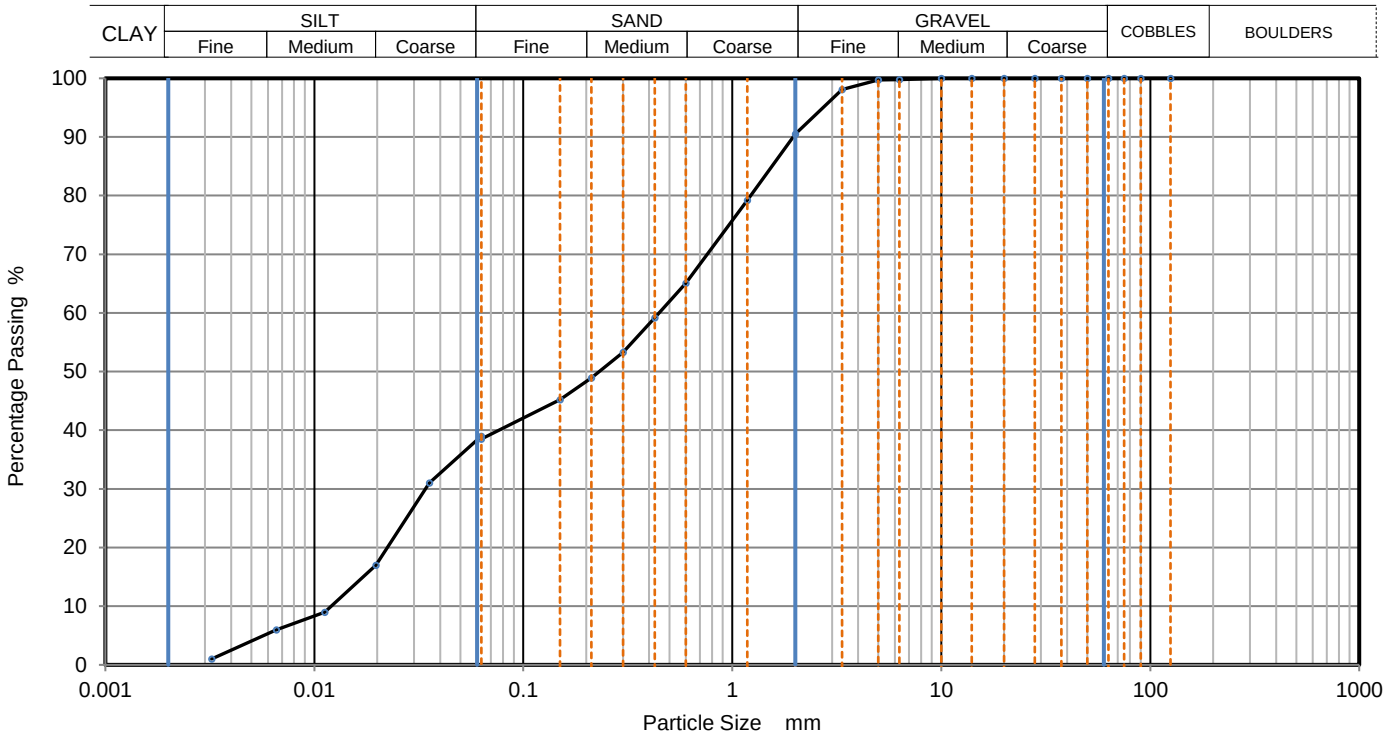
Grading Analysis		
D100	mm	
D60	mm	0.456
D30	mm	0.0497
D10	mm	0.0215
Uniformity Coefficient		21
Curvature Coefficient		0.25

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	29/03/2017 15:52	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**	Job Ref	**16-1239**
		Borehole/Pit No.	WOPTP-03
Site Name	West Offaly Power station and the Ash Disposal Facility	Sample No.	3
Soil Description	MADE GROUND: Grey sandy slightly gravelly organic SILT.	Depth, m	2.00
Specimen Reference	6	Specimen Depth: m	Sample Type: B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5	KeyLAB ID	Caus201702248



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	39
90	100	0.0355	31
75	100	0.0197	17
63	100	0.0112	9
50	100	0.0066	6
37.5	100	0.0032	1
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	98		
2	91		
1.18	79		
0.6	65	Particle density	(assumed)
0.425	59	1.40	Mg/m3
0.3	53		
0.212	49		
0.15	45		
0.063	39		

Dry Mass of sample, g: 901

Sample Proportions	% dry mass
Cobbles	0
Gravel	10
Sand	52
Fines <0.063mm	38

Grading Analysis		
D100	mm	
D60	mm	0.445
D30	mm	0.0346
D10	mm	0.012
Uniformity Coefficient		37
Curvature Coefficient		0.22

Remarks

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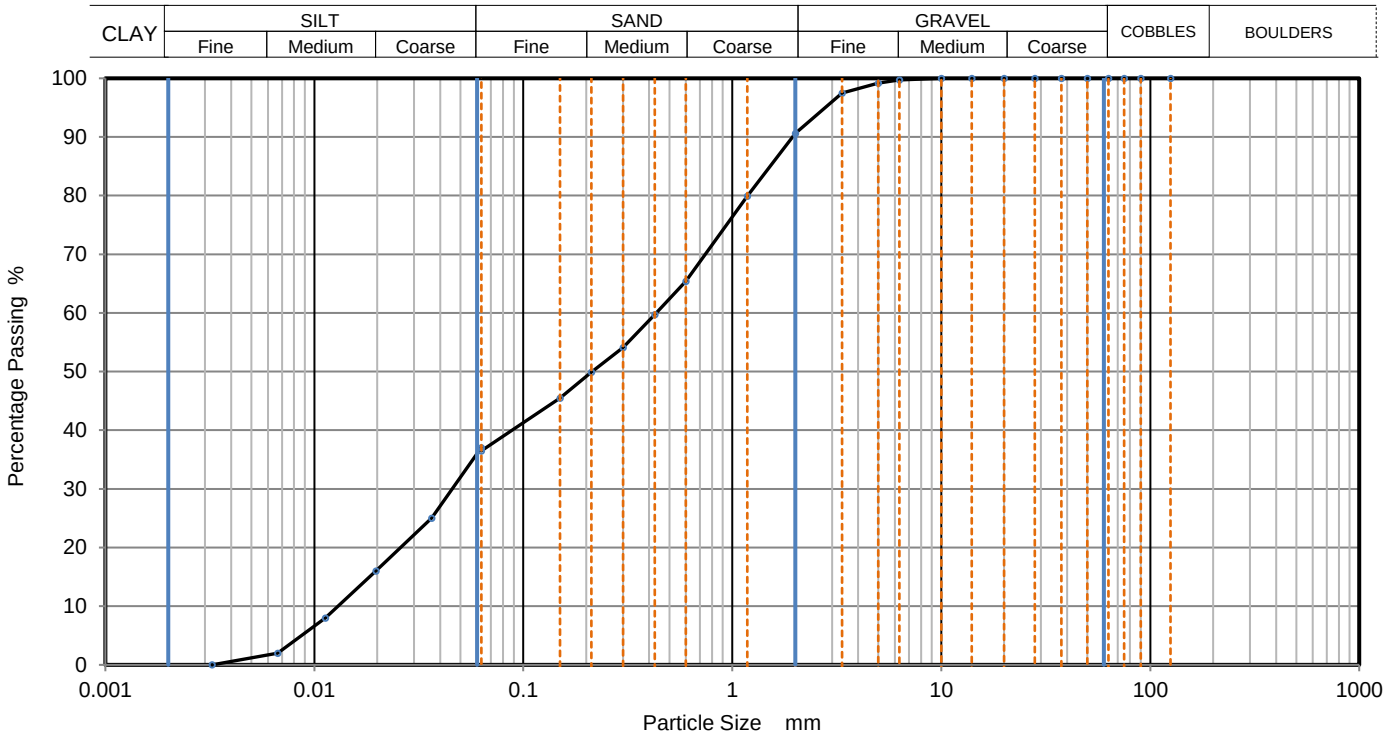
Approved	Sheet printed	**Fig** 1
Stephen.Watson	29/03/2017 15:52	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOPTP-04
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	1
Soil Description	MADE GROUND: Grey sandy slightly gravelly organic SILT.			Depth, m	0.50
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2017022410



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	37
90	100	0.0364	25
75	100	0.0197	16
63	100	0.0113	8
50	100	0.0067	2
37.5	100	0.0032	0
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	98		
2	91		
1.18	80		
0.6	65	Particle density	(assumed)
0.425	60	1.40	Mg/m3
0.3	54		
0.212	50		
0.15	46		
0.063	37		

Dry Mass of sample, g	1229

Sample Proportions	% dry mass
Cobbles	0
Gravel	9
Sand	54
Fines <0.063mm	36

Grading Analysis		
D100	mm	
D60	mm	0.432
D30	mm	0.0466
D10	mm	0.0133
Uniformity Coefficient		33
Curvature Coefficient		0.38

Remarks

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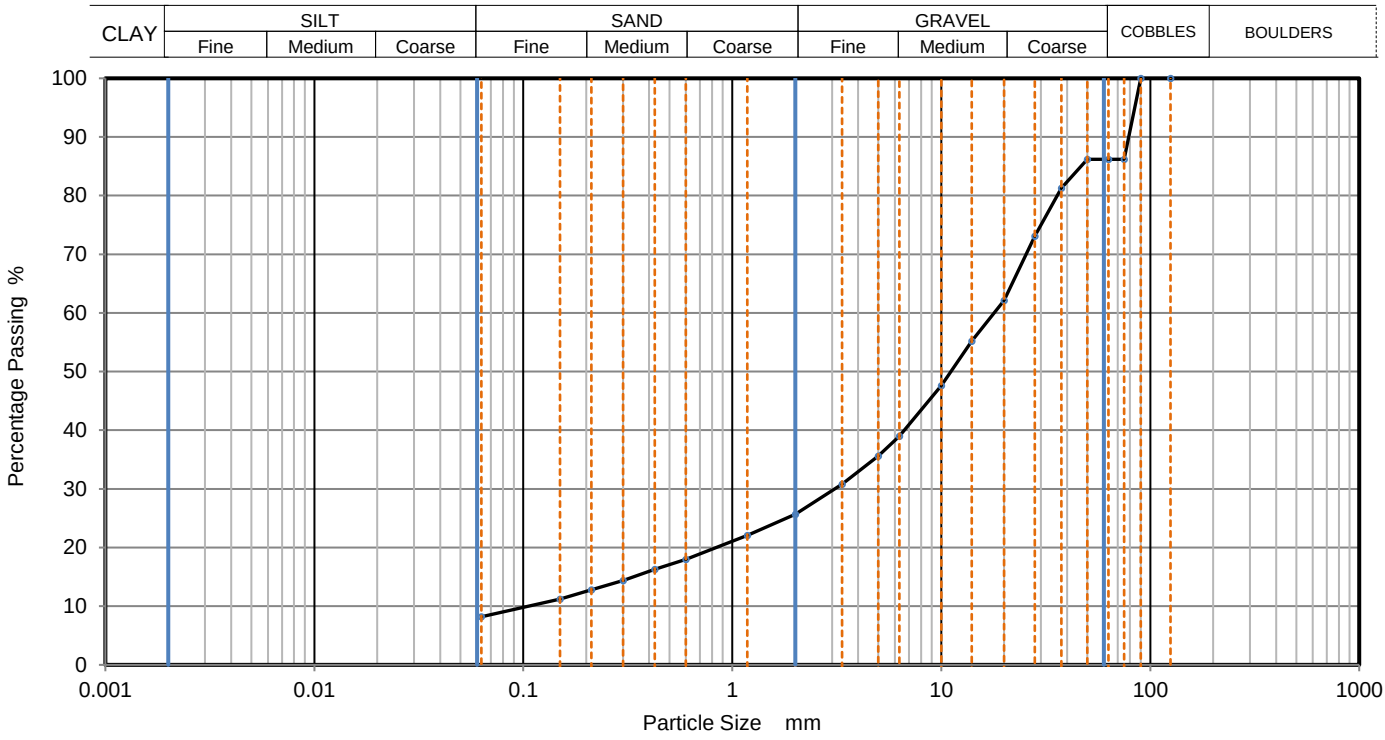
Approved	Sheet printed	**Fig** 1
Stephen.Watson	29/03/2017 15:52	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOPTP-06
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	1
Soil Description	Brownish grey silty sandy fine to coarse sandy GRAVEL with low cobble content.			Depth, m	1.00
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2017022420



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	86		
63	86		
50	86		
37.5	81		
28	73		
20	62		
14	55		
10	48		
6.3	39		
5	36		
3.35	31		
2	26		
1.18	22		
0.6	18		
0.425	16		
0.3	14		
0.212	13		
0.15	11		
0.063	8		

Dry Mass of sample, g	6195

Sample Proportions	% dry mass
Cobbles	14
Gravel	61
Sand	18
Fines <0.063mm	8

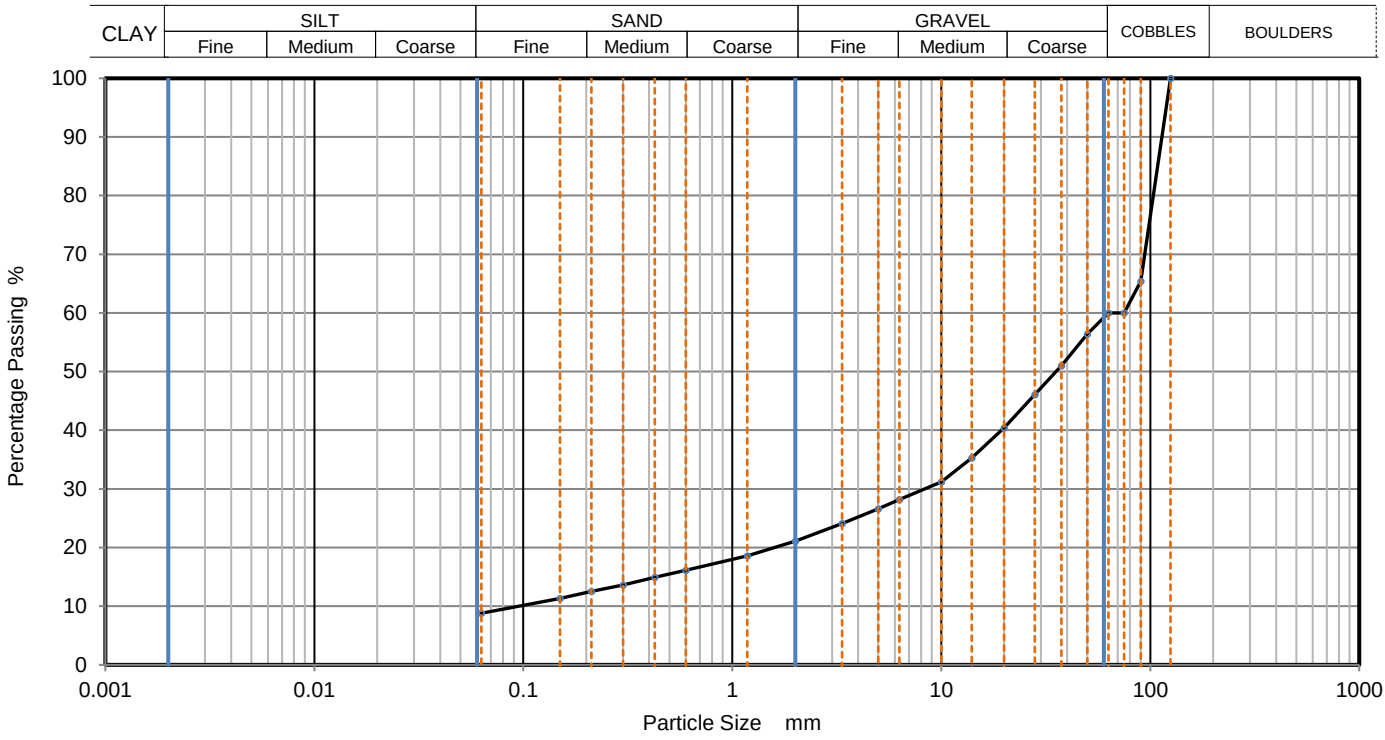
Grading Analysis		
D100	mm	
D60	mm	17.9
D30	mm	3.1
D10	mm	0.106
Uniformity Coefficient		170
Curvature Coefficient		5.1

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	29/03/2017 15:52	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOPTP-07
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	1
Soil Description	Dark brown sandy fine to coarse subangular GRAVEL with medium cobble content.			Depth, m	1.00
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2017022421



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	65		
75	60		
63	60		
50	56		
37.5	51		
28	46		
20	40		
14	35		
10	31		
6.3	28		
5	27		
3.35	24		
2	21		
1.18	19		
0.6	16		
0.425	15		
0.3	14		
0.212	13		
0.15	11		
0.063	9		

Dry Mass of sample, g	11014

Sample Proportions	% dry mass
Cobbles	40
Gravel	39
Sand	12
Fines <0.063mm	9

Grading Analysis		
D100	mm	125
D60	mm	62.8
D30	mm	8.31
D10	mm	0.0951
Uniformity Coefficient		660
Curvature Coefficient		12

Remarks

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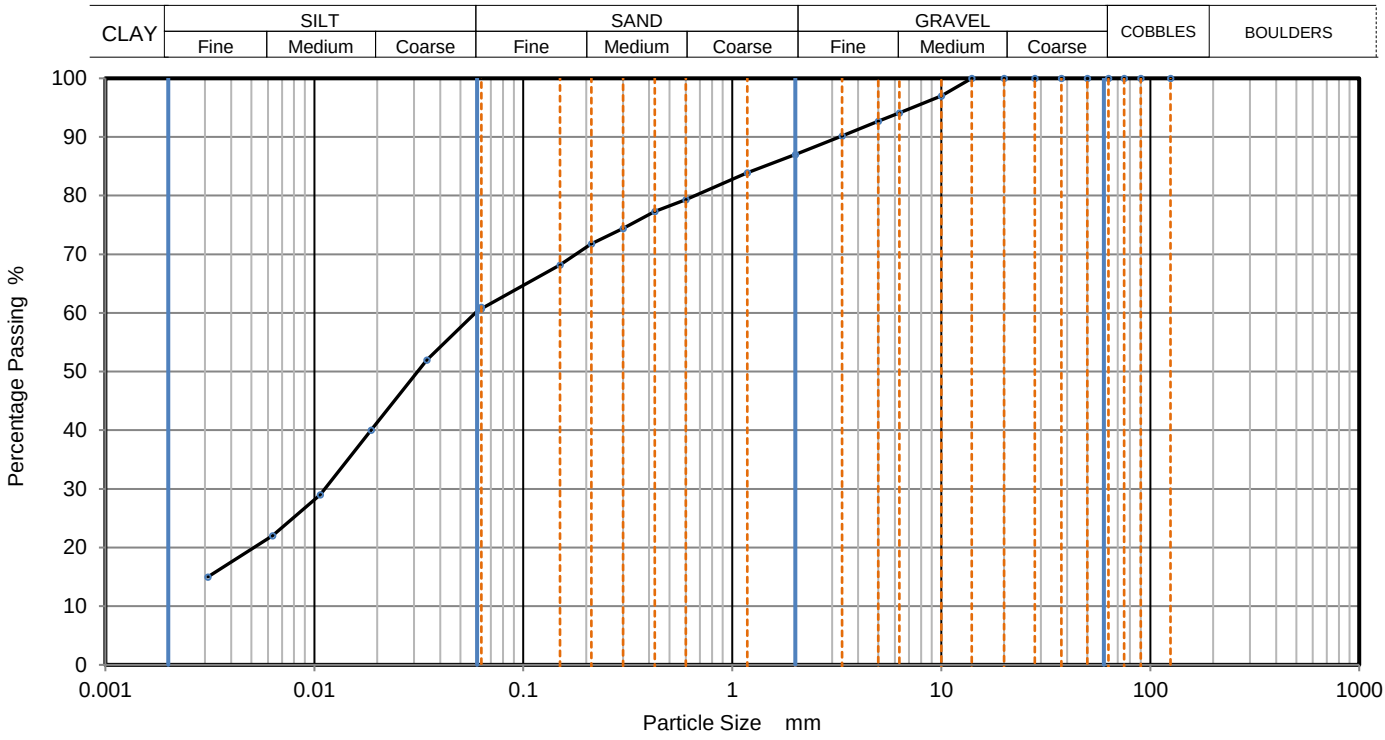
Approved	Sheet printed	**Fig** 1
Stephen.Watson	29/03/2017 15:52	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WPATP-03/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	3
Soil Description	Blueish grey sandy slightly gravelly CLAY.			Depth, m	1.00
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2017022426



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	61
90	100	0.0346	52
75	100	0.0187	40
63	100	0.0107	29
50	100	0.0063	22
37.5	100	0.0031	15
28	100		
20	100		
14	100		
10	97		
6.3	94		
5	93		
3.35	90		
2	87		
1.18	84		
0.6	79	Particle density	(assumed)
0.425	77	1.40	Mg/m3
0.3	74		
0.212	72		
0.15	68		
0.063	61		

Dry Mass of sample, g	3991

Sample Proportions	% dry mass
Cobbles	0
Gravel	13
Sand	26
Fines <0.063mm	61

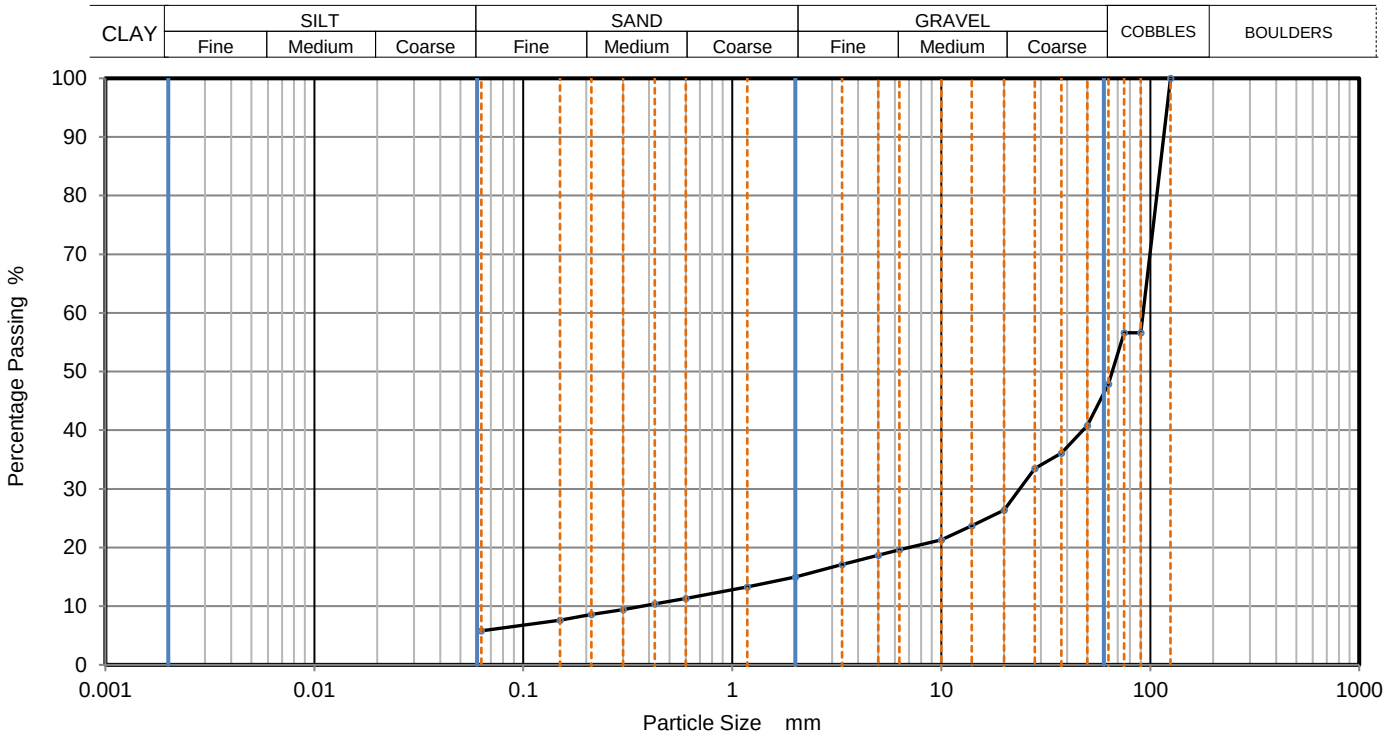
Grading Analysis		
D100	mm	
D60	mm	0.06
D30	mm	0.0114
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	29/03/2017 15:52	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WPATP-08/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	5
Soil Description	Grey slightly sandy fine to coarse GRAVEL with medium to high cobble content.			Depth, m	3.00
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2017022435



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	57		
75	57		
63	48		
50	41		
37.5	36		
28	34		
20	26		
14	24		
10	21		
6.3	20		
5	19		
3.35	17		
2	15		
1.18	13		
0.6	11		
0.425	10		
0.3	9		
0.212	9		
0.15	8		
0.063	6		

Dry Mass of sample, g	6499

Sample Proportions	% dry mass
Cobbles	52
Gravel	33
Sand	9
Fines <0.063mm	6

Grading Analysis		
D100	mm	125
D60	mm	92.3
D30	mm	23.8
D10	mm	0.366
Uniformity Coefficient		250
Curvature Coefficient		17

Remarks

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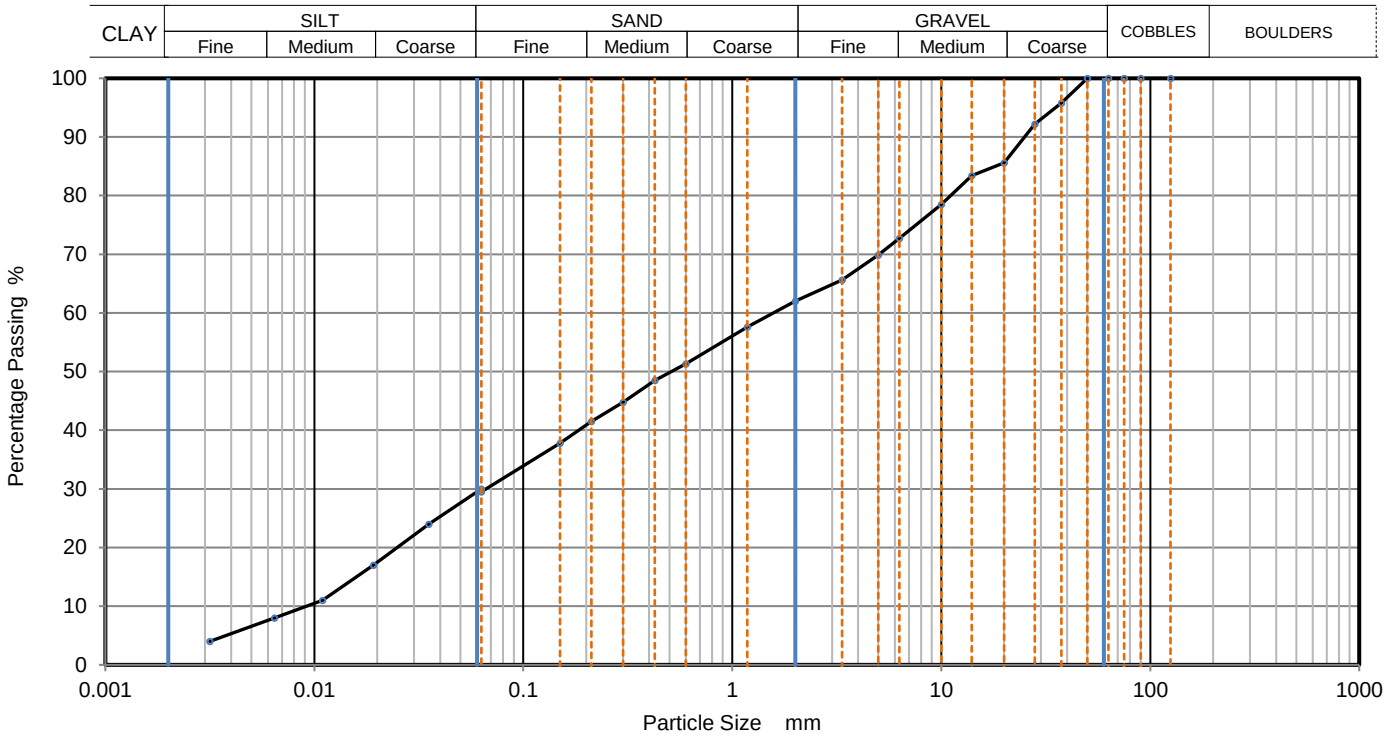
Approved	Sheet printed	**Fig** 1
Stephen.Watson	29/03/2017 15:52	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WPATP-09/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	1
Soil Description	Grey sandy gravelly CLAY.			Depth, m	1.00
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2017022436



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	30
90	100	0.0353	24
75	100	0.0192	17
63	100	0.0109	11
50	100	0.0064	8
37.5	96	0.0032	4
28	92		
20	86		
14	83		
10	79		
6.3	73		
5	70		
3.35	66		
2	62		
1.18	58		
0.6	51	Particle density	(assumed)
0.425	49	1.40	Mg/m3
0.3	45		
0.212	42		
0.15	38		
0.063	30		

Dry Mass of sample, g	4787

Sample Proportions	% dry mass
Cobbles	0
Gravel	38
Sand	32
Fines <0.063mm	30

Grading Analysis		
D100	mm	
D60	mm	1.58
D30	mm	0.0661
D10	mm	0.0094
Uniformity Coefficient		170
Curvature Coefficient		0.29

Remarks

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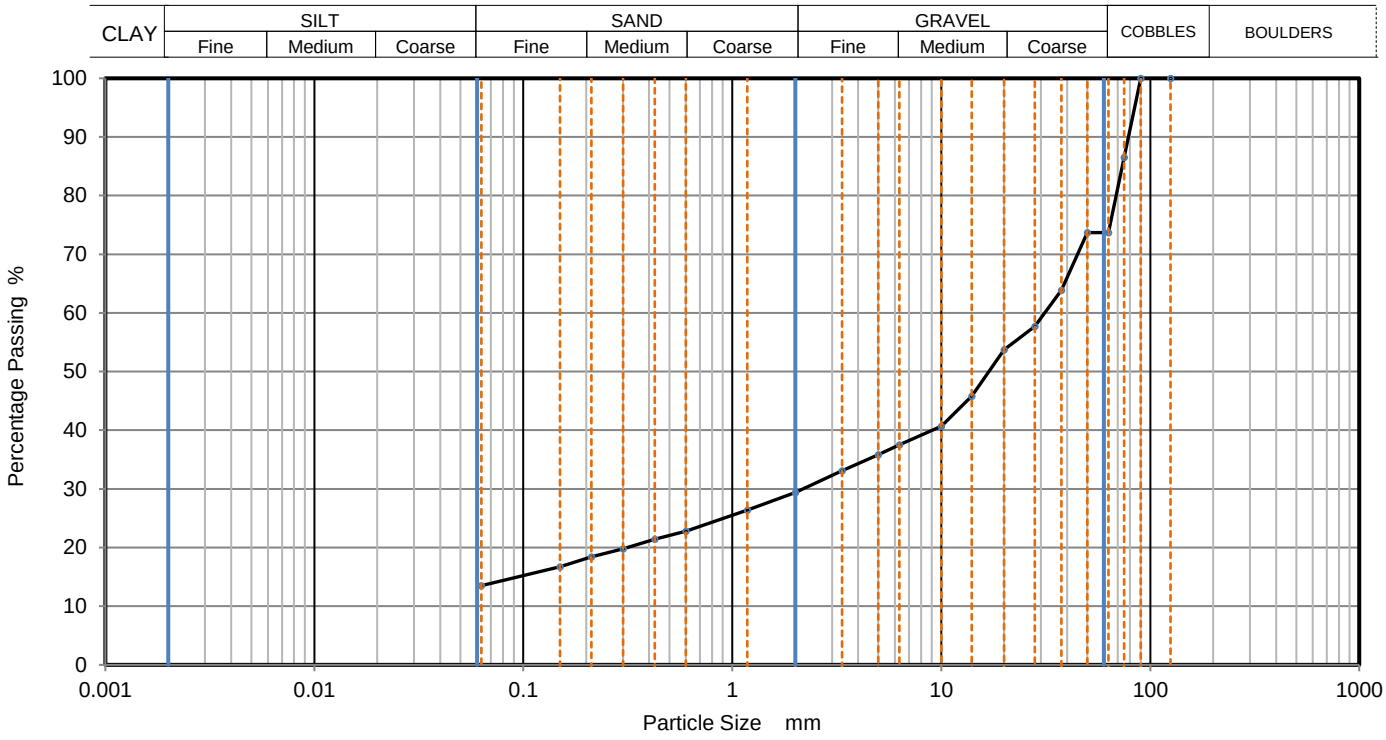
Approved	Sheet printed	**Fig** 1
Stephen.Watson	29/03/2017 15:52	Sheet

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	16-1239
				Borehole/Pit No.	WPATP-09/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	3
Soil Description	Grey sandy fine to coarse subangular GRAVEL.			Depth, m	2.00
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2017022437



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	87		
63	74		
50	74		
37.5	64		
28	58		
20	54		
14	46		
10	41		
6.3	38		
5	36		
3.35	33		
2	29		
1.18	26		
0.6	23		
0.425	21		
0.3	20		
0.212	18		
0.15	17		
0.063	14		

Dry Mass of sample, g	7675

Sample Proportions	% dry mass
Cobbles	26
Gravel	44
Sand	16
Fines <0.063mm	13

Grading Analysis		
D100	mm	
D60	mm	31.2
D30	mm	2.17
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

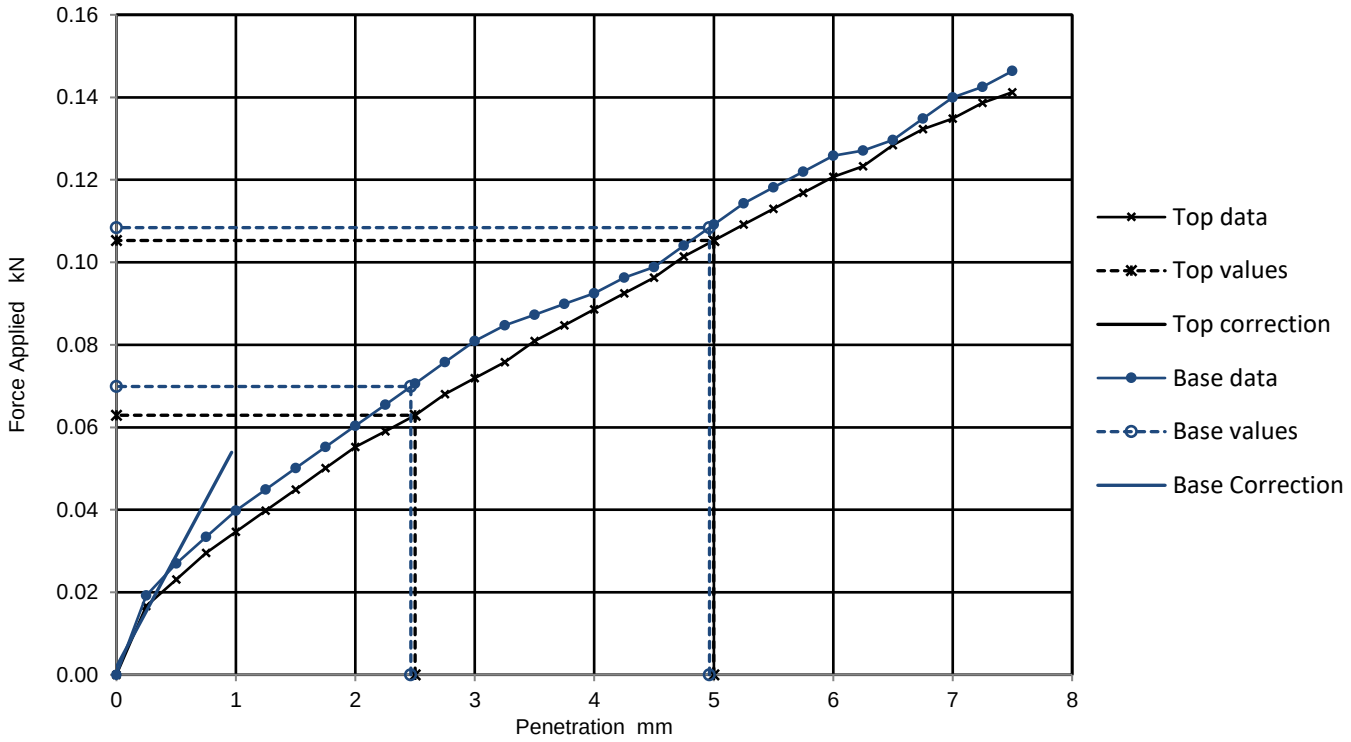
Approved	Sheet printed	Fig 1
Stephen.Watson	29/03/2017 15:53	Sheet

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	16-1239
				Borehole/Pit No.	WOPTP-01
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	1
Soil Description	MADE GROUND: Grey sandy slightly gravelly organic CLAY.			Depth m	1.00
Specimen Reference	8	Specimen Depth	m	Sample Type	B
Specimen Description	MADE GROUND: Grey sandy slightly gravelly organic CLAY.			KeyLAB ID	Caus201702240
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		0	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	1.27	Mg/m3	Surcharge applied	13.5	kg
	Dry density	0.45	Mg/m3		8	kPa
	Moisture content	182.8	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	No	0.5	0.5	0.5	0.5	182.8
BASE	Yes	0.5	0.5	0.5		183.5

General remarks	Test specific remarks	Approved
Tested at natural moisture content		Stephen.Watson

Fig No.	1
Sheet No	1

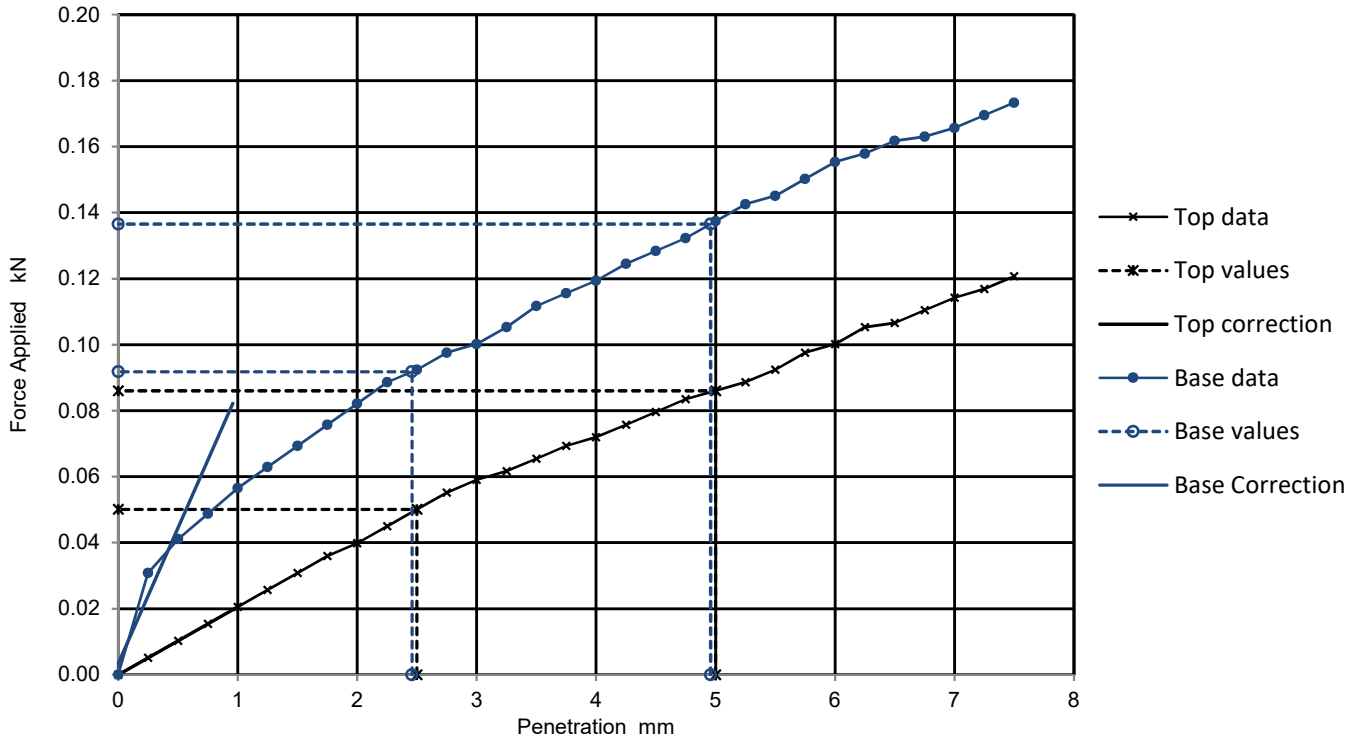
Lab Sheet Reference :

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	16-1239
				Borehole/Pit No.	WOPTP-01
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	3
Soil Description	MADE GROUND: Grey sandy slightly gravelly organic CLAY.			Depth m	2.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Specimen Description	MADE GROUND: Grey sandy slightly gravelly organic CLAY.			KeyLAB ID	Caus201702241
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		0	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	1.36	Mg/m3	Surcharge applied	13.5	kg
	Dry density	0.58	Mg/m3		8	kPa
	Moisture content	135.5	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	Yes	0.4	0.4	0.4	0.55	135.5
BASE	Yes	0.7	0.7	0.7		138.3

General remarks	Test specific remarks	Approved
Tested at natural moisture content		Stephen.Watson

Fig No.	1
Sheet No	2

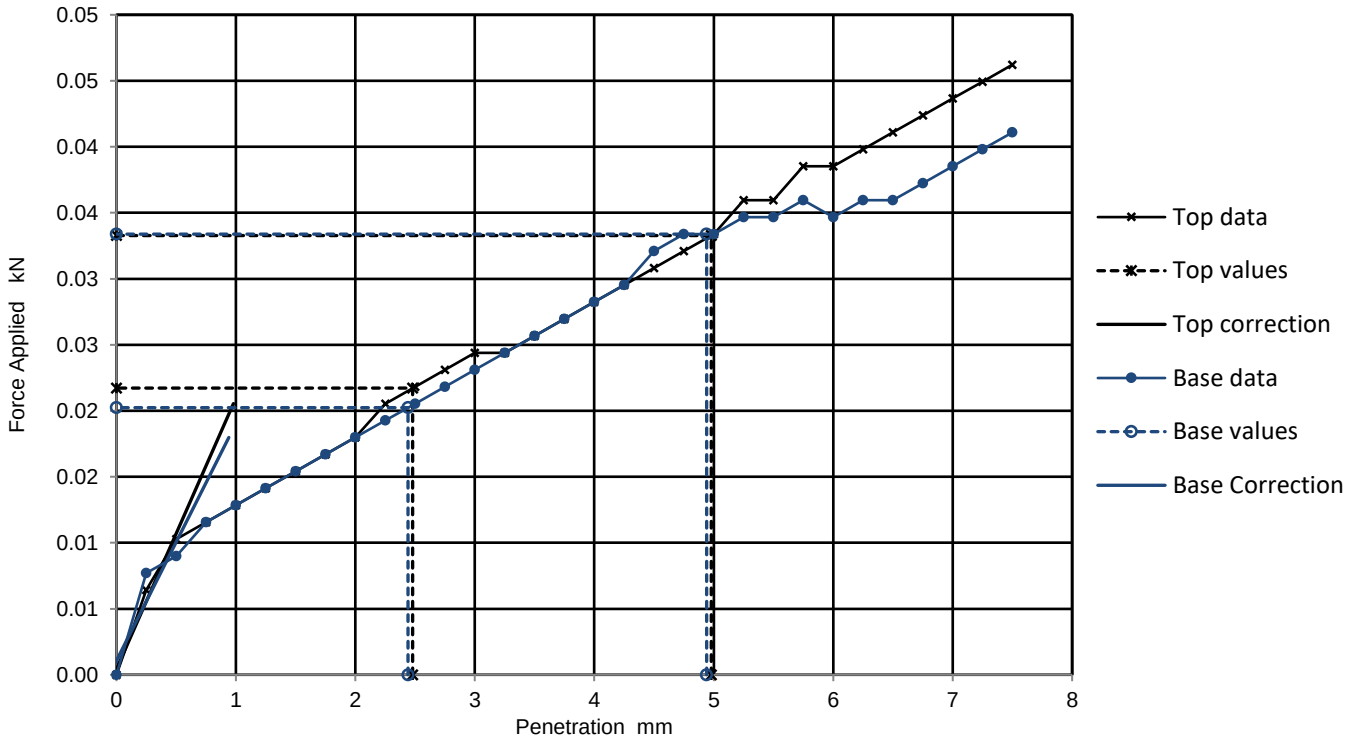
Lab Sheet Reference :

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	16-1239
				Borehole/Pit No.	WOPTP-02
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	3
Soil Description	MADE GROUND: Grey sandy organic SILT.			Depth m	2.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Specimen Description	MADE GROUND: Grey sandy organic SILT.			KeyLAB ID	Caus201702244
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		0	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	1.12	Mg/m3	Surcharge applied	13.5	kg
	Dry density	0.38	Mg/m3		8	kPa
	Moisture content	192.5	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	Yes	0.2	0.2	0.2	0.2	192.5
BASE	Yes	0.2	0.2	0.2		193.8

General remarks	Test specific remarks	Approved
Tested at natural moisture content		Stephen.Watson

Fig No.	1
Sheet No	3

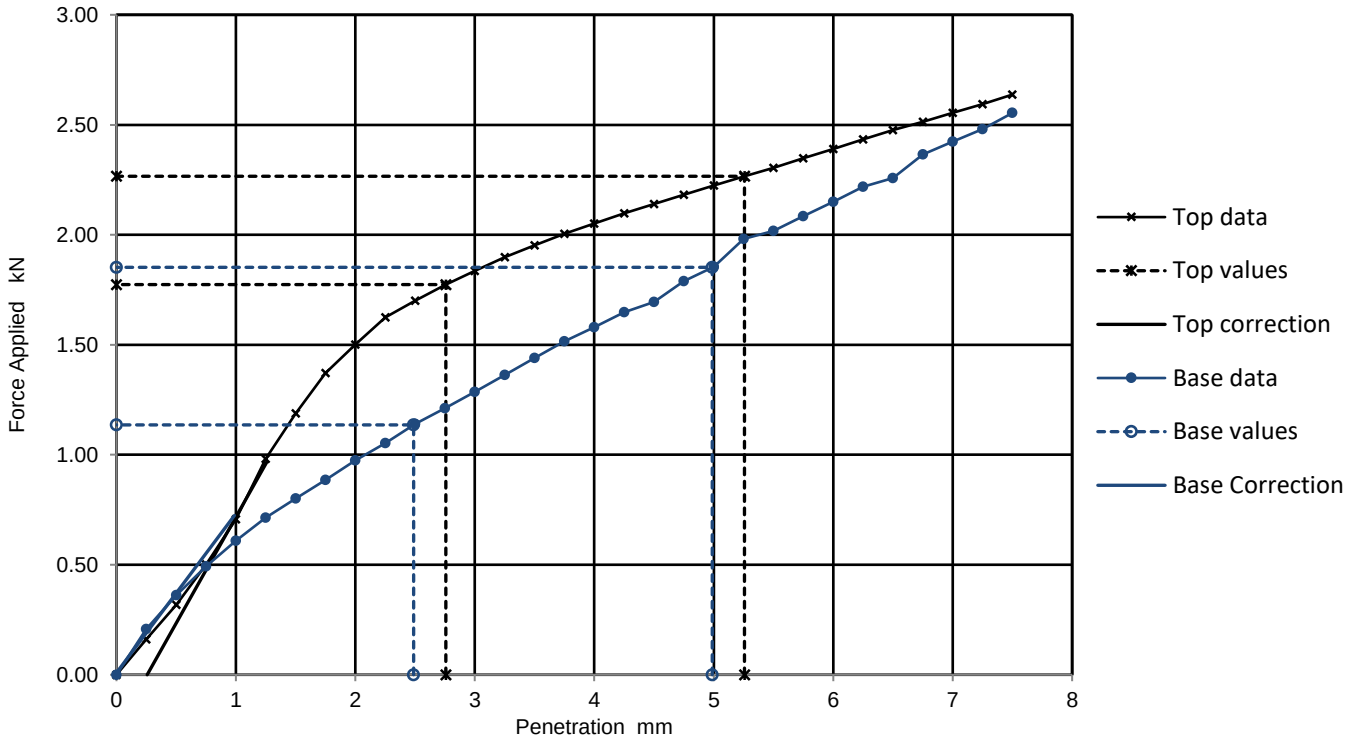
Lab Sheet Reference :

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	16-1239
				Borehole/Pit No.	WOPTP-03
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	1
Soil Description	MADE GROUND: Grey sandy organic SILT.			Depth m	1.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Specimen Description	MADE GROUND: Grey sandy organic SILT.			KeyLAB ID	Caus201702247
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		0	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	1.27	Mg/m3	Surcharge applied	13.5	kg
	Dry density	0.56	Mg/m3		8	kPa
	Moisture content	127.7	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	Yes	13.0	11.0	13.0	11.2	127.7
BASE	Yes	8.6	9.3	9.3		126.9

General remarks	Test specific remarks	Approved
Tested at natural moisture content		Stephen.Watson

Fig No.	1
Sheet No	4

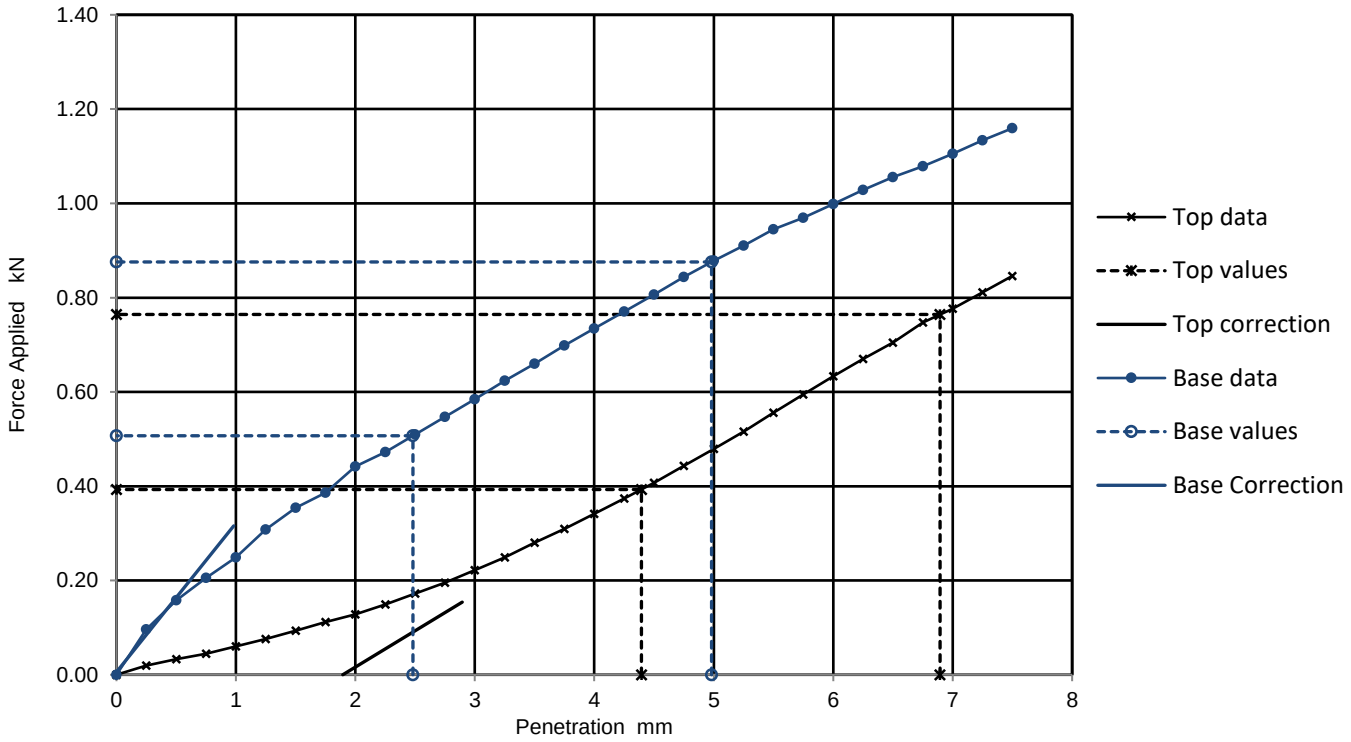
Lab Sheet Reference :

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	16-1239
				Borehole/Pit No.	WOPTP-04
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	3
Soil Description	MADE GROUND: Grey sandy organic SILT.			Depth m	1.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Specimen Description	MADE GROUND: Grey sandy organic SILT.			KeyLAB ID	Caus2017022412
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		0	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	1.26	Mg/m3	Surcharge applied	13.5	kg
	Dry density	0.47	Mg/m3		8	kPa
	Moisture content	165.4	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	Yes	3.0	3.8	3.8	4.1	165.4
BASE	Yes	3.8	4.4	4.4		166.6

General remarks	Test specific remarks	Approved
Tested at natural moisture content		Stephen.Watson

Fig No.	1
Sheet No	5

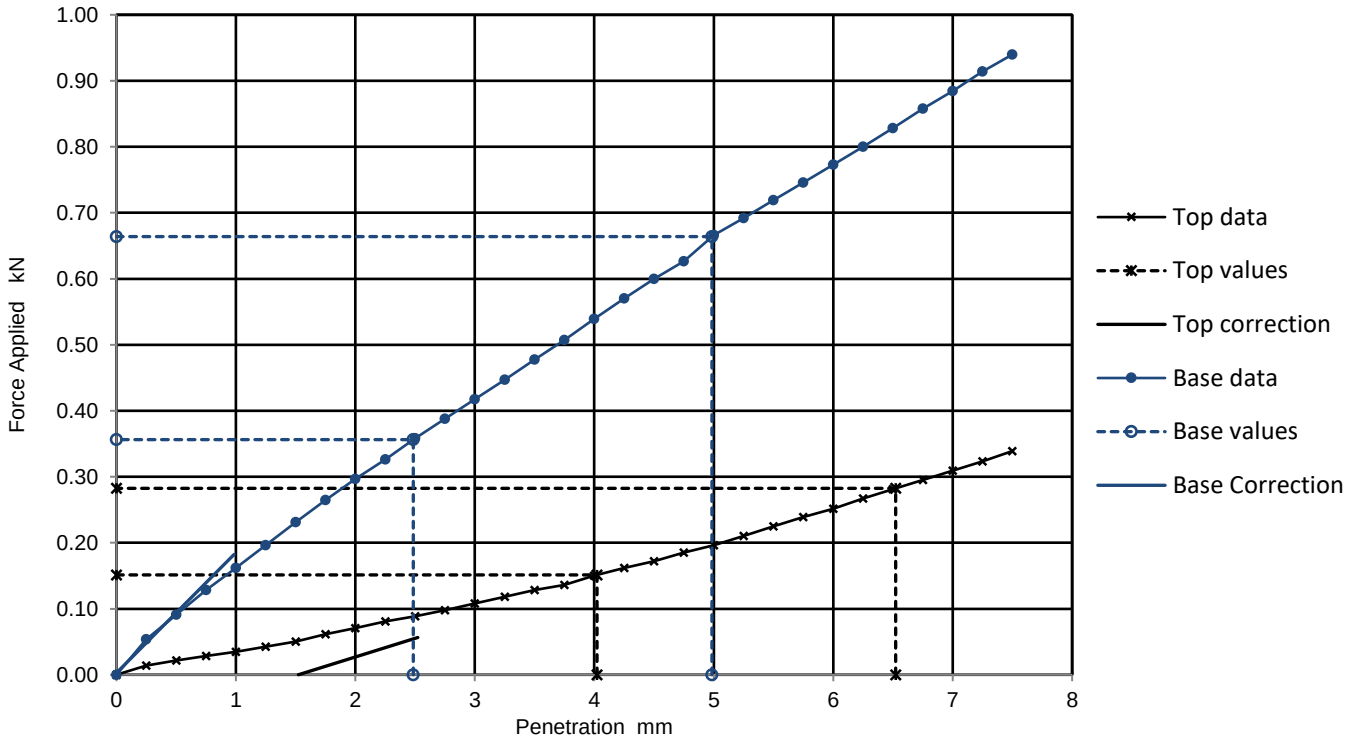
Lab Sheet Reference :

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	16-1239
				Borehole/Pit No.	WOPTP-05
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	8
Soil Description	MADE GROUND: Grey sandy organic SILT.			Depth m	3.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Specimen Description	MADE GROUND: Grey sandy organic SILT.			KeyLAB ID	Caus2017022418
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		0	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	1.38	Mg/m3	Surcharge applied	13.5	kg
	Dry density	0.57	Mg/m3		8	kPa
	Moisture content	143.8	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	Yes	1.1	1.4	1.4	2.4	143.8
BASE	Yes	2.7	3.3	3.3		134.5

General remarks	Test specific remarks	Approved
Tested at natural moisture content		Stephen.Watson

Fig No.	1
Sheet No	6

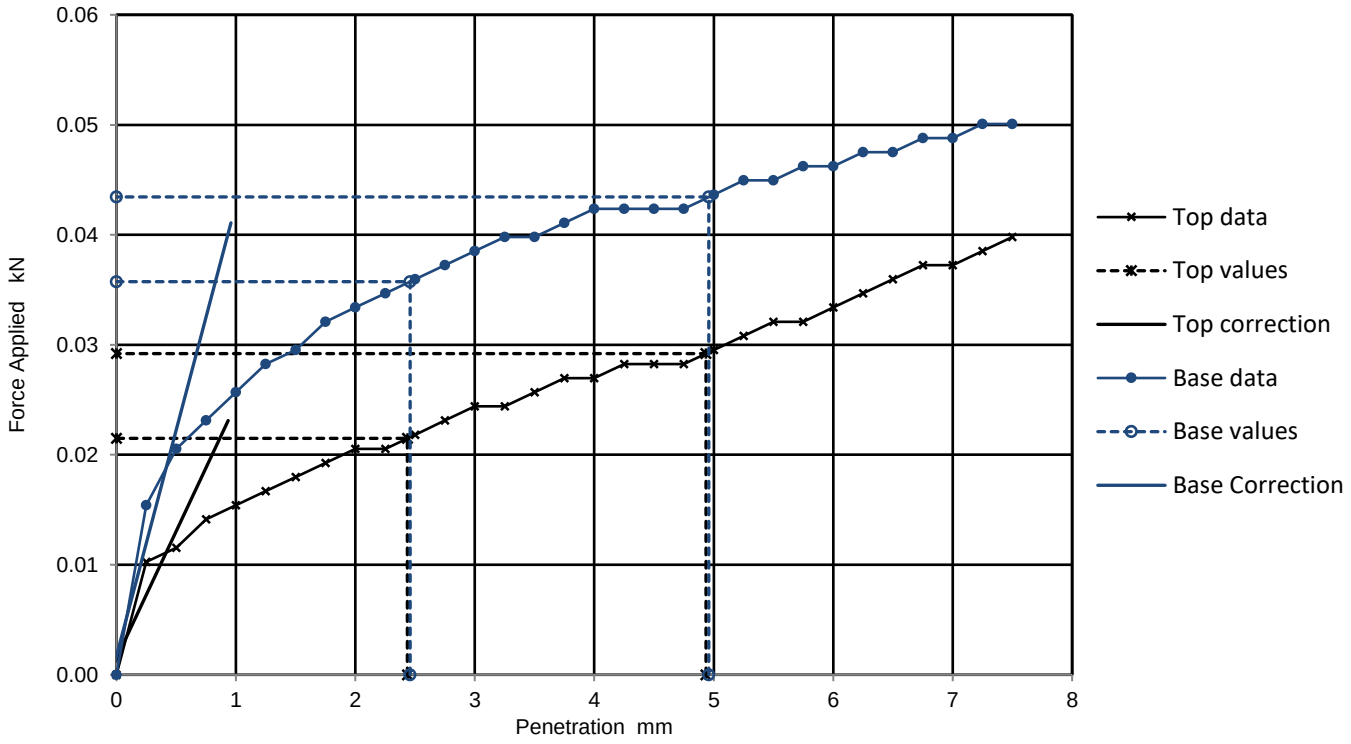
Lab Sheet Reference :

CAUSEWAY GEOTECH	**California Bearing Ratio (CBR)**			Job Ref	16-1239
				Borehole/Pit No.	WPATP-04/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	5
Soil Description	Blueish grey slightly sandy CLAY.			Depth m	3.00
Specimen Reference	7	Specimen Depth	m	Sample Type	B
Specimen Description	Blueish grey slightly sandy CLAY.			KeyLAB ID	Caus2017022429
Test Method	BS1377 : Part 4 : 1990, clause 7			CBR Test Number	1

Specimen Preparation

Condition	REMOULDED			Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer			Period of soaking		days
				Time to surface		days
				Amount of swell recorded		mm
Material retained on 20mm sieve removed		0	%	Dry density after soaking		Mg/m3
Initial Specimen details	Bulk density	1.93	Mg/m3	Surcharge applied	13.5	kg
	Dry density	1.46	Mg/m3		8	kPa
	Moisture content	31.9	%			

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP	Yes	0.2	0.2	0.2	0.3	31.9
BASE	Yes	0.3	0.2	0.3		27.8

General remarks	Test specific remarks	Approved
Tested at natural moisture content		Stephen.Watson

Fig No.	1
Sheet No	7

Lab Sheet Reference :

Moisture Condition Value at Natural Moisture Content
Summary of Results

Project No.	Project Name
16-1239	West Offaly Power station and the Ash Disposal Facility

Hole No.	Sample				Soil Description	Retained on 20mm sieve	Moisture Content <20mm	Moisture Condition Value	Method of Interpretation	Remarks
	Ref	Top	Base	Type		%	%			
WOPTP-02	7	4.00		B	MADE GROUND: Grey sandy organic SILT.	0	209.0	2.4	Best fit line	
WPATP-02/17	5	3.00		B	Grey slightly sandy very gravelly CLAY.	47	31.6	5.4	Best fit line	
WPATP-04/17	3	2.00		B	Grey slightly sandy CLAY.	0	46.6	2.4	Best fit line	
WPATP-05/17	3	2.00		B	Grey sandy gravelly CLAY.	9	13.6	4.7	Best fit line	
WPATP-05/17	5	3.00		B	Grey sandy gravelly CLAY.	41	7.8	>18	Best fit line	

Key	Date Printed	Approved By	Table
Test performed in accordance with BS1377:Part4:1990, clause 5.4 unless annotated otherwise	29/03/2017		sheet

CAUSEWAY GEOTECH	**Moisture Condition Value / Moisture Content Relationship**			Job Ref	16-1239
				Borehole/Pit No.	WOPTP-04
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	9
Soil Description	MADE GROUND: Grey sandy organic SILT.			Depth	4
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Specimen Description	MADE GROUND: Grey sandy organic SILT.			KeyLAB ID	Caus2017022415
Test Method	BS1377:Part4:1990:clause 5.5			Date started	

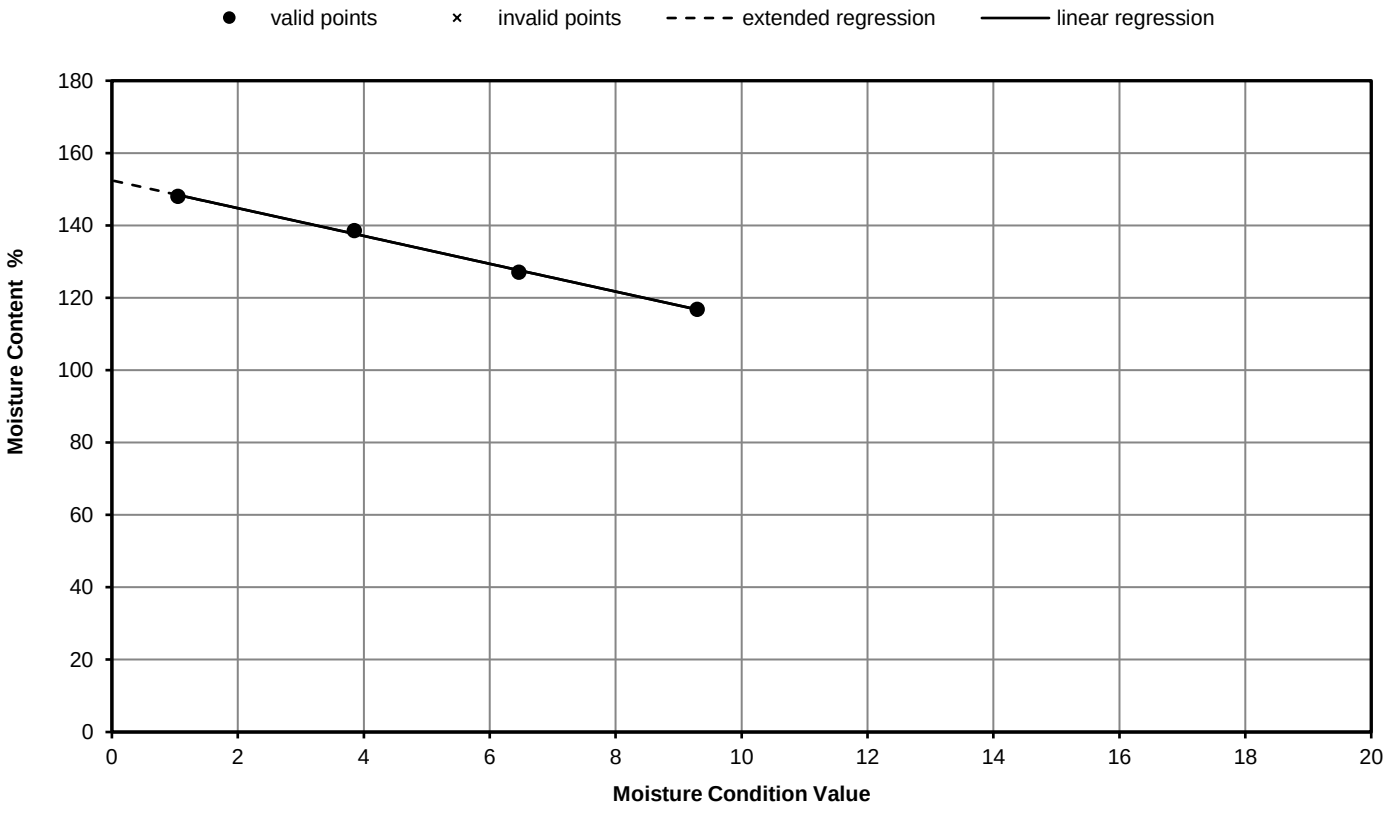
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	148	%
Initial Moisture Content of test sample below 20mm	148	%
Separate specimens tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	
Moisture Content, %	148.0	138.6	127.1	116.8	
Moisture Condition Value	1.0	3.9	6.5	9.3	
MCV report	1	3.9	6.5	9.3	
Effective / Valid data point	YES	YES	YES	YES	
Vane Shear strength (kPa)	7	13	40	68	



Approved
Stephen.Watson

CAUSEWAY GEOTECH	Moisture Condition Value / Moisture Content Relationship			Job Ref	16-1239
				Borehole/Pit No.	WPATP-10/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	3
Soil Description	Grey sandy very gravelly CLAY.			Depth	2
Specimen Reference	8	Specimen Depth	m	Sample Type	B
Specimen Description	Grey sandy very gravelly CLAY.			KeyLAB ID	Caus2017022438
Test Method	BS1377:Part4:1990:clause 5.5			Date started	

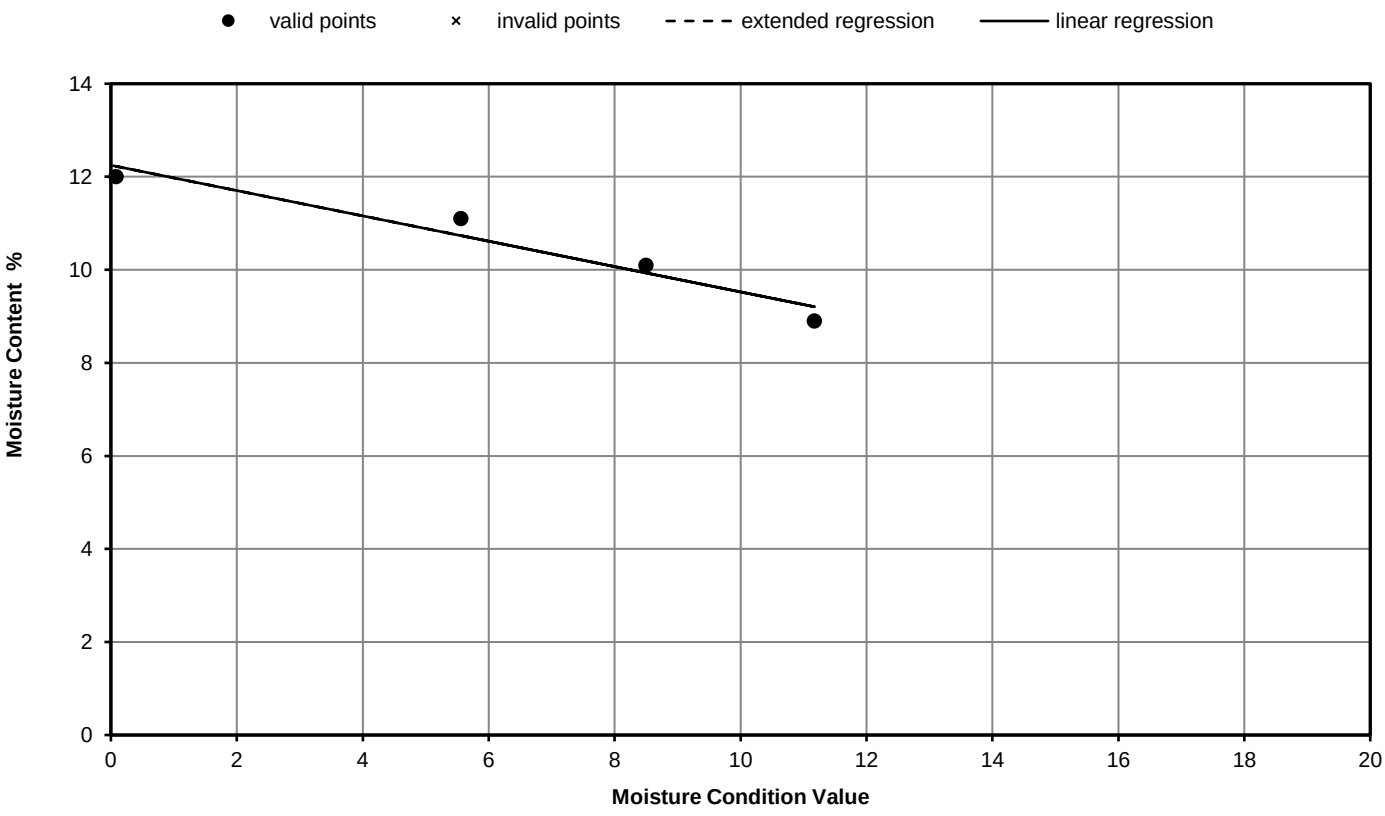
Sample preparation

Amount of material larger than 20mm sieve removed	37	%
Natural Moisture Content of sample	7.3	%
Initial Moisture Content of test sample below 20mm	12	%
Separate specimens tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	
Moisture Content, %	12.0	8.9	10.1	11.1	
Moisture Condition Value	0.1	11.2	8.5	5.6	
MCV report	0.1	11.2	8.5	5.6	
Effective / Valid data point	YES	YES	YES	YES	
Vane Shear strength (kPa)	4	83	55	27	

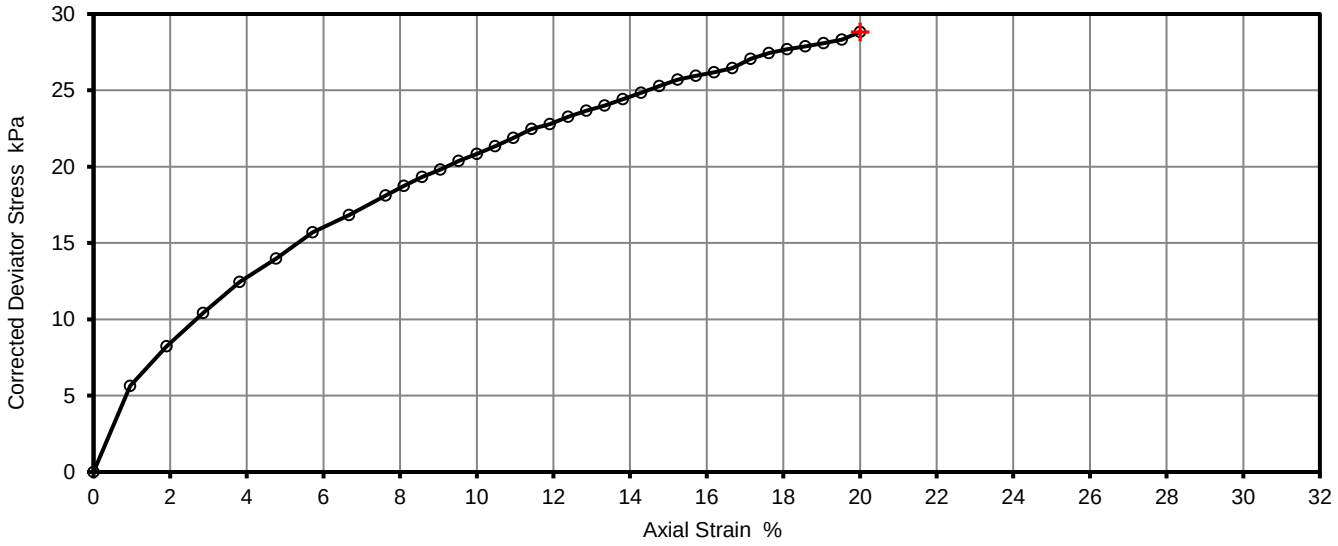


Approved
Stephen.Watson

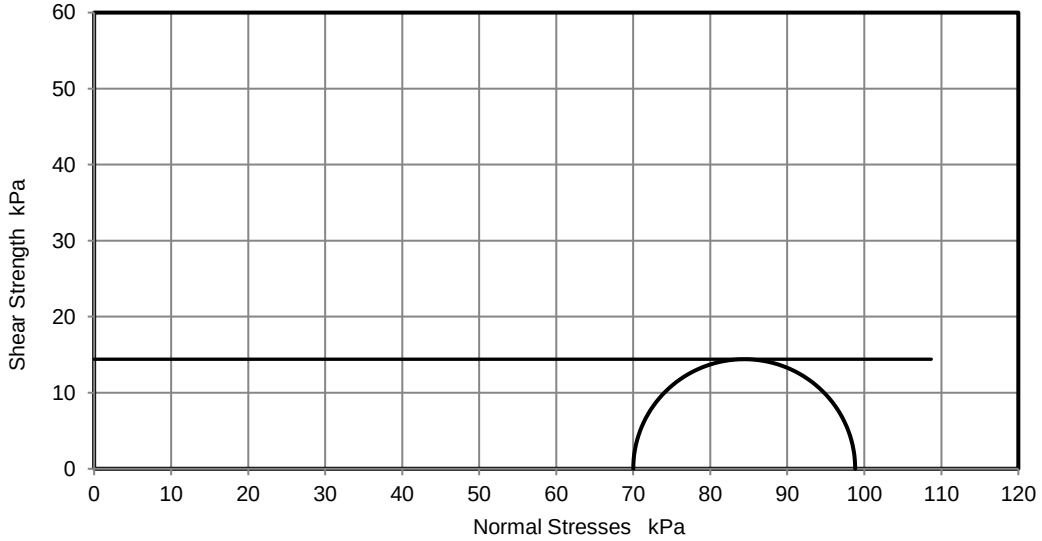
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	16-1239
				Borehole/Pit No.	WPATP-01/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	5
Soil Description	Grey slightly sandy slightly gravelly CLAY.			Depth	3.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Specimen Description	Very soft grey slightly sandy slightly gravelly CLAY.			KeyLAB ID	Caus2017022423
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	

Test Number		1	
Length		210.0	mm
Diameter		105.2	mm
Bulk Density		2.13	Mg/m3
Moisture Content		19.5	%
Dry Density		1.78	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		70	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	29	kPa
	Undrained Shear Strength, cu	14	kPa ½(σ1 - σ3)f
	Mode of Failure		

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

REMOULDED SPECIMEN -Testing terminated at 20% strain

Approved: Stephen.Watson

Printed: 29/03/2017 16:29

Fig. No. 1

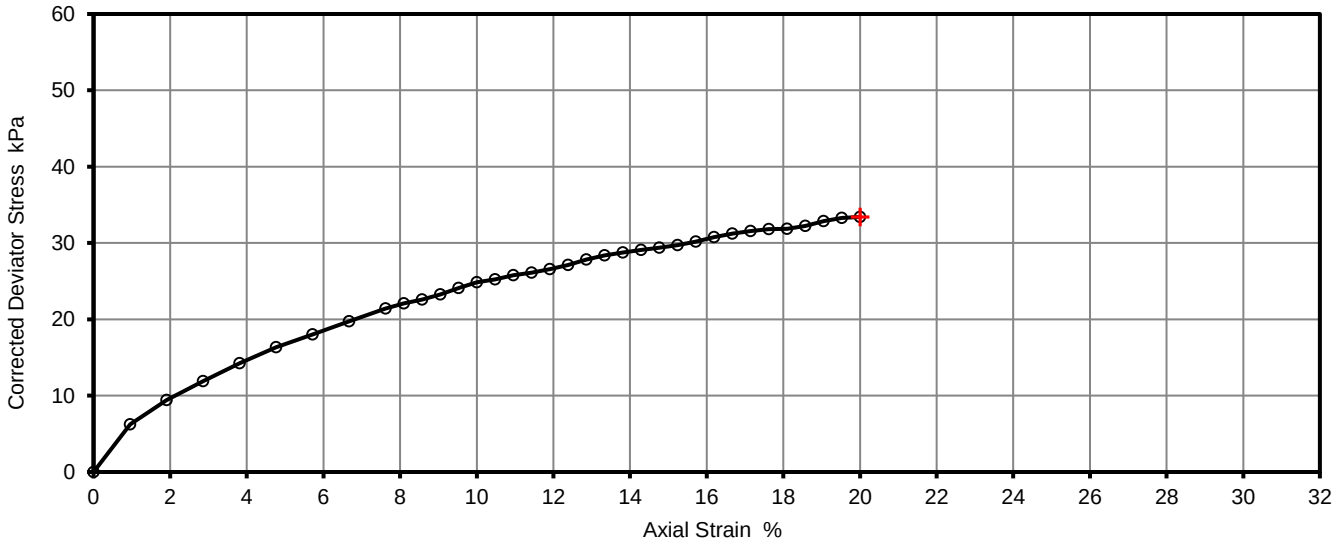
Sheet 1

Lab Sheet Reference :

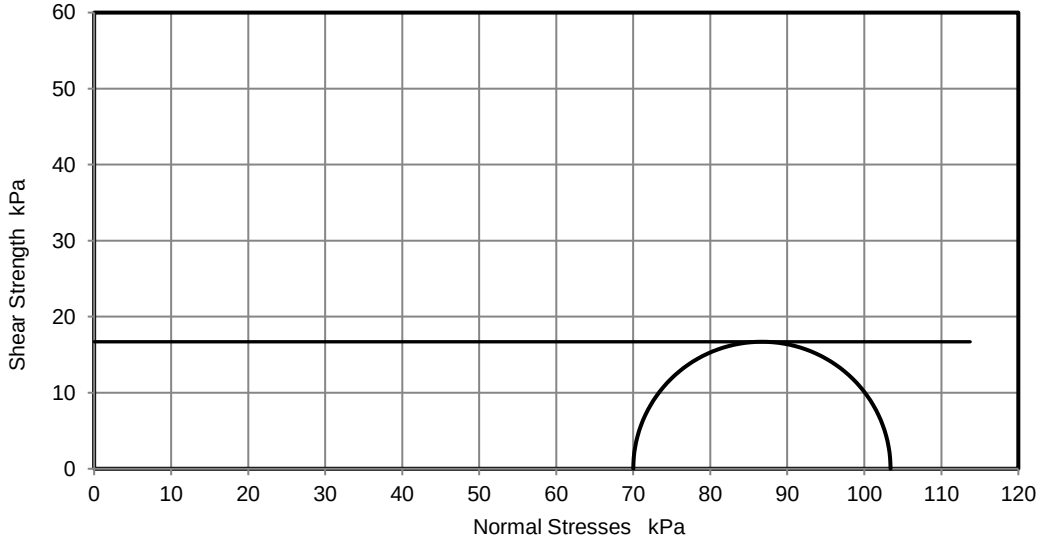
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	16-1239
				Borehole/Pit No.	WPATP-02/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	5
Soil Description	Grey slightly sandy very gravelly CLAY.			Depth	3.00
Specimen Reference	7	Specimen Depth	m	Sample Type	B
Specimen Description	Very soft grey slightly sandy very gravelly CLAY.			KeyLAB ID	Caus2017022424
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	

Test Number		1	
Length		210.0	mm
Diameter		105.2	mm
Bulk Density		2.13	Mg/m3
Moisture Content		19.5	%
Dry Density		1.78	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		70	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	33	kPa
	Undrained Shear Strength, cu	17	kPa ½(σ1 - σ3)f
	Mode of Failure		

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

REMOULDED SPECIMEN -Testing terminated at 20% strain

Approved: Stephen.Watson

Printed: 29/03/2017 16:29

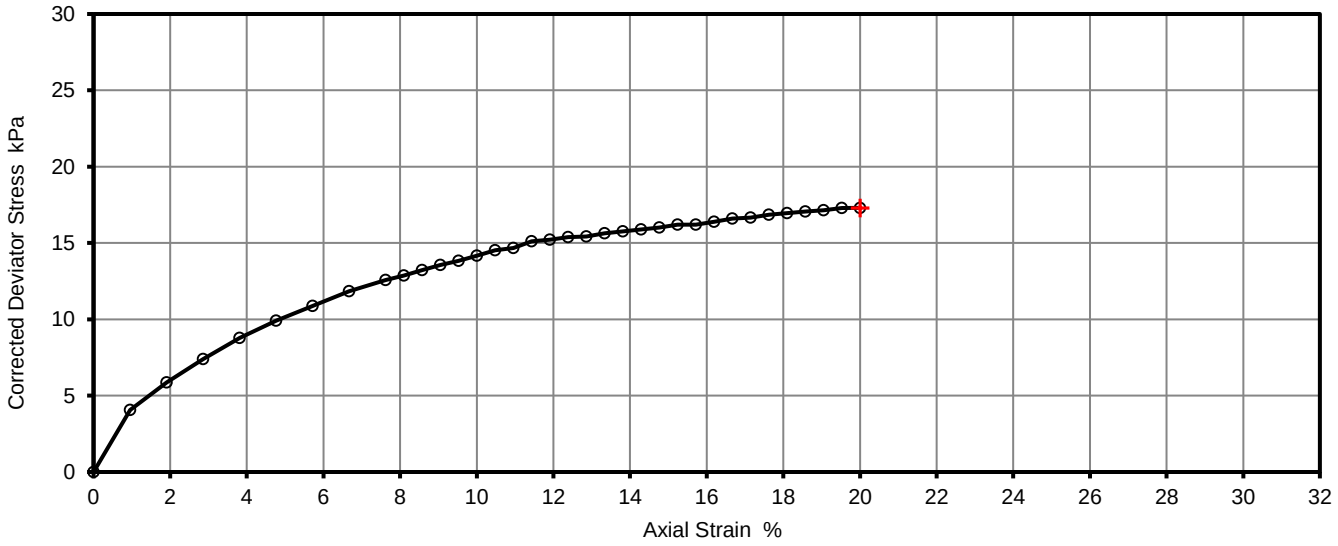
Lab Sheet Reference :

Fig. No. 1

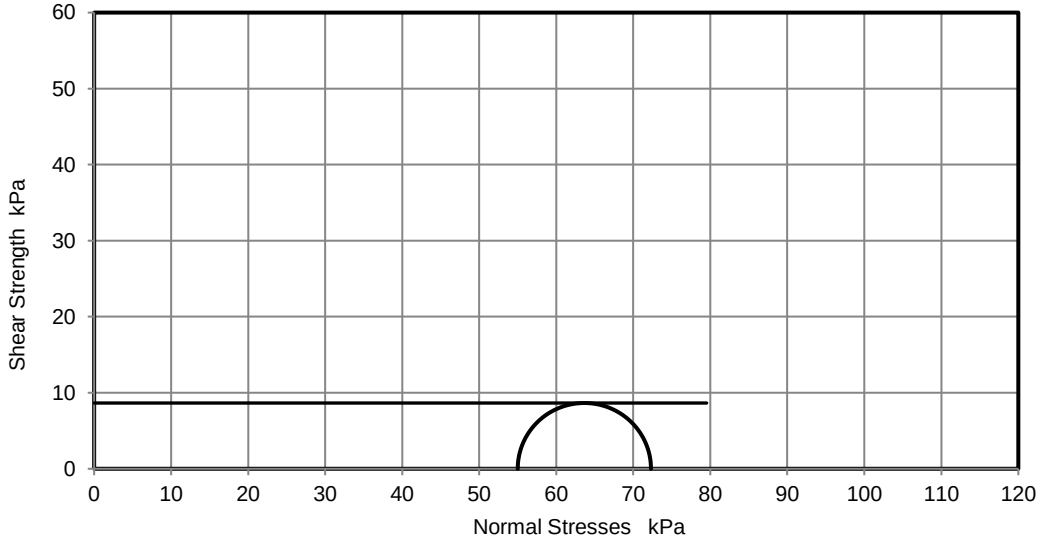
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	16-1239
				Borehole/Pit No.	WPATP-07/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	3
Soil Description	Grey slightly sandy gravelly CLAY.			Depth	2.00
Specimen Reference	4	Specimen Depth	m	Sample Type	B
Specimen Description	Very soft grey slightly sandy gravelly CLAY.			KeyLAB ID	Caus2017022433
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	

Test Number		1	
Length		210.0	mm
Diameter		105.2	mm
Bulk Density		2.40	Mg/m3
Moisture Content		9.6	%
Dry Density		2.19	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		55	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	17	kPa
	Undrained Shear Strength, cu	9	kPa ½(σ1 - σ3)f
	Mode of Failure		

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

REMOULDED SPECIMEN -Testing terminated at 20% strain

Approved: Stephen.Watson

Printed: 29/03/2017 16:29

Lab Sheet Reference :

Fig. No. 1

Summary of Laboratory Vane Test Results

Project No.	Project Name
16-1239	West Offaly Power station and the Ash Disposal Facility

Hole No.	Sample				Soil Description at test horizon	Moisture Content %	Vane shear strength		Sensitivity	Remarks
	Ref	Top	Base	Type			Undisturbed kPa	Remoulded kPa		
WOPTP-02	7	4.00		B	mADE GROUND: Very soft grey sandy organic SILT.	189		17		
WOPTP-04	9	4.00		B	MADE GROUND: Very soft grey sandy organic SILT.	147		13		
WPATP-04/17	5	3.00		B	Soft blueish grey slightly sandy CLAY.	33		20		
WPATP-05/17	3	2.00		B	Very soft grey sandy gravelly CLAY.	17		17		
WPATP-10/17	3	2.00		B	Soft grey sandy very gravelly CLAY.	11		22		

Notes	Date Printed	Approved By	Table
Tests performed in accordance with BS 1377:Part 7:clause 3 using 19mm x 30mm vane Tests carried out in nominally 100mm diameter tube unless noted otherwise Shear strengths are average of at least 3 tests unless noted otherwise	29/03/2017		1 sheet 1

LABORATORY RESTRICTION REPORT

Project Reference	16-1239	To	Darren O'Mahony
Project Name	West Offaly Power Station and the Ash Disposal Facility	Position	Project Manager
TR reference	16-1239 / 1	From	Stephen Watson
		Position	Laboratory Manager

The following sample(s) and test(s) are restricted as detailed below. Could you please complete the "Required Action" column and return the completed form to the laboratory.

Hole Number	Sample			Test Type	Reason for Restriction	Required Action
	Number	Depth (m)	Type			
WPATP-01/17	4	2.0	D	Atterberg Limits	Fibrous PEAT - Testing not suitable	Cancelled
WPATP-04/17	1	1.0	D	Atterberg Limits	Fibrous PEAT - Testing not suitable	Cancelled
WPATP-05/17	2	1.0	D	Atterberg Limits	Fibrous PEAT - Testing not suitable	Cancelled
WPATP-04/17	5	3.0	B	QUICK triaxial (remoulded)	No suitable test specimen. Sample slumped while setting up test.	Lab vane test carried out
WPATP-05/17	3	2.0	B	QUICK triaxial (remoulded)	No suitable test specimen. Sample slumped while setting up test.	Lab vane test carried out
WPATP-10/17	3	2.0	B	QUICK triaxial (remoulded)	No suitable test specimen. Sample slumped while setting up test.	Lab vane test carried out
WOPTP-02	7	4.0	B	QUICK triaxial (remoulded)	No suitable test specimen. Sample slumped while setting up test.	Lab vane test carried out
WOPTP-04	9	4.0	B	QUICK triaxial (remoulded)	No suitable test specimen. Sample slumped while setting up test.	Lab vane test carried out
WOPTP-04	7	3.50	B	CBR	No suitable test specimen. Sample damaged/split in transit to laboratory.	Testing cancelled
WPATP-07/17	3	2.00	B	CBR	Greater than 25% gravel retained on the 20mm test sieve. GRADING ZONE (X) - Testing not applicable as BS1377 part 4 table 2	Testing cancelled
WPATP-10/17	4	2.00	D	CBR	Greater than 25% gravel retained on the 20mm test sieve. GRADING ZONE (X) - Testing not applicable as BS1377 part 4 table 3	Testing cancelled

For electronic reporting a form of electronic signature or printed name is acceptable

Laboratory Signature Stephen Watson	Project Manager Signature Darren O'Mahony
Date 29 March 2017	Date 29 March 2017

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

UKAS TESTING
2183

Final Report

Report No.:	17-05120-1
Initial Date of Issue:	06-Mar-2017
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Brian Mooney Colm Hurley Darren O'Mahony Lucy Peaker Mark Nyhan Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Stephen Franey Stephen Watson Andy Garne
Project	16-1239 West Offaly Power Station & Ash Disposal Facility

Quotation No.:		**Date Received:**	02-Mar-2017
Order No.:		**Date Instructed:**	02-Mar-2017
No. of Samples:	13		
Turnaround (Wkdays):	3	**Results Due:**	06-Mar-2017
Date Approved:	06-Mar-2017		

Approved By:

Details: Keith Jones, Technical Manager

Results - Soil

Project: 16-1239 West Offaly Power Station & Ash Disposal Facility

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	17-05120	17-05120	17-05120	17-05120	17-05120	17-05120	17-05120	17-05120
Quotation No.:					**Chemtest Sample ID.:**	419241	419242	419243	419244	419245	419246	419247	419248	419249
Order No.:					Client Location ID.:	WOPTP-01	WOPTP-02	WOPTP-03	WOPTP-03	WOPTP-05	WOPTP-06	WPATP-01/17	WPATP-02/17	WPATP-03/17
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	3	3	1	2	2	1	2	3	1
					Date Sampled:	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Moisture	N	2030	%	0.020		58	54	51	36	53	5.8	84	21	8.0
pH	U	2010		N/A		12.2	12.3	10.8	11.7	11.1	11.3	9.1	9.7	9.7
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010		1.0	0.63	1.8	1.0	1.7	1.4	< 0.010	0.34	0.026
Organic Matter	U	2625	%	0.40								83		

Chemtest
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Results - Soil

Project: 16-1239 West Offaly Power Station & Ash Disposal Facility

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			17-05120	17-05120	17-05120	17-05120
Quotation No.:		**Chemtest Sample ID.:**			419250	419251	419252	419253
Order No.:		Client Location ID.:			WPATP-05/17	WPATP-07/17	WPATP-08/17	WPATP-09/17
		Sample Type:			SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			1	2	3	2
		Date Sampled:			01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Moisture	N	2030	%	0.020	87	8.8	6.4	9.6
pH	U	2010		N/A	8.8	9.6	9.2	9.1
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	0.11	0.015	< 0.010
Organic Matter	U	2625	%	0.40	86			

Report Information

Key

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

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

Sample Deviation Codes

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

Sample Retention and Disposal

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

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

+44 (0)28 2766 6640
info@causewaygeotech.com
www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

Client:	**Bord Na Mona**
From:	**Stephen Watson** **Laboratory Manager** **Causeway Geotech Ltd**
Tel:	**+44(0)2827666640**
E-mail:	**stephen.watson@causewaygeotech.com**
Date:	**04/04/17**
Ref:	**16-1239 – Schedule 2**

West Offaly Power Station and the Ash Disposal Facility

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 60 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

+44 (0)28 2766 6640
info@causewaygeotech.com
www.causewaygeotech.com

Project Name **West Offaly Power Station and the Ash Disposal Facility**

Report Reference. **16-1239 – Schedule 2**

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

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	Number of test results included in the report
SOIL	Moisture content - oven drying method	BS 1377-2:1990	13
SOIL	Liquid limit - cone penetrometer	BS 1377-2:1990	10
SOIL	Liquid limit - cone penetrometer - one point	BS 1377-2:1990	10
SOIL	Plastic limit	BS 1377-2:1990	10
SOIL	Plasticity index and liquidity index	BS 1377-2:1990	10
SOIL	Particle size distribution - wet sieving	BS 1377-2:1990	6
SOIL	Particle size distribution - dry sieving	BS 1377-2:1990	6
SOIL	Particle size distribution -sedimentation hydrometer method	BS 1377-2:1990	4
SOIL	Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.12 to 24 kN)	BS 1377- 7:1990	4
SOIL	pH Value of Soil		6
SOIL	Sulphate Content water extract		6
SOIL	Organic Matter		1

Summary of Classification Test Results

Project No.	Project Name
16-1239	West Offaly Power station and the Ash Disposal Facility

Hole No.	Sample				Soil Description	Density bulk Mg/m3	Density dry Mg/m3	*w* %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type										
WOP-BH01/17	2	1.20		U	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			92.0	100	110 -1pt	NP			
WOP-BH01/17	5	3.20		U	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			140.0	100	151 -1pt	NP			
WOP-BH02/17	11	1.20		B	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			143.0	100	147 -1pt	99	48		ME
WOP-BH02/17	2	2.00		U	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			142.0	100	148 -1pt	101	47		ME
WOP-BH02/17	4	4.00		U	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			181.0	100	165 -1pt	125	40		ME
WOP-BH02/17	6	5.80		B	Dark brown amorphous PEAT.			223.0						
WOP-BH03/17	2	1.20		B	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			166.0	66	169 -1pt	122	47		ME
WOP-BH03/17	5	4.20		B	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			269.0	58	175 -1pt	130	45		ME
WOP-BH03/17	7	6.50		B	Dark grey sandy slightly gravelly organic SILT.			223.0	70	156 -1pt	98	58		ME
WOP-BH04/17	3	1.20		B	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			44.0	44	63 -1pt	39	24		MH
WOP-BH04/17	9	5.50		B	Grey slightly sandy subangular to subrounded fine to coarse GRAVEL.			6.0						
WOP-BH05/17	3	2.00		B	Dark grey slightly sandy slightly gravelly SILT.			45.0	64	108 -1pt	85	23		ME
WOP-BH06/17	9	8.50		B	Dark grey slightly sandy subangular to subrounded fine to coarse GRAVEL.			15.0						

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

Key

Density test
Linear measurement unless :
wd - water displacement
wi - immersion in water

Liquid Limit
4pt cone unless :
cas - Casagrande method
1pt - single point test

Particle density
sp - small pyknometer
gj - gas jar

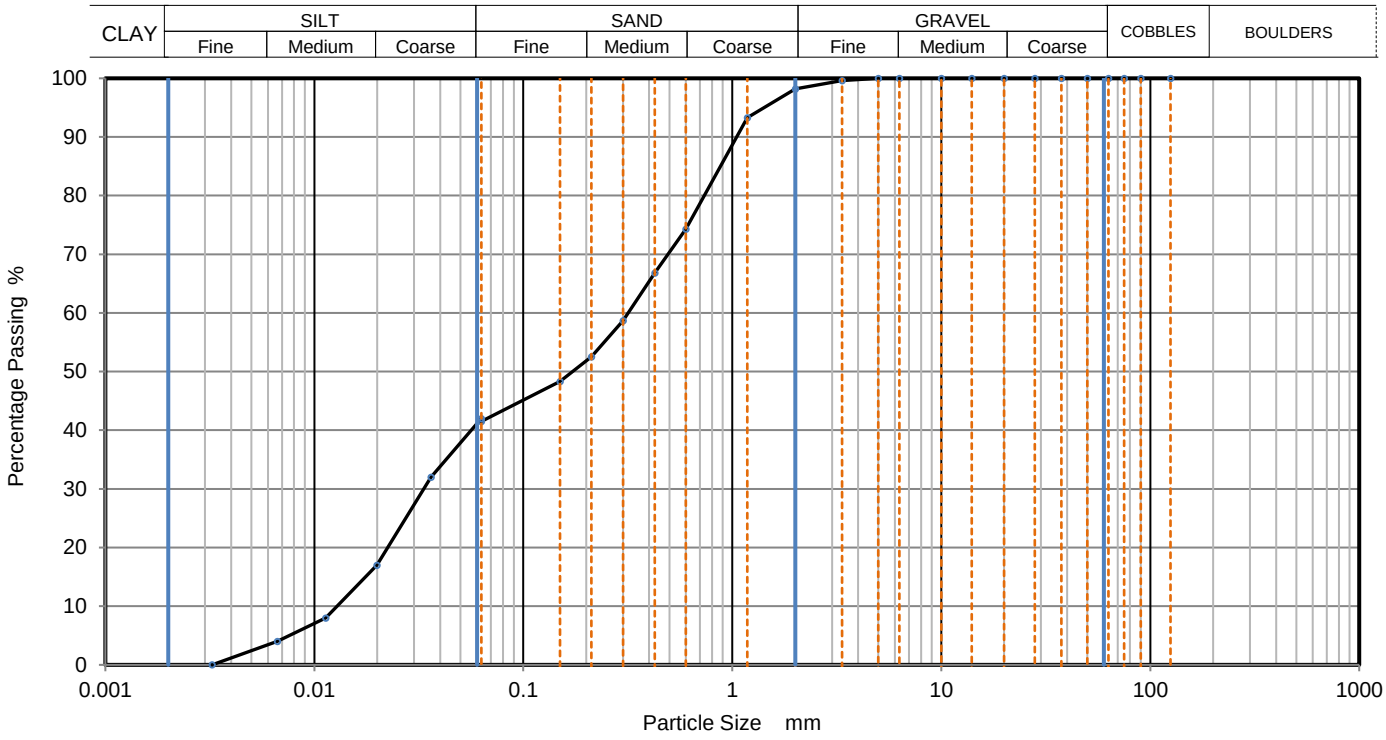
Date Printed: 04/04/2017 00:00

Approved By: Stephen.Watson

Table 1

sheet 1

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	16-1239
				Borehole/Pit No.	WOP-BH03/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	2
Soil Description	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			Depth, m	1.20
Specimen Reference	8	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2017031022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	42
90	100	0.0362	32
75	100	0.0199	17
63	100	0.0113	8
50	100	0.0066	4
37.5	100	0.0032	0
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	98		
1.18	93		
0.6	74	Particle density	(assumed)
0.425	67	1.40	Mg/m3
0.3	59		
0.212	53		
0.15	48		
0.063	42		

Dry Mass of sample, g	1013

Sample Proportions	% dry mass
Cobbles	0
Gravel	2
Sand	57
Fines <0.063mm	41

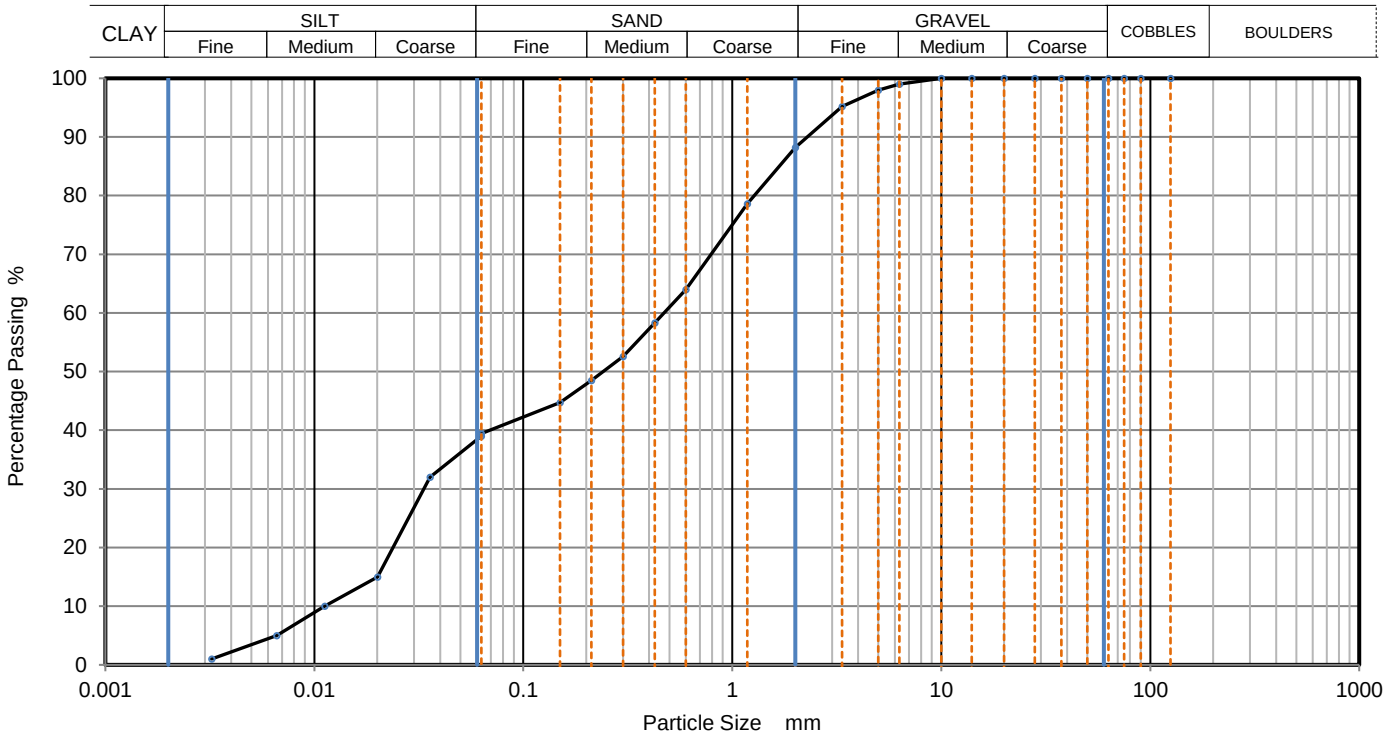
Grading Analysis		
D100	mm	
D60	mm	0.317
D30	mm	0.0332
D10	mm	0.0128
Uniformity Coefficient		25
Curvature Coefficient		0.27

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	Fig 1
Stephen.Watson	04/04/2017 16:05	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOP-BH03/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	5
Soil Description	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			Depth, m	4.20
Specimen Reference	8	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2017031023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	39
90	100	0.0357	32
75	100	0.0200	15
63	100	0.0112	10
50	100	0.0066	5
37.5	100	0.0032	1
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	98		
3.35	95		
2	88		
1.18	79		
0.6	64	Particle density	(assumed)
0.425	58	1.40	Mg/m3
0.3	53		
0.212	49		
0.15	45		
0.063	39		

Dry Mass of sample, g	752

Sample Proportions	% dry mass
Cobbles	0
Gravel	12
Sand	49
Fines <0.063mm	39

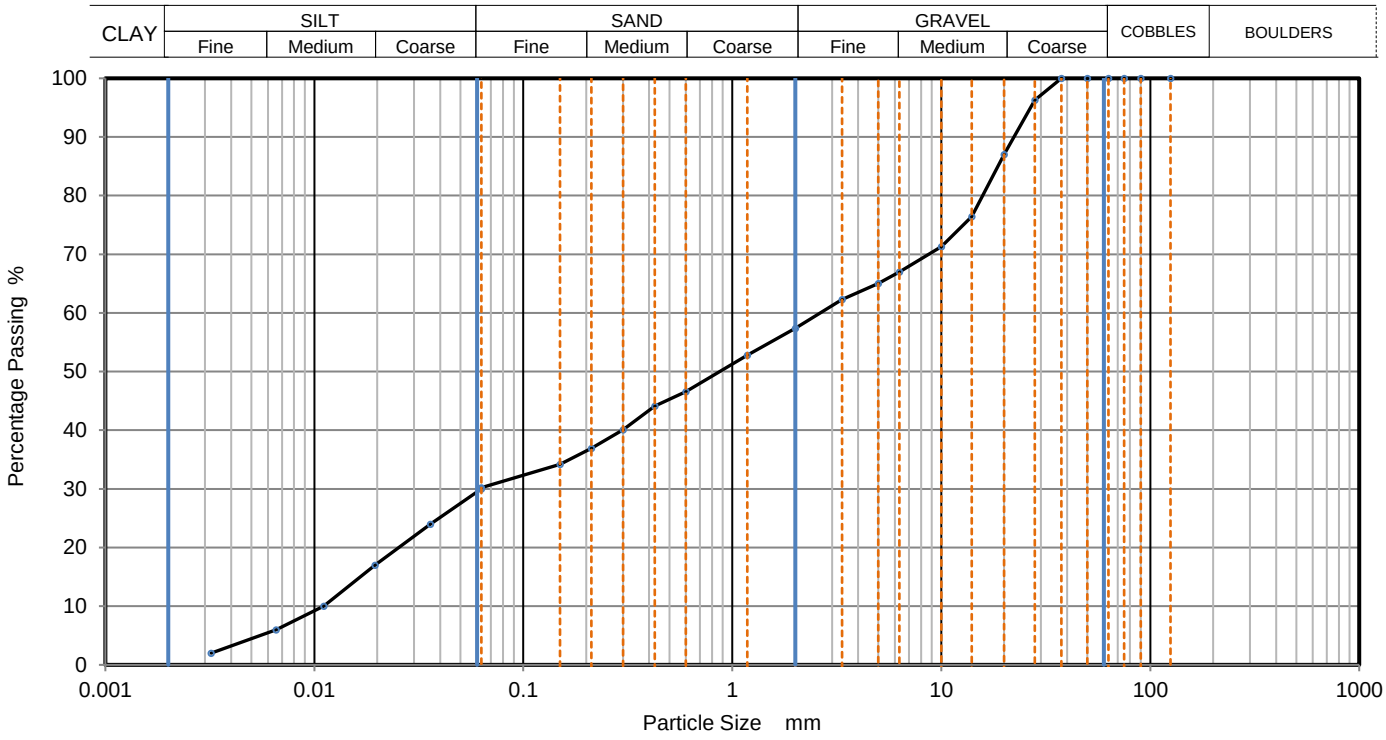
Grading Analysis		
D100	mm	
D60	mm	0.471
D30	mm	0.0334
D10	mm	0.0114
Uniformity Coefficient		41
Curvature Coefficient		0.21

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	04/04/2017 16:05	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOP-BH04/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	3
Soil Description	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			Depth, m	1.20
Specimen Reference	8	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2017031026



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	30
90	100	0.0360	24
75	100	0.0195	17
63	100	0.0111	10
50	100	0.0065	6
37.5	100	0.0032	2
28	96		
20	87		
14	76		
10	71		
6.3	67		
5	65		
3.35	62		
2	57		
1.18	53		
0.6	47	Particle density	(assumed)
0.425	44	1.40	Mg/m3
0.3	40		
0.212	37		
0.15	34		
0.063	30		

Dry Mass of sample, g	2535

Sample Proportions	% dry mass
Cobbles	0
Gravel	43
Sand	27
Fines <0.063mm	30

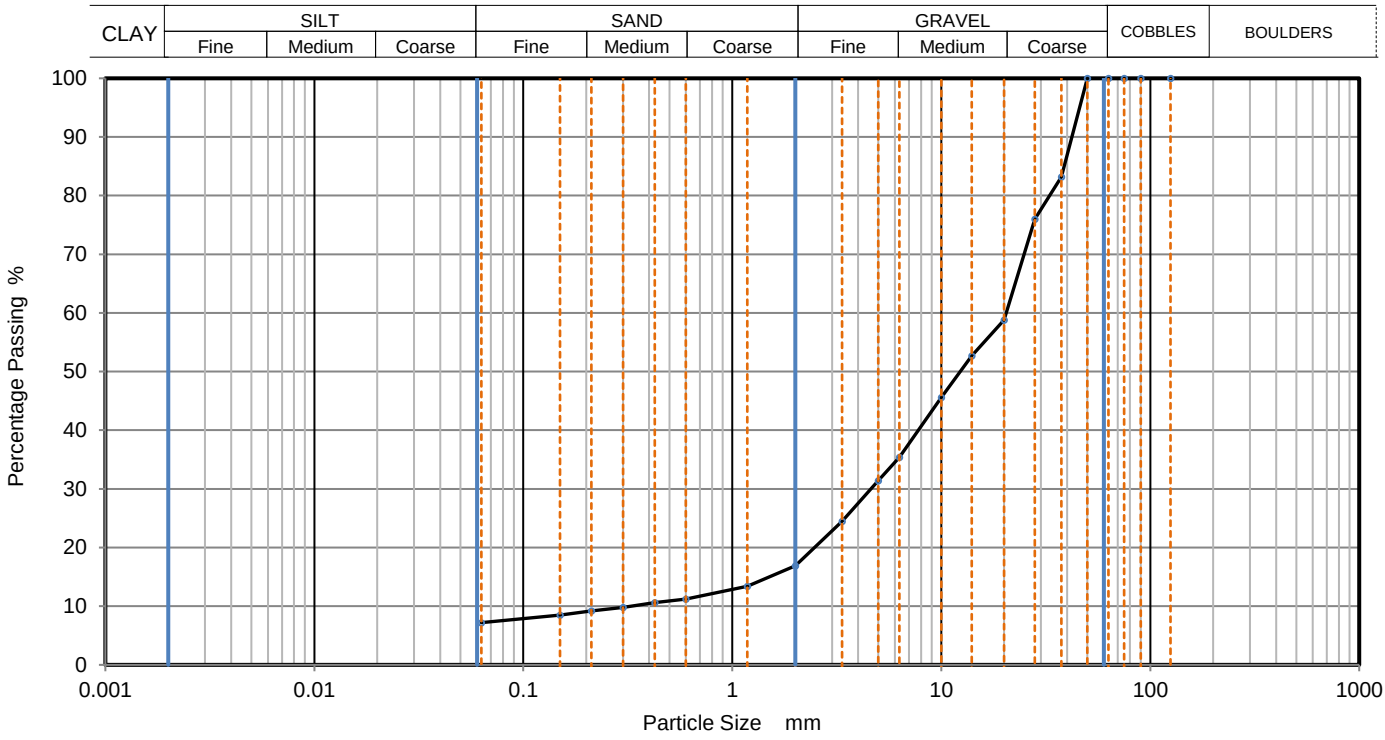
Grading Analysis		
D100	mm	
D60	mm	2.63
D30	mm	0.0619
D10	mm	0.0113
Uniformity Coefficient		230
Curvature Coefficient		0.13

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	04/04/2017 16:05	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOP-BH04/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	9
Soil Description	Grey slightly sandy subangular to subrounded fine to coarse GRAVEL.			Depth, m	5.50
Specimen Reference	5	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2017031027



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	83		
28	76		
20	59		
14	53		
10	46		
6.3	35		
5	31		
3.35	25		
2	17		
1.18	13		
0.6	11		
0.425	11		
0.3	10		
0.212	9		
0.15	9		
0.063	7		

Dry Mass of sample, g	4129

Sample Proportions	% dry mass
Cobbles	0
Gravel	83
Sand	10
Fines <0.063mm	7

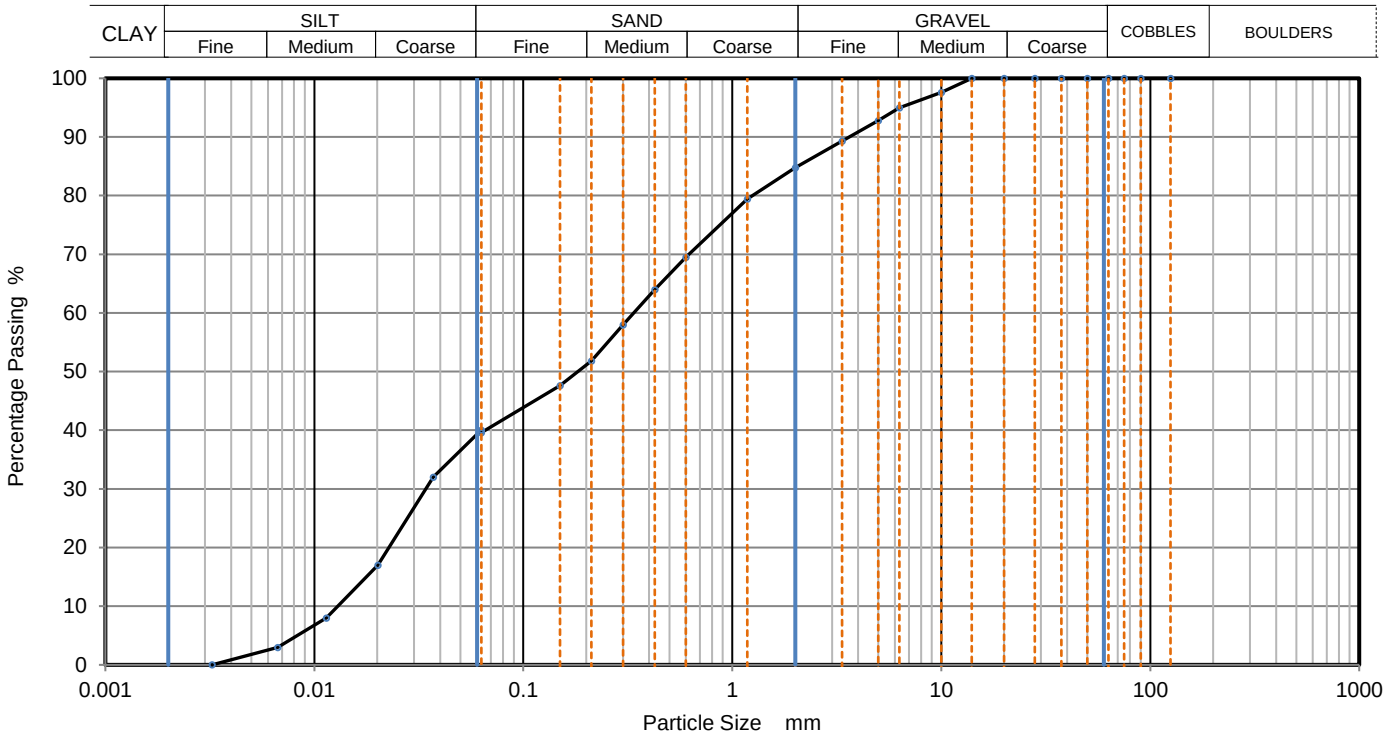
Grading Analysis		
D100	mm	
D60	mm	20.5
D30	mm	4.61
D10	mm	0.33
Uniformity Coefficient		62
Curvature Coefficient		3.2

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	04/04/2017 16:05	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**	Job Ref	**16-1239**
		Borehole/Pit No.	WOP-BH05/17
Site Name	West Offaly Power station and the Ash Disposal Facility	Sample No.	3
Soil Description	Dark grey slightly sandy slightly gravelly SILT.	Depth, m	2.00
Specimen Reference	8	Specimen Depth: m	Sample Type: B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5	KeyLAB ID	Caus2017031028



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	40
90	100	0.0371	32
75	100	0.0202	17
63	100	0.0114	8
50	100	0.0067	3
37.5	100	0.0032	0
28	100		
20	100		
14	100		
10	98		
6.3	95		
5	93		
3.35	89		
2	85		
1.18	79		
0.6	70	Particle density	(assumed)
0.425	64	1.40	Mg/m3
0.3	58		
0.212	52		
0.15	48		
0.063	40		

Dry Mass of sample, g	1899

Sample Proportions	% dry mass
Cobbles	0
Gravel	15
Sand	45
Fines <0.063mm	40

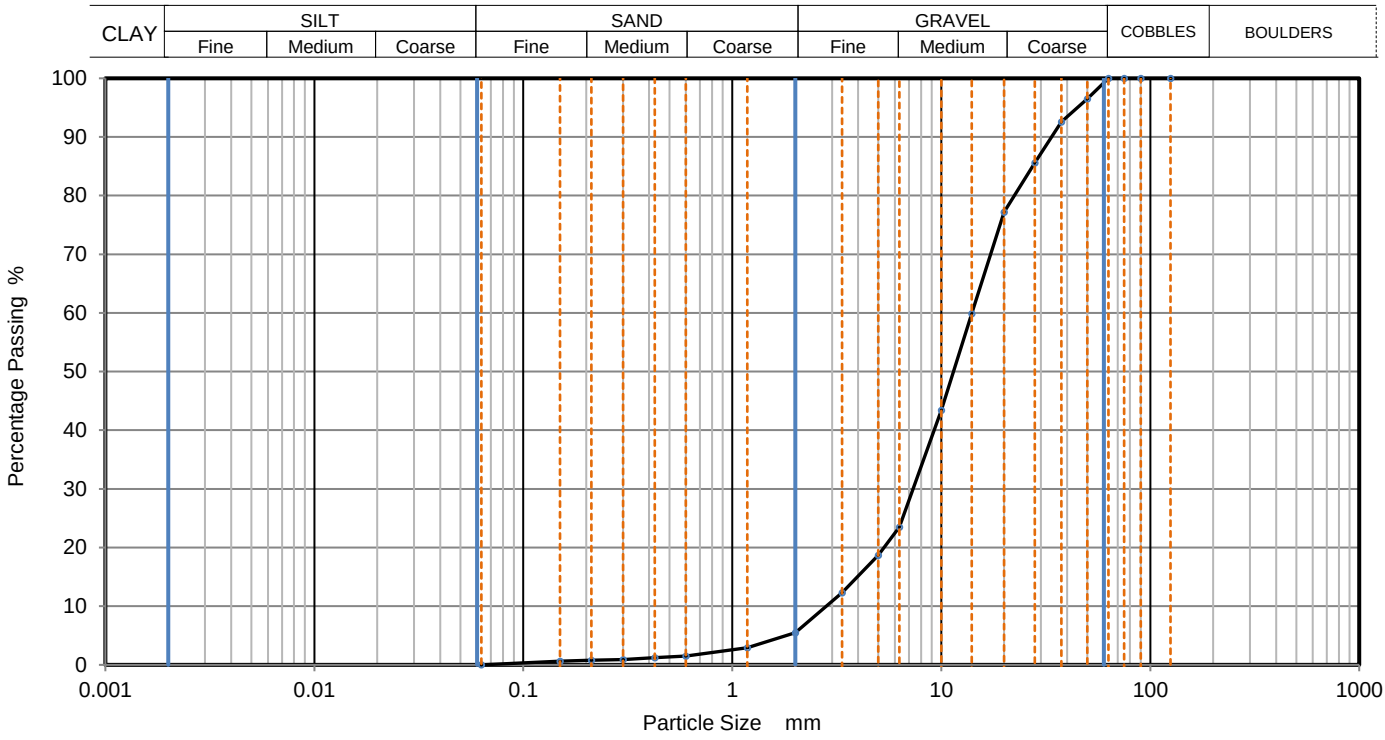
Grading Analysis		
D100	mm	
D60	mm	0.336
D30	mm	0.0345
D10	mm	0.0129
Uniformity Coefficient		26
Curvature Coefficient		0.27

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	04/04/2017 16:05	Sheet

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	16-1239
				Borehole/Pit No.	WOP-BH06/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	9
Soil Description	Dark grey slightly sandy subangular to subrounded fine to coarse GRAVEL.			Depth, m	8.50
Specimen Reference	5	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	Caus2017031033



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	97		
37.5	93		
28	86		
20	77		
14	60		
10	43		
6.3	24		
5	19		
3.35	12		
2	6		
1.18	3		
0.6	2		
0.425	1		
0.3	1		
0.212	1		
0.15	1		
0.063	0		

Dry Mass of sample, g	8091

Sample Proportions	% dry mass
Cobbles	0
Gravel	95
Sand	5
Fines <0.063mm	0

Grading Analysis		
D100	mm	
D60	mm	14
D30	mm	7.33
D10	mm	2.82
Uniformity Coefficient		5
Curvature Coefficient		1.4

Remarks

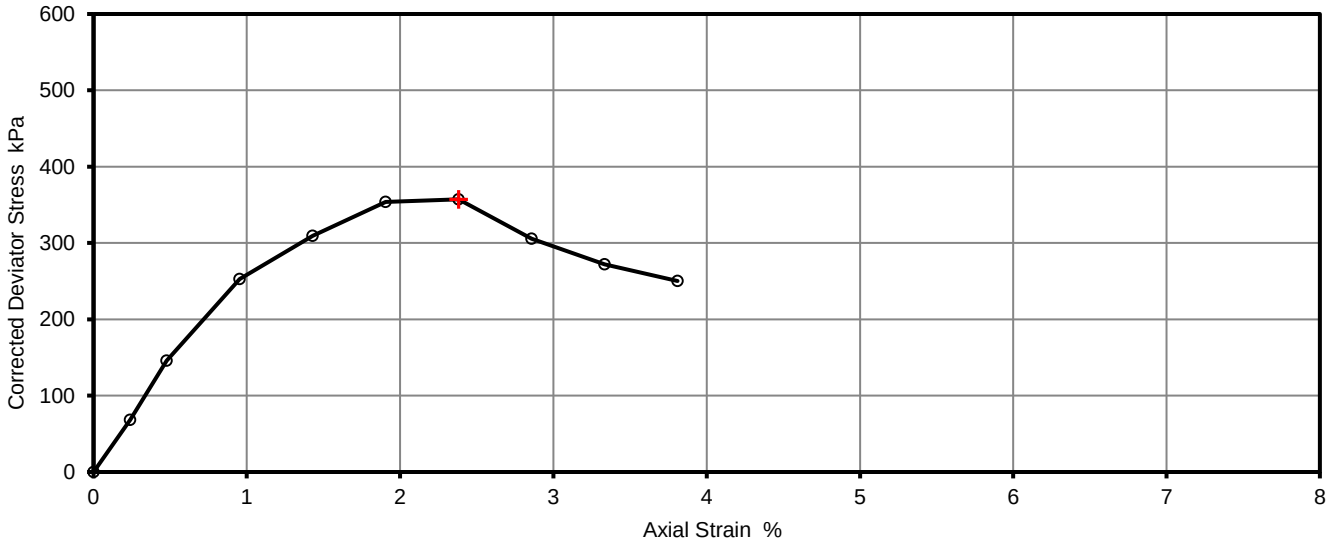
Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	Fig 1
Stephen.Watson	04/04/2017 16:05	Sheet

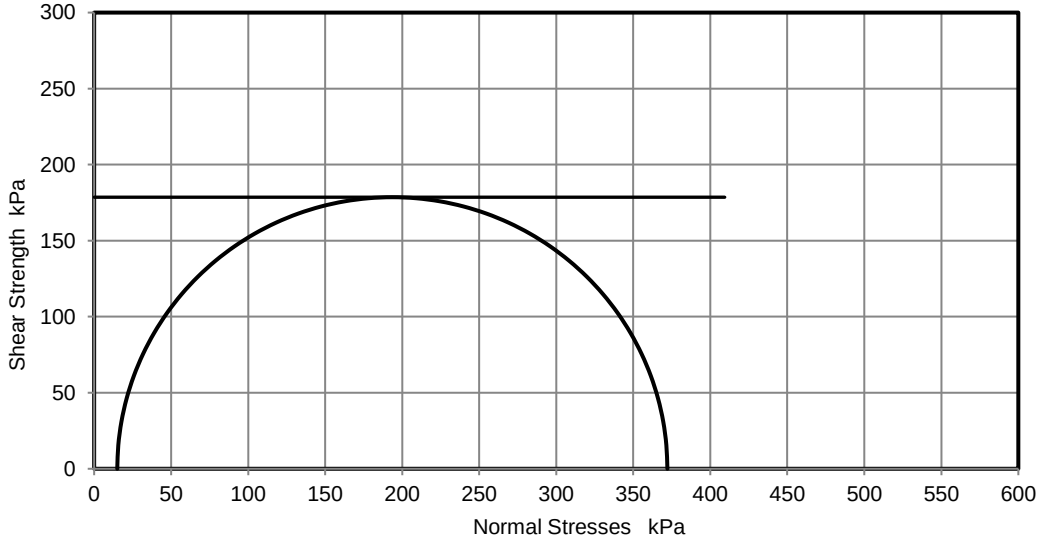
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	16-1239
				Borehole/Pit No.	WOP-BH01/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	2
Soil Description	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			Depth	1.20
Specimen Reference	8	Specimen Depth	m	Sample Type	U
Specimen Description	MADE GROUND - Very stiff dark grey sandy slightly gravelly laminated organic SILT.			KeyLAB ID	Caus2017031013
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	

Test Number		1	
Length		210.0	mm
Diameter		103.2	mm
Bulk Density		1.28	Mg/m3
Moisture Content		92.2	%
Dry Density		0.66	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		15	kPa
At failure	Axial Strain	2.4	%
	Deviator Stress, (σ1 - σ3)f	357	kPa
	Undrained Shear Strength, cu	179	kPa ½(σ1 - σ3)f
	Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Strengths corrected for area change, and membrane effects based on Fig 11 BS1377

Approved: Stephen.Watson

Printed: 04/04/2017 16:11

Fig. No. 1

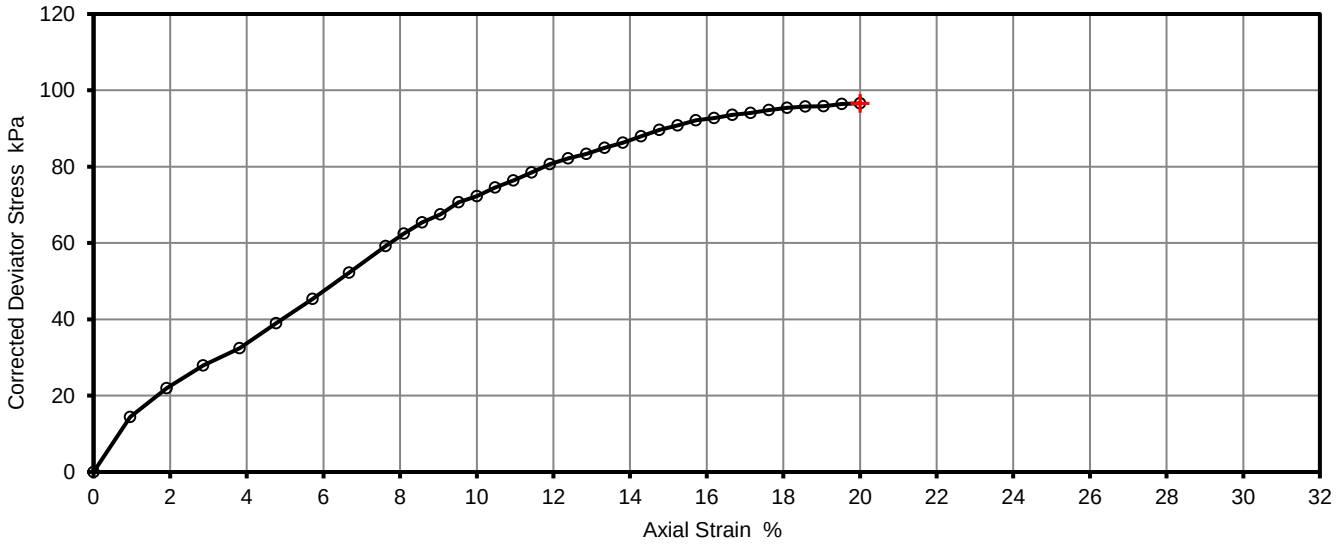
Sheet 1

Lab Sheet Reference :

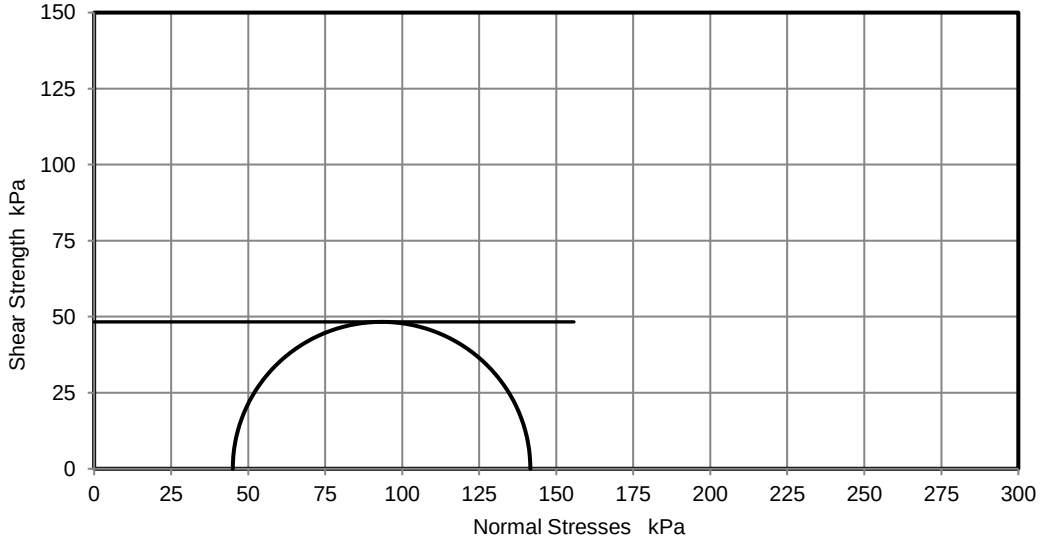
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	16-1239
				Borehole/Pit No.	WOP-BH01/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	5
Soil Description	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			Depth	3.20
Specimen Reference	8	Specimen Depth	m	Sample Type	U
Specimen Description	MADE GROUND - Firm dark grey sandy slightly gravelly laminated organic SILT.			KeyLAB ID	Caus2017031015
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	

Test Number		1	
Length		210.0	mm
Diameter		103.2	mm
Bulk Density		1.32	Mg/m3
Moisture Content		140.0	%
Dry Density		0.55	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		45	kPa
At failure	Axial Strain	20.0	%
	Deviator Stress, (σ1 - σ3)f	97	kPa
	Undrained Shear Strength, cu	48	kPa ½(σ1 - σ3)f
	Mode of Failure		

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Testing terminated at 20% strain

Approved: Stephen.Watson

Printed: 04/04/2017 16:11

Fig. No. 1

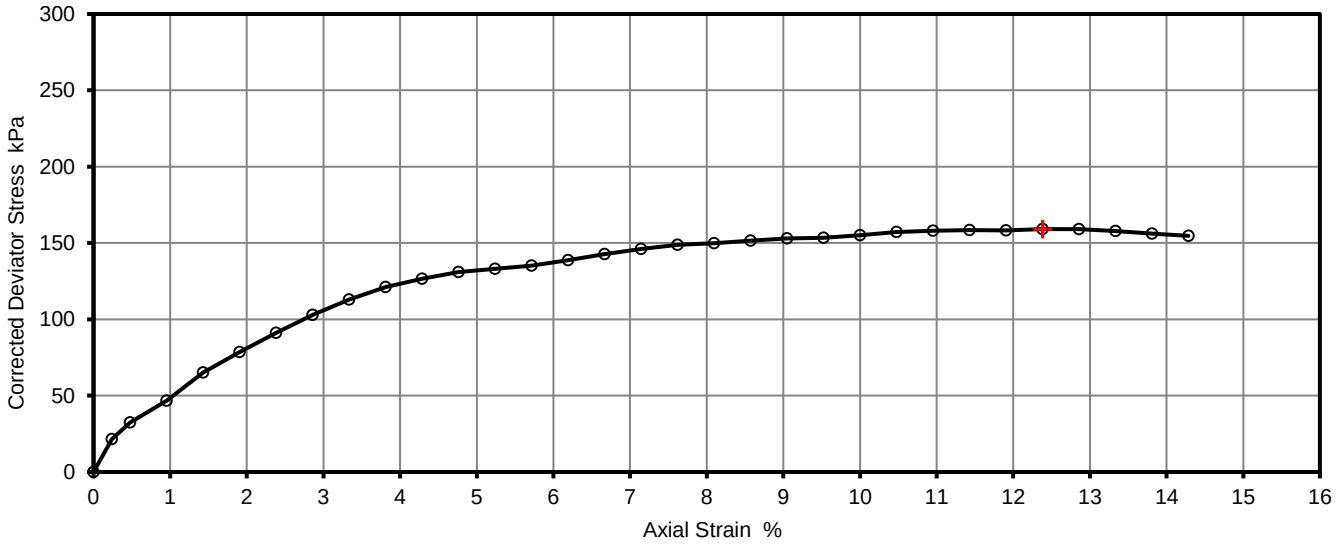
Sheet 2

Lab Sheet Reference :

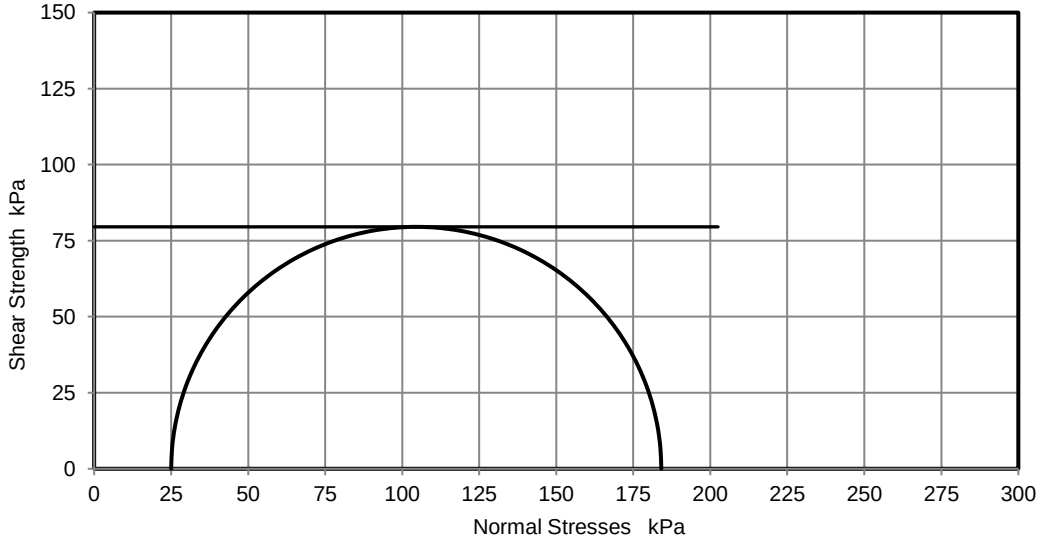
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	16-1239
				Borehole/Pit No.	WOP-BH02/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	2
Soil Description	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			Depth	2.00
Specimen Reference	8	Specimen Depth	m	Sample Type	U
Specimen Description	MADE GROUND - Stiff dark grey sandy slightly gravelly laminated organic SILT.			KeyLAB ID	Caus2017031018
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	

Test Number		1	
Length		210.0	mm
Diameter		103.2	mm
Bulk Density		1.26	Mg/m3
Moisture Content		142.1	%
Dry Density		0.52	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		25	kPa
At failure	Axial Strain	12.4	%
	Deviator Stress, (σ1 - σ3)f	159	kPa
	Undrained Shear Strength, cu	80	kPa ½(σ1 - σ3)f
	Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Strengths corrected for area change, and membrane effects based on Fig 11 BS1377

Approved: Stephen.Watson

Printed: 04/04/2017 16:11

Fig. No. 1

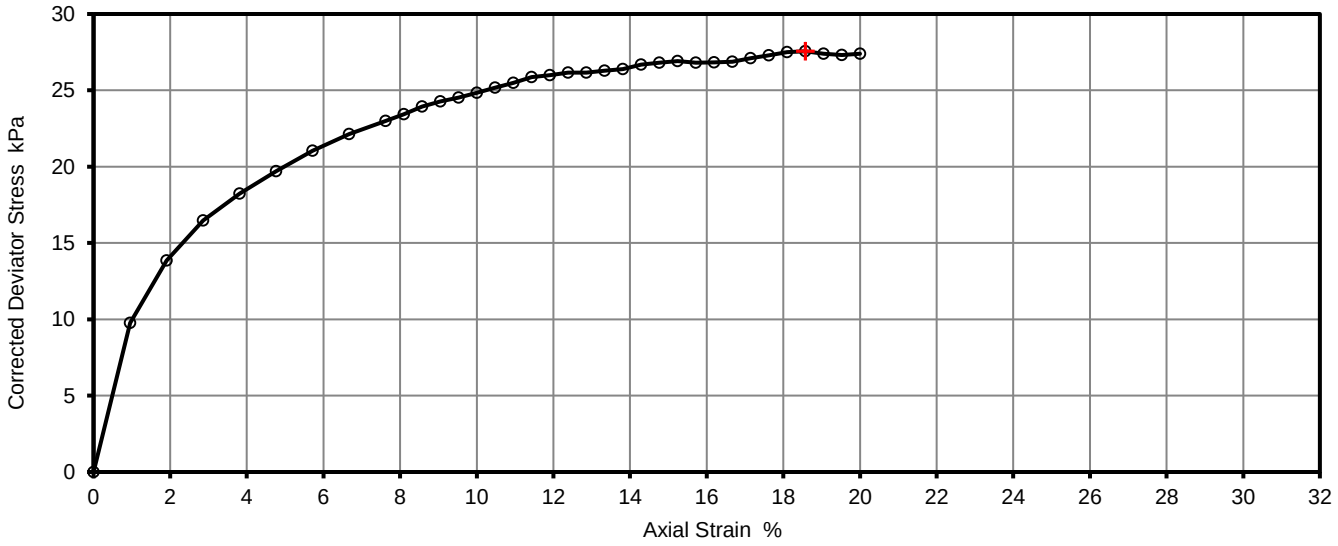
Sheet 3

Lab Sheet Reference :

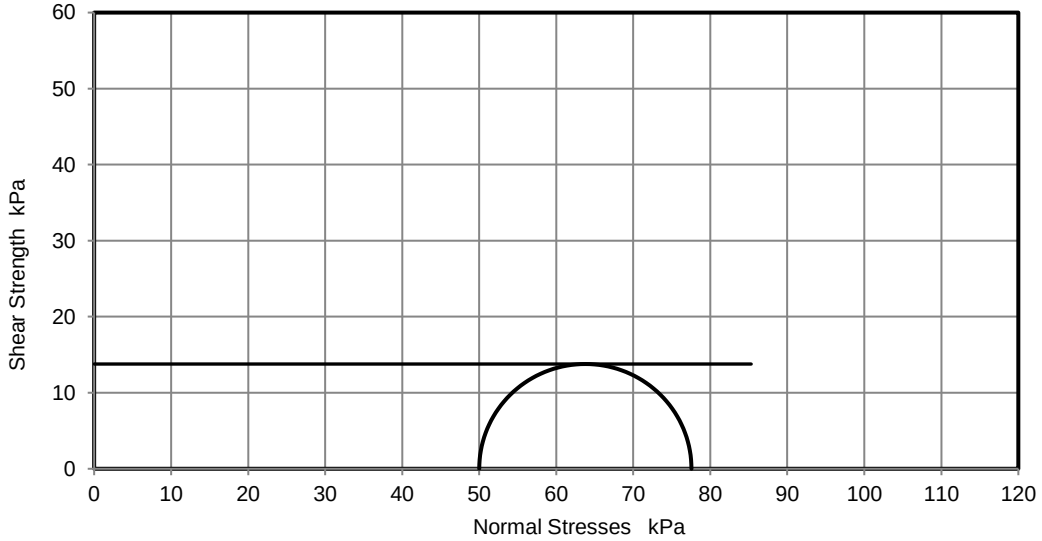
CAUSEWAY GEOTECH	**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen**			Job Ref	16-1239
				Borehole/Pit No.	WOP-BH02/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	4
Soil Description	MADE GROUND - Dark grey sandy slightly gravelly laminated organic SILT.			Depth	4.00
Specimen Reference	8	Specimen Depth	m	Sample Type	U
Specimen Description	MADE GROUND - Very soft dark grey sandy slightly gravelly laminated organic SILT.			KeyLAB ID	Caus2017031019
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	

Test Number		1	
Length		210.0	mm
Diameter		103.2	mm
Bulk Density		1.23	Mg/m3
Moisture Content		181.1	%
Dry Density		0.44	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		50	kPa
At failure	Axial Strain	18.6	%
	Deviator Stress, (σ1 - σ3)f	28	kPa
	Undrained Shear Strength, cu	14	kPa ½(σ1 - σ3)f
	Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Strengths corrected for area change, and membrane effects based on Fig 11 BS1377

Approved: Stephen.Watson

Printed: 04/04/2017 16:11

Lab Sheet Reference :

Fig. No. 1

Sheet 4

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

UKAS TESTING
2183

Final Report

Report No.:	17-07344-1
Initial Date of Issue:	29-Mar-2017
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Aisling O'Kane Brian Mooney Colm Hurley Darren O'Mahony John Cameron John Duggan Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Stephen Curtis Stephen Franey Stephen Watson Lucy Peaker
Project	16-1239 West Offaly Power Station and the Ash Disposal Facil

Quotation No.:		**Date Received:**	27-Mar-2017
Order No.:		**Date Instructed:**	27-Mar-2017
No. of Samples:	6		
Turnaround (Wkdays):	3	**Results Due:**	29-Mar-2017
Date Approved:	29-Mar-2017		

Approved By:

Details: Keith Jones, Technical Manager

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

Results - Soil

Project: 16-1239 West Offaly Power Station and the Ash Disposal Facil

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	17-07344	17-07344	17-07344	17-07344	17-07344	17-07344
Quotation No.:				**Chemtest Sample ID.:**	430405	430406	430407	430408	430409	430410
Order No.:				Client Location ID.:	WOP-BH02/17	WOP-BH02/17	WOP-BH03/17	WOP-BH04/17	WOP-BH04/17	WOP-BH05/17
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	1.2	5.8	4.2	1.2	5.5	2.0
				Bottom Depth (m):	1.7	6.3	4.7	1.7	6.0	2.5
				Date Sampled:	24-Mar-2017	24-Mar-2017	24-Mar-2017	24-Mar-2017	24-Mar-2017	24-Mar-2017
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Moisture	N	2030	%	0.020	55	62	61	27	6.0	44
pH	U	2010		N/A	9.7	9.7	11.3	8.9	9.3	11.5
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	1.7	0.48	1.3	1.0	0.038	1.4
Organic Matter	U	2625	%	0.40	19	8.8				

Report Information

Key

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

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

Sample Deviation Codes

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

Sample Retention and Disposal

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

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

+44 (0)28 2766 6640
info@causewaygeotech.com
www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

Client:	**Bord Na Mona**
From:	**Stephen Watson** **Laboratory Manager** **Causeway Geotech Ltd**
Tel:	**+44(0)2827666640**
E-mail:	**stephen.watson@causewaygeotech.com**
Date:	**13/04/17**
Ref:	**16-1239 – Schedule 3**

West Offaly Power Station and the Ash Disposal Facility

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 60 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

Causeway Geotech Ltd
8 Drumahiskey Road, Ballymoney
Co. Antrim, N. Ireland, BT53 7QL

Registered in Northern Ireland. Company Number: NI610766
Approved: ISO 9001 • ISO 14001 • OHSAS 18001

CAUSEWAY GEOTECH

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info@causewaygeotech.com
www.causewaygeotech.com

Project Name **West Offaly Power Station and the Ash Disposal Facility**

Report Reference. **16-1239 – Schedule 3**

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

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	Number of test results included in the report
SOIL	Moisture content - oven drying method	BS 1377-2:1990	6
SOIL	Liquid limit - cone penetrometer	BS 1377-2:1990	5
SOIL	Liquid limit - cone penetrometer - one point	BS 1377-2:1990	5
SOIL	Plastic limit	BS 1377-2:1990	5
SOIL	Plasticity index and liquidity index	BS 1377-2:1990	5
SOIL	Particle size distribution - wet sieving	BS 1377-2:1990	4
SOIL	Particle size distribution - dry sieving	BS 1377-2:1990	4
SOIL	Particle size distribution -sedimentation hydrometer method	BS 1377-2:1990	4
SOIL	pH Value of Soil		4
SOIL	Sulphate Content water extract		4
SOIL	Organic Matter		1

Summary of Classification Test Results

Project No.	Project Name
16-1239	West Offaly Power station and the Ash Disposal Facility

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										
WOA-BH01/17	1	0.80		B	Dark brown fibrous PEAT.			132.0						
WOA-BH01/17	4	3.80		B	Grey brown sandy slightly gravelly organic SILT.			123.0	64	113 -1pt	95	18		ME
WOA-BH02/17	2	1.80		B	Grey slightly sandy slightly gravelly CLAY.			24.0	94	29 -1pt	19	10		CL
WOA-BH02A/17	1	0.80		B	Grey slightly sandy very gravelly CLAY.			7.1	30	21 -1pt	12	9		CL
WOA-BH02A/17	7	2.50		D	Grey sandy very gravelly CLAY.			9.6	34	22 -1pt	12	10		CL
WOA-BH02A/17	4	4.80		B	Grey sandy very gravelly CLAY.			5.5	20	21 -1pt	12	9		CL

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

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	

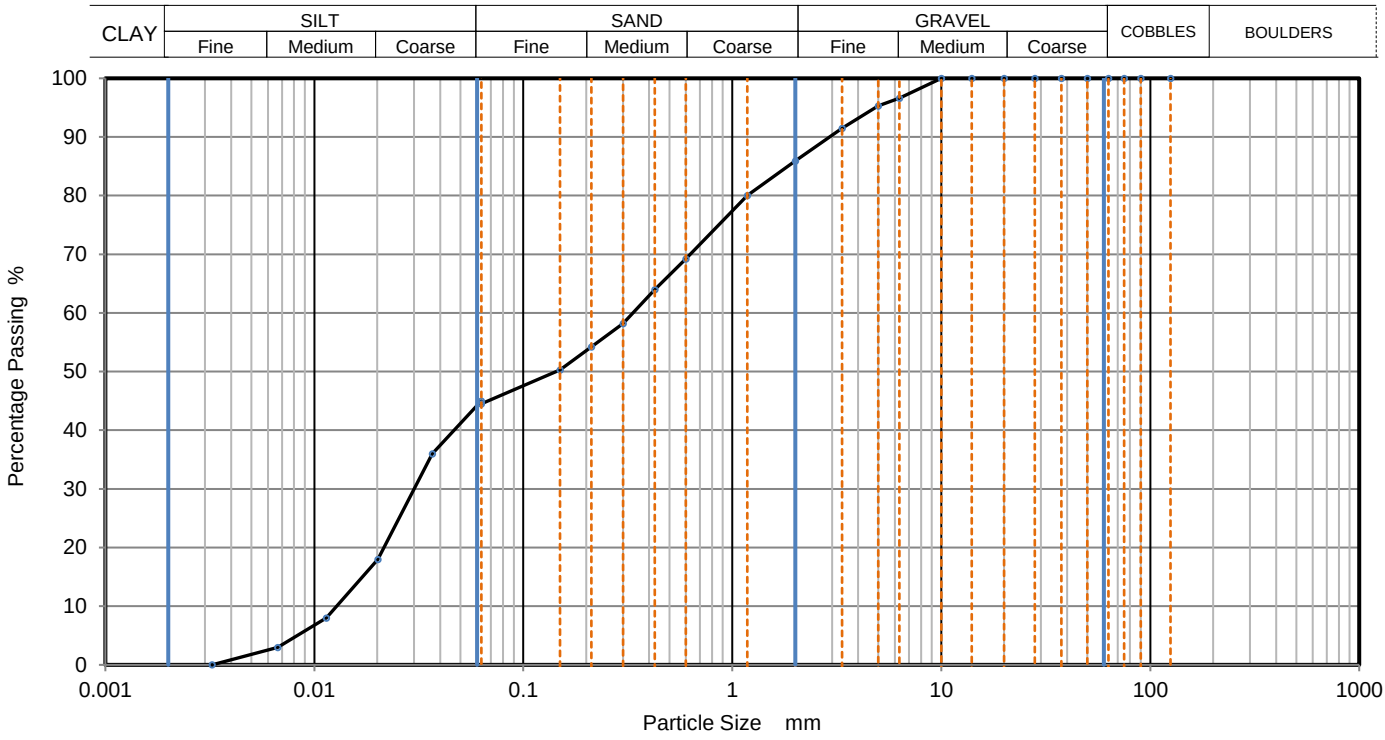
Date Printed: 04/11/2017 00:00

Approved By: Stephen.Watson

Table 1

sheet 1

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOA-BH01/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	4
Soil Description	Grey brown sandy slightly gravelly organic SILT.			Depth, m	3.80
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201703108



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	45
90	100	0.0366	36
75	100	0.0202	18
63	100	0.0114	8
50	100	0.0067	3
37.5	100	0.0032	0
28	100		
20	100		
14	100		
10	100		
6.3	97		
5	95		
3.35	92		
2	86		
1.18	80		
0.6	69	Particle density	(assumed)
0.425	64	1.40	Mg/m3
0.3	58		
0.212	54		
0.15	50		
0.063	45		

Dry Mass of sample, g	1515

Sample Proportions	% dry mass
Cobbles	0
Gravel	14
Sand	41
Fines <0.063mm	44

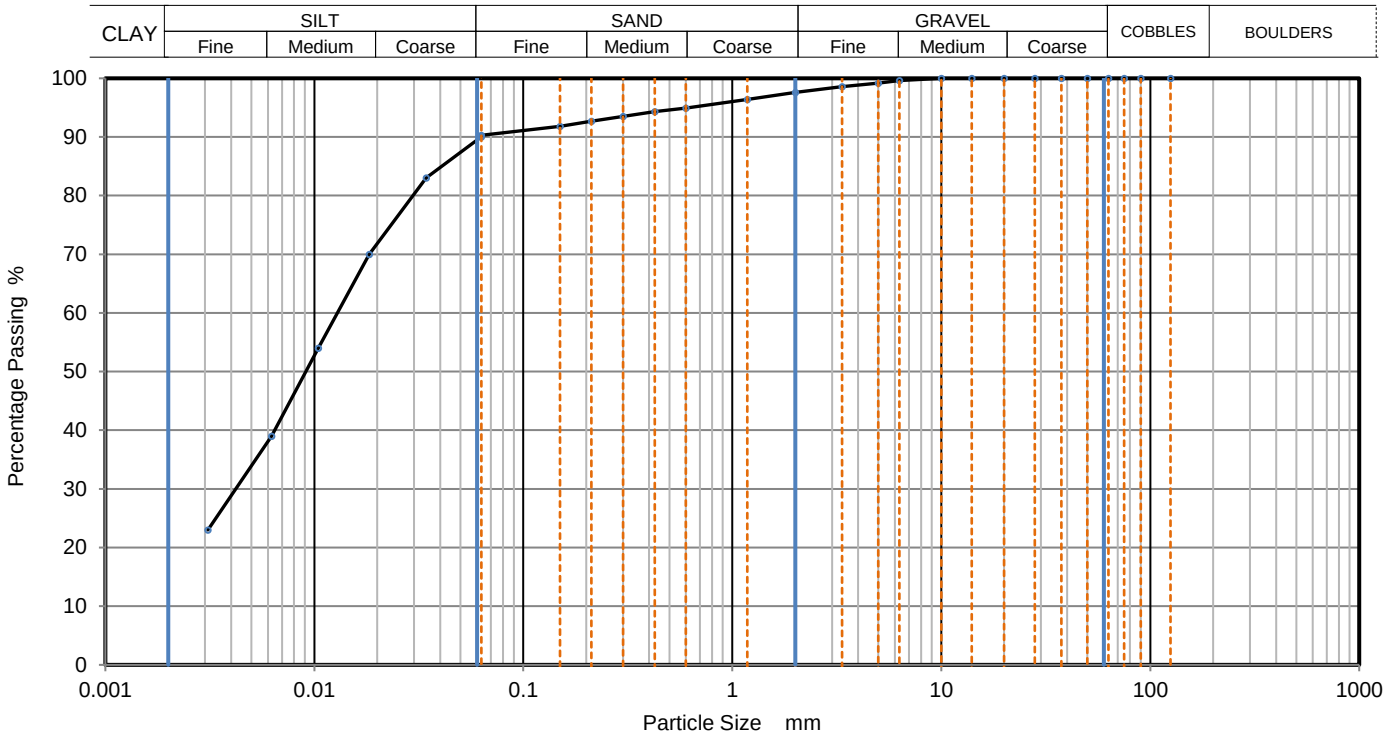
Grading Analysis		
D100	mm	
D60	mm	0.334
D30	mm	0.0298
D10	mm	0.0126
Uniformity Coefficient		27
Curvature Coefficient		0.21

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	11/04/2017 12:04	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOA-BH02/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	2
Soil Description	Grey slightly sandy slightly gravelly CLAY.			Depth, m	1.80
Specimen Reference	9	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus201703109



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	90
90	100	0.0343	83
75	100	0.0183	70
63	100	0.0104	54
50	100	0.0062	39
37.5	100	0.0031	23
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	99		
2	98		
1.18	96		
0.6	95	Particle density	(assumed)
0.425	94	1.40	Mg/m3
0.3	94		
0.212	93		
0.15	92		
0.063	90		

Dry Mass of sample, g	2564

Sample Proportions	% dry mass
Cobbles	0
Gravel	2
Sand	7
Fines <0.063mm	90

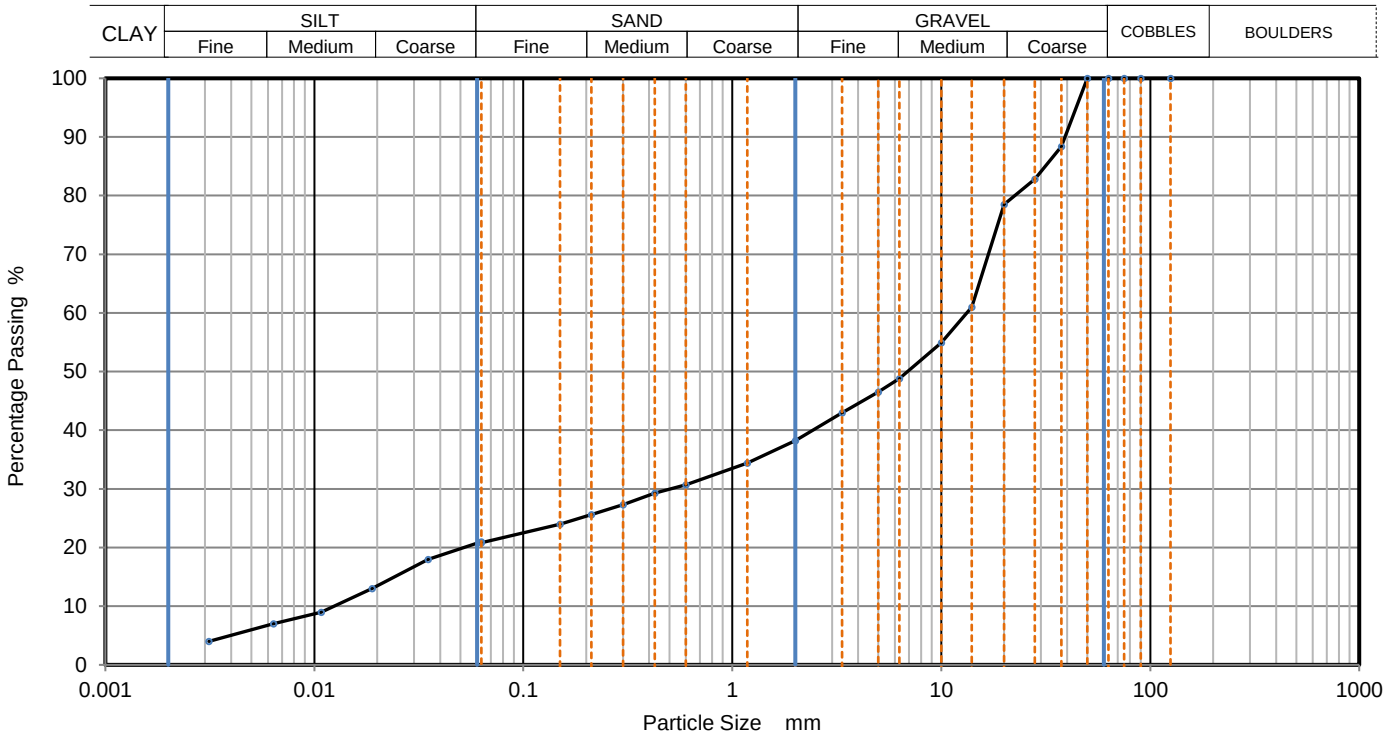
Grading Analysis		
D100	mm	
D60	mm	0.0129
D30	mm	0.00421
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	11/04/2017 12:04	Sheet

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**16-1239**
				Borehole/Pit No.	WOA-BH02A/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	1
Soil Description	Grey slightly sandy very gravelly CLAY.			Depth, m	0.80
Specimen Reference	9	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2017031010



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	21
90	100	0.0350	18
75	100	0.0189	13
63	100	0.0108	9
50	100	0.0064	7
37.5	88	0.0031	4
28	83		
20	79		
14	61		
10	55		
6.3	49		
5	47		
3.35	43		
2	38		
1.18	34		
0.6	31	Particle density	(assumed)
0.425	29	1.40	Mg/m3
0.3	27		
0.212	26		
0.15	24		
0.063	21		

Dry Mass of sample, g	4564

Sample Proportions	% dry mass
Cobbles	0
Gravel	62
Sand	17
Fines <0.063mm	21

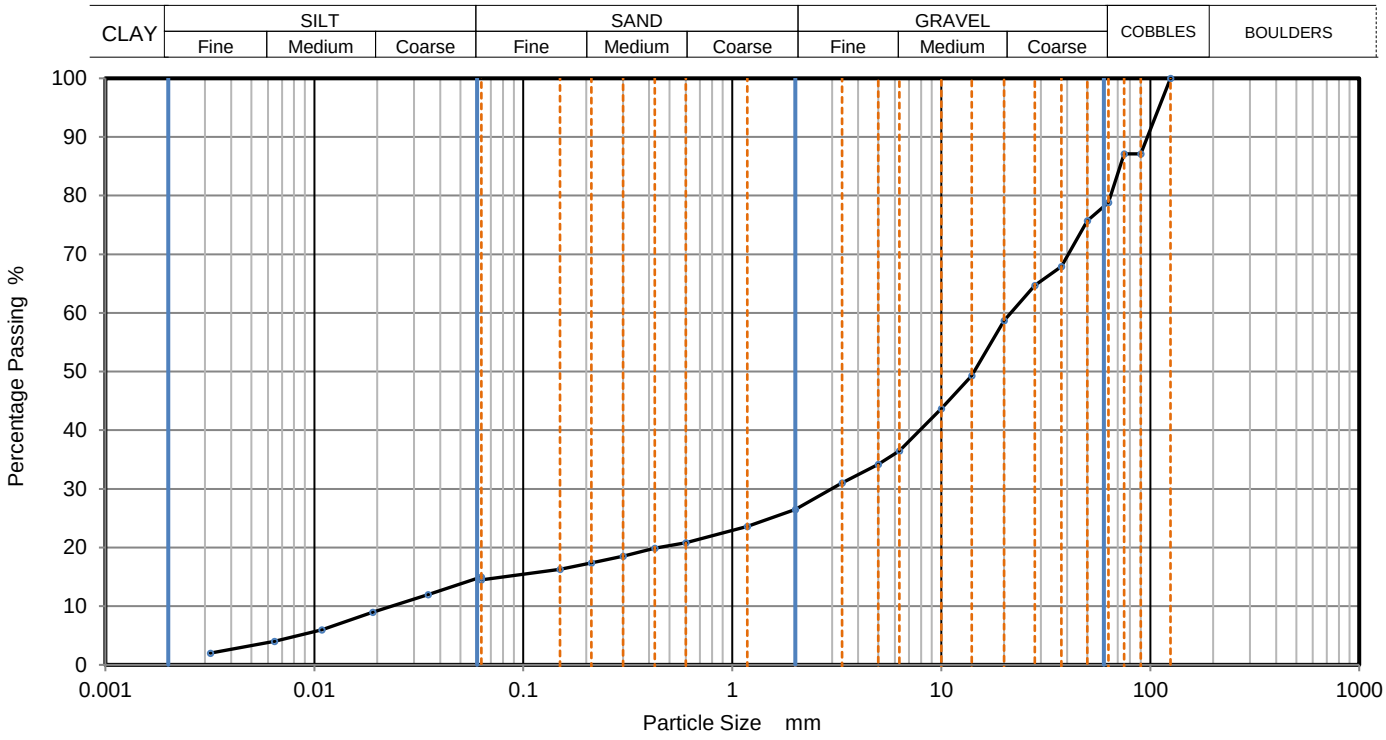
Grading Analysis		
D100	mm	
D60	mm	13.2
D30	mm	0.509
D10	mm	0.012
Uniformity Coefficient		1100
Curvature Coefficient		1.6

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	**Fig** 1
Stephen.Watson	11/04/2017 12:04	Sheet

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	16-1239
				Borehole/Pit No.	WOA-BH02A/17
Site Name	West Offaly Power station and the Ash Disposal Facility			Sample No.	4
Soil Description	Grey sandy very gravelly CLAY.			Depth, m	4.80
Specimen Reference	9	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2017031012



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	15
90	87	0.0350	12
75	87	0.0190	9
63	79	0.0109	6
50	76	0.0064	4
37.5	68	0.0032	2
28	65		
20	59		
14	49		
10	44		
6.3	37		
5	34		
3.35	31		
2	27		
1.18	24		
0.6	21	Particle density	(assumed)
0.425	20	1.40	Mg/m3
0.3	19		
0.212	17		
0.15	16		
0.063	15		

Dry Mass of sample, g	11389

Sample Proportions	% dry mass
Cobbles	21
Gravel	52
Sand	12
Fines <0.063mm	15

Grading Analysis		
D100	mm	125
D60	mm	21.5
D30	mm	2.99
D10	mm	0.0229
Uniformity Coefficient		940
Curvature Coefficient		18

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved	Sheet printed	Fig 1
Stephen.Watson	11/04/2017 12:04	Sheet

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

Final Report

Report No.:	17-08518-1
Initial Date of Issue:	13-Apr-2017
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Aisling O'Kane Brian Mooney Colm Hurley Darren O'Mahony John Cameron John Duggan Lucy Peaker Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Stephen Curtis Stephen Franey Stephen Watson
Project	16-1239 - West Offaly Power Station & Ash Disp. Facility

Quotation No.:		**Date Received:**	07-Apr-2017
Order No.:		**Date Instructed:**	07-Apr-2017
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	13-Apr-2017
Date Approved:	13-Apr-2017		

Approved By:

Details: Glynn Harvey, Laboratory Manager

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

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 16-1239 - West Offaly Power Station & Ash Disp. Facility

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		17-08518	17-08518	17-08518	17-08518
Quotation No.:			**Chemtest Sample ID.:**		437051	437052	437053	437054
Order No.:			Client Location ID.:		WOA-BH01/17	WOA-BH01/17	WOA-BH02/17	WOA-BH02A/17
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.80	3.80	1.80	0.80
			Bottom Depth (m):		1.20	4.20	2.20	1.20
			Date Sampled:		06-Apr-2017	06-Apr-2017	06-Apr-2017	06-Apr-2017
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Moisture	N	2030	%	0.020	52	41	19	6.8
pH	U	2010		N/A	9.4	11.0	9.0	9.4
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	1.9	1.4	0.039	< 0.010
Organic Matter	U	2625	%	0.40	24			

Report Information

Key

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

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

Sample Deviation Codes

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

Sample Retention and Disposal

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

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

CAUSEWAY GEOTECH

APPENDIX N

SPT hammer energy measurement report

SPT Calibration Report

EQUIPE GROUP
www.equipegroup.com

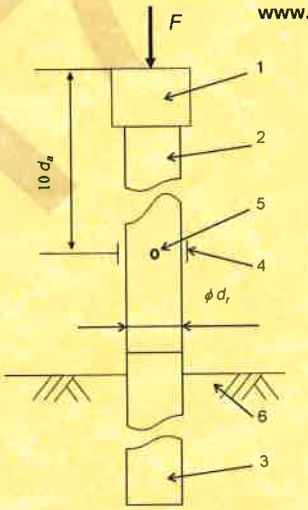
Hammer Energy Measurement Report

Type of Hammer	SPT HAMMER
Client	CAUSEWAY GEOTECH
Test No	EQU1763
Test Depth (m)	7.50
Date of Test	18 February 2017
Valid until	18 February 2018
Hammer ID	EQU1763

Mass of the hammer	m = 63.5kg
Falling height	h = 0.76m
E_{theor} =	$m \times g \times h$ = 473J

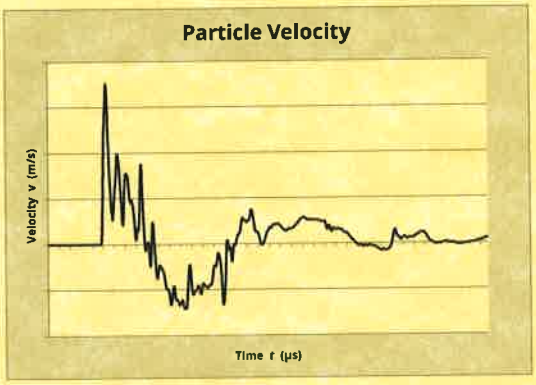
Characteristics of the instrumented rod

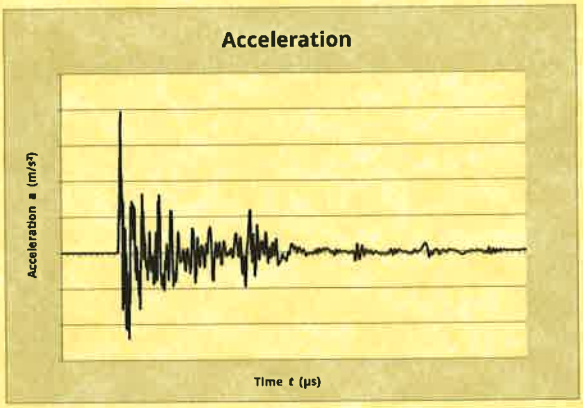
Diameter	d_r = 0.052 m
Length of the instrumented rod	0.558 m
Area	A = 11.61 cm^2
Modulus	E_a = 206843 MPa

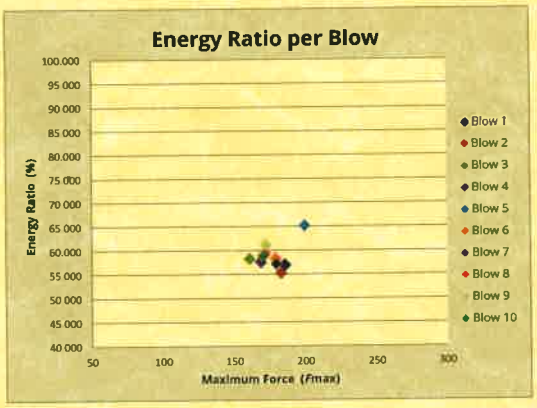


Key
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011







Observations:
1.

E_{meas} =	**0.277** kN-m
E_{theor} =	**0.473** kN-m

Energy Ratio $(E_r) = \frac{E_{meas}}{E_{theor}}$ = **58.61%**

Equipe SPT Analyzer Operators: AF

Prepared by: Checked by: Date 02/03/2017

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