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**WINDFARM AT DEREENACRINNIG WEST,  
DRUMOLEAGUE, CO. CORK**

**SITE INVESTIGATION CONTRACT**

**GEOTECHNICAL REPORT**

**NO. P16177**

**Client:** Mr. George O'Mahony

**Engineer:** Jennings O'Donovan &  
Partners

Consulting Engineers,

Finisklin,

Sligo,

Ireland.



## REPORT CONTROL SHEET

<b>Employer</b>	Mr. George O'Mahony & Assoc.					
<b>Employer's Representative</b>	Jennings O'Donovan & Partners Consulting Engineers					
<b>Project Name</b>	Windfarm at Dereenacrinnig West –Site Investigation Contract					
<b>Report Name</b>	Windfarm at Dereenacrinnig West –Site Investigation Contract –Geotechnical Report					
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# 1 INTRODUCTION

## 1.1 SCOPE OF WORKS

In November 2016, Jennings O'Donovan & Partners, Consulting Engineers acting as the Employer's Representative on behalf of their Client, Mr. G O'Mahony commissioned Priority Geotechnical (PGL), to carry out a site investigation contract for the proposed windfarm development at Dereenacrinnig West, Drumoleague, Co. Cork. The windfarm development comprised of seven (7) turbines, 3km of associated access roadways, upgrade of 1.3km of existing roadway and electrical sub-station infrastructure.

The purpose of the investigation is to provide geotechnical information for the provision and design of the windfarm development and associated works.

The scope of the ground investigation, which was specified by Mott MacDonald, as Tendered (initially) comprised of the following:

- 32Nr. Trial pits excavations;
- 7Nr. Rotary core boreholes;
- 8Nr. Dynamic probes;
- Standpipe well installations;
- All associated sampling;
- *In-situ* testing, standard penetration testing and California bearing ratio (CBR);
- Geophysical investigation, MASW and electrical resistivity;
- Laboratory testing of soil and rock samples;
- Factual and interpretative reporting.

The final works as completed are detailed in Section 3.2 of this factual report. The fieldworks were carried out between 22<sup>nd</sup> November and 22<sup>nd</sup> December, 2016.

This investigation was carried out in accordance with the contract specification: Specification and Related Documents for Ground Investigation in Ireland (Engineers Ireland, October 2006), Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (1999) Code of Practice for Site Investigation +A2:2010 and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9).

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## 1.2 REPORTING

This geotechnical report (ref: P16177\_RP\_F01) presents the factual records of the fieldwork with respect to the site investigation works contract for the proposed windfarm development at Dereenacrinnig West, Drumoleague, Co. Cork and the geotechnical interpretation of same.

A non-intrusive geophysical survey was undertaken by PGL. A report titled “Dereenacrinnig Wind Farm, Geophysical Investigation” (ref: PGL P16177\_GP\_Rp\_F01, March, 2017) is presented in **APPENDIX B** of this combined factual and interpretative report.

*No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations. The geotechnical interpretation may be subject to change where further information becomes available.*

*No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.*

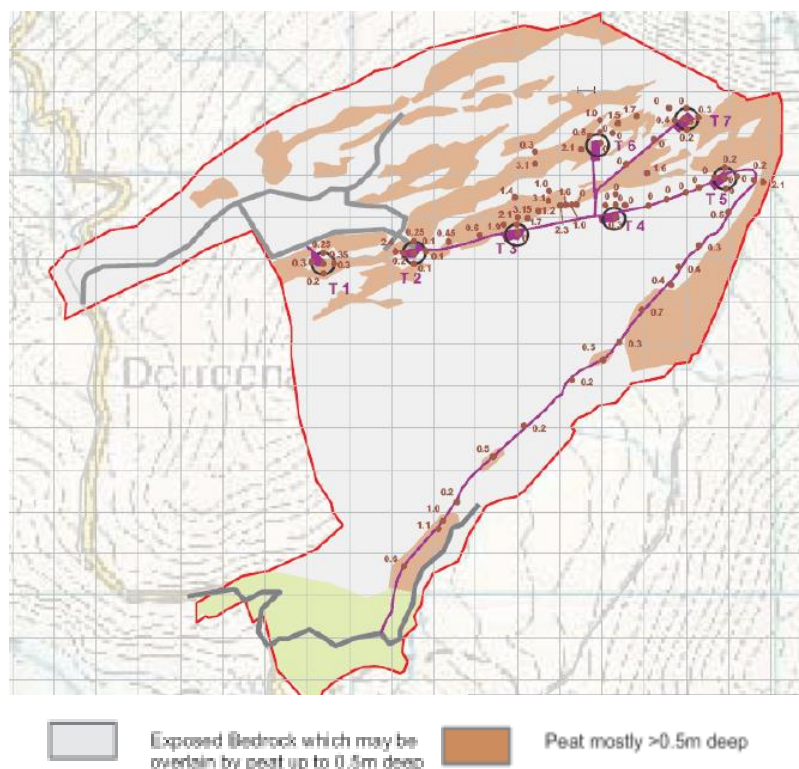
*This report has been prepared for the Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.*

### 1.3 SITE LOCATION & DESCRIPTION

The up-land site approx' 1km<sup>2</sup> was north of Castledonovan in Co. Cork, at Dereenacrinning West, at elevations 200mOD to 400mOD Malin.

### 1.4 PUBLISHED GEOLOGY

The published geology maps; Geological Society of Ireland, GSI, Sheet 24 1:100,000 mapping shows the site to be underlain the Gun Point Formation (GP) described as green-grey Sandstones and purple Siltstones. This formation has been observed to be well folded and generally steeply dipping 50° to 60° across the site. The south of the site is underlain by the Castlehaven Formation (CE), described as purple Mudstone and Siltstone. The very north of the site is underlain by the Toe Head Formation (TH) described as cross-bedded sandstones and purple Siltstones with some Mudstones. There are two published bedrock faults within the site area. Both faults run in a generally northeast-southwest direction, one passing under the northern boundary of the site and one passing close to the southern boundary. The Teagasc mapping on the GSI website shows this area of the site to be underlain by blanket Peat, glacial tills derived from Devonian Sandstones and shallow bedrock. Peat deposits (H3- H7) were measured across the site by Others (2010) and found to be between 0.1m to 3.15m deep.



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## 2 FIELDWORK

### 2.1 GENERAL

The fieldwork was carried out in general accordance with British Standards (BS 5930 (1999) Code of Practice for Site Investigation +A2:2010 and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9). Details of the equipment and plant used are presented below.

Operation	Equipment	Nominal diameter, mm	Flush	Comments
Rotary Coring and Open Hole Drilling	Delta Base 520 6t tracked rig	Symmetrix 131mm diameter open hole  76mm diameter core	Compressed Air mist	Standard Penetration Test, N values obtained in overburden. Visual observations of ground and groundwater conditions. Installation of standpipe monitoring wells.
Trial pit excavations	12t tracked excavator	N/A	N/A	Visual observations of ground and groundwater conditions. Bulk disturbed sampling.
Dynamic probe	TRL  Competitor DP(H)	8kg/ 575mm drop ht.  50kg/ 500mm	N/A	Pen rate mm/blow recorded & CBR estimated.  N <sub>100 H</sub> blows/100mm

The exploratory locations were selected by JO'D and set out subject to work space restrictions and available access. The 'as constructed' exploratory locations were subsequently surveyed using Trimble V8 GPS equipment to the Ordinance Survey, Irish Transverse Mercator (ITM) system of co-ordinates and elevations to Malin Head datum. These locations are shown on the Exploration Location Plans (dwg. No.: P16177-SI-0A, P16177-SI-01 to P16177-SI-06) presented in **APPENDIX D** of this report.

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## 2.2 EXPLORATORY HOLES

The exploratory holes as completed during the ground investigation are listed in the following table(s):

### SUMMARY OF EXPLORATORY HOLES

Type	Quantity, Nr.	Depth Range, m bgl	Comments
Trial Pit Excavations	32	0.55 – 3.20	TP01A <sup>1</sup> , TP02A, TP03A, TP04A, TP05A, TP06A and TP07A.  TP01, TP02, TP03, TP04, TP05, TP06, TP07, TP08, TP09, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21 and TP22.  TPS1, TPS2 and TPS3.
Rotary Boreholes	4	6.70– 7.10	BHT01, BHT02, BHT03 and BHT04 <sup>2</sup> .
Dynamic probes	8	0.60 – 3.30	DP01, DP02, DP03, DP04, DP05, DP06, DP07 and DP08 (existing road from Castledonovan).

## 2.3 SAMPLING

Fifty six (56) bulk disturbed samples (B), forty nine (49) small disturbed samples (D), and 21.25lin.m rotary core were recovered from the exploratory holes in accordance with Geotechnical Investigation and Sampling – Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

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<sup>1</sup> Annotation A referenced turbine locations; TP01A = T01 (BHT01).

<sup>2</sup> Rotary boreholes at turbines T05 – T07 were removed from the scope of works. Trial pits TP05A, TP06A and TP07A were excavated to bedrock. Details of bedrock is also provided for in the geophysical survey report, **APPENDIX B**.

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## 2.4 GROUNDWATER MONITORING

Groundwater was recorded when encountered/ observed during boring and trial pit excavations over a period of 20 minutes, noting any changes that may occur. Groundwater levels were also monitored at start and end of drilling shifts. Groundwater is presented in a table in Section 5 of this factual report.

It should be noted that the normal rate of boring may not permit the recording of equilibrium groundwater levels for any one groundwater water strike where casing may exclude low volume flows as the borehole progresses. Groundwater conditions observed in the borings or pits are those appertaining to the period of the investigation. Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. The groundwater regime should be assessed from standpipe well installations, where available.



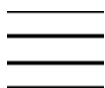
Arisings backfill to borehole



BENTONITE grout backfill to rotary boreholes/ installation



GRAVEL backfill to installation/ rotary borehole



uPVC slotted pipe

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## 2.5 IN SITU TESTING

Standard Penetration Tests, N values, were typically carried out in the boreholes using the 60° solid cone (CPT) in place of the standard split barrel sampler. The Standard Penetration Test was carried out in accordance with Geotechnical Investigation and Testing, Part 3 Standard penetration test, BS EN ISO 22476-3:2005+A1:2011. The data was presented on the relevant logs in **APPENDIX A**.

The geophysical survey comprised of Resistivity Soundings, Seismic Refraction Profiling and Multi-Channel Analysis of Surface Wave (MASW) at 7 proposed turbine locations as well as a proposed substation location. The survey fieldwork was carried out by PGL between the 12<sup>th</sup> and 14<sup>th</sup> December, 2016. A separate report has been produced and is presented in **APPENDIX B** of this report.

TRL dynamic probes (8kg drop weight, 575mm drop height) were carried out in pit excavations to establish *in situ* California bearing ratio, CBR to refusal depths between 0.18m bgl to 2.30m bgl. The data from the testing was presented in **APPENDIX A** with the relevant trial pit records.

PGL's Competitor dynamic probing rig was to undertake dynamic probing (DP(H); heavy, 50kg drop weight, 500mm drop height) in general accordance with Geotechnical Investigation and Testing, Part 2, Dynamic probing, BS EN ISO 22476-2:2005. The blows per 100mm (N<sub>100</sub>) were recorded to refusal being 25blows without progress over 100mm. Eight (8) number dynamic probes (DP01, DP02, DP03, DP04, DP05, DP06, DP07 and DP08) were advanced to refusal to depths between 0.6m below existing ground level (bgl) to 3.3m bgl.

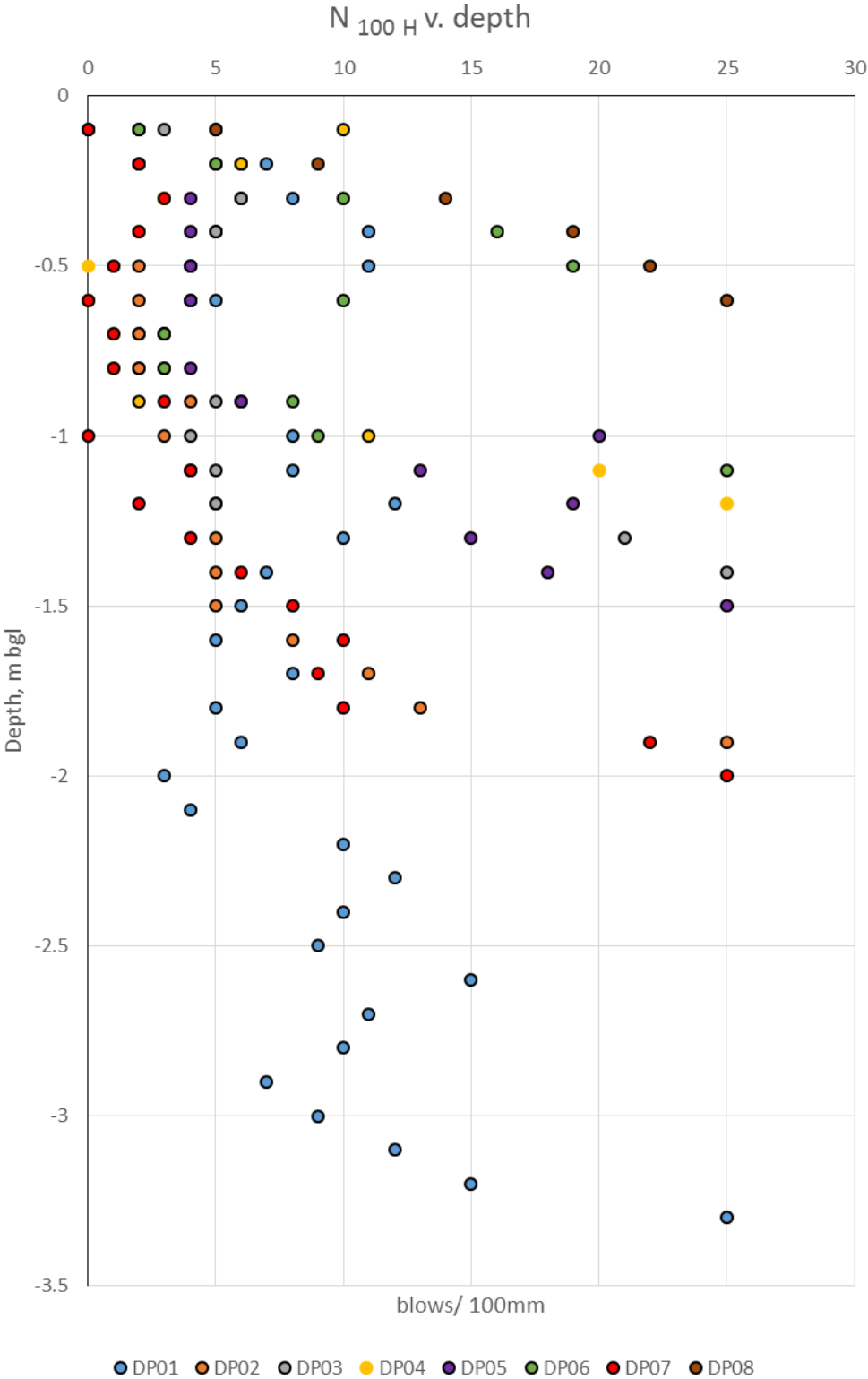
### SUMMARY OF IN-SITU TESTING

Type	Quantity	Remarks
Standard penetration test, N <sub>SPT</sub> value	4Nr.	Nspt refusals N presented a numerical value 50; See <b>APPENDIX A</b>
Geophysical survey	840lin.m 2D res 161lin.m Seismic/ MASW	P16177_GP_Rp_F01, <i>March, 2017</i> See <b>APPENDIX B</b>
Dynamic probing (TRL)	32Nr.	DCP01A, DCP02A, DCP03A, DCP04A, DCP05A, DCP06A and DCP07A.

Type	Quantity	Remarks
		DCP01, DCP02, DCP03, DCP04, DCP05, DCP06, DCP07, DCP08, DCP09, DCP10, DCP11, DCP12, DCP13, DCP14, DCP15, DCP16, DCP17, DCP18, DCP19, DCP20, DCP21 and DCP22.  DCPS1, DCPS2 and DCPS3. See <b>APPENDIX A</b>
Dynamic probing (DPH)	8Nr.	N <sub>100 H</sub> See <b>APPENDIX A</b>



The distribution of  $N_{100}$  values with depth (m below existing ground level, bgl) is presented below for dynamic probing DP(H). Refusals,  $N_{100} = 25$ , were plotted. The  $N_{100}$  values for the boreholes are presented on probe logs in **APPENDIX A**.



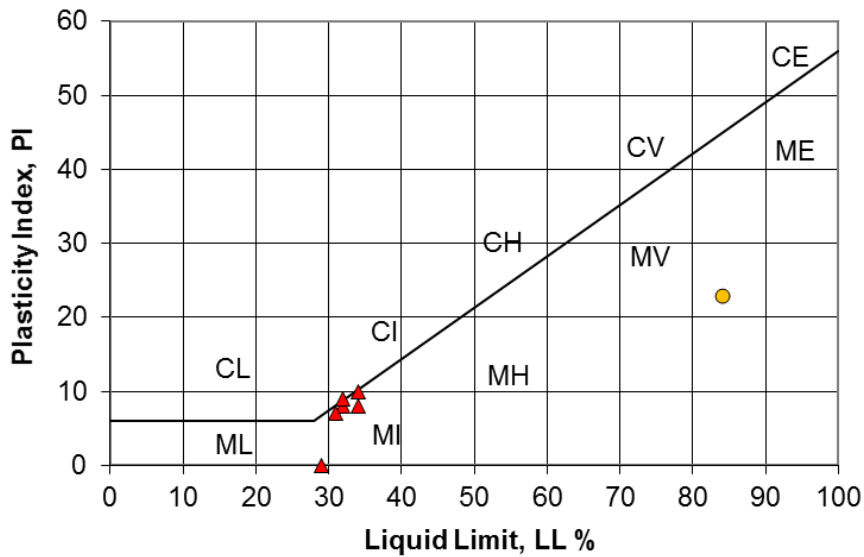
### 3 LABORATORY TESTING

All samples were transported to Priority Geotechnical's laboratory in Midleton, Co. Cork examined, logged and prepared for scheduled testing. Laboratory testing was proposed by PGL, being revised and approved by Jennings O'Donovan. Testing was carried out by PGL, in accordance with BS1377 (1990), Methods of test for soils for civil engineering purposes and the ISRM suggested methods for rock characterisation, testing and monitoring. Specialist chemical testing was undertaken by Chemtest Ltd. (UK) on behalf of PGL. Specialist rock testing was carried out by GSTL Ltd (UK) on behalf of PGL. The laboratory test results were presented in **APPENDIX C**. A summary of tests undertaken were detailed below.

#### SUMMARY OF LABORATORY TESTING UNDERTAKEN – SUPERFICIAL DEPOSITS

SOILS		
Type	No.	Remarks
Natural Moisture Content	39	9% to 795%
Atterberg Limits	08	Liquid limit, LL 29% to 187% Plastic limit, PL 23% to 102% and NP non-plastic soils Plasticity index, PI 7 to 85
Particle Size Distribution (grading)	15	See <b>APPENDIX C</b>
pH	03	7.4 to 8.1
SO <sub>4</sub> water soluble	03	<0.010g/l to 0.013g/l
SO <sub>4</sub> acid soluble	03	<0.01%
Loss on ignition	04	0.73% to 81%
Proctor compaction (Moisture content/dry density relationship)	01	TP06 0.75m; Optimum moisture content 6% Maximum dry density 2.02Mg/m <sup>3</sup>
California Bearing Ratio, CBR	16	0.5% to 2.5%
CBR Moisture content relationship	01	TP06 0.75m See <b>APPENDIX C</b>

### Summary of plasticity data



### SUMMARY OF LABORATORY TESTING UNDERTAKEN – SOLID GEOLOGY

ROCK		
Type	No.	Remarks
UCS with Young's Modulus and Poisson's Ratio	01	16MPa 55.7GPa 0.215
Point Load Test (IP <sub>50</sub> )	06	0.7MPa to 4.7MPa
Magnesium sulphate soundness value MSSV,	04	6% to 9%
pH	01	7.4 to 8.7
SO <sub>4</sub> water soluble	01	<0.010g/l

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## 4 GROUND CONDITIONS

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report. The records provide descriptions, in accordance with BS 5930 (1999) +A2: 2010 and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, in situ testing and details of the samples taken, together with any observations made during the site investigation.

The turbine sites were characterised by dark brown to black PEAT and peaty CLAY 0.22m to 0.6m thick and slightly sandy gravelly SILT with Cobble content deposits 0.7m thick to 1.1m thick overlying bedrock BHTP01 to BHTP04 (T01 – T04). Based on tactile assessment, the Silt was described as soft. Medium strong to strong SILTSTONE was encountered 1.55m bgl (BHT03) to 1.65m bgl (BHT01). Sandstone was found to underlie the Siltstone at BHT01 and BHT04, below 4.5m bgl to 5.05m bgl. Strong SANDSTONE was encountered at 1.55m bgl (BHT02). Peaty CLAY 0.8m thick was encountered at TP05A (T05) overlying 0.7m of firm slightly sandy gravelly SILT with Cobble content to a depth 1.5m bgl. Peaty CLAY 0.17m thick was encountered at TP06A (T06) overlying 0.63m of firm slightly sandy slightly gravelly SILT with Cobble content to a depth 0.8m bgl. PEAT 0.28m thick was encountered at TP07A (T07) overlying 0.92m of firm to stiff slightly sandy gravelly SILT with Cobble content to a depth 1.2m bgl.

The access road was characterised by mixed deposits. Topsoil; slightly sandy slightly gravelly SILT, 180mm to 300mm thick; PEAT 170mm to 600mm thick and peaty CLAY 150mm to 900mm overlay silty sandy GRAVEL (TP01, TP02, TP03 and TPS1) with varied Cobble content deposits 600mm to 1.55m thick and soft becoming firm to stiff, slightly sandy slightly gravelly SILT with varied Cobble content, 650mm to 2.7m thick. The Gravels and Silts were underlain by shallow bedrock 0.75m bgl to 2.3m bgl. Clayey PEAT was encountered 2.0m deep at TP12.

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## 5 GROUNDWATER CONDITIONS

Groundwater was not encountered during rotary drilling. Groundwater was encountered in trial excavations between ground level, 0.00m bgl and 2.00m bgl. Details of the ground water and installations are presented graphically on the relevant exploratory logs within **APPENDIX A** and are summarised below. See also section 3.4 for general details.

No standpipe well, installations were constructed.

### SUMMARY OF GROUNDWATER INFORMATION OBTAINED DURING SITE WORKS

Location	Depth water strike, m bgl	Comments
TPS1	2.00	Water strike at 2.0m bgl, trickle flow rate.
TP01	0.80	Water strike at 0.80m bgl. Trickle flow rate.
TP05A	0.30	Trickle flow rate.
TP07	0.10	Water strike at 0.10m bgl. Steady flow rate.
TP09	1.40	Water strike at 1.40m. Trickle flow rate.
TP12	0.10	Water strike at 0.10m bgl. Trickle flowrate.
TP20	1.20	Waterstrike at 1.20m bgl. Trickle flow rate.
TP21	0.00	Water encountered at ground level.

# 6 GEOTECHNICAL REVIEW

## 6.1 GROUND MODEL

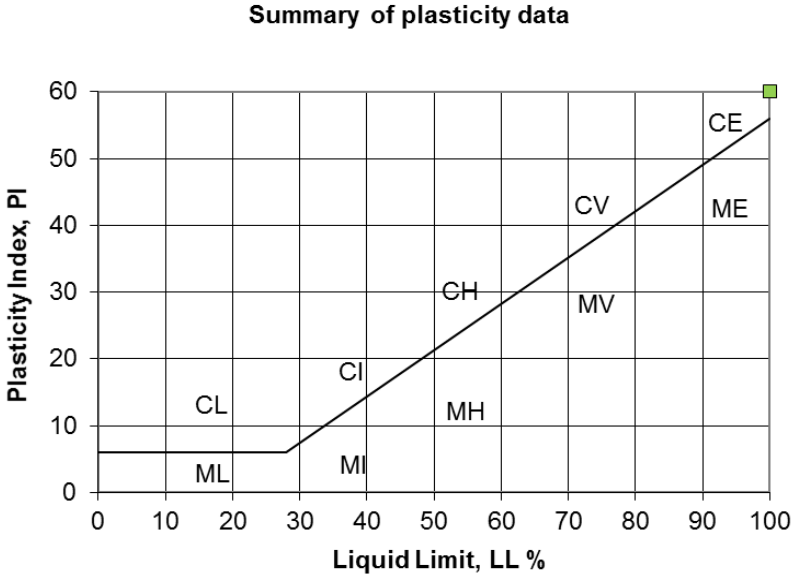
The site was characterised by shallow bedrock overlain by organic (shallow blanket PEAT) and mixed glacial deposits slightly sandy slightly gravelly SILT and silty sandy GRAVEL.

Groundwater was assumed at the boundary of the rock and superficial deposits with perched groundwater within the shallow peat deposits.

## 6.2 CHARACTERISTIC PROPERTIES

### 6.2.1 PEAT

The Peat was characterised by extremely high plasticity (liquid limit, LL 187%), high organic content 81% and natural moisture content,  $w$  248% and 765%.



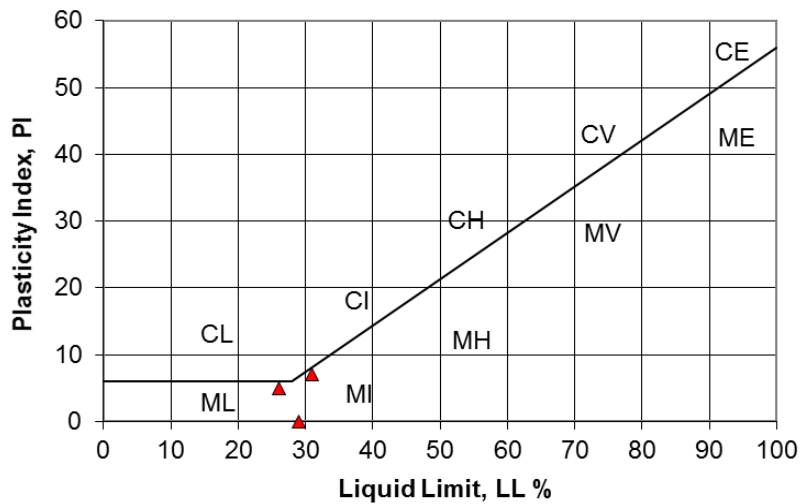
The Peat deposits are expected to be highly compressible, noting Peat was 2m thick at location TP12.

*Historical in situ hand vane tests (Others, 2010) indicated undrained shear strengths 16kPa to 34kPa describing very soft to soft deposits.*

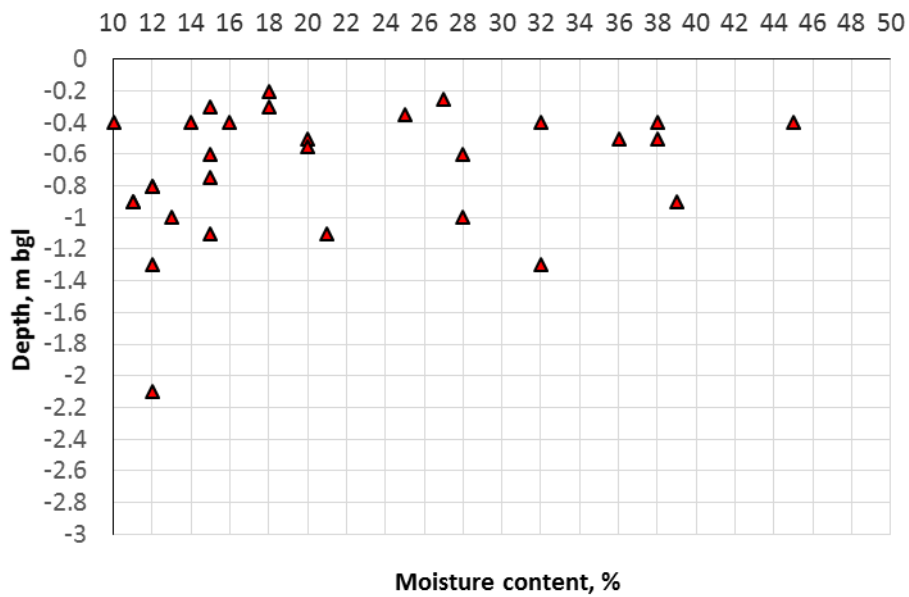
## 6.2.2 SILT

The Silt was characterised by natural moisture content,  $w$  10% to 45%, low plasticity (ML) and low organic content (<6%). Grading analysis indicated 22% to 42% silt fraction with 29% to 52% gravel fraction, 5% to 34% sand fraction with up to 20% coarse Cobble content. The deposits are described as mixed glacial tills.

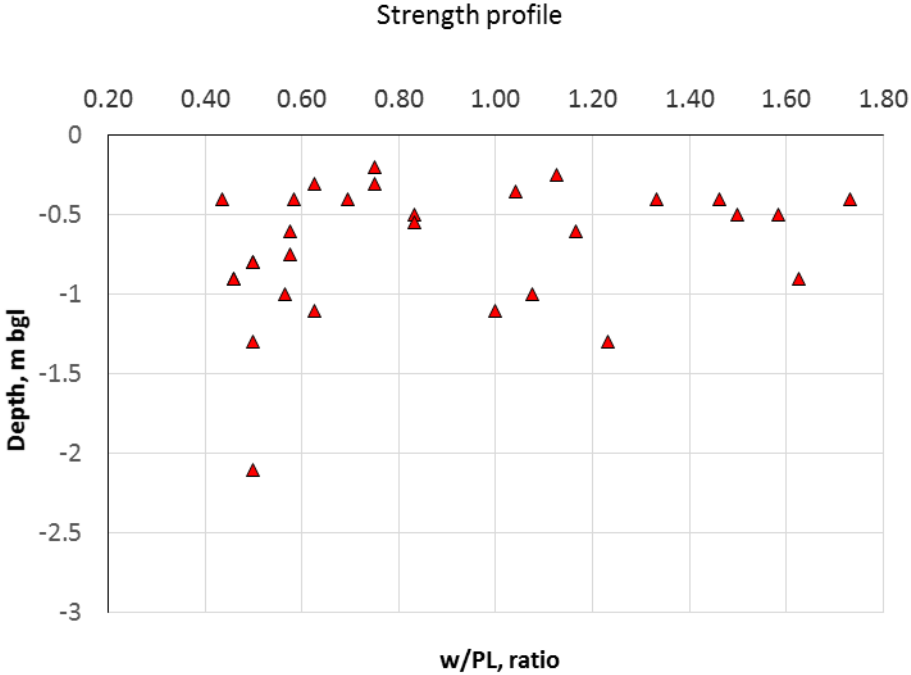
Summary of plasticity data



Moisture content profile - Silt



The ratio of natural moisture content to plastic limit indicated soft ( $w/PL > 1.2$ ) to 'firm to stiff' deposits ( $w/PL < 1.0$ ) (C504 Engineering in glacial tills, Figure 5.19). It can be seen that soft deposits were present to depths up to 1.3m bgl at locations; TP04, TP05, TP06, TP07, TP11, TP13, TP15, TP17, TP18, TP19, TP03A and TPS3. Undrained shear strengths are expected to vary between 20kPa and >75kPa ('very soft to soft' to stiff, BS5930; 1999). The soft deposits were typically in the upper 0.5 -1.0 with exceptions of TP04, TP07, TP19 and TPS3 where the soft deposits extended deeper. It is noted the *in situ* tactile assessment indicated firm deposits (40kPa – 75kPa BS5930; 1999). Plasticity data indicated a friction angle,  $\phi = 26^\circ$  (C504 figure 5.1).

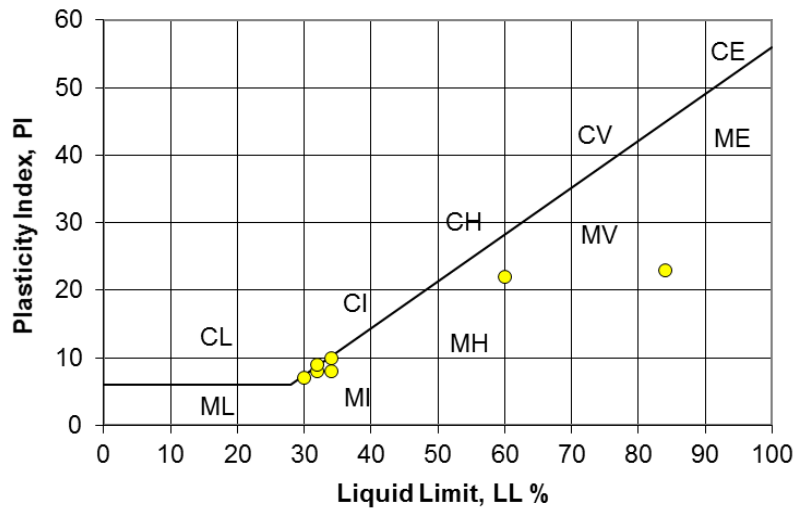




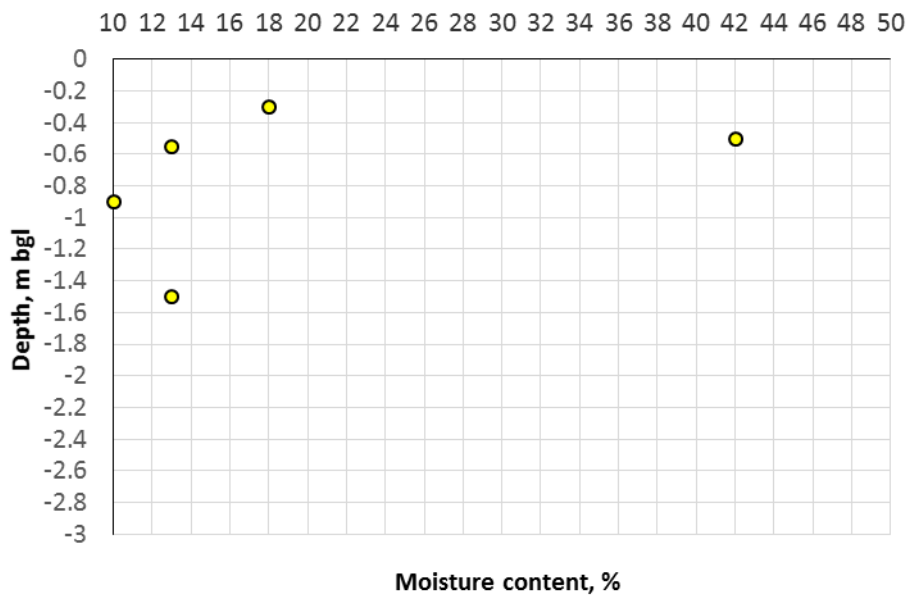
### 6.2.3 GRAVEL

The Gravel was characterised by natural moisture content,  $w$  10% to 42% and intermediate to very high plasticity (MI – MV). Grading analysis indicated 34% to 66% gravel fraction with 14% to 25% sand fraction, 7% to 27% silt fraction with 4% to 24% coarse Cobble content. The deposits are described as mixed glacial tills.

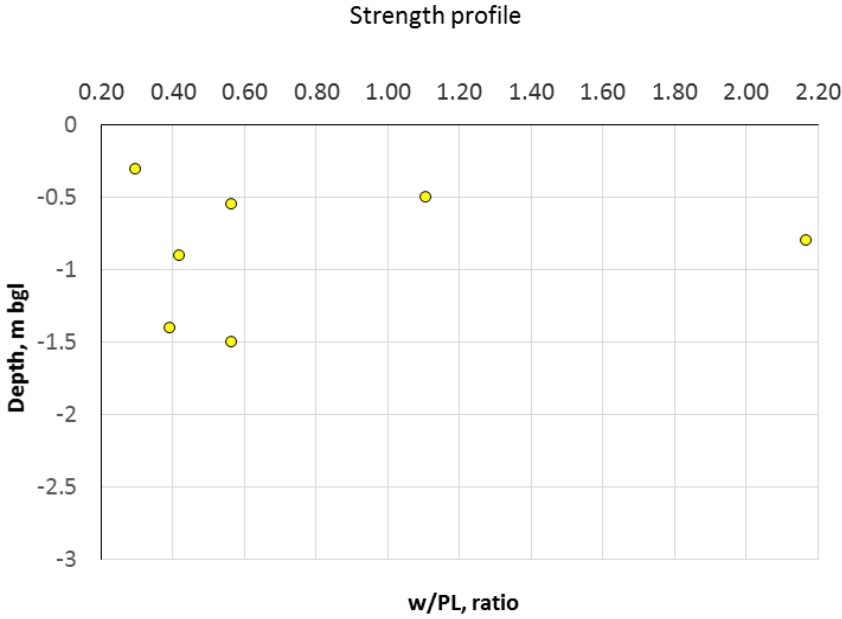
Summary of plasticity data



Moisture content profile - Gravel



The ratio of natural moisture content to plastic limit indicated soft ( $w/PL > 1.2$ ) to 'firm to stiff' deposits ( $w/PL < 1.0$ ). It can be seen that soft deposits were present to depths up to 0.8m bgl at locations; TP08 and TPS3.



No assessment of the relative density of the Gravels was provided. The higher plasticity of the Gravels were attributed to the overlying organic deposits.

The SILT and GRAVEL shall be considered a singular deposit - mixed glacial till with varied granular fractions, having similar characteristics with only variation in the proportions of the varied constituents/ fractions and characterised by varied undrained shear strengths.

**6.2.4 SANDSTONE and SILTSTONE**

The rock mass characterization has been established using the Rock Quality Designation, (RQD, Deere, 1964), Rock Mass Rating (RMR) using the Geo-mechanics System (Bieniawski, 1989) and Geologic Strength Index (GSI, Hoek and Brown 1997, 2002). A review of the rock properties, strength (medium strong to strong  $I_{P50}$ , 1.1MPa – 4.7MPa, UCS 16MPa), fracture spacing (NI– 400mm) and condition (slightly weathered no infill), Rock Quality Designation (RQD non-intact/ 9% - 78%) and groundwater (assumed 'dry' within the zone of influence of the expected foundations) was undertaken. The rock mass rating, RMR range was 44 - 64.

The Siltstone and Sandstone bedrock was classified as Class III-II fair to good rock with unit weight  $2.71\text{Mg/m}^3$ . A Poisson's ratio,  $\nu$  of 0.15 - 0.20 can be expected and was measured as  $\nu = 0.215$ . The intact Young's Modulus,  $E$  was  $55.7\text{GPa}$ . Allowing for the non-intact nature of the rock mass this was reduced by a factor of 0.15 yielding a design modulus of  $8.4\text{GPa}$ .

The rock characteristic properties were summarized as follows:

	T01		T02		T03				T04	
RMR	44	52	62	64	59	64	54	63	54	57
Class	III		II		III-II		III-II		III	
Cohesion	250kPa		300kPa		300kPa		275kPa		250kPa	
Friction	30°		35°		35°		32°		30°	
Rock	Siltstone		Sandstone		Siltstone		Sandstone		Siltstone	
$E^3$ , MPa	5093	9530	18430	20761	15303	20761	10979	19570	10979	13446
	7079	11220	19953	22387	16788	22387	12589	21135	12589	14962

Note there was a reasonable correlation between the Young's Modulus,  $E$  derived from direct measurement (BHT03) the assessment of rock mass rating, RMR and the indirect geophysical measurements (MASW).

### 6.3 PAVEMENT AND HARDSTANDING CONSTRUCTION

It is recommended to construct pavement and hardstanding from a formation level in weathered bedrock were practical. Where the depth of superficial deposits exceeds 1.0m 600mm capping is recommended. Laboratory test data and moisture content data suggested an adjustment factor of 0.5 for the *in situ* determined CBR values. CBR values of 22% were attributed to coarse particles or transition to the weathered rock mass. It is recommended that plate loading tests, using a 600mm plate, be used to control CBR during the construction phase for both the roadway and also hardstanding associate with crane platforms. The risk associated with pavement failure are high during construction and commissioning phased of windfarm development.

<sup>3</sup>  $E = 3.5 \times \text{RMR}^{3.75}/1000$  and  $10^n$  where  $n = (\text{RMR}-10)/40$  (Boyd, 1993; BS8004)

---

Natural moisture content data and a single California bearing ratio, CBR/ moisture content relationship, suggested CBR2% at moisture content,  $w > 10\%$ . Typically the superficial deposits were wet of optimum moisture content (6%/ CBR50%) and so low CBR values were measured. It is not seen as practical to 'dry' the deposits *in situ* and so a design capping thickness of 600mm is proposed within the sandy gravelly SILT and silty sandy GRAVEL deposits with 150mm sub-base (cl.804 or similar) unbound surfacing. A summary assessment of CBR data is presented in **APPENDIX E**.

Where the sub-formation, the underside of capping (subgrade) is on weathered rock, no capping is required and 150mm sub-base (cl.804 or similar) shall be provided subject to a review by the Engineer.

At natural moisture content  $< 15\%$ , compaction levels of 95% maximum dry density can be achieved. It is recommended that the sub- grade deposits (slightly) sandy (slightly) gravelly SILT, be compacted to increase stiffness. Between moisture content 5% to 19%, CBR  $> 20\%$  is expected.

'Reversal road' construction shall be considered where the weathered rock mass was at depths  $< 1.0\text{m}$  bgl. Shallow road cuttings are also recommended. A minimum road width at formation of 7m is expected in shallow cutting and through Peat deposits.

Drainage shall be provided a minimum of 450mm below sub-formation.

### 6.3.1 Existing roadway

Dynamic probing DPH indicated varied strength to depths between 0.6m bgl and 3.3m bgl. Undrained shear strength was between 20kPa and 100kPa indicating soft deposit typically becoming firm to stiff with depth below 1.0m bgl.

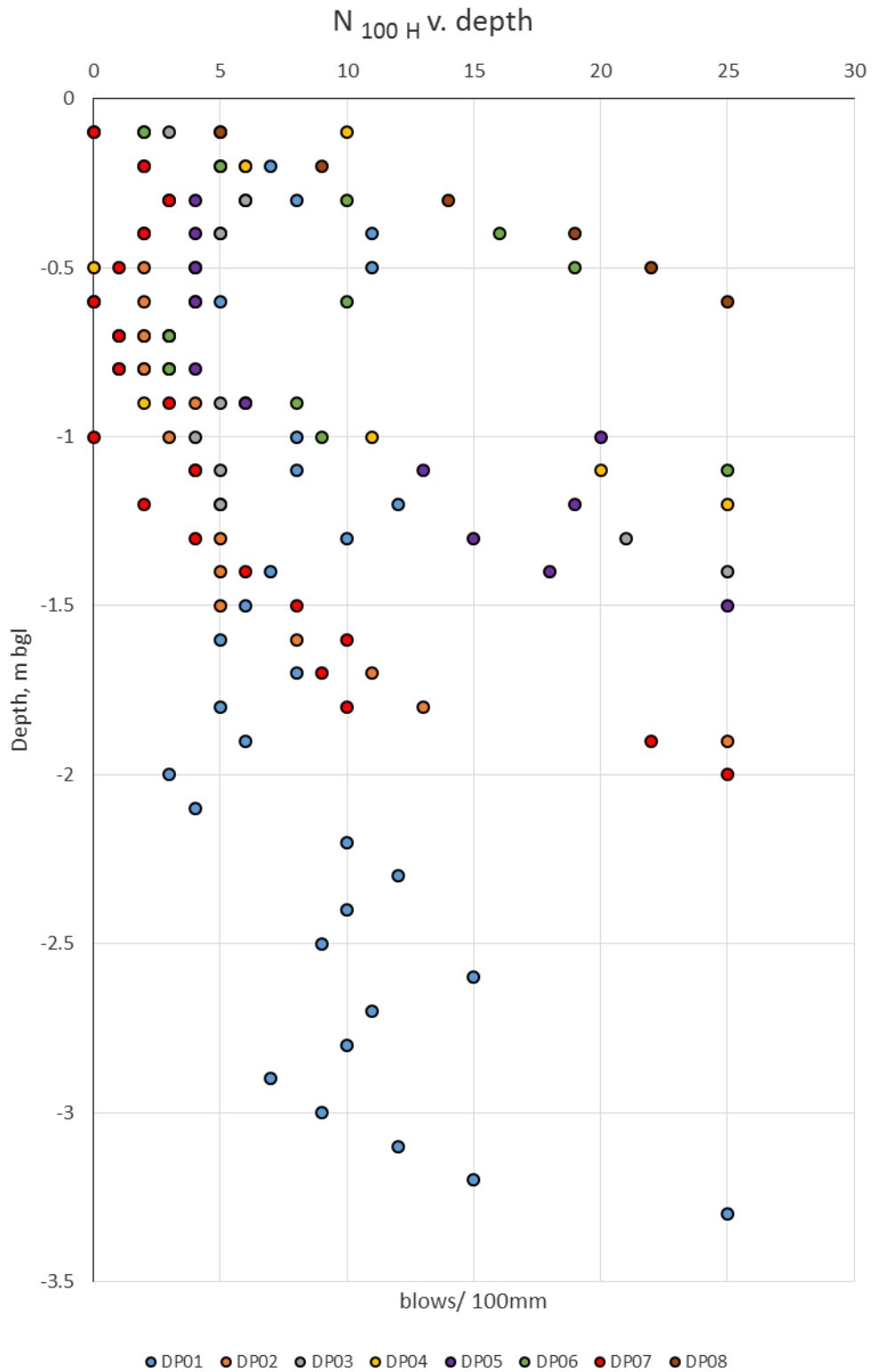
California bearing ratio, CBR was derived based on the relationship;

$$\text{CBR ( \% )} = s_u \text{ (kPa) } / 15.$$

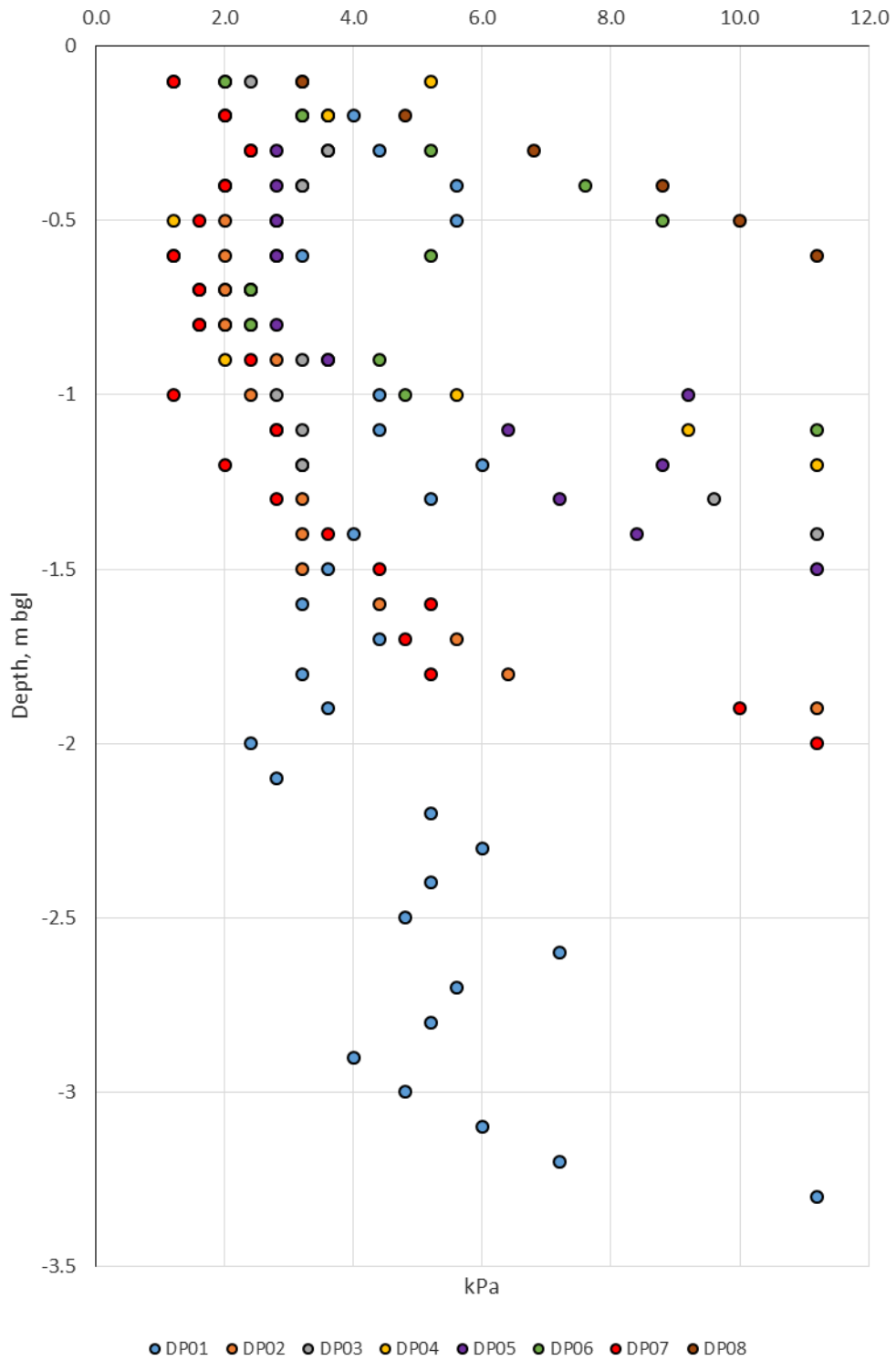
It can be seen that CBR2% is expected to varied depths between 1.0m bgl and 2.0m bgl.

In order to fully assess the existing pavement the full construction detail, sub-base and surfacing thicknesses should be reviewed.

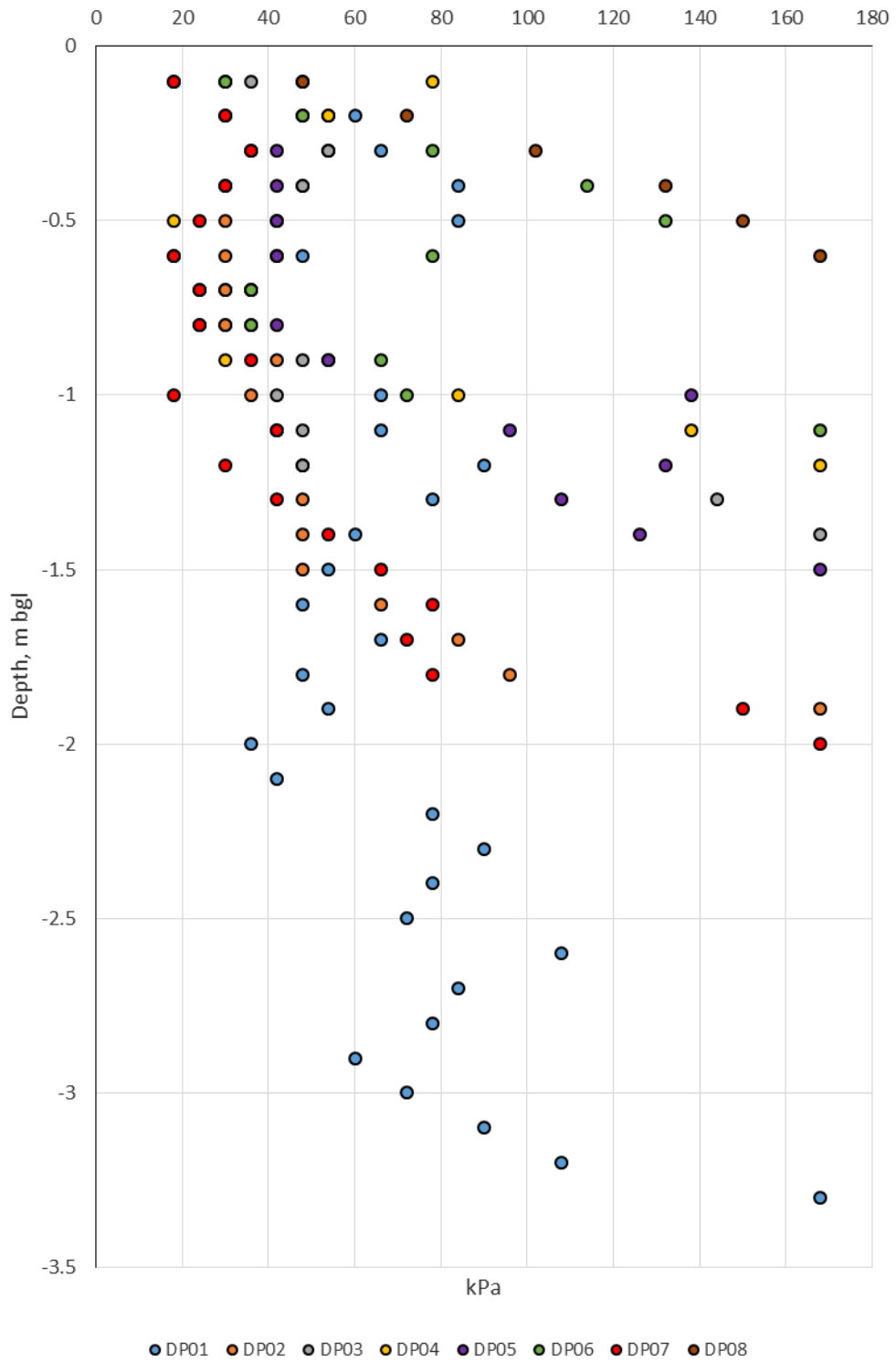
A pavement condition survey and Falling Weight Deflectometer FWD analysis should be undertaken to assess the structural integrity of the existing roadway to take the temporary trafficking associated with turbine deliveries.



### Assumed CBR profile



### Strength profile



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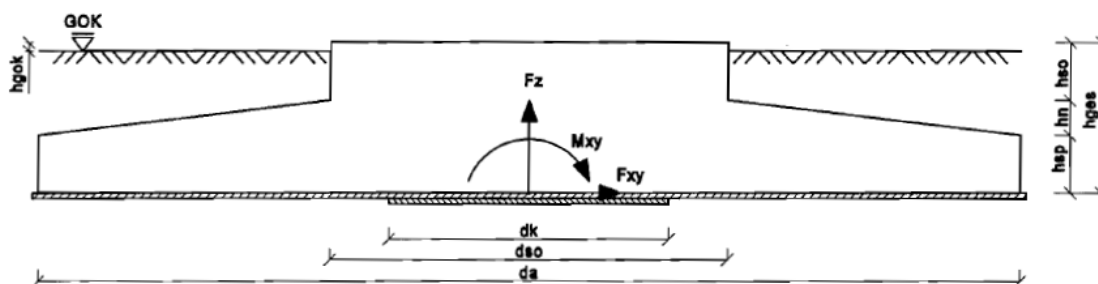
## 6.4 RE-USE OF AGGREGATE MATERIALS

With a 10% fines value of 102kN to 117kN and magnesium sulphate soundness values, MSSV 6% to 9%, the Sandstone and Siltstone is expected to be suitable for re-use as capping with  $50\text{kN} < 10\%FV < 130\text{kN}$  and  $MSSV < 25\%$ .

No direct assessment was made of borrow pits and so further assessment is recommended where aggregate is produced on site. Water absorption capacity WAC (limit  $< 2\%$ ) is recommended along with aggregate impact value AIV (limit  $< 35\%$ , soaked) to assess strength and durability. Flakiness index (FI  $< 40$ ), grading ( $< 6\%$  fines content) and plasticity (Liquid limit  $< 21\%$ ) of aggregate shall also be assessed.

## 6.5 FOUNDATIONS

Foundations for the proposed turbines are within the range 13.2m to 16.8m outer diameter (da) and 1.6m thick (hges);



Minimum allowable bearing pressure of 77kPa to 127kPa is required for settlements not exceeding 3mm/m over a period of 20 years.

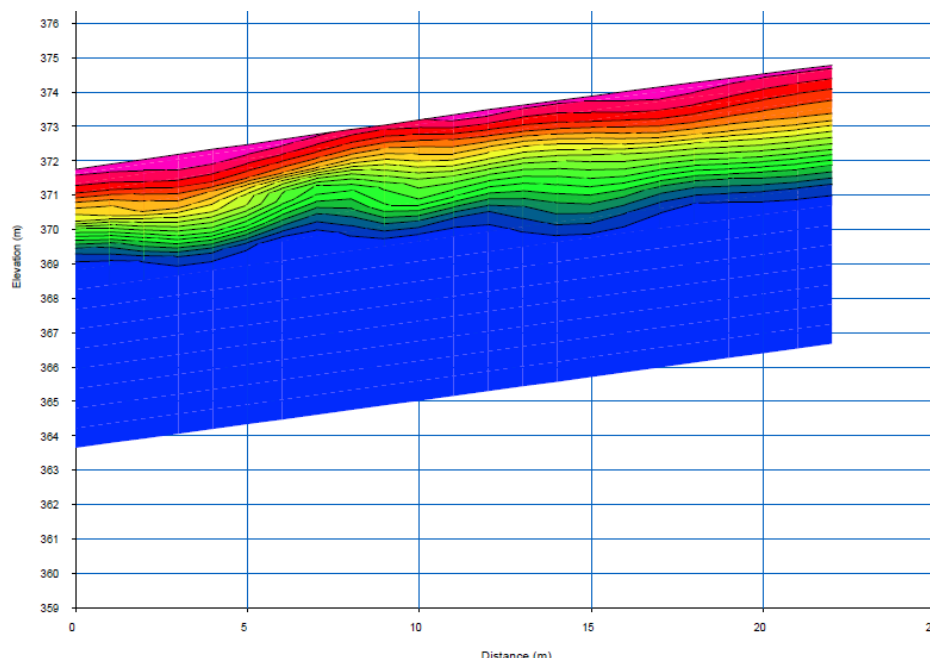


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### 6.5.1 Turbine sites

Turbines are expected to be founded within the bedrock at least below 1.7m bgl. Based on the core information for the upper 5.5m of bedrock the rock was described as Class 3, weakly cemented Sandstone/ Siltstone <sup>4</sup> in accordance with Figure 4. Weak and broken rock of the Code of practice for Foundations, BS8004, 1986. An allowable bearing capacity of 250kPa is provided for settlement up to 0.5% foundation width (Figure 1, BS8004) where the bedrock is non-intact in the upper zone weathered zone.

For settlement of the order 3mm/m an allowable bearing pressure of 130kPa to 255kPa is recommended taking a closely spaced, fracture spacing,  $j$  100mm to 400mm and a single unconfined compressive strength,  $q_c$  of 16MPa <sup>3</sup>. The geophysical survey data indicated an increasing Modulus with depths and so the proposed allowable bearing pressure is likely to be conservative over the full depth of influence of the foundations and where the rock strength is stronger. Shear failure of the foundation is not expected at the level of loading applied where an ultimate bearing pressure of 4MPa is expected. Settlement, particularly differential settlement, will be the limiting factor.

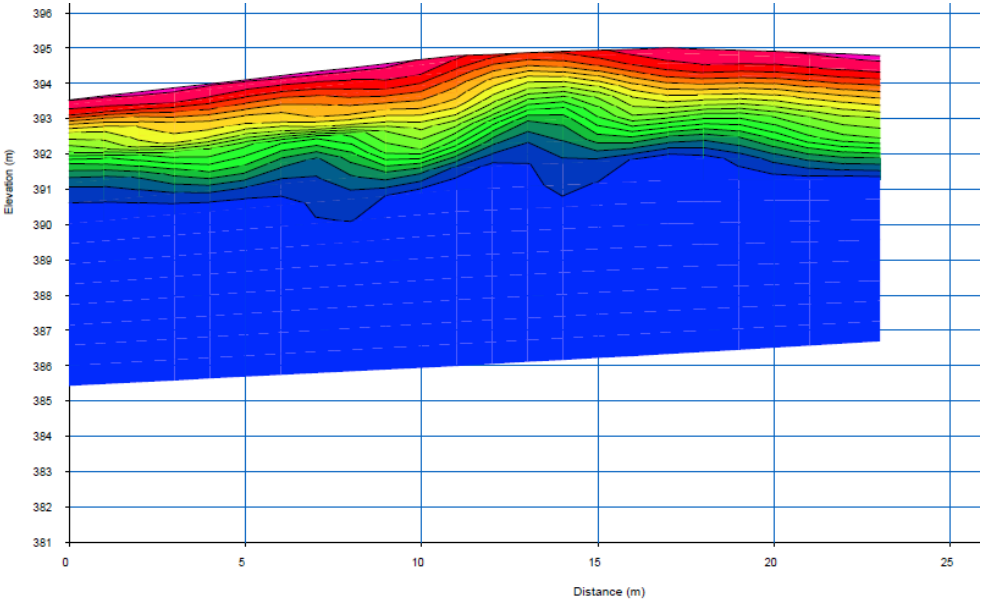


### Seismic profile T01

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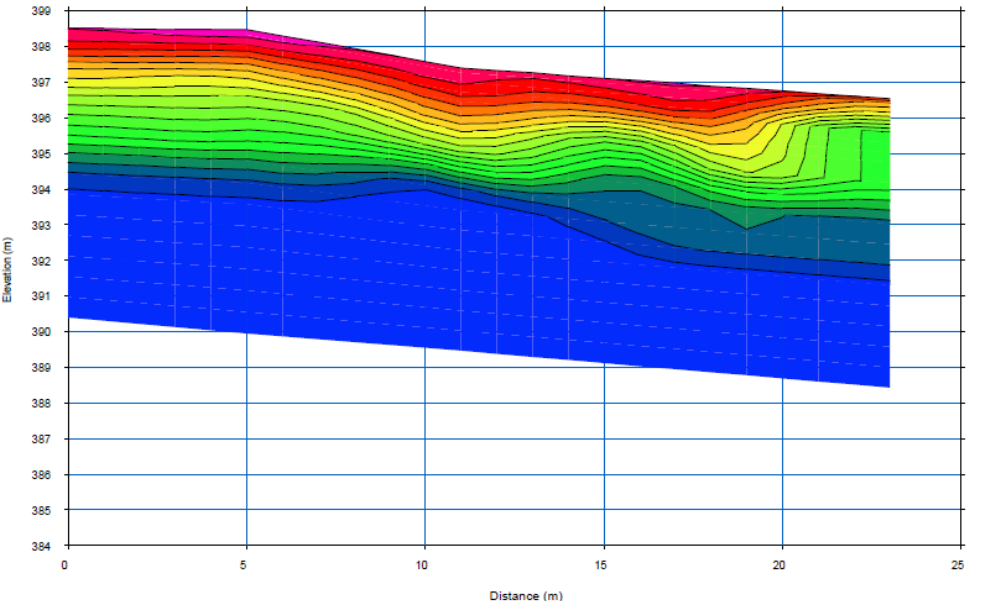
<sup>4</sup> A UCS of 16MPa was measured conservatively indicating a weak rock in contrast with high point load indices up to 4.7MPa indicating strong rock.

Turbine; T01 foundations are recommended to be constructed below 371mOD within the bedrock. Bases on the rock mass characteristic at the turbine location a lower limit of allowable bearing pressure of 160kPa is recommended.



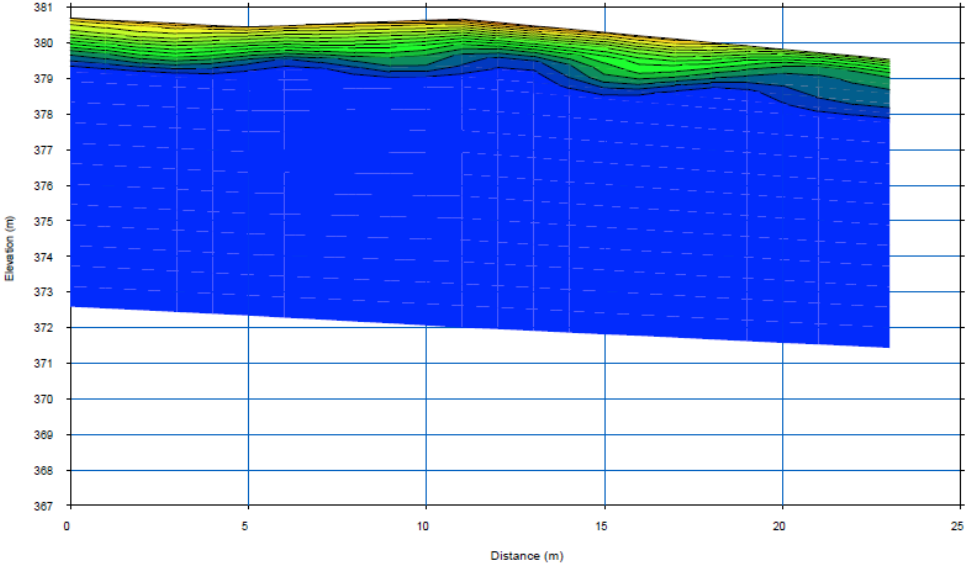
**Seismic profile T02**

Turbine; T02 foundations are recommended to be constructed below 393mOD within the bedrock. Bases on the rock mass characteristic at the turbine location an allowable bearing pressure of 255kPa is recommended.



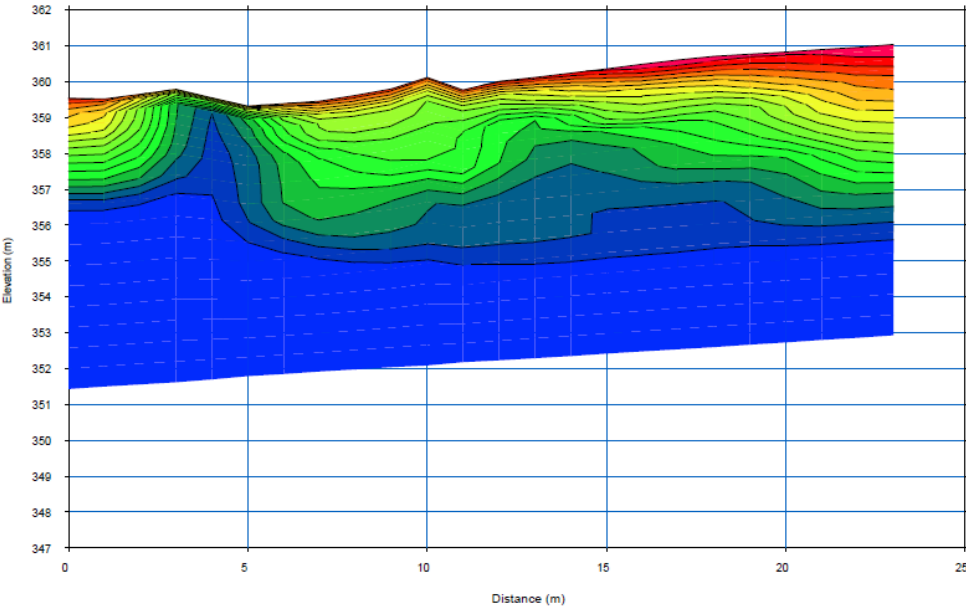
**Seismic profile T03**

Turbine; T03 foundations are recommended to be constructed below 396mOD within the bedrock. Bases on the rock mass characteristic at the turbine location an allowable bearing pressure of 215kPa is recommended.



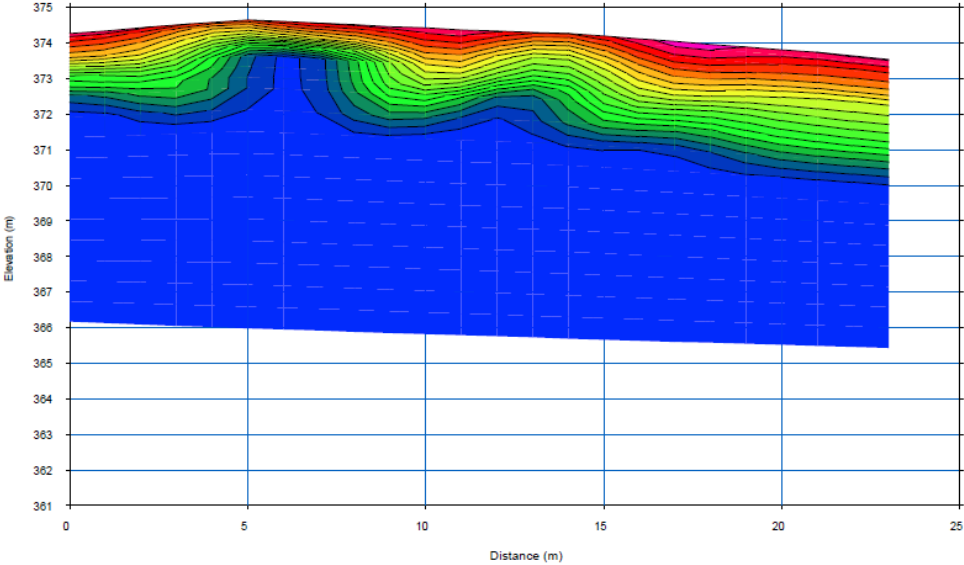
**Seismic profile T04**

Turbine; T04 foundations are recommended to be constructed below 379.5mOD within the bedrock. Note the rotary borehole appears to be at a location at a higher elevation. Bases on the rock mass characteristic at the turbine location an allowable bearing pressure of 130kPa is recommended.



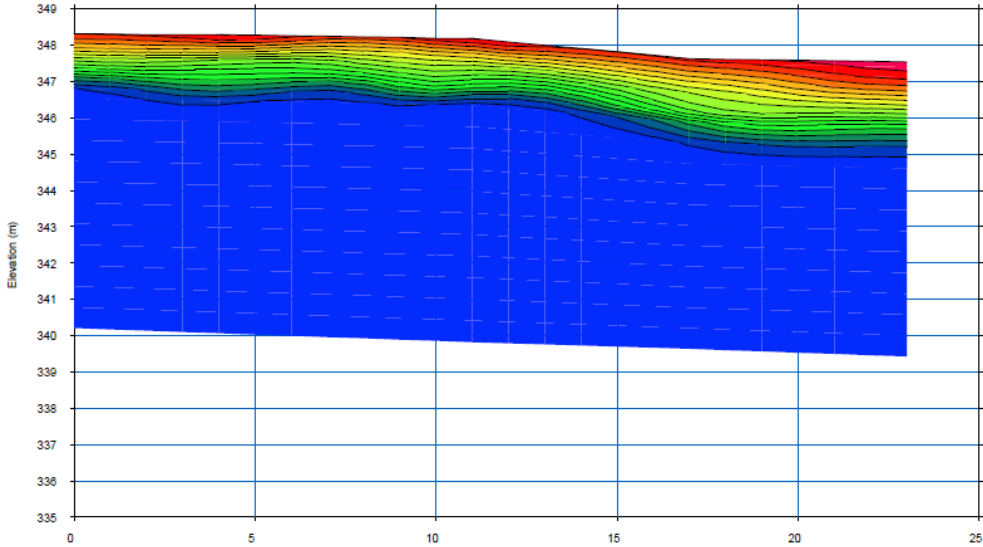
**Seismic profile T05**

Turbine; T05 foundations are recommended to be constructed below 359mOD within the bedrock. Bases on the rock mass characteristic derived from geophysical investigation at the turbine location an allowable bearing pressure of 130kPa is recommended.



**Seismic profile T06**

Turbine; T06 foundations are recommended to be constructed below 373mOD within the bedrock. Bases on the rock mass characteristic derived from geophysical investigation at the turbine location an allowable bearing pressure of 195kPa is recommended.



**Seismic profile T07**

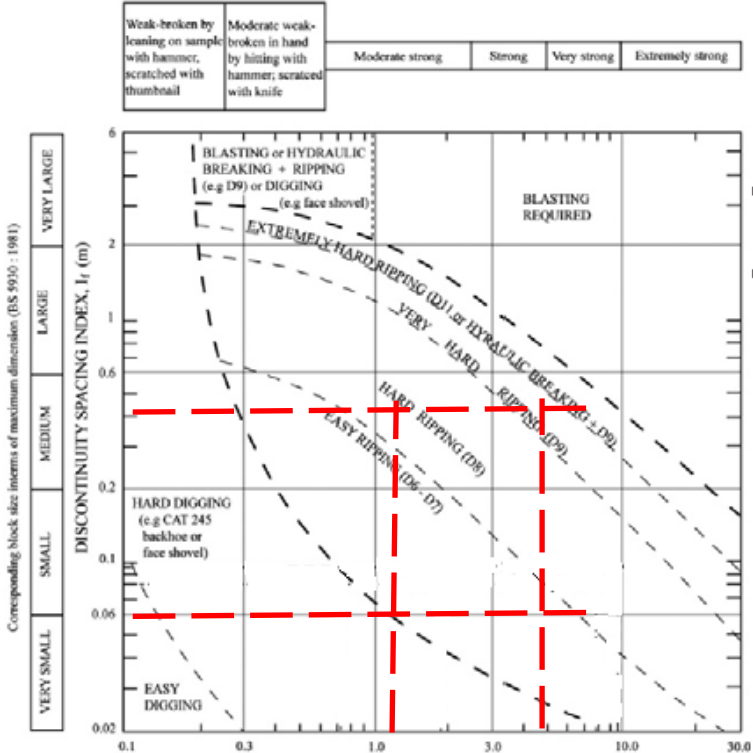
Turbine; T07 foundations are recommended to be constructed below 347mOD within the bedrock. Bases on the rock mass characteristic derived from geophysical investigation at the turbine location an allowable bearing pressure of 215kPa is recommended.

In all cases T01 – T07, the recommended lower limit of allowable bearing pressure exceeds the minimum requirement for the proposed foundation design where the foundations are constructed within the rock mass.

It is recommended at construction phase that plate bearing tests are carried out to verify the bearing pressure and assess the Modulus of the rock mass at foundation level.

**6.5.1.1 Excavation**

Excavation where required shall be by means of hydraulic excavator with hydraulic ripping and some hydraulic breaking in the upper zone of the slightly weathered rock. The energy requirement has not been assessed but can be expected to vary with location and depth. The rates of excavation at turbines; T02 and T03 will be reduced where fracture spacing and RQD was greater.



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### **6.5.2 Substation**

Silty sandy GRAVEL/ slightly sandy gravelly SILT was identified below a depth 0.55m bgl to 1.1m bgl TRL probing indicated CBR22% indicative of medium dense granular deposits or firm to stiff cohesive deposits.

TPS3 at a depth 1.1m bgl yielded a  $w/PL = 1$  indicative of undrained shear strength 75kPa (C504 figure 5.19). An ultimate bearing pressure of 385kPa is expected. This should be verified by direct measurement using plate loading tests to determine soil strength. A safe bearing pressure of 75kPa is recommended (BS8004; Code of practice for Foundations; 1986) for settlements up to 25mm below a depth 1.0m bgl where the Silt fraction (17% to 44%) is considered dominant in terms of soil behaviour. Traditional shallow foundations will be suitable for the sub-station structure.

## **6.6 GROUNDWATER**

Control of groundwater will be required during road construction. Appropriate drainage shall be provided to keep groundwater below formation level. Perched groundwater flow can be expected within the peaty deposits over the Silt.

## **6.7 CHEMICAL**

pH and sulphate data indicated the site to be characterised by design sulphate class DS-1 in accordance with BRE special digest 1 (2003) concrete in aggressive ground or XA1 in accordance with IS EN 206.

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## 7 REGISTER OF GEOTECHNICAL HAZARDS

Geotechnical hazards comprise of;

- Poor formation in the existing roadway;
- Localised soft extremely high plasticity compressible organic deposits, excessive rutting, long term settlement;
- Perched groundwater flow;
- Localised shallow bedrock, excavation in rock and
- Varied weathering profile of the rock mass.

The exact extents associated with the geo-hazards identified are not fully defined specifically the deeper Peat deposit associate with TP12.

---

## 8 SUMMARY

1. The turbine sites were characterised by dark brown to black PEAT, peaty CLAY and slightly sandy (slightly) gravelly SILT with varied Cobble content deposits 1.55m thick to 1.65m thick overlying bedrock. Medium strong to strong SILTSTONE was encountered 1.55m bgl (T03) to 1.65m bgl (T01). Sandstone was found to underlie the Siltstone at T01 and T04, below 4.5m bgl to 5.05m bgl. Strong SANDSTONE was encountered at 1.55m bgl (BHT02). Firm to stiff slightly sandy gravelly SILT overlay Bedrock 0.8m to 1.5m bgl at turbines; T05 to T07.
2. The access road was characterised by mixed deposits. Topsoil (slightly sandy slightly gravelly SILT/ clayey PEAT and PEAT, 150mm to 900mm thick, overlay silty sandy with varied Cobble content deposits 600mm to 1.55m thick and soft becoming firm to stiff, slightly sandy slightly gravelly SILT with varied Cobble content, 650mm to 2.7m thick. The Gravels and Silts were underlain by shallow bedrock 0.75m bgl to 2.3m bgl.
3. Clayey PEAT was encountered 2.0m deep at location TP12.
4. TRL dynamic probing was carried out at the thirty two (32) number trial pit locations providing for an estimate of unadjusted California bearing ratio, CBR. The data is presented in **APPENDIX A** of this report.
5. Dynamic probing DPH was carried out at eight (8) number locations along the existing access roadway from Castledonovan. The data is presented in **APPENDIX A** of this report.
6. A non-intrusive geophysical survey utilising Resistivity Soundings, Seismic Refraction Profiling and Multi-Channel Analysis of Surface Wave (MASW) at 7 proposed turbine locations techniques were carried out by PGL. A report ref: P16177\_GP\_Rp\_F01, *March, 2017*, is presented within **APPENDIX B** of this report.
7. Groundwater was encountered between depths of 0.0 m bgl (ground level) and 2.0m bgl in trial pit excavations. Details are summarised herein and presented on the relevant trial pit logs presented in **APPENDIX A** of this report.
8. No groundwater was encountered during rotary drilling at the turbine locations. No standpipe wells were installed, see Section 5.



- 
9. Perched groundwater flow can be expected within the peaty deposits over the Silt.
  10. Detailed records of the ground and groundwater conditions can be found on the exploratory logs and photographic records presented within **APPENDIX A** of this report. Further details of the ground conditions can be found in the geophysical survey report presented within **APPENDIX B** of this report.
  11. Laboratory testing was undertaken to determine the classification, engineering properties of the soil and rock encountered during the site investigation. The data is presented in **APPENDIX C** of this report.
  12. The exploratory locations are presented on the location plans presented within **APPENDIX D** of this report.
  13. The Peat (CE) deposits are expected to be highly compressible. Historical in situ hand vane tests (*Others, 2010*) indicated undrained shear strengths 16kPa to 34kPa describing very soft to soft deposits.
  14. The Silt (ML) was described as soft to 'firm to stiff' deposits. The soft deposits were present to depths up to 1.3m bgl at locations; *TP04*, TP05, TP06, *TP07*, TP11, TP13, TP15, TP17, TP18, *TP19*, TP03A and *TPS3*. Undrained shear strengths are expected to vary between 20kPa and >75kPa. Plasticity data indicated a friction angle,  $\phi = 26^\circ$ .
  15. The SILT and GRAVEL shall be considered a singular deposit - mixed glacial till.
  16. The rock mass rating, RMR range was 44 - 64. The Siltstone and Sandstone bedrock was classified as Class III-II fair to good rock with unit weight 2.71Mg/m<sup>3</sup>. A Poisson's ratio,  $\nu$  was measured = 0.215. The intact Young's Modulus, E was 55.7GPa. Allowing for the non-intact nature of the rock mass this was reduced by a factor of 0.15 yielding a design modulus of 8.4GPa. A friction angle between 30° and 35° with cohesion 250kPa to 300kPa are recommended.
  17. The Sandstone and Siltstone is expected to be suitable for re-use as capping with 50kN < 10%FV < 130kN and MSSV <25%.

- 
18. For settlement of the order 3mm/m at the proposed turbine locations, an allowable bearing pressure of 130kPa to 255kPa is recommended.
  19. A safe bearing pressure of 75kPa is recommended below a depth 1.0m bgl for foundations associated with the sub-station infrastructure.
  20. Excavation shall be by means of hydraulic excavator with hydraulic ripping and some hydraulic breaking in the upper zone of the slightly weathered rock. The rates of excavation at turbines; T02 and T03 will be reduced where fracture spacing and RQD was greater.
  21. A capping requirement of 600mm is recommended for pavement design. No capping is required where the subgrade is on weathered rock, 150mm of surfacing cl. 804 sub-base or similar is recommended. A summary of the CBR assessment is provided in **APPENDIX E**.
  22. 'Reversal road' construction shall be considered where the weathered rock mass was at depths <1.0m bgl. Shallow road cuttings are also recommended. A minimum road width at formation of 7m is expected in shallow cutting and through Peat deposits. Drainage shall be provided a minimum of 450mm below sub-formation, the underside of capping
  23. A CBR<sub>2%</sub> is expected to varied depths between 1.0m bgl and 2.0m bgl along the existing roadway as assessed by dynamic probes DP(H); DP01 to DP08.
  24. The site was characterised by design sulphate class DS-1 in accordance with BRE special digest 1 (2003) concrete in aggressive ground or XA1 in accordance with IS EN 206.
  25. A summary register of geotechnical hazards has been provided.
  26. A number of recommendations are made with regard to quality control and verifying design details at construction phase, typically requiring *in situ* plate loading testing.

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## APPENDIX A

### EXPLORATORY HOLE AND PHOTOGRAPHIC RECORDS

Rotary boreholes	BHT01, BHT02, BHT03 and BHT04 <sup>5</sup> .
Trial pit excavations/ TRL dynamic probes	TP01A, TP02A TP03A, TP04A, TP05A, TP06A and TP07A.  TP01, TP02, TP03, TP04, TP05 <sup>6</sup> ,TP06, TP07, TP08, TP09, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21 and TP22.  TPS1, TPS2 and TPS3.  DCP01A, DCP02A, DCP03A, DCP04A, DCP05A, DCP06A and DCP07A.  DCP01, DCP02, DCP03, DCP04, DCP05, DCP06, DCP07, DCP08, DCP09, DCP10, DCP11, DCP12, DCP13, DCP14, DCP15, DCP16, DCP17, DCP18, DCP19, DCP20, DCP21 and DCP22.  DCPS1, DCPS2 and DCPS3.
Dynamic probes, DP(H)	DP01, DP02, DP03, DP04, DP05, DP06, DP07 and DP08.

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<sup>5</sup> Rotary boreholes at turbines T05 – T07 were removed from the scope of works.

<sup>6</sup> No photographic record is available for TP05.

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# KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

## DESCRIPTIONS

\*\* Drillers Description  
Friable Easily crumbled

## SAMPLES

U( ) Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler  
U( )F, U( )P F- not recovered, P-partially recovered  
U38 Undisturbed 38mm diameter sample  
P(F), (P) Piston sample - disturbed  
B Bulk sample - disturbed  
D Jar Sample - disturbed  
W Water Sample  
CBR California Bearing Ratio mould sample  
ES Chemical Sample for Contamination Analysis  
SPTLS Standard Penetration Test S lump sample from split sampler

## CORE RECOVERY AND ROCK QUALITY

TCR Total Core Recovery (% of Core Run)  
SCR Solid Core Recovery (length of core having at least one full diameter as % of core run)  
RQD Rock Quality Designation (length of solid core greater than 100mm as % of core run)  
Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column  
lf Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery  
AZCL Assumed Zone of Core Loss  
NI Non intact

## GROUNDWATER

▽ Groundwater strike  
▼ Groundwater level after standing period  
Date/Water Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

## INSITU TESTING

S Standard Penetration Test - split barrel sampler  
C Standard Penetration Test - solid 60° cone  
SW Self Weight Penetration  
Ivp, HVp (R) In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength  
K(F), (C), (R), (P) Permeability Test  
HP Hand Penetrometer Test

## MEASURED PROPERTIES

N Standard Penetration Test - blows required to drive 300mm after seating drive  
x/y Denotes x blows for y mm within the Standard Penetration Test  
x\*/y Denotes x blows for y mm within the seating drive  
 $c_u$  Undrained Shear Strength ( $\text{kN/m}^2$ )  
CBR California Bearing Ratio

## ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113



Priority Geotechnical Ltd.  
Tel: 021 4631600  
Fax: 021 4638690  
www.prioritygeotechnical.ie

Borehole No.

**BHT01**

Sheet 1 of 1

Project Name: Dereenacrinnig Windfarm	Project No. P16177	Co-ords: 510906E - 551802N	Hole Type RC
Location: Drimoleague, Co. Cork.		Level: 375.64m OD	Scale 1:50
Client: Jennings O'Donovan & Partners		Dates: 28/11/2016	Logged By JMS

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max)	Coring (%)			Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
		50 (0 for 100mm/50 for 0mm) 1.65-2.65	30mm 160mm				1.65	373.99		Open hole boring. Driller described: Peat.	1
		2.65 - 3.40		85	85	0				Lithology: Moderately weak, grey SILTSTONE.	2
		3.40 - 4.15		100	91	21				Weathering: Slightly weathered with apparent loss of strength, minor oxidation colouration along fractures and minor clay smearing on fracture surfaces.	3
		4.15 - 5.35	100	93	20	26/m			Fractures: 2 sets apparent. Set 1 is dipping 0-10 degrees with planar to undulating rough to smooth fracture surfaces and close spacing. Set 2 is dipping 20-30 degrees with planar to undulating smooth fracture surfaces and close spacing.	4	
		5.35 - 6.45	100	90	20					5	
		6.45 - 7.10	100	100	0	11/m			<u>6.30 - 6.45m: Non intact.</u>	6	
										7	
						7.10	368.54		End of Borehole at 7.100m	8	
									9		

<b>Groundwater:</b>					<b>Hole Information:</b>			<b>Chiselling:</b>			
Struck, m	Rose to	After, min	Sealed	Comment	Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)	Depth Top	Depth Base	Duration	Tool
				None encountered.	7.10						
					<b>Equipment:</b> Deltabase 520						

<b>Remarks:</b> Borehole terminated at 7.10m bgl.	<b>Shift Data:</b>			
	Groundwater	Shift	Hole Depth (m)	Remarks
		28/11/2016 08:00	0.00	Start of shift.
	Dry	28/11/2016 18:00	3.40	End of shift.
	29/11/2016 08:00	3.40	Start of shift.	
	29/11/2016 18:00	7.70	End of borehole.	



Number:

BHT01

Project  
Project No  
Engineer

Dereenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners





Number:

BHT01

Project  
Project No  
Engineer






Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 510882.03 - 551794.23 <b>Level:</b> 372.69	<b>Date:</b> 22/12/2016
--	----------------------------	---	-------------------------

<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 	<b>Scale:</b> 1:25
---	---	--------------------

<b>Client:</b> Jennings O'Donovan & Partners	<b>Depth:</b> 1.25	<b>Logged:</b> VT
--	--------------------	-------------------

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20	372.49		Soft, black, slightly gravelly peaty CLAY (Topsoil).
	0.40 - 1.05 0.40 - 1.05	B D		0.40	372.29		Firm, light brown, slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, Sandstone lithology.
							Soft to firm, red brown, slightly gravelly slightly sandy SILT with medium cobble content and low boulder content. Gravel is fine to coarse., angular to sub-rounded. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology.
	1.05 - 1.25 1.05 - 1.25	B D		1.05	371.64		Soft, grey brown, slightly sandy gravelly SILT with high cobble content and high boulder content. Cobbles are angular to sub-angular, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-angular, 200-500mm Sandstone lithology. End of Pit at 1.25m
				1.25	371.44		

**Stability:** Good. **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.25m bgl, bedrock.



DCP01A in TP01A

0.0 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	0	-	0.00	-
1	32	320	0.32	0
2	36	40	0.36	4
3	37	10	0.37	22
4	38	10	0.38	22
5	39	10	0.39	22
6	39	0	0.39	
7	39	0	0.39	
8	39	0	0.39	
9	41	20	0.41	9
10	43	20	0.43	9
11	44	10	0.44	22
12	45	10	0.45	22
13	45	0	0.45	
14	45	0	0.45	
15	46	10	0.46	22
16	46	0	0.46	
17	47	10	0.47	22

10

Unadjusted CBR, %	
22	CBR, Kleyn
26	CBR, TRL

**Adjustments**

**0.71**      *moderate*  
**0.5**        *dry*  
**0.35**      *very dry*  
**0.5**        *not assessed*



**Number:**

**TP01A**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners





**Number:**

**TP01A**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



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Borehole No.

**BHT02**

Sheet 1 of 1

Project Name: Dereenacrinnig Windfarm	Project No. P16177	Co-ords: 511129E - 551861N	Hole Type RC
Location: Drimoleague, Co. Cork.		Level: 395.70m OD	Scale 1:50
Client: Jennings O'Donovan & Partners		Dates: 25/11/2016	Logged By JMS

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max)	Coring (%)			Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
[Pattern]		50 (36 for 1.35 - 1.95m, 50 for 1.95 - 2.45m) (C)	30mm 400mm				1.55	394.15	[Pattern]	Open hole boring. Driller described: Peat.	1
		1.95 - 2.45		75	0	0				[Pattern]	Lithology: Moderately strong, grey purple, fine grained SANDSTONE.
		2.45 - 3.15		100	76	26			Weathering: Slightly weathered with minor loss of strength, minor orange oxidation colouration and minor clay smearing along fracture surfaces.		3
		3.15 - 5.10		97	97	57	31/m		Fractures: 1 set dipping 15-30 degrees with planar to stepped rough fracture surfaces and close spacing. <i>1.55 - 1.95m: Non intact.</i>		4
		5.10 - 5.75		95	95	47					5
		5.75 - 7.00		100	100	25					6
				100	100	12	7.00	388.70		7	
									End of Borehole at 7.000m	8	
										9	

<b>Groundwater:</b>				<b>Hole Information:</b>			<b>Chiselling:</b>				
Struck, m	Rose to	After, min	Sealed	Comment	Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)	Depth Top	Depth Base	Duration	Tool
				None encountered.	7.00						
<b>Equipment:</b>							Deltabase 520				

<b>Remarks:</b> Borehole terminated at 7.00m bgl.	<b>Shift Data:</b>			
	Groundwater	Shift	Hole Depth (m)	Remarks
		25/11/2016 08:00	0.00	Start of shift.
	Dry	25/11/2016 18:00	2.75	End of shift.
	28/11/2016 08:00	2.75	Start of shift.	
	28/11/2016 18:00	7.00	End of borehole.	





<p>Number: BHT02</p>	<p>Project: Dereenacrinnig Wind Farm Project No: P16177 Engineer: Jennings O'Donovan &amp; Partners</p>	
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**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511125.00 - 551856.90  
**Level:** 396.25      **Date:** 22/12/2016

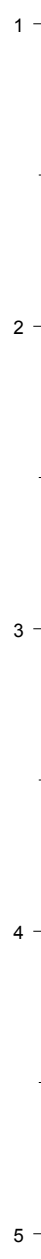
**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 3.00

**Client:** Jennings O'Donovan & Partners      **Depth:** 0.70      **Scale:** 1:25  
**Logged**

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20 - 0.70	B		0.20	396.05		Soft, dark brown black, slightly gravelly peaty CLAY. Gravel is fine to coarse, angular to rounded. (Topsoil)
	0.20 - 0.70	D		0.70	395.55		Soft, grey brown, slightly gravelly slightly sandy SILT with high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, Sandstone lithology. Cobbles are angular to sub-angular, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-angular, 200-500mm dia. Sandstone lithology.
							0.70m: Bedrock. End of Pit at 0.70m

**Stability:** Moderate.      **Groundwater:** None encountered.  
**Plant:**  
**Backfill:** Arisings.

**Remarks:** Borehole terminated at 0.70m bgl, bedrock.



DCP02A in TP02A

0.0 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	0	-	0.00	-
1	20	200	0.2	0
2	21	10	0.21	22
3	21	0	0.21	
4	22	10	0.22	22
5	24	20	0.24	9
6	25	10	0.25	22
7	25	0	0.25	
8	26	10	0.26	22
9	27	10	0.27	22
10	27	0	0.27	
11	28	10	0.28	22
12	29	10	0.29	22
13	29	0	0.29	
14	29	0	0.29	
15	29	0	0.29	

10

Unadjusted CBR, %	
22	CBR, Kleyn
26	CBR, TRL

**Adjustments**

0.71 moderate  
 0.5 dry  
 0.35 very dry  
 0.5 not assessed





<b>Number:</b> TP02A	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP02A**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



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Borehole No.

**BHT03**

Sheet 1 of 1

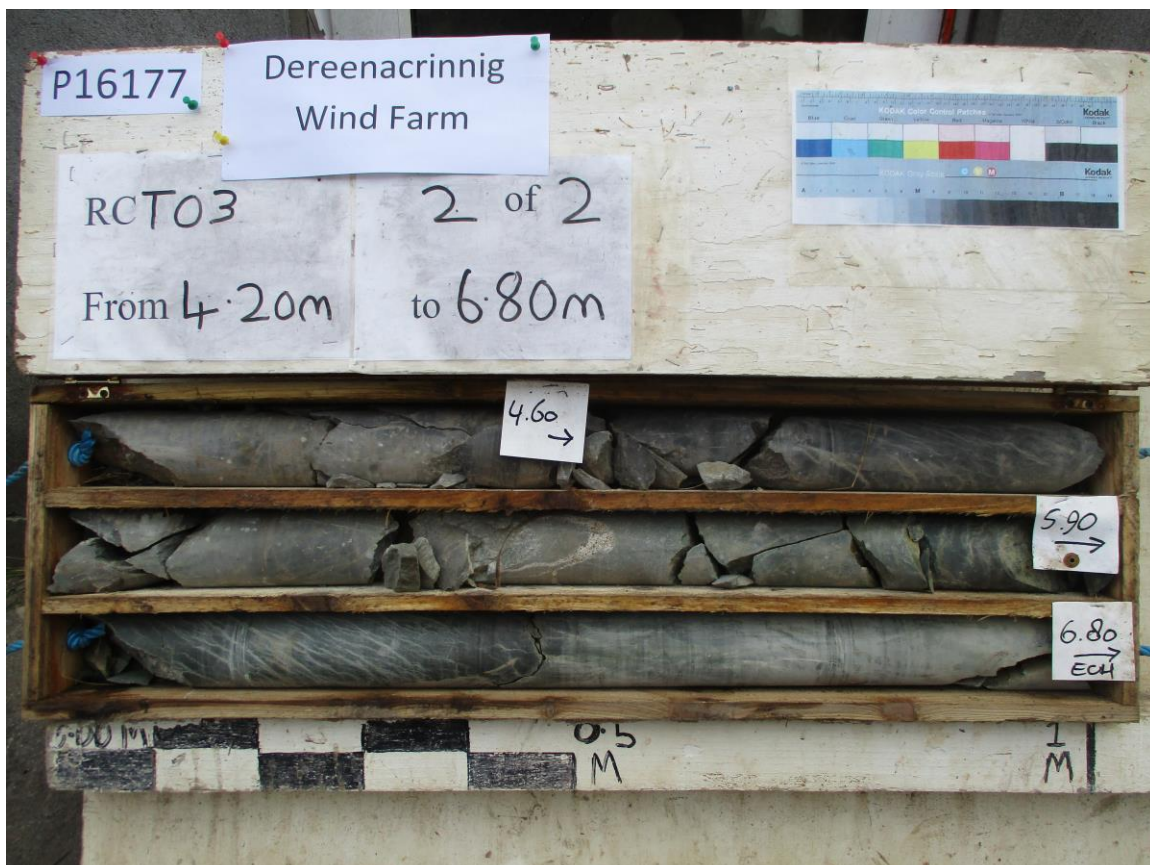
Project Name: Dereenacrinnig Windfarm	Project No. P16177	Co-ords: 511356E - 551903N	Hole Type RC
Location: Drimoleague, Co. Cork.		Level: 398.85m OD	Scale 1:50
Client: Jennings O'Donovan & Partners		Dates: 25/11/2016	Logged By JMS

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max)	Coring (%)			Depth (m) / Fl (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
[Pattern]		50 (49 for 75mm/50 for 0mm) (C) 1.55 - 2.75	30mm 80mm	100	92	0	1.55	397.30	 Open hole boring. Driller described: Peat.	1	
		2.75 - 4.00		100	100	74	10/m	 Lithology: Moderately strong, purple red SILTSTONE.  Weathering: Slightly weathered with minor loss of strength and minor orange oxidation on select surfaces.  Fractures: 2 apparent sets. Set 1 is dipping 30 to 40 degrees with planar to undulating rough fracture surfaces and close spacing. Set 2 is dipping 60 to 70 degrees with planar rough fracture surfaces and medium spacing.		2	
		4.00 - 4.60	100	92	33	4.50	394.35		3		
		4.60 - 5.90	100	100	44	21/m	5				
		5.90 - 6.80	100	100	78	6.80	392.05		6		
									 Lithology: Moderately strong, grey green fine grained SANDSTONE with minor quartz veins and minor coarse sandstone infill along fused fractures.  Weathering: Slightly weathered with minor loss of strength apparent, minor vugging on veins and minor orange oxidation on select fractures.  Fractures: 2 apparent sets. Set 1 is dipping 30 to 40 degrees with planar to undulating rough fracture surfaces and close spacing. Set 2 is dipping 60 to 70 degrees with planar rough fracture surfaces and medium spacing.	7	
								End of Borehole at 6.800m	8		
									9		

<b>Groundwater:</b>				<b>Hole Information:</b>			<b>Chiselling:</b>				
Struck, m	Rose to	After, min	Sealed	Comment	Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)	Depth Top	Depth Base	Duration	Tool
				None encountered.	6.80						
<b>Equipment:</b>							Deltabase 520				

<b>Remarks:</b> Borehole terminated at 6.80m bgl.	<b>Shift Data:</b>		Groundwater	Shift	Hole Depth (m)	Remarks
	Dry	25/11/2016 08:00	0.00	25/11/2016 18:00	6.80	Start of shift. End of borehole.





<p><b>Number:</b> BHT03</p>	<p><b>Project</b> Dereenacrinnig Wind Farm  <b>Project No</b> P16177  <b>Engineer</b> Jennings O'Donovan &amp; Partners</p>	
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<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511344.22 - 551904.85 <b>Level:</b> 399.99	<b>Date:</b> 25/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20 x 3.00	<b>Scale:</b> 1:25
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<b>Client:</b> Jennings O'Donovan & Partners	<b>Depth:</b> 1.70	<b>Logged:</b> VT
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.60 - 1.30	B		0.60	399.39		(TOPSOIL) Soft, dark brown silty PEAT.
	0.60 - 1.30	D					Firm, slightly gravelly sandy SILT with medium cobble content. Gravel is fine to coarse, angular to sub-rounded. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-150mm dia. Sandstone lithology.
	1.30 - 1.70	B		1.30	398.69		Firm to stiff, blue grey slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, Sandstone lithology. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology.
	1.30 - 1.70	D		1.70	398.29		End of Pit at 1.70m

**Stability:** Good. **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.70m bgl, bedrock.

DCP03A in TP03A

0.6 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	3	-	0.60	-
1	2	20	0.62	9
2	2	20	0.62	9
3	3	30	0.63	5
4	16	160	0.76	1
5	4	40	0.64	4
6	1	10	0.61	22
7	4	40	0.64	4
8	2	20	0.62	9
9	1	10	0.61	22
10	2	20	0.62	9
11	1	10	0.61	22
12	1	10	0.61	22

**30**

**Unadjusted CBR, %**

**9**      *CBR, Kleyn*

**8**      *CBR, TRL*

***Adjustments***

***0.71***      ***moderate***

***0.5***      ***dry***

***0.35***      ***very dry***

***0.5***      ***not assessed***



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Borehole No.

**BHT04**

Sheet 1 of 1

Project Name: Dereenacrinnig Windfarm	Project No. P16177	Co-ords: 511565E - 551958N	Hole Type RC
Location: Drimoleague, Co. Cork.		Level: 384.06m OD	Scale 1:50
Client: Jennings O'Donovan & Partners		Dates: 23/11/2016	Logged By JMS

Well	Water Strike (m)	Depth (m)	Type /Fs (min, max)	Coring (%)			Depth (m) / FI (/m)	Level (mOD)	Legend	Stratum Description	
				TCR	SCR	RQD					
[Pattern]		50 (18,21/50 for 0mm) (C)					1.60	382.46	[Pattern]	Open hole boring. Driller described: Peat.	1
		1.60 - 3.15	20mm 90mm	100	87	0	5/m		[Pattern]	Lithology: Moderately weak, purple grey SILTSTONE.  Weathering: Slightly weathered with apparent loss of strength, minor oxidation colouration and minor clay smearing on fracture surfaces.  Fractures: 3 sets apparent. Set 1 is dipping 5-15 degrees with planar to undulating rough fracture surfaces and close spacing. Set 2 is dipping circa 30 degrees with planar to stepped smooth fracture surfaces and close spacing. Set 3 is dipping circa 40 degrees with planar rough fracture surfaces and close spacing. <i>2.50 - 2.60m: Mostly non intact.</i> <i>3.00 - 3.15m: Mostly non intact.</i>	2
		3.15 - 3.65		100	73	0			[Pattern]		3
		3.65 - 5.05	40mm 120mm	100	93	9	16/m		[Pattern]		4
		5.05 - 5.60		100	91	0	5.05	379.01	[Pattern]	Lithology: Moderately strong, green grey fine grained SANDSTONE with quartz veins.  Weathering: Slightly weathered with vugging on veins, orange oxidation colouration along fracture surfaces and minor clay smearing. Green oxidation colouration on select fracture surfaces.	5
		5.60 - 6.70	40mm 90mm	100	100	0	14/m	6.70	377.36	[Pattern]	Fractures: 3 sets apparent. Set 1 is dipping 5-15 degrees with planar to undulating rough fracture surfaces and close spacing. Set 2 is dipping circa 30 degrees with planar to stepped smooth fracture surfaces and close spacing. Set 3 is dipping circa 40 degrees with planar rough fracture surfaces and close spacing. End of Borehole at 6.700m
											7
											8
											9

<b>Groundwater:</b>					<b>Hole Information:</b>			<b>Chiselling:</b>			
Struck, m	Rose to	After, min	Sealed	Comment	Hole Depth (m)	Hole Dia (mm)	Casing Dia (mm)	Depth Top	Depth Base	Duration	Tool
				None encountered.	6.70						
					<b>Equipment:</b> Deltabase 520						

<b>Remarks:</b> Borehole terminated at 6.70m bgl.	<b>Shift Data:</b>			
	Groundwater	Shift	Hole Depth (m)	Remarks
		23/11/2016 08:00	0.00	Start of shift.
	Dry	23/11/2016 18:00	3.15	End of shift.
	24/11/2016 08:00	3.15	Start of shift.	
	24/11/2016 18:00	6.70	End of borehole.	





<p>Number: BHT04</p>	<p>Project: Dereenacrinnig Wind Farm Project No: P16177 Engineer: Jennings O'Donovan &amp; Partners</p>	
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Number:

BHT04

Project  
Project No  
Engineer

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Trial Pit No  
**TP04A**  
 Sheet 1 of 1

**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511559.33 - 551956.84  
**Level:** 384.52      **Date:** 25/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 3.00

**Client:** Jennings O'Donovan & Partners      **Depth:** 1.05      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30 - 1.00 0.30 - 1.00	B D		0.22	384.30		(TOPSOIL) Soft, dark brown black, slightly gravelly clayey PEAT.
				1.05	383.47		Firm to stiff, slightly sandy slightly gravelly SILT with medium cobble content and low boulder content. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-angular, 200-400mm dia. Sandstone lithology.
							End of Pit at 1.05m

**Stability:** Good.      **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.05m bgl, bedrock.

DCP04A in TP04A

0.2 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	10	-	0.20	-
1	8	80	0.28	2
2	7	70	0.27	2
3	0	0	0.2	
4	4	40	0.24	4
5	9	90	0.29	1
6	5	50	0.25	3
7	2	20	0.22	9
8	1	10	0.21	22
9	1	10	0.21	22
10	1	10	0.21	22
11	1	10	0.21	22
12	0	0	0.2	

50

Unadjusted CBR, %		
2	CBR, Kleyn	22
5	CBR, TRL	

**Adjustments**

**0.71**      *moderate*  
**0.5**        *dry*  
**0.35**       *very dry*  
**0.5**        *not assessed*



<b>Number:</b> TP04A	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511798.49 - 552076.53 <b>Level:</b> 358.72	<b>Date:</b> 22/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20 x 3.20	<b>Scale:</b> 1:25
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<b>Client:</b> Jennings O'Donovan & Partners	<b>Depth:</b> 1.50	<b>Logged:</b> VT
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.00 - 0.80	B		0.50	358.22		Dark brown black, peaty CLAY. (Topsoil)
	0.00 - 0.80	D					Dark brown black, peaty CLAY with low cobble content. Cobbles are 63mm to 200mm dia, angular to sub-rounded.
	0.80 - 1.50	B		0.80	357.92		Firm, grey blue, slightly sandy gravelly SILT with medium cobble content, low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular. Cobbles are 63mm to 200mm dia, angular to sub-rounded, Sandstone lithology. Boulders are 200mm to 550mm dia, angular to sub-rounded, Sandstone lithology.
	0.80 - 1.50	D					End of Pit at 1.50m
			1.50	357.22			

**Stability:** Good. **Groundwater:** Trickle flow rate.  
**Plant:** 12T track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.50m bgl due to obstruction.

DCP05A in TP05A

0.5 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	4	-	0.50	-
1	2	20	0.52	9
2	3	30	0.53	5
3	3	30	0.53	5
4	3	30	0.53	5
5	2	20	0.52	9
6	2	20	0.52	9
7	0	0	0.5	
8	2	20	0.52	9
9	2	20	0.52	9
10	2	20	0.52	9
11	2	20	0.52	9
12	1	10	0.51	22

20

Unadjusted CBR, %

9 CBR, Kleyn

12 CBR, TRL

*Adjustments*

*0.71 moderate*

*0.5 dry*

*0.35 very dry*

*0.5 not assessed*





**Number:**

**TP05A**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
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**Number:**

**TP05A**

**Project**  
**Project No**  
**Engineer**

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Trial Pit No  
**TP06A**  
 Sheet 1 of 1

**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511542.07 - 552109.44  
**Level:** 377.39      **Date:** 24/11/2016

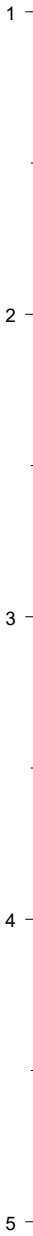
**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 3.50

**Client:** Jennings O'Donovan & Partners      **Depth:** 0.80      **Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20 - 0.80	B		0.17	377.22		(TOPSOIL) Dark brown black, gravelly clayey PEAT. Gravel is fine to coarse, angular to sub-angular, Sandstone lithology.
	0.20 - 0.80	D					Firm, light brown grey, slightly gravelly slightly sandy SILT with medium cobble content. Gravel is fine to coarse, angular to sub-rounded. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology.
				0.80	376.59		End of Pit at 0.80m

**Stability:** Moderate.      **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 0.80m bgl, bedrock.





Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	6	-	0.20	-
1	7	70	0.27	2
2	8	80	0.35	2
3	4	40	0.39	4
4	4	40	0.43	4
5	2	20	0.45	9
6	2	20	0.47	9
7	2	20	0.49	9
8	3	30	0.52	5
9	1	10	0.53	22
10	1	10	0.54	22
11	2	20	0.56	9
12	1	10	0.57	22
13	0	0	0.57	
14	1	10	0.58	22
15	1	10	0.59	22
16	0	0	0.59	
17	1	10	0.6	22
18	1	10	0.61	22
19	2	20	0.63	9
20	0	0	0.63	

35

## Unadjusted CBR, %

5	CBR, Kleyn	22
7	CBR, TRL	

**Adjustments**

<b>0.71</b>	<b>moderate</b>
<b>0.5</b>	<b>dry</b>
<b>0.35</b>	<b>very dry</b>
<b>0.5</b>	<b>not assessed</b>



<b>Number:</b> TP06A	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP06A**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511760.44 - 552193.89  
**Level:** 348.45      **Date:** 24/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 3.60

**Client:** Jennings O'Donnovan & Partners      **Depth:** 1.20      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30 - 1.10	B		0.28	348.17		(TOPSOIL) Dark brown black, slightly gravelly PEAT. Gravel is fine to medium, angular to sub-angular Sandstone lithology.
	0.30 - 1.10	D					Firm to stiff, light brown grey, slightly sandy gravelly SILT with medium cobble content. Gravel is fine to coarse, angular to sub-angular. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone and Siltstone lithology.
				1.20	347.25		End of Pit at 1.20m

**Stability:** Good.      **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.20m bgl, bedrock.

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	5	-	0.30	-
1	3	30	0.33	5
2	4	40	0.37	4
3	2	20	0.39	9
4	2	20	0.41	9
5	2	20	0.43	9
6	2	20	0.45	9
7	3	30	0.48	5
8	1	10	0.49	22
9	3	30	0.52	5
10	1	10	0.53	22
11	3	30	0.56	5
12	1	10	0.57	22
13	0	0	0.57	
14	1	10	0.58	22
15	1	10	0.59	22
16	1	10	0.6	22
17	0	0	0.6	
18	1	10	0.61	22
19	1	10	0.62	22
20	1	10	0.63	
21	1	10	0.64	
22	1	10	0.65	
23	1	10	0.66	
24	1	10	0.67	
25	1	10	0.68	

20

## Unadjusted CBR, %

9	CBR, Kleyn	22
13	CBR, TRL	

## Adjustments

0.71	moderate
0.5	dry
0.35	very dry
0.5	not assessed





<b>Number:</b> TP07A	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP07A**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



Priority Geotechnical Ltd.  
 Tel: 021 4631600  
 Fax: 021 4638690  
 www.prioritygeotechnical.ie

Trial Pit No  
**TP01**  
 Sheet 1 of 1

**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 510809.58 - 550969.85  
**Level:** 216.32      **Date:** 24/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.00 x 1.20

**Client:** Jennings O'Donnovan & Partners      **Depth:** 0.90      **Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.30 - 0.90	B		0.30	216.02		(TOPSOIL) Firm, brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded.
	0.30 - 0.90	D					Light brown grey, silty sandy GRAVEL with medium cobble content and medium boulder content. Gravel is fine to coarse, angular to sub-angular, Sandstone lithology. Boulders are angular to sub-angular, 63-600mm dia. Sandstone lithology.
				0.90	215.42		End of Pit at 0.90m

**Stability:** Moderate.      **Groundwater:** Water strike at 0.80m bgl. Trickle flow rate.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 0.90m bgl, bedrock.



DCP01 in TP01

0.42 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	12	-	0.42	-
1	4	40	0.46	4
2	2	20	0.48	9
3	1	10	0.49	22
4	5	50	0.54	3
5	8	80	0.62	2
6	3	30	0.65	5
8	1	5	0.66	53
9	2	20	0.68	9
10	1	10	0.69	22
11	1	10	0.70	22
12	1	10	0.71	22
13	2	20	0.73	9
14	2	20	0.75	9
16	1	5	0.76	53
18	1	5	0.77	53
19	0	0	0.77	-

20

**Unadjusted CBR, %**

**9**      *CBR, Kleyn*

**12**     *CBR, TRL*

**Adjustments**

**0.71**      *moderate*

**0.5**        *dry*

**0.35**      *very dry*

**0.5**        *not assessed*



**Number:**

**TP01**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners





**Number:**

**TP01**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



Priority Geotechnical Ltd.  
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 www.prioritygeotechnical.ie

Trial Pit No  
**TP02**  
 Sheet 1 of 1

**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 510891.98 - 550989.76  
**Level:** 225.10      **Date:** 24/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 2.10 x 1.20

**Client:** Jennings O'Donovan & Partners      **Depth:** 2.10      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20 - 0.85 0.20 - 0.85	B D		0.20	224.90		(TOPSOIL) Firm, brown, slightly gravelly slightly sandy SILT. Sand is fine to coarse.
							Firm, light brown orange, slightly sandy slightly gravelly SILT with high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology., Boulders are angular to sub-angular, 200-500mm dia. Sandstone lithology.
	0.90 - 2.10 0.90 - 2.10	B D		0.85	224.25		Grey brown green, very silty very sandy GRAVEL. Gravel is fine to coarse, angular to sub-rounded. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-angular, 200-5600mm dia. Sandstone lithology.
				2.10	223.00		End of Pit at 2.10m

**Stability:** Good.      **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 2.10m bgl, bedrock.

DCP02 in TP02

0.34 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	4	-	0.34	-
1	8	80	0.42	2
2	4	40	0.46	4
3	9	90	0.55	1
4	3	30	0.58	5
5	1	10	0.59	22
6	1	10	0.6	22
8	2	10	0.62	22
9	1	10	0.63	22
10	1	10	0.64	22
11	1	10	0.65	22
13	1	5	0.66	53
15	1	5	0.67	53
17	1	5	0.68	53
18	0	0	0.68	-

10

**Unadjusted CBR, %**

**22**     *CBR, Kleyn*

**26**     *CBR, TRL*

**Adjustments**

**0.71**     *moderate*

**0.5**     *dry*

**0.35**     *very dry*

**0.5**     *not assessed*





<b>Number:</b> TP02	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Number:</b> TP02	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511062.64 - 551016.87 <b>Level:</b> 233.01	<b>Date:</b> 24/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 	<b>Scale:</b> 1:25
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<b>Client:</b> Jennings O'Donnovan & Partners	<b>Depth:</b> 2.30	<b>Logged:</b> VT
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20 - 0.40 0.20 - 0.40	B D		0.18	232.83		(TOPSOIL) Firm, brown, slightly gravelly slightly sandy SILT. Gravel is fine to coarse, angular to sub-rounded, Sandstone lithology. Sand is fine to coarse.
	0.40 - 1.40 0.40 - 1.40	B D		0.40	232.61		Firm, light brown, slightly gravelly sandy SILT with low cobble content. Gravel is fine to coarse, angular to sub-angular, Sandstone lithology. Sand is fine to coarse. Cobbles are angular to sub-rounded, Sandstone lithology.
	1.40 - 2.30 1.40 - 2.30	B D		1.40	231.61		Firm, grey brown, slightly gravelly sandy SILT with medium cobble content and low boulder content. Gravel is fine to coarse, angular to sub-rounded, Sandstone lithology. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-rounded, 200-500mm dia. Sandstone lithology.
							Silty very sandy GRAVEL with medium cobble content.
				2.30	230.71		End of Pit at 2.30m

**Stability:** Good. **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 2.30m bgl, bedrock.

DCP03 in TP03

0.25 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	5	-	0.25	-
1	4	40	0.29	4
2	4	40	0.33	4
3	2	20	0.35	9
6	1	3	0.36	89
7	2	20	0.38	9
8	1	10	0.39	22
9	3	30	0.42	5
10	1	10	0.43	22
11	1	10	0.44	22
12	15	150	0.59	1
13	5	50	0.64	3
14	4	40	0.68	4
15	3	30	0.71	5
16	2	20	0.73	9
17	3	30	0.76	5
18	1	10	0.77	22
19	2	20	0.79	9
20	2	20	0.81	9
21	1	10	0.82	22
22	0	0	0.82	-

30

Unadjusted CBR, %	
9	CBR, Kleyn
8	CBR, TRL

**Adjustments**

**0.71**      *moderate*  
**0.5**        *dry*  
**0.35**       *very dry*  
**0.5**        *not assessed*





<b>Number:</b> TP03	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Number:</b> TP03	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511093.42 - 551120.27 <b>Level:</b> 235.97	<b>Date:</b> 24/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20 x 3.00	<b>Scale:</b> 1:25
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<b>Client:</b> Jennings O'Donnovan & Partners	<b>Depth:</b> 1.70	<b>Logged:</b> VT
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40 - 1.00 0.40 - 1.00	B D		0.40	235.57		(TOPSOIL) Dark brown black, slightly sandy gravelly PEAT. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Sandstone lithology.
							Soft, light brown, slightly gravelly sandy SILT. Gravel is fine to coarse, angular to sub-rounded, Sandstone lithology.
	1.00 - 1.70 1.00 - 1.70	B D		1.00	234.97		Firm to stiff, blue grey, slightly sandy gravelly SILT with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, Sandstone lithology.
				1.70	234.27		End of Pit at 1.70m

**Stability:** Good. **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.70m bgl, bedrock.



DCP04 in TP04

0.55 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	15	-	0.55	-
1	24	240	0.79	0
2	7	70	0.86	2
3	2	20	0.88	9
4	6	60	0.94	2
5	3	30	0.97	5
6	4	40	1.01	4
10	0	-	-	-

50

**Unadjusted CBR, %**

3      *CBR, Kleyn*  
5      *CBR, TRL*

**Adjustments**

**0.71**      *moderate*  
**0.5**      *dry*  
**0.35**      *very dry*  
**0.5**      *not assessed*



**Number:**

**TP04**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



<b>Number:</b> TP04	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511197.23 - 551249.71  
**Level:** 243.22      **Date:** 23/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 5.00

**Client:** Jennings O'Donovan & Partners      **Depth:** 1.30      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40 - 1.30	B		0.40	242.82		(TOPSOIL) Firm, dark brown black, clayey PEAT.
	0.40 - 1.30	D		1.30	241.92		Soft, brown grey, slightly sandy gravelly SILT with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Sandstone lithology. Cobbles are angular to sub-rounded, 63-200mm dia. Siltstone lithology. Boulders are angular to sub-rounded, 200-1500mm dia. Siltstone lithology.
							End of Pit at 1.30m

**Stability:** Poor.      **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.30m bgl, bedrock.

DCP05 in TP05

0.6 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	20	-	0.6	-
1	14	140	0.74	1
2	3	30	0.77	5
3	3	30	0.8	5
4	1	10	0.81	22
5	2	20	0.83	9
6	3	30	0.86	5
7	12	120	0.98	1
8	2	20	1	9
9	3	30	1.03	5
15	0	-	-	-

**30**

Unadjusted CBR, %	
5	CBR, Kleyn
8	CBR, TRL

**Adjustments**

**0.71**      *moderate*  
**0.5**        *dry*  
**0.35**      *very dry*  
**0.5**        *not assessed*



**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511291.55 - 551357.60  
**Level:** 256.13      **Date:** 23/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 3.00

**Client:** Jennings O'Donnovan & Partners      **Depth:** 1.20      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							(TOPSOIL) Dark brown black, clayey PEAT.
	0.40 - 0.75 0.40 - 0.75	B D		0.40	255.73		
	0.75 - 1.20 0.75 - 1.20	B B		0.75	255.38		Soft to firm, slightly gravelly sandy SILT with high cobble content. Gravel is fine to coarse. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology.
				1.20	254.93		Firm, light blue grey, slightly gravelly slightly sandy SILT with medium cobble content and low boulder content. Gravel is fine to coarse, angular to sub-rounded. Sandstone lithology. Sand is fine to coarse. Cobbles are angular to sub-rounded, 60-200mm dia. Sandstone lithology. Boulders are angular to sub-rounded, 200-600mm dia. Siltstone and Sandstone lithology. End of Pit at 1.20m

**Stability:** Good.      **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.20m bgl, bedrock.



Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	13	-	0.53	-
1	6	60	0.59	2
2	2	20	0.61	9
3	2	20	0.63	9
4	4	40	0.67	4
5	4	40	0.71	4
6	1	10	0.72	22
7	1	10	0.73	22
8	1	10	0.74	22
11	2	7	0.76	37
13	5	25	0.81	7
21	1	1	0.82	309
30	1	1	0.83	359
35	0	0	0.83	-

15

## Unadjusted CBR, %

16 CBR, Kleyn

17 CBR, TRL

*Adjustments**0.71 moderate**0.5 dry**0.35 very dry**0.5 not assessed*



<b>Number:</b> TP06	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP06**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511382.47 - 551532.85  
**Level:** 286.25      **Date:** 23/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 3.00

**Client:** Jennings O'Donnovan & Partners      **Depth:** 2.10      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼							(TOPSOIL) Dark brown black, slightly gravelly clayey PEAT.	
	0.60 - 1.30 0.60 - 1.30	B D		0.60	285.65		Firm, light brown, slightly gravelly sandy SILT with medium cobble content and medium boulder content. Gravel is fine to coarse, angular to sub-rounded. Sandstone lithology. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-angular 200-1000mm dia. Sandstone lithology.	1
	1.30 - 2.10 1.30 - 2.10	B D		1.30	284.95		Firm to stiff, blue grey, slightly gravelly sandy SILT with medium cobble content and low boulder content. Gravel is fine to coarse, angular to sub-rounded. Sandstone lithology. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-rounded, 200-600mm dia. Sandstone lithology.	2
				2.10	284.15		End of Pit at 2.10m	3 4 5

**Stability:** Good to moderate.      **Groundwater:** Water strike at 0.10m bgl. Steady flow rate.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 2.10m bgl, bedrock.

DCP07 in TP07

0.88 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	28	-	0.88	-
1	9	90	0.97	1
2	3	30	1	5
3	3	30	1.03	5
4	5	50	1.08	3
5	4	40	1.12	4
6	1	10	1.13	22
7	6	60	1.19	2
8	2	20	1.21	9
9	2	20	1.23	9
10	2	20	1.25	9
11	2	20	1.27	9
12	1	10	1.28	22
20	0	0	1.28	-

25

**Unadjusted CBR, %**

7      *CBR, Kleyn*

10     *CBR, TRL*

**Adjustments**

**0.71**      *moderate*

**0.5**        *dry*

**0.35**      *very dry*

**0.5**        *not assessed*





<b>Number:</b> TP07	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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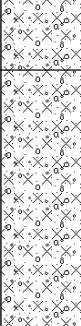


<b>Number:</b> TP07	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511449.24 - 551596.66 <b>Level:</b> 293.53	<b>Date:</b> 23/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donnovan & Partners	<b>Depth:</b> 1.60	<b>Logged:</b> VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50 - 0.75 0.50 - 0.75	B D		0.50	293.03		(TOPSOIL) Firm to stiff, dark brown black, slightly gravelly clayey PEAT with low cobble content. Gravel is fine to coarse, angular to sub-rounded. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology.
	0.80 - 1.60 0.80 - 1.60	B B		0.75	292.78		Firm to stiff, light brown green, slightly gravelly slightly sandy SILT. Gravel is fine to coarse, angular to sub-rounded. Sand is fine to coarse.
				1.60	291.93		Firm, blue green, slightly sandy gravelly SILT with medium cobble content and low boulder content. Gravel is fine to coarse, angular to sub-rounded. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-rounded, 200-500mm dia. Sandstone lithology.
							End of Pit at 1.60m

**Stability:** Good to moderate.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Groundwater:** None encountered.

**Remarks:** Trial pit terminated at 1.60m bgl, bedrock.

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	9	-	0.59	-
1	5	50	0.64	3
2	2	20	0.66	9
3	2	20	0.68	9
4	4	40	0.72	4
5	3	30	0.75	5
6	4	40	0.79	4
7	2	20	0.81	9
8	4	40	0.85	4
9	2	20	0.87	9
10	1	10	0.88	22
11	1	10	0.89	22
12	1	10	0.9	22
13	1	10	0.91	22
14	1	10	0.92	22
18	1	3	0.93	
20	0	0	0.93	-

30

**Unadjusted CBR, %**5      *CBR, Kleyn*8      *CBR, TRL***Adjustments****0.71**      *moderate***0.5**      *dry***0.35**      *very dry***0.5**      *not assessed*








<b>Number:</b> TP08	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511594.68 - 551757.68 <b>Level:</b> 312.98	<b>Date:</b> 23/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20  3.20 <b>Depth:</b> 1.40	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donnovan & Partners		<b>Logged:</b> VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.00 - 0.30 0.00 - 0.30	B D					(TOPSOIL) Dark brown, clayey PEAT.
	0.40 - 1.40	B		0.28 0.40	312.70 312.58	 	Firm, light brown green, slightly gravelly CLAY with organic content. Gravel is fine to coarse, angular to sub-rounded. Firm, light blue grey, slightly gravelly slightly sandy SILT with medium cobble content and low boulder content. Gravel is fine to coarse, angular to sub-rounded. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Boulders are angular to sub-rounded, 200-400mm dia. Sandstone lithology.
				1.40	311.58		End of Pit at 1.40m

**Stability:** Good. **Groundwater:** Water strike at 1.40m. Trickle flow rate.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.40m bgl, bedrock.

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	5	-	0.33	-
1	5	50	0.38	3
2	3	30	0.41	5
3	3	30	0.44	5
4	1	10	0.45	22
5	1	10	0.46	22
6	1	10	0.47	22
7	1	10	0.48	22
8	1	10	0.49	22
9	1	10	0.5	22
10	2	20	0.52	9
12	2	10	0.54	22
14	1	5	0.55	53
15	2	20	0.57	9
16	2	20	0.59	9
17	1	10	0.6	22
18	1	10	0.61	22
19	1	10	0.62	22
20	0		0.62	-

10

## Unadjusted CBR, %

22 CBR, Kleyn

26 CBR, TRL

*Adjustments*

0.71 moderate

0.5 dry

0.35 very dry

0.5 not assessed



<b>Number:</b> TP09	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Number:</b> TP09	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511725.65 - 551895.24 <b>Level:</b> 329.09	<b>Date:</b> 23/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20 x 3.80	<b>Scale:</b> 1:25
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<b>Client:</b> Jennings O'Donnovan & Partners	<b>Depth:</b> 1.90	<b>Logged:</b> VT
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.00 - 0.70 0.00 - 0.70	B D					(TOPSOIL) Dark brown black PEAT with low cobble content. Cobbles are angular top sub-rounded, 63-150mm dia.
	0.90 - 1.40 0.90 - 1.40	B D		0.70 0.85	328.39 328.24		Firm, light brown, slightly gravelly sandy SILT with medium cobble content and low boulder content. Gravel is fine to coarse, angular to sub-rounded. Sand is fine to coarse. Cobbles are angular to sub-angular, 200-300mm dia. Sandstone lithology.
				1.90	327.19		Firm to stiff, slight blue grey, slightly sandy gravelly SILT with medium cobble content and low boulder content. Gravel is fine to coarse, angular to sub-rounded. Sand is fine to coarse. Cobbles are angular to sub-rounded, 630-200mm dia. Sandstone lithology. Boulders are angular to sub-rounded, 200-520mm dia. Sandstone lithology.
							End of Pit at 1.90m

**Stability:** Good. **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.90m bgl, bedrock.

DCP10 in TP10

0.75 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	5	-	0.75	-
1	9	90	0.84	1
2	3	30	0.87	5
3	2	20	0.89	9
4	3	30	0.92	5
7	4	13	0.96	15
8	2	20	0.98	9
9	1	10	0.99	22
10	1	10	1.00	22
11	2	20	1.02	9
12	1	10	1.03	22
14	2	10	1.05	22
16	1	5	1.06	53
18	1	5	1.07	53
19	2	20	1.09	9
20	1	10	1.10	22
21	1	10	1.11	22
22	1	10	1.12	22
23	1	10	1.13	22
24	1	10	1.14	22
25	1	10	1.15	22
30	5	10	1.2	22
35	0	0	1.2	-

10

**Unadjusted CBR, %**

**22**     *CBR, Kleyn*

**26**     *CBR, TRL*

**Adjustments**

**0.71**     *moderate*

**0.5**     *dry*

**0.35**     *very dry*

**0.5**     *not assessed*



<b>Number:</b> TP10	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP10**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners





**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511851.30 - 552006.60  
**Level:** 338.63      **Date:** 23/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 3.10

**Client:** Jennings O'Donnovan & Partners      **Depth:** 1.15      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40 - 0.80 0.40 - 0.80	B D		0.40	338.23		(TOPSOIL) Dark brown black, clayey PEAT with low boulder content.
	0.90 - 1.15 0.90 - 1.15	B D		0.85	337.78		Soft to firm, light brown, slightly sandy slightly gravelly SILT with medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology.
				1.15	337.48		Firm, grey blue, slightly gravelly sandy SILT.
							End of Pit at 1.15m

**Stability:** Good.      **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.15m bgl, bedrock.

DCP11 in TP11

0.47 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	7	-	0.47	-
1	12	120	0.59	1
2	17	170	0.76	1
3	2	20	0.78	9
4	2	20	0.8	9
5	2	20	0.82	9
6	2	20	0.84	9
7	3	30	0.87	5
8	8	80	0.95	2
9	8	80	1.03	2
10	4	40	1.07	4
11	1	10	1.08	22
12	5	50	1.13	3
13	3	30	1.16	5
14	7	70	1.23	2
15	0	0	-	-

35

**Unadjusted CBR, %**

**5**      *CBR, Kleyn*

**7**      *CBR, TRL*

***Adjustments***

**0.71**      *moderate*

**0.5**      *dry*

**0.35**      *very dry*

**0.5**      *not assessed*



<b>Number:</b> TP11	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP11**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners





**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511906.36 - 552114.95  
**Level:** 349.14      **Date:** 23/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 2.00

**Client:** Jennings O'Donnovan & Partners      **Depth:** 2.00      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.00 - 1.00	B					Dark brown black, clayey PEAT.
	1.00 - 2.00	B		2.00	347.14		End of Pit at 2.00m

**Stability:** Good.      **Groundwater:** Water strike at 0.10m bgl. Trickle flowrate.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 2.00m bgl, bedrock.

DCP12 in TP12

1.3 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	100	1000	1.3	0
1	100	1000	2.3	0
			-	-

1000

Unadjusted CBR, %

0 CBR, Kleyn

0 CBR, TRL

*Adjustments*

*0.71 moderate*

*0.5 dry*

*0.35 very dry*

*0.5 not assessed*



<b>Number:</b> TP12	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Number:</b> TP12	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511670.28 - 552018.67  
**Level:** 375.78      **Date:** 22/11/2016

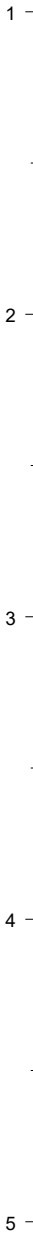
**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 3.10

**Client:** Jennings O'Donnovan & Partners      **Depth:** 0.75      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.00 - 0.30 0.00 - 0.30	B D					Firm, dark brown, peaty CLAY.
	0.35 - 0.75 0.35 - 0.75	B D		0.32	375.46		Firm, grey brown, slightly gravelly sandy SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 200mm dia, angular to sub-angular, Sandstone lithology.
				0.75	375.03		End of Pit at 0.75m

**Stability:** Good.      **Groundwater:** None encountered.  
**Plant:** 12T track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 0.75m bgl due to obstruction.



DCP13 in TP13

0.36 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	6	-	0.36	-
1	3	30	0.39	5
2	2	20	0.41	9
3	3	30	0.44	5
4	1	10	0.45	22
5	2	20	0.47	9
6	1	10	0.48	22
7	1	10	0.49	22
8	1	10	0.5	22
9	3	30	0.53	5
10	1	10	0.54	22
11	2	20	0.56	9
12	3	30	0.59	5
13	3	30	0.62	5
14	3	30	0.65	5
15	1	10	0.66	-

20

**Unadjusted CBR, %**

**9**      *CBR, Kleyn*

**13**     *CBR, TRL*

**Adjustments**

**0.71**     *moderate*

**0.5**      *dry*

**0.35**     *very dry*

**0.5**      *not assessed*



<b>Number:</b> TP13	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP13**

**Project**  
**Project No**  
**Engineer**



Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners





<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511517.09 - 551958.43 <b>Level:</b> 385.00	<b>Date:</b> 25/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20  3.50 <b>Depth:</b> 1.30	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners		<b>Logged:</b> VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50 - 1.20	B		0.50	384.50		Dark brown black, slightly gravelly peaty CLAY. Gravel is fine to coarse, angular to sub-angular (Topsoil).
	0.50 - 1.20	D					Firm, light brown grey, slightly sandy slightly gravelly SILT with medium cobble content, low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 200mm dia, angular to sub-rounded. Boulders are 200mm to 600mm dia, angular to sub-rounded.
				1.30	383.70		End of Pit at 1.30m

**Stability:** Good. **Groundwater:** None encountered.  
**Plant:** 12T track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.30m bgl due to obstruction.

DCP14 in TP14

0.58 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	8	-	0.58	-
1	7	70	0.65	2
2	13	130	0.78	1
3	2	20	0.8	9
4	2	20	0.82	9
5	1	10	0.83	22
8	1	3	0.84	89
9	1	10	0.85	22
10	1	10	0.86	22
11	1	10	0.87	22
12	1	10	0.88	22
13	1	10	0.89	22
14	1	10	0.9	22
15	1	10	0.91	22
16	1	10	0.92	22
17	1	10	0.93	22
18	1	10	0.94	22
19	1	10	0.95	22
20	1	10	0.96	22
25	0	-	0.96	-

10

Unadjusted CBR, %	
22	CBR, Kleyn
26	CBR, TRL

**Adjustments**

**0.71**      *moderate*  
**0.5**        *dry*  
**0.35**      *very dry*  
**0.5**        *not assessed*



<b>Number:</b> TP14	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP14**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners





<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511623.30 - 552060.49 <b>Level:</b> 371.22	<b>Date:</b> 24/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20 x 3.40	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners	<b>Depth:</b> 3.20	<b>Logged:</b> VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50 - 1.10 0.50 - 1.10	B D		0.50	370.72		Dark brown, gravelly PEAT.
	1.10 - 2.10 1.10 - 2.10	B D		1.10	370.12		Soft, light brown, slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 150mm dia, angular to sub-rounded, Sandstone and Shale lithology.
	2.10 - 3.10 2.10 - 3.10	B D		3.20	368.02		Firm, blue grey, slightly sandy gravelly SILT with medium cobble content, low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 200mm dia, angular to sub-rounded, Sandstone and Shale lithology. Boulders are 200mm dia, angular to sub-rounded, Sandstone and Shale lithology.
							End of Pit at 3.20m

**Stability:** Good. **Groundwater:** None encountered.  
**Plant:** 12T track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 3.20m bgl due to obstruction.

DCP15 in TP15

0.58 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	8	-	0.58	-
1	7	70	0.65	2
2	7	70	0.72	2
3	2	20	0.74	9
4	3	30	0.77	5
5	4	40	0.81	4
6	3	30	0.84	5
7	7	70	0.91	2
8	5	50	0.96	3
9	2	20	0.98	9
10	2	20	1.00	9
11	4	40	1.04	4
13	2	10	1.06	22
15	2	10	1.08	22
16	4	40	1.12	4
17	3	30	1.15	5
18	4	40	1.19	4
19	3	30	1.22	5
20	1	10	1.23	22
21	1	10	1.24	22
22	1	10	1.25	22
23	1	10	1.26	22
24	1	10	1.27	22
25	1	-	1.28	-

**30**

**Unadjusted CBR, %**

**5**     *CBR, Kleyn*

**8**     *CBR, TRL*

**Adjustments**

**0.71**     *moderate*

**0.5**     *dry*

**0.35**     *very dry*

**0.5**     *not assessed*





<b>Number:</b> TP15	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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Priority Geotechnical Ltd.  
 Tel: 021 4631600  
 Fax: 021 4638690  
 www.prioritygeotechnical.ie

Trial Pit No  
**TP16**  
 Sheet 1 of 1

**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511441.37 - 551948.82  
**Level:** 396.17      **Date:** 25/11/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 4.00

**Client:** Jennings O'Donnovan & Partners      **Depth:** 0.65      **Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30 - 0.65	B		0.28	395.89		Soft, dark brown black, slightly gravelly peaty CLAY. Gravel is fine to coarse and sub-angular (Topsoil).
	0.30 - 0.65	D		0.65	395.52		Firm, light brown, slightly sandy slightly gravelly SILT with medium cobble content, medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 200mm dia, sub-angular to sub-rounded. Boulders are 200mm to 400mm dia, angular to sub-angular, Sandstone and Shale lithology. End of Pit at 0.65m

**Stability:** Moderate to good.      **Groundwater:** None encountered.  
**Plant:** 12T track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 0.65m bgl due to obstruction.



DCP16 in TP16

0.38 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	8	-	0.38	-
1	3	30	0.41	5
2	1	10	0.42	22
3	2	20	0.44	9
4	1	10	0.45	22
6	1	5	0.46	53
7	1	10	0.47	22
9	1	5	0.48	53
10	1	10	0.49	22
12	1	5	0.5	53
13	2	20	0.52	9
14	2	20	0.54	9
16	1	5	0.55	53
25	0	-	-	-

10

**Unadjusted CBR, %**

22     *CBR, Kleyn*

26     *CBR, TRL*

**Adjustments**

**0.71**     *moderate*

**0.5**     *dry*

**0.35**     *very dry*

**0.5**     *not assessed*



**Number:**

**TP16**

**Project  
Project No  
Engineer**



Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511360.97 - 551923.09  
**Level:** 399.98      **Date:** 25/11/2016

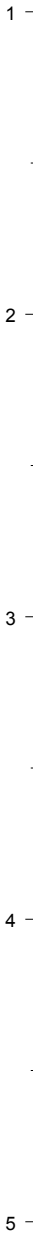
**Location:** Drimoleague, Co. Cork.      **Dimensions (m):**       **Scale:** 1:25

**Client:** Jennings O'Donovan & Partners      **Depth:** 0.55      **Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.25 - 0.55	B		0.25	399.73		Soft, dark brown black, PEAT.
	0.25 - 0.55	D		0.55	399.43		Firm, light brown grey, slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 200mm dia, angular to sub-rounded, Sandstone lithology. Boulders are 200mm to 400mm dia, angular to sub-angular, Shale lithology. End of Pit at 0.55m

**Stability:** Good.      **Groundwater:** None encountered.  
**Plant:** 12T track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 0.55m bgl due to obstruction.





DCP17 in TP17

0.33 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	8	-	0.33	-
1	4	40	0.37	4
2	2	20	0.39	9
3	3	30	0.42	5
6	2	7	0.44	37
7	1	10	0.45	22
9	1	5	0.46	53
10	1	10	0.47	22
11	1	10	0.48	22
13	1	5	0.49	53
15	0	-	-	-

10

**Unadjusted CBR, %**

22 CBR, Kleyn

26 CBR, TRL

**Adjustments**

0.71 moderate

0.5 dry

0.35 very dry

0.5 not assessed





<b>Number:</b> TP17	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP17**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511286.32 - 551894.88 <b>Level:</b> 398.18	<b>Date:</b> 25/11/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20 x 3.50	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donnovan & Partners	<b>Depth:</b> 1.60	<b>Logged:</b> VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50 - 0.80 0.50 - 0.80	B D		0.50	397.68		Dark brown black, peaty CLAY (Topsoil).
	0.80 - 1.40 0.80 - 1.40	B D		0.80	397.38		Firm, light brown, slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 200mm dia, angular to sub-rounded, Sandstone lithology.
				1.40	396.78		Firm to stiff, blue grey, slightly sandy gravelly SILT with high cobble content, medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are 63mm to 200mm dia, angular to sub-rounded, Sandstone lithology. Boulders are 200mm to 400mm dia, angular to sub-angular, Sandstone and Shale lithology.
				1.40	396.78		Weathered Bedrock.
				1.60	396.58		End of Pit at 1.60m

**Stability:** Good. **Groundwater:** None encountered.  
**Plant:** 12T track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.60m bgl due to obstruction.

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	5	-	0.55	-
1	3	30	0.58	5
2	2	20	0.6	9
3	1	10	0.61	22
4	2	20	0.63	9
5	1	10	0.64	22
6	2	20	0.66	9
7	0	0	0.66	
8	0	0	0.66	
9	1	3	0.67	89
10	1	10	0.68	22
11	1	10	0.69	22
12	1	10	0.7	22
13	1	10	0.71	22
14	1	10	0.72	22
15	3	30	0.75	5
16	1	10	0.76	22
17	3	30	0.79	5
18	1	10	0.8	22
19	2	20	0.82	9
20	4	40	0.86	4
21	2	20	0.88	9
22	1	10	0.89	22
23	2	20	0.91	9
24	1	10	0.92	22
25	1	10	0.93	22
26	1	10	0.94	22
27	1	10	0.95	22
28	1	10	0.96	22
29	0	0	0.96	-
30	0	0	0.96	-
35	0	-	0.96	-

10

## Unadjusted CBR, %

22 CBR, Kleyn

26 CBR, TRL

## Adjustments

0.71 moderate

0.5 dry

0.35 very dry

0.5 not assessed





**Number:**

**TP18**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners





**Number:**

**TP18**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 511041.42 - 551857.42  
**Level:** 386.64      **Date:** 22/12/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 3.00

**Client:** Jennings O'Donnovan & Partners      **Depth:** 1.10      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.90 - 1.10	B		0.90	385.74		Soft, dark brown to black, slightly gravelly peaty CLAY. Gravel is fine to coarse, angular to sub-rounded, Sandstone lithology.
	0.90 - 1.10	D		1.10	385.54		Soft to firm, light brown grey, slightly sandy gravelly SILT with medium cobble content and low boulder content. Gravel is fine to coarse. Sand is fine to coarse. Cobbles are angular to sub-angular, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-angular, 200-400mm dia. Sandstone lithology. End of Pit at 1.10m

**Stability:** Good.      **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.10m bgl, bedrock.

DCP19 in TP19

0.0 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	0	-	0.00	-
1	41	410	0.41	0
2	48	70	0.48	2
3	51	30	0.51	5
4	55	40	0.55	4
5	59	40	0.59	4
6	63	40	0.63	4
7	65	20	0.65	
8	65	0	0.65	
9	65	0	0.65	
10	65	0	0.65	
11	65	0	0.65	
12	65	0	0.65	
13	65	0	0.65	
14	66	10	0.66	22
15	66	0	0.66	
16	66	0	0.66	
17	66	0	0.66	
18	66	0	0.66	

40

Unadjusted CBR, %		
4	CBR, Kleyn	22
6	CBR, TRL	

**Adjustments**

**0.71**      *moderate*  
**0.5**        *dry*  
**0.35**      *very dry*  
**0.5**        *not assessed*





<b>Number:</b> TP19	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP19**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 510961.96 - 551859.11 <b>Level:</b> 377.72	<b>Date:</b> 22/12/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20 x 3.50	<b>Scale:</b> 1:25
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<b>Client:</b> Jennings O'Donnovan & Partners	<b>Depth:</b> 1.40	<b>Logged:</b> VT
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.55 - 1.40	B D		0.35	377.37		Soft, brown to dark brown, slightly gravelly peaty CLAY.
	0.55 - 1.40			0.55	377.17		Firm, slightly sandy, gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are angular to sub-angular, 63-200mm dia. Sandstone lithology. Soft to firm, grey brown, slightly sandy gravelly SILT with high cobble content and high boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular.
				1.40	376.32		End of Pit at 1.40m

**Stability:** Good. **Groundwater:** Waterstrike at 1.20m bgl. Trickle flow rate.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 1.40m bgl, bedrock.

DCP20 in TP20

0.0 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	0	-	0.00	-
1	36	360	0.36	0
2	40	40	0.4	4
3	42	20	0.42	9
4	44	20	0.44	9
5	45	10	0.45	22
6	46	10	0.46	22
7	47	10	0.47	22
8	49	20	0.49	9
9	50	10	0.5	22
10	50	0	0.5	
11	51	10	0.51	22
12	52	10	0.52	22
13	52	0	0.52	
14	53	10	0.53	22
15	55	20	0.55	9
16	57	20	0.57	9
17	59	20	0.59	9
18	60	10	0.6	22
19	61	10	0.61	22

20

Unadjusted CBR, %

16 CBR, Kleyn

12 CBR, TRL

Adjustments

0.71 moderate

0.5 dry

0.35 very dry

0.5 not assessed





<b>Number:</b> TP20	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP20**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 510813.20 - 551832.17 <b>Level:</b> 349.93	<b>Date:</b> 22/12/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 4.00	<b>Scale:</b> 1:25
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<b>Client:</b> Jennings O'Donnovan & Partners	<b>Depth:</b> 2.40	<b>Logged:</b> VT
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
↓				0.15	349.78		Soft, dark brown to black, slightly sandy peaty CLAY. Sand is fine to coarse.	1
	0.50 - 1.50	B D		0.45	349.48		Soft, light brown, slightly gravelly sandy SILT. Gravel is fine to coarse, angular to sub-angular. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia.	
	1.50 - 2.40	B D		2.40	347.53		Soft to firm, grey, slightly gravelly sandy SILT. Gravel is fine to coarse, angular to sub-angular. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Boulders are angular to sub-rounded, 200-800mm dia. Sandstone lithology.	
							End of Pit at 2.40m	2
								3
								4
								5

**Stability:** Good.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Groundwater:** Water encountered at ground level.

**Remarks:** Trial pit terminated at 2.40m bgl, possible boulders or bedrock.

DCP21 in TP21

0.0 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	0	-	0.00	-
1	29	290	0.29	0
2	31	20	0.31	9
3	33	20	0.33	9
4	37	40	0.37	4
5	39	20	0.39	9
6	40	10	0.4	22
7	42	20	0.42	9
8	43	10	0.43	22
9	45	20	0.45	9
10	47	20	0.47	9
11	50	30	0.5	5
12	52	20	0.52	9
13	56	40	0.56	4
14	59	30	0.59	5
15	62	30	0.62	5
16	63	10	0.63	22
17	64	10	0.64	22

20

**Unadjusted CBR, %**

9      *CBR, Kleyn*  
 12     *CBR, TRL*

**Adjustments**

**0.71**      *moderate*  
**0.5**        *dry*  
**0.35**      *very dry*  
**0.5**        *not assessed*





<b>Number:</b> TP21	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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<b>Number:</b> TP21	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Project Name:** Dereenacrinnig Windfarm      **Project No.:** P16177      **Co-ords:** 510701.89 - 551995.91  
**Level:** 311.55      **Date:** 22/12/2016

**Location:** Drimoleague, Co. Cork.      **Dimensions (m):** 1.20 x 4.50

**Client:** Jennings O'Donnovan & Partners      **Depth:** 0.95      **Scale:** 1:25  
**Logged:** VT

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20 - 0.95 0.20 - 0.95	B D		0.95	310.60		Soft to firm, grey, slightly gravelly sandy SILT with medium cobble content and medium boulder content. Gravel is fine to coarse. Sand is fine to coarse. Cobbles are angular to sub-rounded, 63-200mm dia. Boulders are angular to sub-rounded, 200-500mm dia. Sandstone lithology.
							End of Pit at 0.95m

**Stability:** Good.      **Groundwater:** None encountered.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Remarks:** Trial pit terminated at 0.95m bgl, bedrock.

DCP22 in TP22

0.0 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	0	-	0.00	-
1	5	50	0.05	3
2	8	30	0.08	5
3	10	20	0.1	9
4	12	20	0.12	9
5	13	10	0.13	22
6	17	40	0.17	4
7	17	0	0.17	
8	18	10	0.18	22
9	18	0	0.18	
10	18	0	0.18	
11	18	0	0.18	
12	18	0	0.18	
13	18	0	0.18	

20

Unadjusted CBR, %		
9	CBR, Kleyn	22
12	CBR, TRL	

**Adjustments**

**0.71**      *moderate*  
**0.5**        *dry*  
**0.35**      *very dry*  
**0.5**        *not assessed*





<b>Number:</b> TP22	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TP22**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511146.34 - 551192.30 <b>Level:</b> 239.83	<b>Date:</b> 22/12/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20 x 4.10	<b>Scale:</b> 1:25
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<b>Client:</b> Jennings O'Donnovan & Partners	<b>Depth:</b> 2.10	<b>Logged:</b> VT
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.35	239.48		Soft, dark brown to black, gravelly very silty PEAT.
	0.55 - 1.50 0.55 - 1.50	B D		0.55	239.28		Firm, red brown, slightly gravelly slightly sandy SILT with medium cobble content. Gravel is fine to coarse, angular to sub-angular. Sand is fine to coarse. Cobbles are angular to sub-angular, Sandstone lithology.
	1.50 - 2.10 1.50 - 2.10	B D					Grey, silty sandy GRAVEL with medium cobble content and medium boulder content. Gravel is fine to coarse, angular to sub-angular. Sand is fine to coarse. Cobbles are angular to sub-angular, 63-200mm dia. Sandstone lithology.
				2.10	237.73		End of Pit at 2.10m

**Stability:** Good.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Groundwater:** None encountered.

**Remarks:** Trial pit terminated at 2.10m bgl, possible bedrock.

DCPS1 in TPS1

0.0 m bgl

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	0	-	0.00	-
1	7	70	0.07	2
2	15	80	0.15	2
3	15	0	0.15	
4	16	10	0.16	22
5	17	10	0.17	22
6	21	40	0.21	4
7	25	40	0.25	4
8	28	30	0.28	5
9	32	40	0.32	4
10	34	20	0.34	9
11	36	20	0.36	9
12	37	10	0.37	22
13	38	10	0.38	22
14	38	0	0.38	
15	38	0	0.38	
16	38	0	0.38	
17	39	10	0.39	22
18	39	0	0.39	

40

Unadjusted CBR, %		
9	CBR, Kleyn	22
6	CBR, TRL	

**Adjustments**

**0.71**      *moderate*  
**0.5**        *dry*  
**0.35**      *very dry*  
**0.5**        *not assessed*





<b>Number:</b> TPS1	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TPS1**




**Project  
Project No  
Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511125.90 - 551212.43 <b>Level:</b> 243.24	<b>Date:</b> 22/12/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 	<b>Scale:</b> 1:25 <b>Logged:</b> VT
<b>Client:</b> Jennings O'Donnovan & Partners		<b>Depth:</b> 2.20

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40 - 1.00 0.40 - 1.00	B D		0.40	242.84		Soft, dark brown to black, slightly gravelly peaty CLAY.
	1.00 - 2.00 1.00 - 2.00	B D		1.00	242.24		Gravelly clayey COBBLES and BOULDERS. Gravel is fine to coarse, angular to sub-rounded. Cobbles are angular to sub-angular, 63-120mm dia. Sandstone lithology. Boulders are angular to sub-angular, 200-1000mm dia. Sandstone lithology.
				2.20	241.04		Firm, blue grey, slightly sandy gravelly SILT with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, Sandstone lithology. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-rounded, 200-400mm dia. Sandstone lithology.
							End of Pit at 2.20m

**Stability:** Good to moderate.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Groundwater:** None encountered.

**Remarks:** Trial pit terminated at 2.2m bgl, possible bedrock.

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	0	-	0.00	-
1	15	150	0.15	1
2	20	50	0.2	3
3	23	30	0.23	5
4	25	20	0.25	9
5	27	20	0.27	9
6	28	10	0.28	22
7	29	10	0.29	22
8	31	20	0.31	9
9	32	10	0.32	22
10	34	20	0.34	9
11	35	10	0.35	22
12	37	20	0.37	9
13	39	20	0.39	9
14	40	10	0.4	22
15	41	10	0.41	22
16	41	0	0.41	
17	42	10	0.42	22
18	42	0	0.42	
19	43	10	0.43	22

20

## Unadjusted CBR, %

9	CBR, Kleyn	22
13	CBR, TRL	

*Adjustments*

<i>0.71</i>	<i>moderate</i>
<i>0.5</i>	<i>dry</i>
<i>0.35</i>	<i>very dry</i>
<i>0.5</i>	<i>not assessed</i>





<b>Number:</b> TPS2	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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**Number:**

**TPS2**

**Project**  
**Project No**  
**Engineer**

Derreenacrinnig Wind Farm  
P16177  
Jennings O'Donovan & Partners



<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511160.14 - 551231.59 <b>Level:</b> 242.44	<b>Date:</b> 22/12/2016
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<b>Location:</b> Drimoleague, Co. Cork.	<b>Dimensions (m):</b> 1.20 x 5.20	<b>Scale:</b> 1:25
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<b>Client:</b> Jennings O'Donnovan & Partners	<b>Depth:</b> 1.90	<b>Logged:</b> VT
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Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50 - 1.10 0.50 - 1.10	B D		0.50	241.94		Dark brown to black, slightly gravelly peaty CLAY.
	1.10 - 1.90 1.10 - 1.90	B D		1.10	241.34		Soft, light brown, slightly sandy gravelly SILT with high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular. Cobbles are angular to sub-angular, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-angular. Sandstone lithology.
				1.90	240.54		Firm, grey blue, slightly sandy gravelly SILT with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are angular to sub-rounded, 63-200mm dia. Sandstone lithology. Boulders are angular to sub-angular, 200-700mm dia. Sandstone lithology.
							End of Pit at 1.90m

**Stability:** Moderate.  
**Plant:** 12t track machine.  
**Backfill:** Arisings.

**Groundwater:** None encountered.

**Remarks:** Trial pit terminated at 1.90m bgl on boulder layer.

Nr. Blows (cumulative)	Penetration, cm	pen. Rate, mm/blow	Depth, m bgl	CBR, % (Kleyn)
0	0	-	0.00	-
1	12	120	0.12	1
2	46	340	0.46	0
3	55	90	0.55	1
4	70	150	0.7	1
5	78	80	0.78	2
6	83	50	0.83	3
7	84	10	0.84	22
8	87	30	0.87	5
9	88	10	0.88	22
10	89	10	0.89	22
11	92	30	0.92	5
12	94	20	0.94	9
13	95	10	0.95	22
14	95	0	0.95	
15	95	0	0.95	
16	95	0	0.95	
17	95	0	0.95	
18	95	0	0.95	

90

Unadjusted CBR, %		
5	CBR, Kleyn	22
3	CBR, TRL	

**Adjustments**

- 0.71**      **moderate**
- 0.5**        **dry**
- 0.35**      **very dry**
- 0.5**        **not assessed**





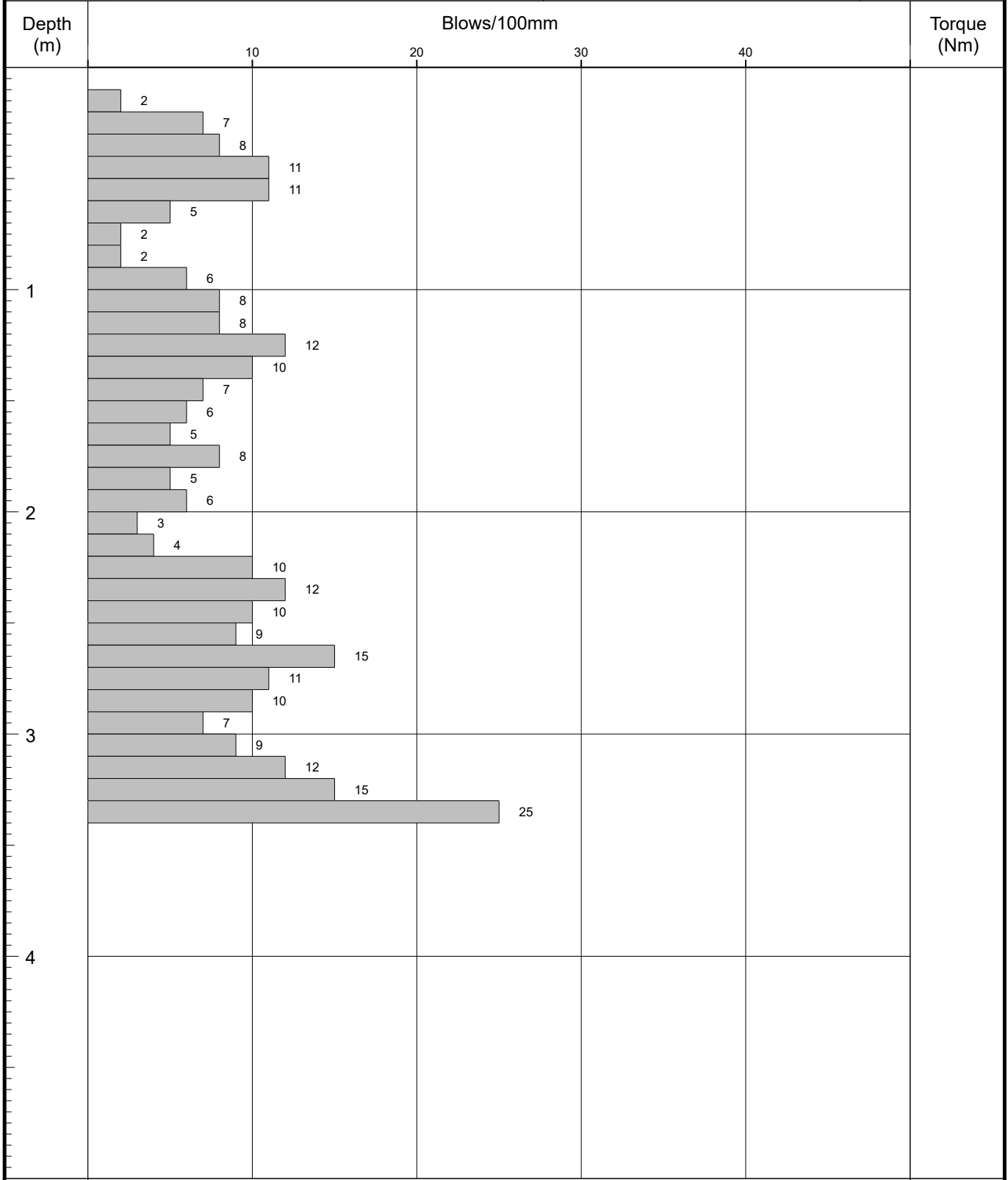
<b>Number:</b> TPS3	<b>Project</b> Derreenacrinnig Wind Farm <b>Project No</b> P16177 <b>Engineer</b> Jennings O'Donovan & Partners	
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Probe No  
**DP01**  
 Sheet 1 of 1

<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511386.11 - 549475.14	<b>Hole Type:</b> DP
<b>Location:</b> Drimoleague, Co. Cork.		<b>Level:</b> 142.98	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners		<b>Dates:</b> 22/12/2016	<b>Logged By:</b>



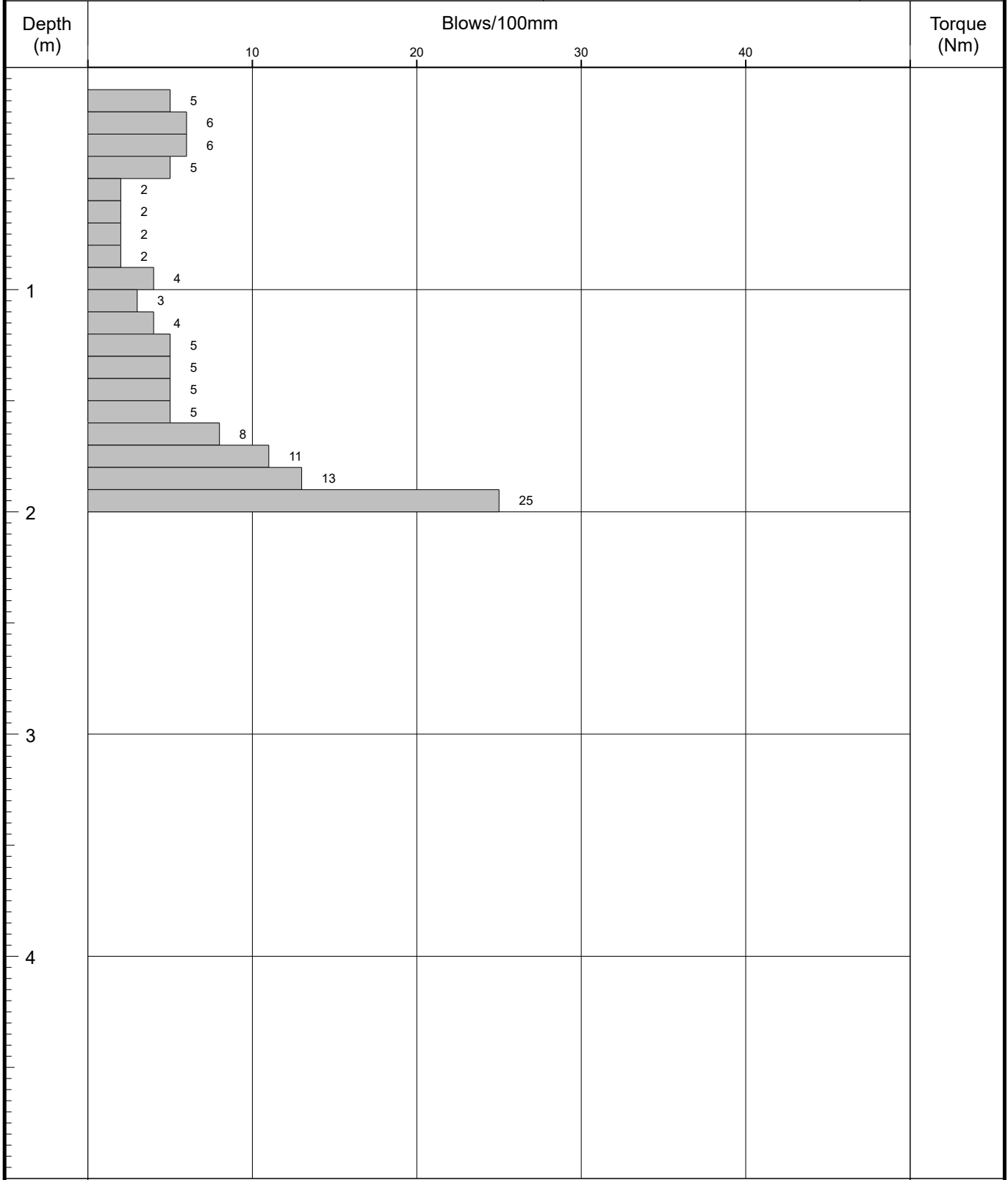
<b>Remarks:</b> DP01 terminated at 3.30m bgl, obstruction.	<b>Fall Height:</b> 500	<b>Cone Base Dia:</b>
	<b>Hammer Wt:</b> 50	<b>Final Depth:</b> 3.30
	<b>Probe Type:</b> DPH	



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Probe No  
**DP02**  
 Sheet 1 of 1

<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511327.38 - 549769.63	<b>Hole Type:</b> DP
<b>Location:</b> Drimoleague, Co. Cork.		<b>Level:</b> 145.55	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners		<b>Dates:</b> 22/12/2016	<b>Logged By:</b>



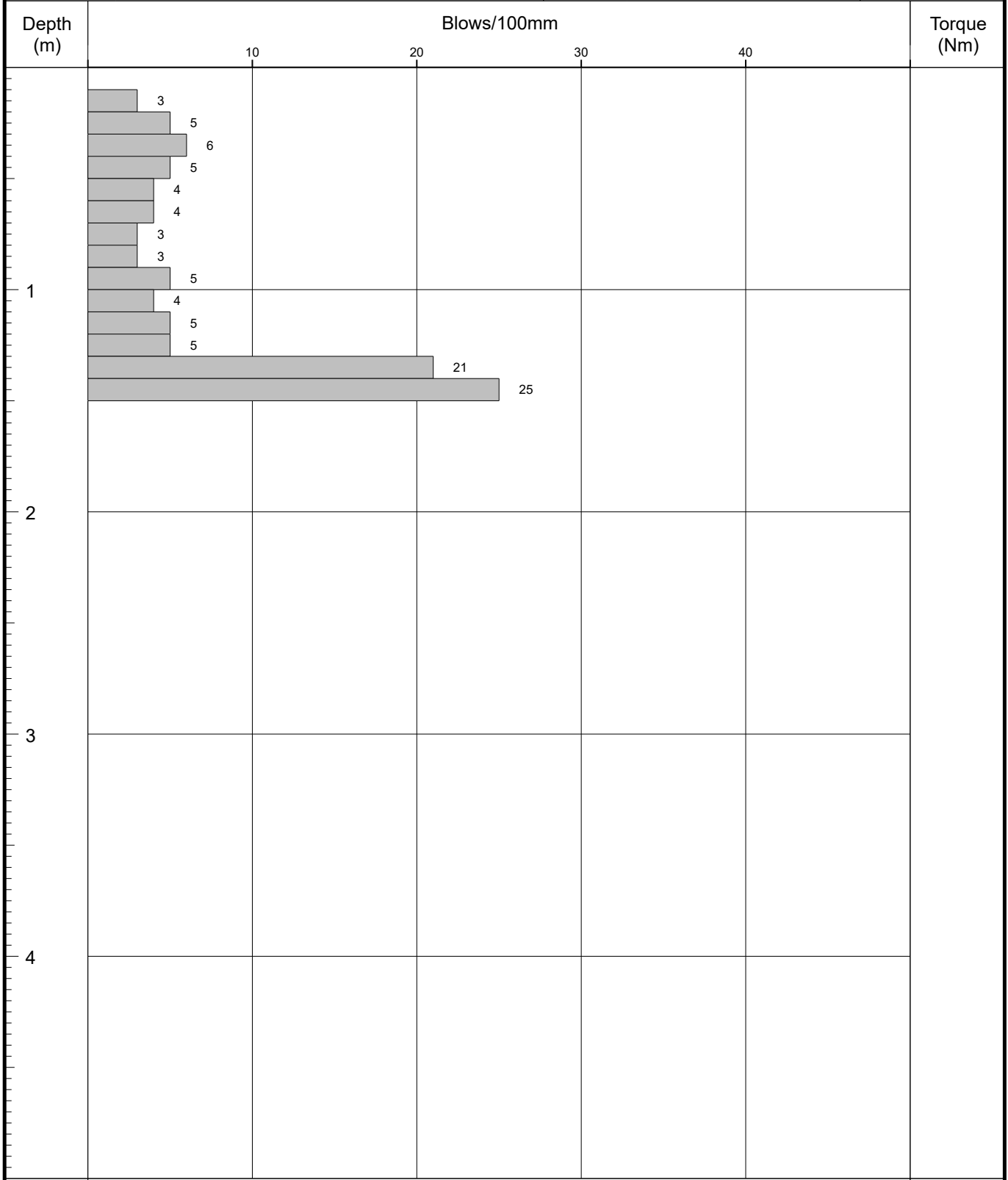
<b>Remarks:</b> DP02 terminated at 1.90m bgl, refusal.	<b>Fall Height:</b> 500	<b>Cone Base Dia:</b>
	<b>Hammer Wt:</b> 50	<b>Final Depth:</b> 1.90
	<b>Probe Type:</b> DPH	



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Probe No  
**DP03**  
 Sheet 1 of 1

<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511264.03 - 550031.30	<b>Hole Type:</b> DP
<b>Location:</b> Drimoleague, Co. Cork.		<b>Level:</b> 156.43	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners		<b>Dates:</b> 22/12/2016	<b>Logged By:</b>



<b>Remarks:</b> DP03 terminated at 1.40m bgl, refusal.	<b>Fall Height:</b> 500	<b>Cone Base Dia:</b>
	<b>Hammer Wt:</b> 50	<b>Final Depth:</b> 1.40
	<b>Probe Type:</b> DPH	

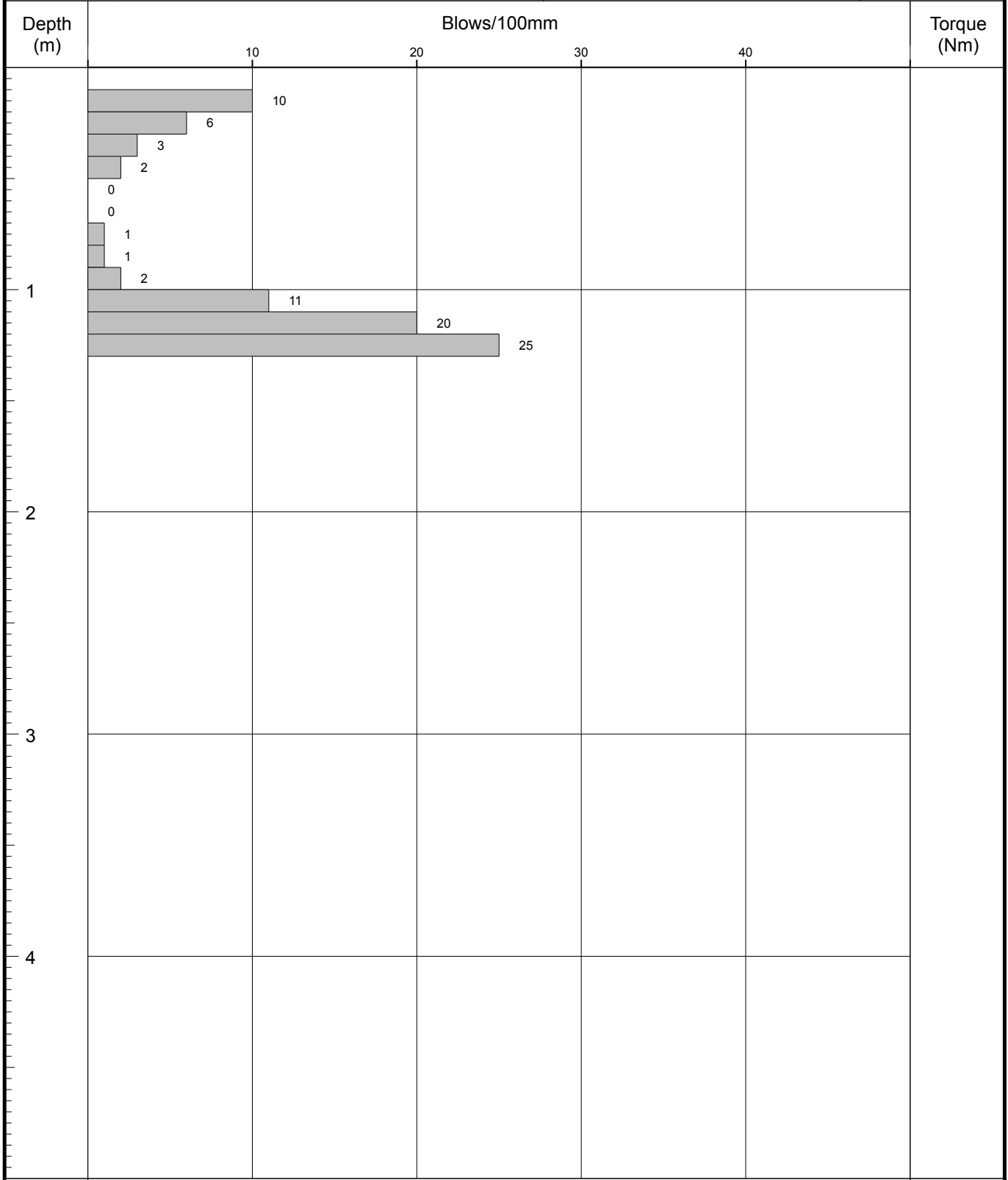




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Probe No  
**DP04**  
 Sheet 1 of 1

<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511076.27 - 550454.73	<b>Hole Type:</b> DP
<b>Location:</b> Drimoleague, Co. Cork.		<b>Level:</b> 174.95	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners		<b>Dates:</b> 22/12/2016	<b>Logged By:</b>



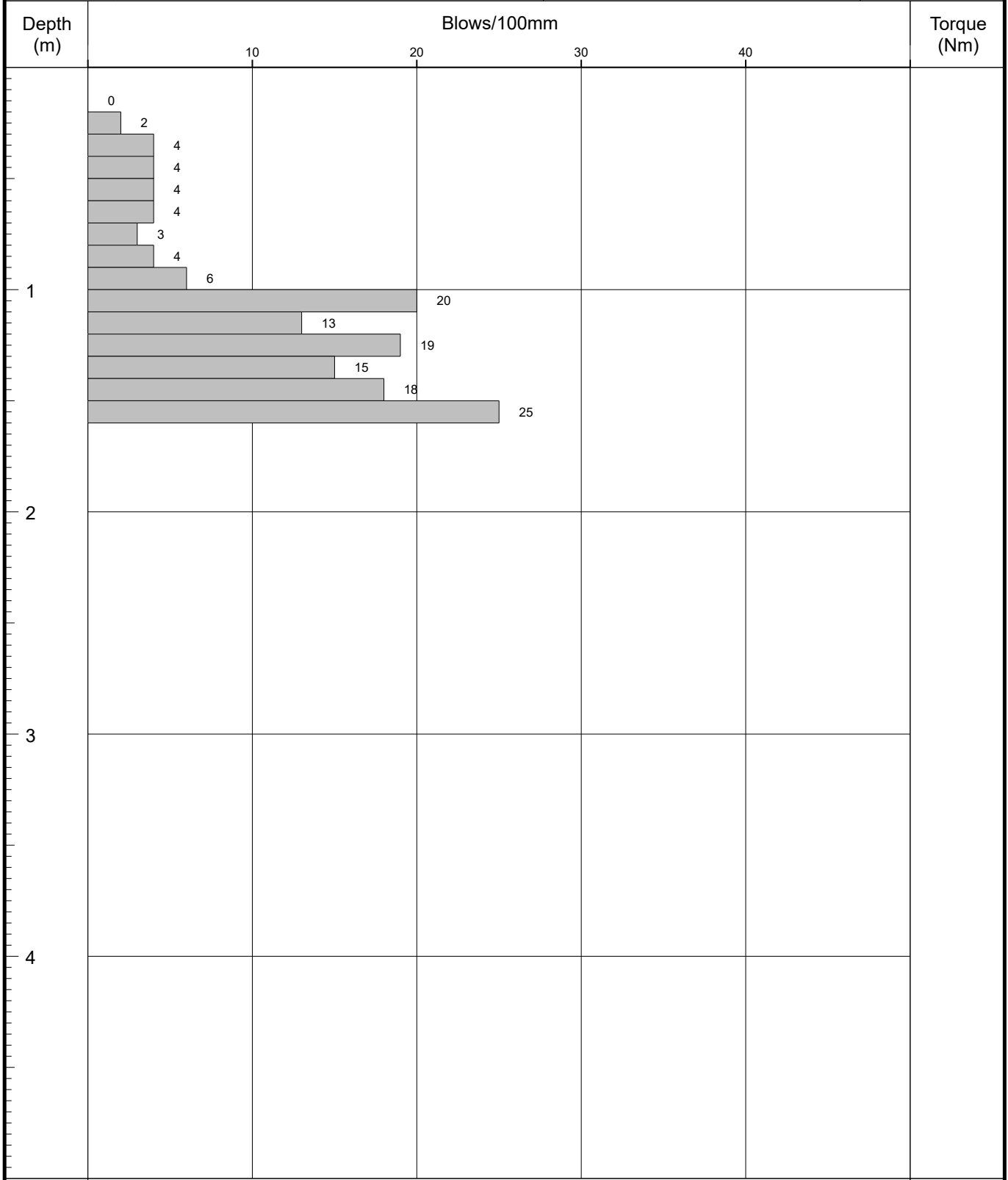
<b>Remarks:</b> DP04 terminated at 1.20m bg, refusal.	<b>Fall Height:</b> 500	<b>Cone Base Dia:</b>
	<b>Hammer Wt:</b> 50	<b>Final Depth:</b> 1.20
	<b>Probe Type:</b> DPH	



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Probe No  
**DP05**  
 Sheet 1 of 1

<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 511028.37 - 550647.52	<b>Hole Type:</b> DP
<b>Location:</b> Drimoleague, Co. Cork.		<b>Level:</b> 186.97	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners		<b>Dates:</b> 22/12/2016	<b>Logged By:</b>



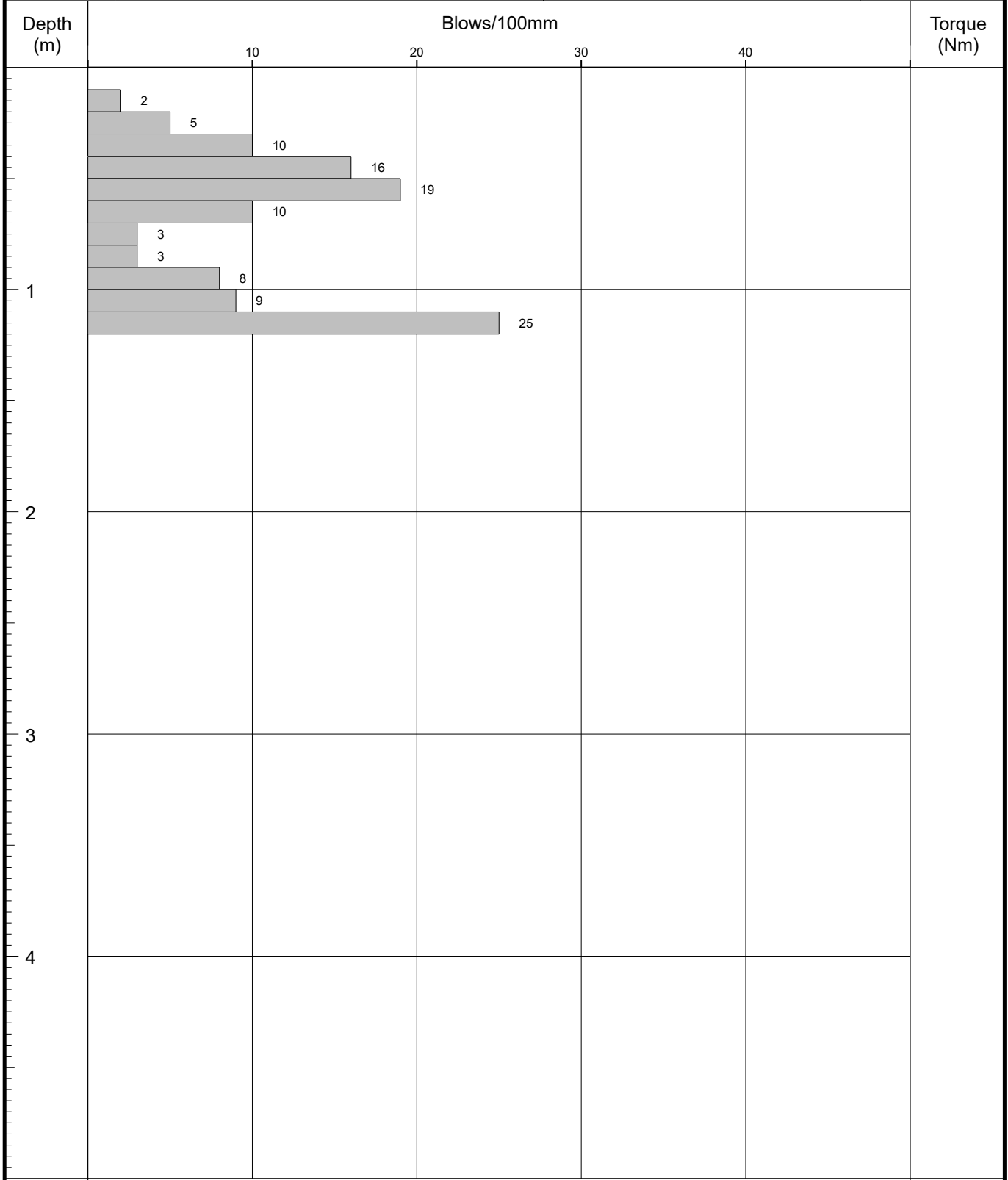
<b>Remarks:</b> DP05 terminated at 1.50m bg, refusal.	<b>Fall Height:</b> 500	<b>Cone Base Dia:</b>
	<b>Hammer Wt:</b> 50	<b>Final Depth:</b> 1.20
	<b>Probe Type:</b> DPH	



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Probe No  
**DP06**  
 Sheet 1 of 1

<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 510967.71 - 550739.18	<b>Hole Type:</b> DP
<b>Location:</b> Drimoleague, Co. Cork.		<b>Level:</b> 191.63	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners		<b>Dates:</b> 22/12/2016	<b>Logged By:</b>



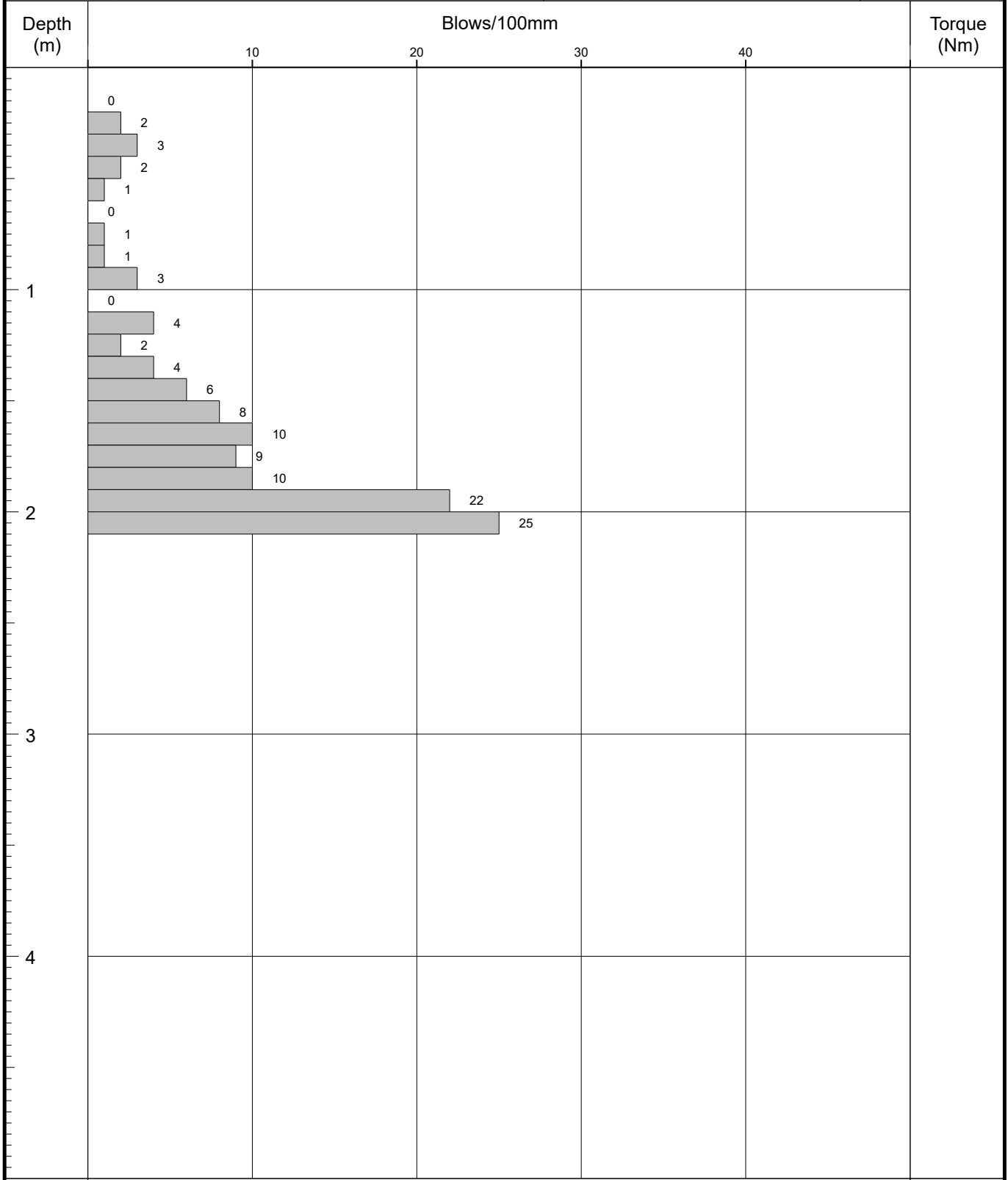
<b>Remarks:</b> DP06 terminated at 1.10m bgl.	<b>Fall Height:</b> 500	<b>Cone Base Dia:</b>
	<b>Hammer Wt:</b> 50	<b>Final Depth:</b> 1.10
	<b>Probe Type:</b> DPH	



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Probe No  
**DP07**  
 Sheet 1 of 1

<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 510868.00 - 550802.05	<b>Hole Type:</b> DP
<b>Location:</b> Drimoleague, Co. Cork.		<b>Level:</b> 198.34	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners		<b>Dates:</b> 22/12/2016	<b>Logged By:</b>



<b>Remarks:</b> DP07 terminated at 2.00m bgl, refusal.	<b>Fall Height:</b> 500	<b>Cone Base Dia:</b>
	<b>Hammer Wt:</b> 50	<b>Final Depth:</b> 2.00
	<b>Probe Type:</b> DPH	

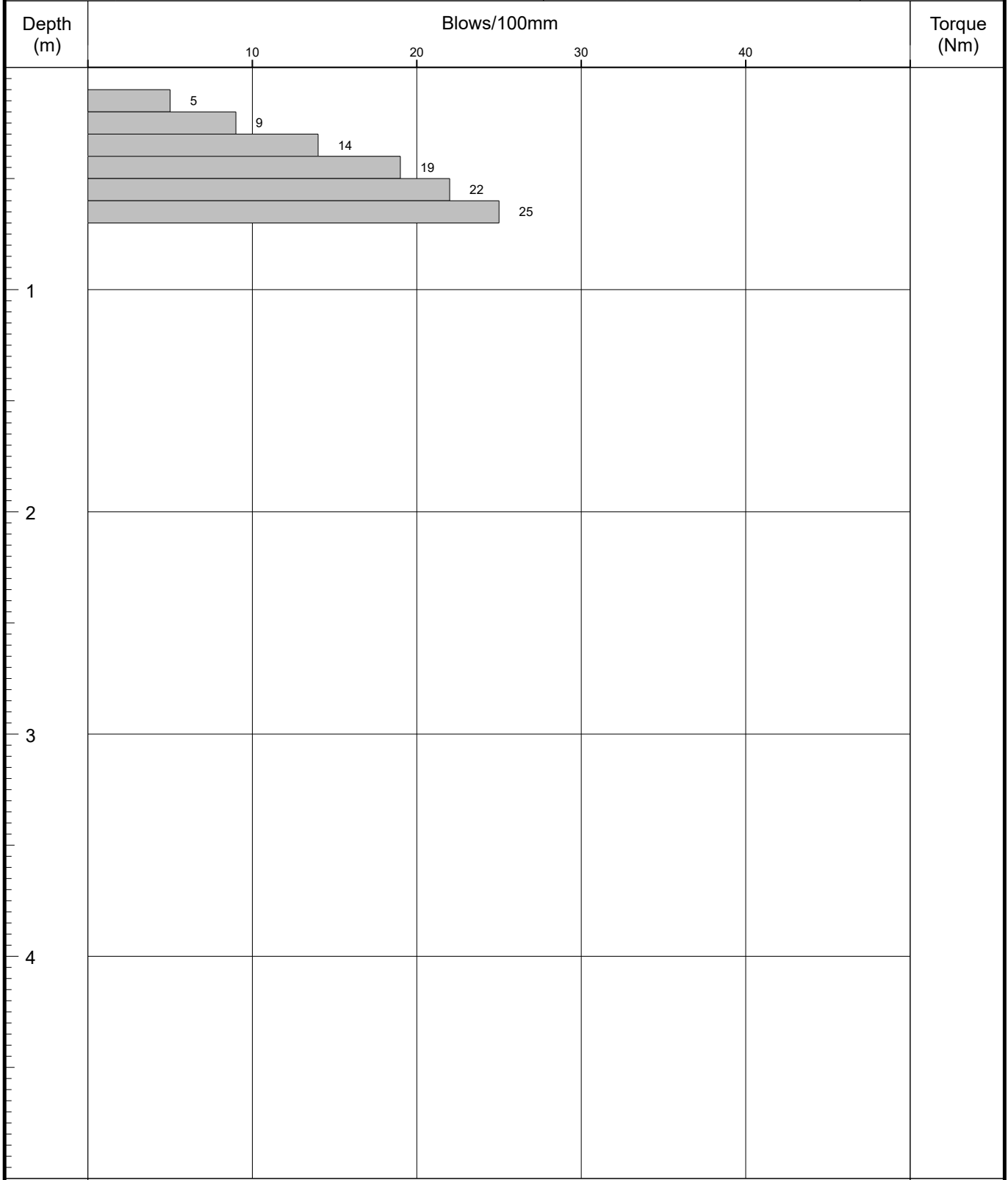




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Probe No  
**DP08**  
 Sheet 1 of 1

<b>Project Name:</b> Dereenacrinnig Windfarm	<b>Project No.:</b> P16177	<b>Co-ords:</b> 510787.80 - 550844.01	<b>Hole Type:</b> DP
<b>Location:</b> Drimoleague, Co. Cork.		<b>Level:</b> 202.37	<b>Scale:</b> 1:25
<b>Client:</b> Jennings O'Donovan & Partners		<b>Dates:</b> 22/12/2016	<b>Logged By:</b>



<b>Remarks:</b> DP08 terminated at 0.60m bgl, refusal.	<b>Fall Height:</b> 500	<b>Cone Base Dia:</b>
	<b>Hammer Wt:</b> 50	<b>Final Depth:</b> 0.60
	<b>Probe Type:</b> DPH	

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**APPENDIX B**

**GEOPHYSICAL REPORT**

Dereenacrinnig Wind Farm,  
Geophysical Investigation

Priority Geotechnical Ltd. (PGL)

P16177\_GP\_Rp\_F01, *March, 2017*



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**DERREENACRINNIG WIND FARM**  
**GEOPHYSICAL INVESTIGATION**  
**REPORT**  
**No. P16177\_GP\_Rp\_F01**

**Client:**

George O'Mahony & Associates

**Consulting Engineers:**





## REPORT CONTROL SHEET

<b>Client</b>	George O'Mahony & Associates					
<b>Engineer Representative</b>	Jennings O'Donovan Consulting Engineers					
<b>Project Name</b>	Derreenacrinnig Wind Farm Geophysical Investigation					
<b>Document Name</b>	Technical Report					
<b>Project Number</b>	P16177					
<b>This Report Comprises of</b>	TOC	Text	No. of Volume	No. of Appendices	Drawings	Electronic data
	<b>1</b>	<b>32</b>	<b>1</b>	<b>4</b>	<b>2</b>	<b>*.pdf *.dwg</b>

Revision	Status	Author(s)	Approved By	Issue Date
D01	Draft - for comment	HP	GH	01.03.2017
F01	Final - no comments	HP	GH	10.03.2017



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## **A) EXECUTIVE SUMMARY**

Priority Geotechnical Ltd. was instructed by Jennings O'Donovan Consulting Engineers on behalf of George O'Mahony & Associates to undertake a geophysical survey in conjunction with a site investigation survey at Derreenacrinnig Wind Farm.

The geophysical survey comprised of Electrical Resistivity Soundings, Seismic Refraction Profiling and Multi-Channel Analysis of Surface Wave (MASW) at 7 proposed turbine locations as well as a proposed substation location.

A full methodology of the above survey techniques is provided as part of this report.

The survey was carried out between 12th and 14th December 2016.

The survey objectives were as follows:

- Establish s-wave seismic velocity to depth at the 7 no. turbine bases.
- Collect electrical resistivity soundings across the 7 no. turbine bases as well as additional soundings at the substation site.

Direct resistance values were recorded at each of proposed locations at various electrode spacings. Direct resistance values (ohm) were converted to soil resistivities (ohm-m), the results are given in APPENDIX B. A location map showing the surveyed locations is given in APPENDIX A.

All shots collected for MASW analysis during this project were processed using the Seisimager / SW Surface wave analysis software.

Initial phase velocities were attempted to be derived for each shot from each spread. No dispersion curves were apparent for all shots at all 7 no. turbine bases with all wave propagation data within the initial 30ms of each record.

The reason no MASW data was present on the data is that the fundamental node of dispersion is not very sensitive with high velocities present near the surface as is the case on this site.

Fundamentally the MASW system is better setup to assess the stiffness characteristics of overburden material rather than bedrock.

In order to provide the required engineering moduli s-wave velocities have been derived from the calculated p-wave velocities (from the seismic refraction methodology) using a ratio of 1:3 (s-wave:p-wave). This is essentially approximating s-wave velocities so caution should be taken with the engineering moduli extrapolated from this approximation. The Poisson's Ratio presented (0.44 for all profiles) is of no use as this is calculated based on the ration of s-wave to p-wave velocity. These results are presented in APPENDIX C.

## B) INTRODUCTION

### B.1) Scope of Works

Priority Geotechnical Ltd. (herein referred to as PGL) was instructed by Jennings O'Donovan Consulting Engineers on behalf of George O'Mahony & Associates to undertake a geophysical survey in conjunction with a site investigation survey at Derreenacrinnig Wind Farm.

The geophysical survey comprised of Electrical Resistivity Soundings, Seismic Refraction Profiling and Multi-Channel Analysis of Surface Wave (MASW) at 7 proposed turbine locations as well as a proposed substation location.

The survey was carried out between 12th and 14th December 2016.

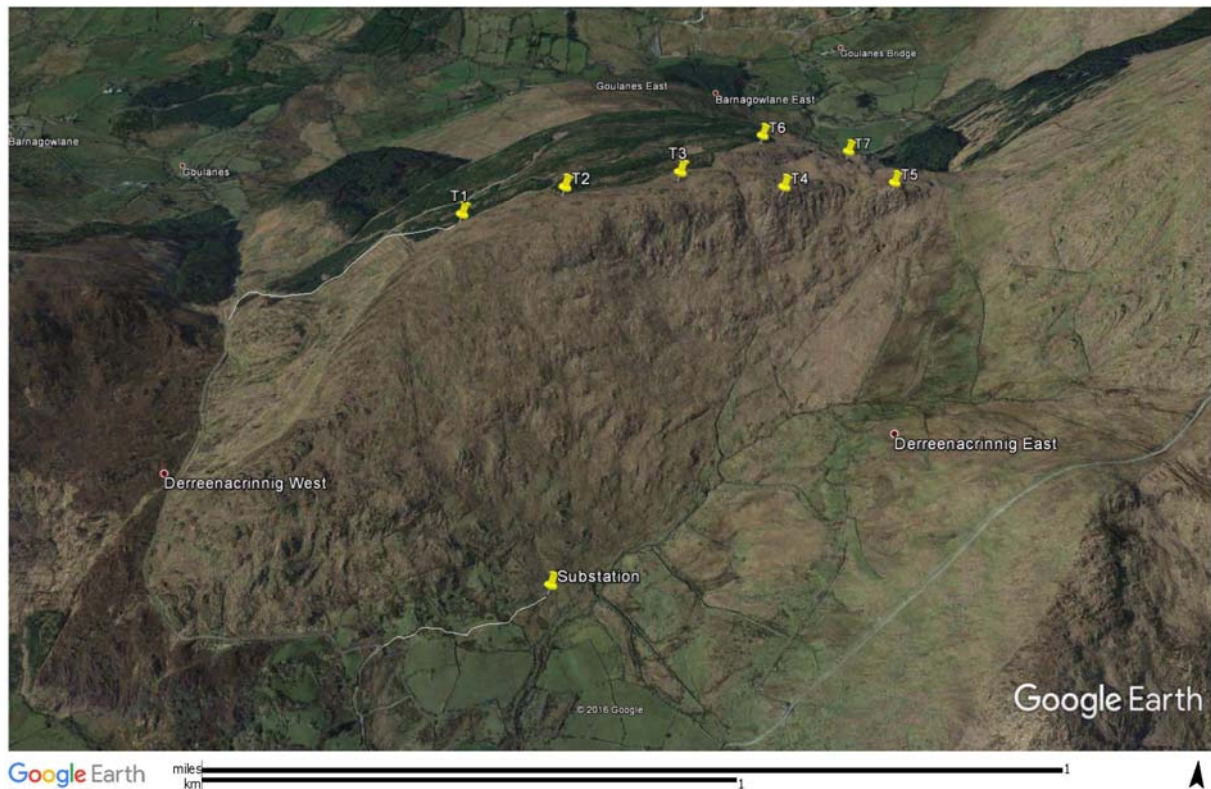


Figure A.1: Satellite image showing turbine and substation location (Google Earth).

## **B.2) Survey Objectives**

The survey objectives were as follows:

- Establish s-wave seismic velocity to depth at the 7 no. turbine bases.
- Collect resistivity soundings across the 7 no. turbine bases as well as additional soundings at the substation site.

## **B.3) Site Topography**

The proposed survey area is in a mountainous area with peat bogs located between rock outcrop. Topography along the survey route ranged from approximately 240m to 380m (OD Malin). All survey work was carried out on foot by a three person field crew.



## B.4) Site Geology

According to the GSI 100k Geology Map (Fig. A.2) the survey area is underlain by the Gun Point Formation, described purple and green medium-coarse grained sandstones (locally pebbly) with thin interbedded purple siltstones.

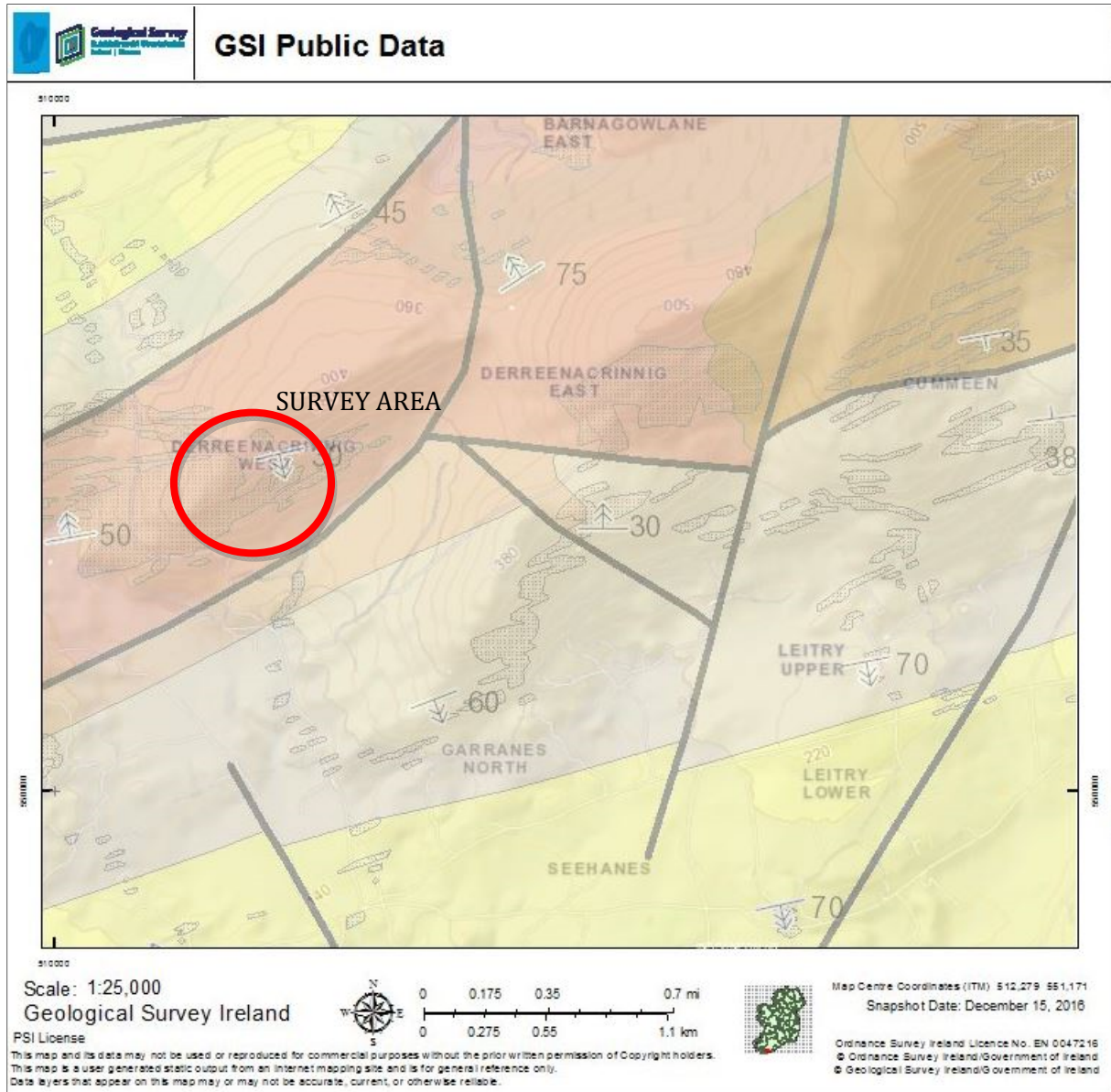


Figure A.2: GSI 100k Bedrock Geology Map of the site. The Gun Point Formation is shown in transparent red underlying the survey area at Derreenacrinnig West.

### B.4.i) Teagasc Soils Map

According to the Teagasc Soils Map the site is underlain by shallow soils derived from non-calcareous rock or gravels with/without peaty surface horizon.

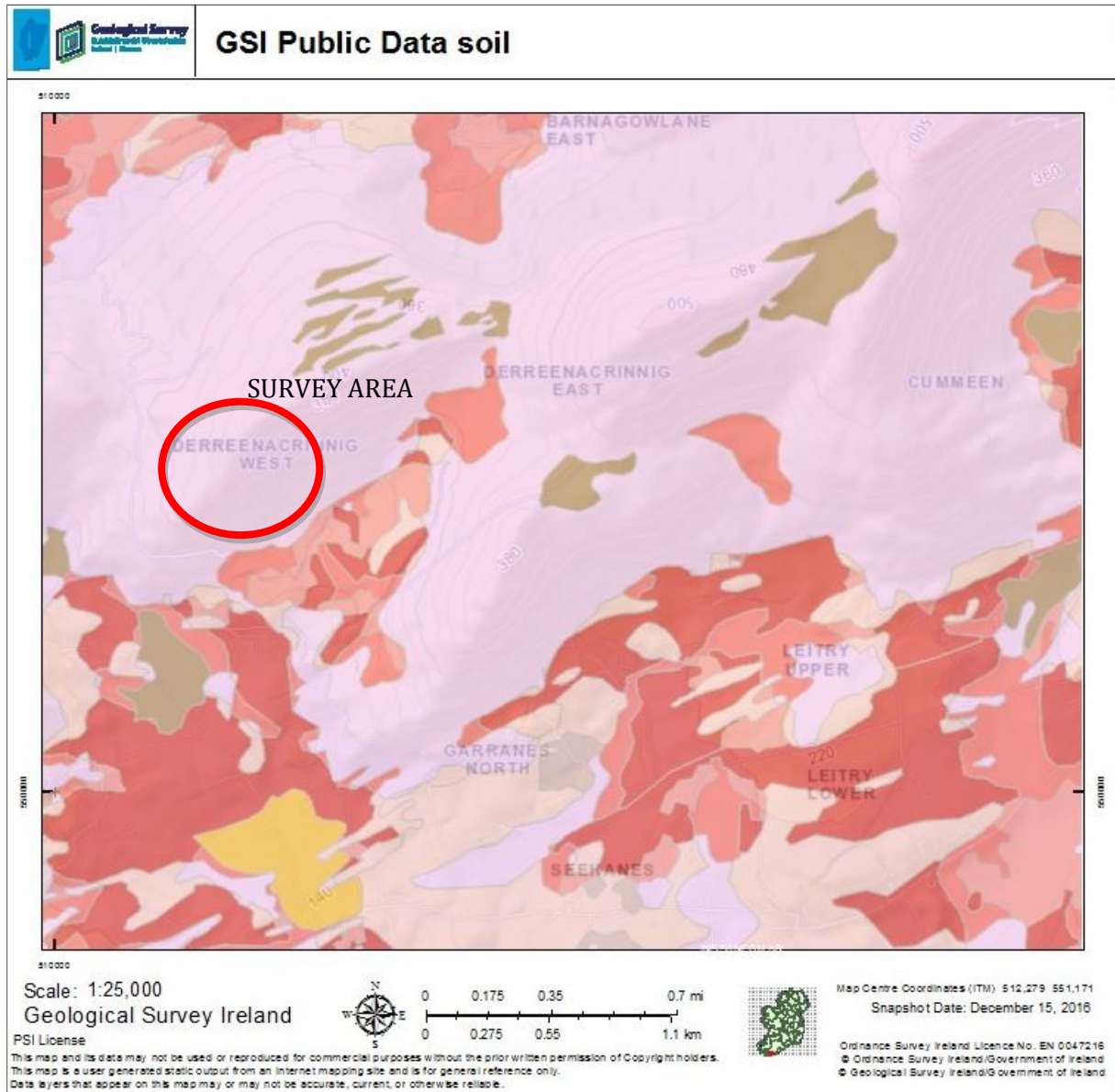


Figure A.3: Teagasc Soils Map showing the site to be underlain by shallow soils derived from non-calcareous rock or gravels with/ without peaty surface horizon (shown in pink).

## **C) SURVEY METHODOLOGY**

The geophysical survey comprised of the following methods;

- Electrical Resistivity Sounding
- Seismic Refraction Profiling
- Multi-Channel Analysis of Surface Wave (MASW)

The methodology for each technique used in this project is outlined below.

### **C.1) Electrical Soil Resistivity Sounding**

DC resistivity measurements were made by injecting a DC current into the ground through two current electrodes and measuring the resulting voltage at the surface between two potential electrodes. This method measures the bulk electrical resistivity which is a function of soil and rock matrix, percentage of fluid saturation and the conductivity of the pore fluids.

Resistivity measurements were taken at the 7 no. turbine bases as well as additional measurements at the substation site.

#### **C.1.i) Data Acquisition**

A GEO Fluke 1623 Ground / Earth Tester with accompanying cable and stainless steel electrodes were used to collect the data. Saline water was used to ensure proper contact resistance was maintained between the electrodes and the ground.

The Wenner 4-Point Method was used to determine ground resistivity's. This method involves placing 4 no. electrodes at varying equal spacing to approximate the soil resistivity as it varies with depth. Electrode spacings of 0.5m, 1.0m, 2.0m 5.0m, 10.0m, 20.0m and 40.0m were used for all locations.

The results provided are given as apparent resistivity and refer to a bulk resistivity of the soil with depth.

#### **C.1.ii) Data Processing**

Direct resistance values were recorded at each of the 7 no. electrode spacings. Direct resistance values (ohm) were converted to soil resistivities (ohm-m) using the following formula;

$$2 * \pi * \text{electrode spacing (m)} * \text{direct resistance (ohm)}$$

## **C.2) Multi-Channel Analysis of Surface Wave Profiling**

In the MASW survey method a surface wave is generated by a source (sledge hammer) at the surface resulting in the generation of a surface wave. Surface waves, often referred to as 'ground roll' are characterized as being of low velocity, low frequency and relatively high amplitude.

Surface waves are dispersive, with the frequency range of the surface waves all having different velocities. The surface wave phase velocity spectrum (the velocity of the different frequencies of surface waves) is a good proxy for shear wave velocities. The frequency range of the surface wave spectrum determines the depth of investigation possible. Lower frequencies see deeper and higher frequencies see shallower.

A total of 7 no. seismic refraction profiles were acquired centred on the 7 no. turbine bases. Some profiles were moved slightly to avoid steep inclines.

### **C.2.i) Data Acquisition**

A 24-channel Geometrics Geode seismic system was utilized with a 24-channel seismic multicore cable, 4.5Hz geophones, and a sledge hammer and plate as a seismic source. A geophone spacing of 1m with a profile length of 23m was used for all profiles.

Data was recorded using SGOS Seismodule Controller software. A total of 16 shots were undertaken on each seismic line;

- 4 shots were taken 1m off the end of each side of the survey profiles
- 4 shots were taken 2m off the end of each side of the survey profiles

No data acquisition filters were used in the acquisition of the MASW shots.

### **C.2.ii) Data Processing**

All shots collected for MASW analysis during this project were processed using the Seisimager / SW Surface wave analysis software.

Initial phase velocities were attempted to be derived for each shot from each spread. No dispersion curves were apparent for all shots at all 7 no. turbine bases with all wave propagation data within the initial 30ms of each record.

The reason no MASW data was present on the data is that the fundamental node of dispersion is not very sensitive with high velocities present near the surface as is the case on this site.

Fundamentally the MASW system is better setup to assess the stiffness characteristics of overburden material rather than bedrock.



### C.2.iii) Data Interpretation

No s-wave results were interpreted based on the issues as outlined above.

## C.3) Seismic Refraction Profiling

Seismic refraction measurements are made by measuring the travel time of direct and refracted acoustic waves as they travel from the surface through one layer to another and back to the surface where their arrival times are recorded. The travel time is a function of the seismic or acoustic velocity and geometry of the subsurface layers of soil and rock.

A total of 7 no. seismic refraction profiles were acquired centred on the 7 no. turbine bases. Profiles were named S1 through to S7 and are consecutive with the turbine base numbers. Some profiles were moved slightly to avoid steep inclines.

### C.3.i) Data Acquisition

A 24-channel Geometrics Geode seismic system was utilized with a 24-channel seismic multicore cable, 4.5Hz geophones, and a sledge hammer and plate as a seismic source. A geophone spacing of 1m with a profile length of 23m was used for all profiles.

Data was recorded using SGOS Seismodule Controller software. A total of 7 shots were undertaken on each seismic line; 2 end-shots, 2 off-shots and 3 mid-shots. To improve signal to noise ratio, individual hammer shots were stacked at each shot location where necessary.

### C.3.ii) Data Processing

Data processing was undertaken utilizing Seisimager Seismic 2D software programs. Surveyed topography was input for each seismic spread. First breaks were picked after which a tomographic inversion was computed using travel-time computation via ray-tracing. Velocity modeling and travel time plots were constructed for each spread. Seismic velocity phases were picked and the thickness of each velocity unit calculated using the intercept-time method.

RMS errors of the tomographic inversion is summarised in Table C.1.

Spread no.	RMS Error
S1	0.71ms
S2	0.78ms
S3	0.54ms
S4	0.25ms
S5	0.11ms
S6	0.61ms
S7	0.78ms

Table C.1: RMS Error of inverted seismic data

### **C.3.iii) Data Interpretation**

It should be noted that when layer thicknesses are modelled from the seismic data the areas of greatest coverage (i.e. the centre of the spread) will have the greatest accuracy. At the edges of the spread less ray coverage reduces the accuracy of layer interpretation and thickness calculation.

Approximate errors for velocities are estimated to be +/-10%. Errors for the calculated layer thickness are of the order of +/-15%. Possible errors due to the "hidden layer" and "velocity" effects may also occur (Soske, 1959). Seismic Refraction generally determines the depth to horizontal or near horizontal layers where the compaction/strength/rock quality changes. Where low velocity layers are present or where layers dip with more than 20 degrees angle the accuracy becomes less.

The results of the seismic refraction survey are given in APPENDIX C.

### **C.4) GNSS Surveying**

Horizontal control and Elevation was provided by a Trimble VRS (Real Time Kinematic/Virtual Reference Station) enabled GPS. Survey Controller software was used to provide high-accuracy, GNSS positioning.

All positions are plotted in Irish Transverse Mercator (ITM). Elevations are to O.D. Malin.

## D) SURVEY RESULTS

### D.1) Electrical Soil Resistivity Sounding

The results of this method are given in APPENDIX B. Location maps showing the surveyed locations are given in APPENDIX A. For the 7 no. turbine bases the location of the soundings is the same as the centre of the seismic refraction profiles.

### D.2) MASW

As outlined in Section B.2.ii, due to the nature of the site no s-wave data was present on the recorded data. Section B.2 outlines that best practice was followed for the acquisition of MASW profiles.

In order to provide the required engineering moduli s-wave velocities have been derived from the calculated p-wave velocities (from the seismic refraction methodology) using a ratio of 1:3 (s-wave:p-wave). This is essentially approximating s-wave velocities so caution should be taken with the engineering moduli extrapolated from this approximation. The Poisson's Ratio presented (0.44 for all profiles) is of no use as this is calculated based on the ration of s-wave to p-wave velocity. These results are presented in APPENDIX C.

### D.3) Seismic Refraction

As part of the MASW acquisition additional shots were acquired for p-wave refraction data acquisition. Modelled seismic velocities ( $V_p$ ) ranged from c. 300 to 3500 m/s for the soil and bedrock materials.

The seismic refraction data has generally been interpreted on the following basis:

<b>P-Wave velocity (m/s)</b>	<b>Interpretation</b>
0 - 500	Peat
500 -1000	Firm OVERBURDEN / Highly fractured SILTSTONE / SANDSTONE
1000 - 1800	Fractured SILTSTONE / SANDSTONE
1800 - 2600	Slightly fractured SILTSTONE / SANDSTONE
> 2600	Fresh SILTSTONE / SANDSTONE

Table B.2.1: Interpretation based on P-Wave velocity

The results of the seismic refraction survey are presented in APPENDIX C as  $V_p$  soundings at the turbine bases. Additionally the seismic refraction profiles are presented as cross sections with

p-wave seismic velocity displayed to depth. The orientation for all profiles is west towards east. Location maps showing the surveyed locations are given in APPENDIX A.

#### D.4) Estimated Excavatability

The rippability of the bedrock can be estimated by the seismic refraction method. The seismic velocity of the rock concerned is compared with a chart of ripper performance based on ripping operations in a wide variety of rock (see Fig. C.1).

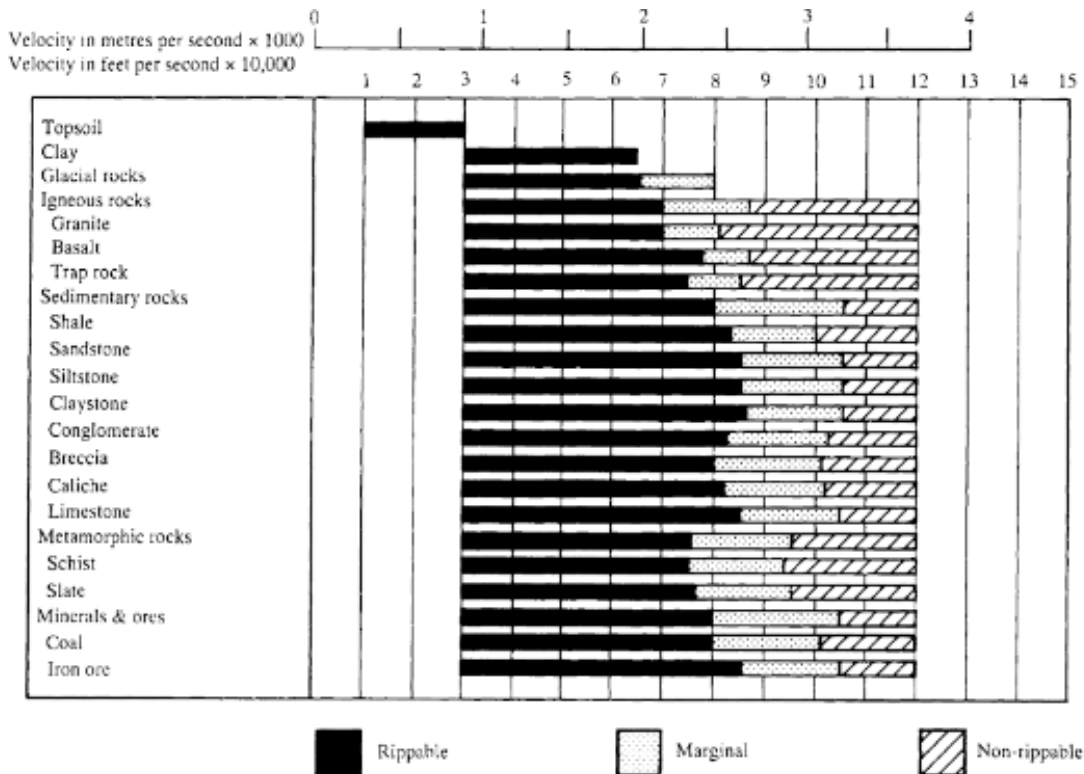


Figure C.1: P-Wave Seismic Velocity in relation to rippability (Bell, 1992)

The excavation of each of the 7 no. turbine bases will encounter sedimentary bedrock at shallow depths or at the surface. In general, it can be said that where P-Wave velocity exceeds 2500m/s rock will be marginal rippable to non-rippable. Where velocities are less than 2500m/s this would indicate probable rippability. However, if the fractures and bedding joints do not allow tooth penetration the material may not be ripped.



## **APPENDIX A: DRAWINGS**

Locations maps have been produced to show seismic refraction and electrical sounding locations and are summarised below. Note that electrical soundings were taken at the same location as the seismic refraction soundings displayed as blue circles on the drawings.

<b>Drawing Number</b>	<b>Geophysical profile</b>	<b>Scale</b>
P16177_Gp_D01	S1-S4 and Substation	1:500 at A1
P16177_Gp_D02	S5-S7	1:500 at A1

FIGURE 1: LOCATION MAP SHOWING SEISMIC REFRACTION PROFILES S1 AND S2  
SCALE 1:500

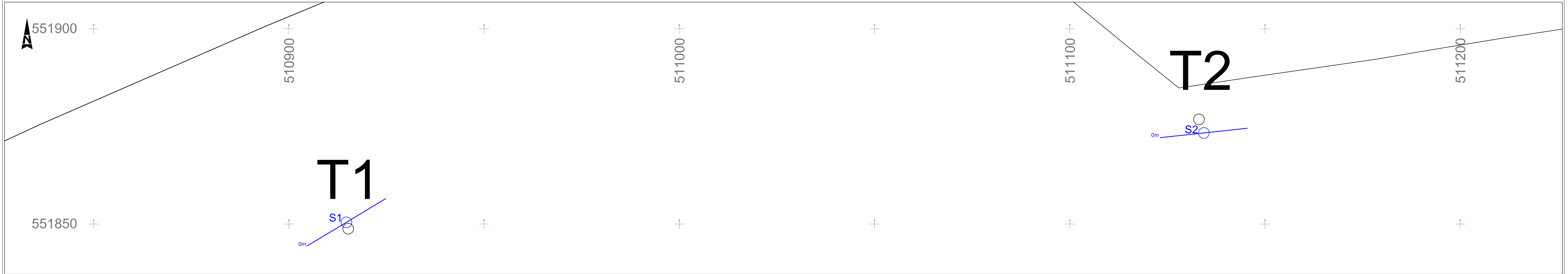


FIGURE 2: LOCATION MAP SHOWING SEISMIC REFRACTION PROFILES S3 AND S4  
SCALE 1:500

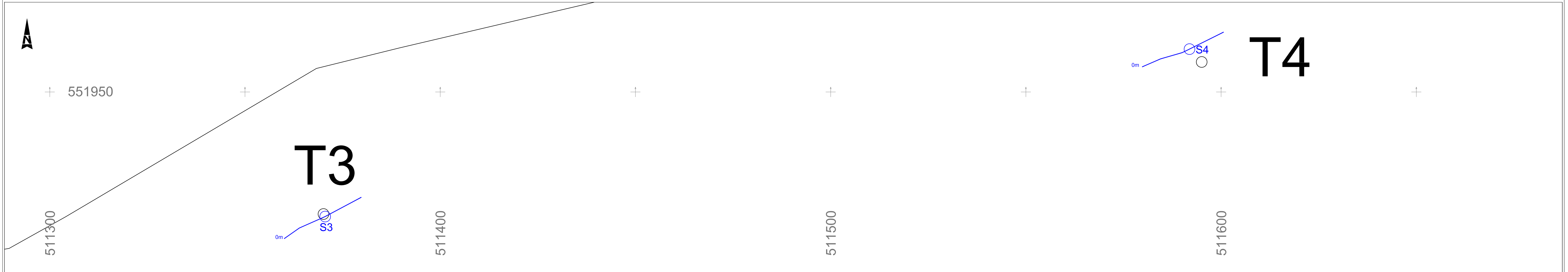
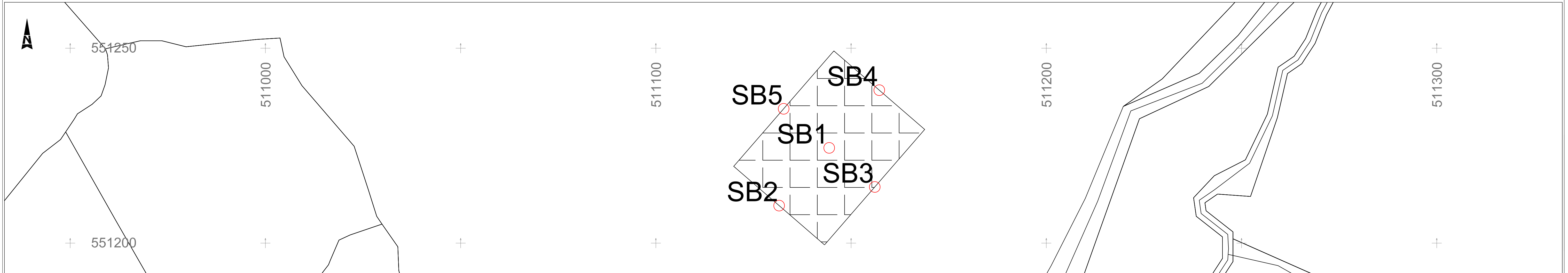


FIGURE 3: LOCATION MAP SHOWING ELECTRICAL SOIL RESISTIVITY SOUNDING LOCATIONS AT SUBSTATION  
SCALE 1:500



PROJECT:  
DERREENACRINNING  
WIND FARM

Sheet Title:  
LOCATION MAP 1 OF 2

CONSULTING ENGINEER:  
Jennings O'Donovan  
Consulting Engineers  
CLIENT:  
George O'Mahoney &  
Associates

SURVEYED BY:  
PRIORITY GEOTECHNICAL  
LTD.

JOB NUMBER:  
P16177

DRAWING NUMBER:  
P16177\_Gp\_D01

COORDINATE SYSTEM:  
ITM

DATUM:  
OD Malin

DRAWN BY:  
Hugh Power

DATE OF ISSUE:  
01/03/2017

SCALE:  
As stated @ A1

APPROVED:  
Greg Hayes

REVISION:  
Rev.00

LEGEND:

SB5 — Electrical Resistivity Sounding Location

S1 — Seismic Refraction Profile

Indicates location that relates to APPENDIX C in Geophysical Report

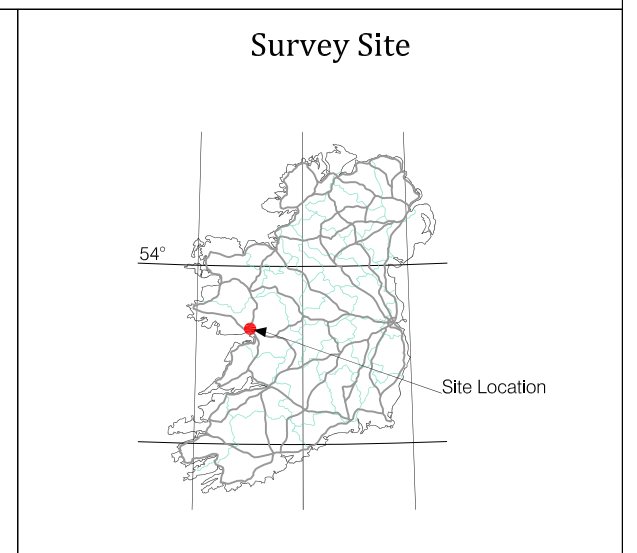
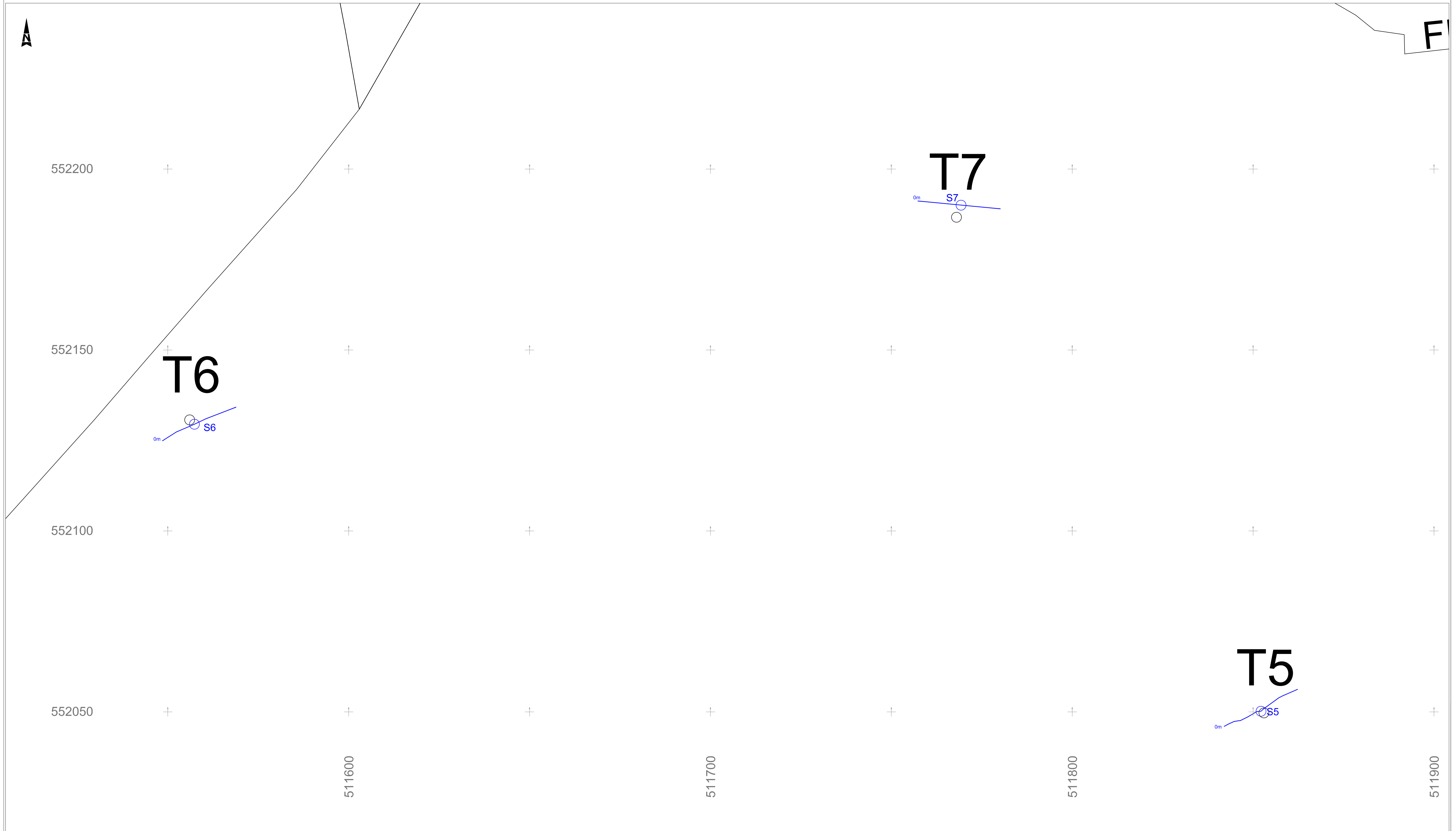


FIGURE 1: LOCATION MAP SHOWING SEISMIC REFRACTION PROFILES S5, S6 AND S7  
SCALE 1:500



PROJECT:  
DERREENACRINNING  
WIND FARM

SHEET TITLE:  
LOCATION MAP 2 OF 2

CONSULTING ENGINEER:  
Jennings O'Donovan  
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SURVEYED BY:  
PRIORITY GEOTECHNICAL  
LTD.

JOB NUMBER:  
P16177

DRAWING NUMBER:  
P16177\_Gp\_D02

COORDINATE SYSTEM:  
ITM

DATUM:  
OD Malin

DRAWN BY:  
Hugh Power

DATE OF ISSUE:  
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SCALE:  
As stated @ A1

APPROVED:  
Greg Hayes

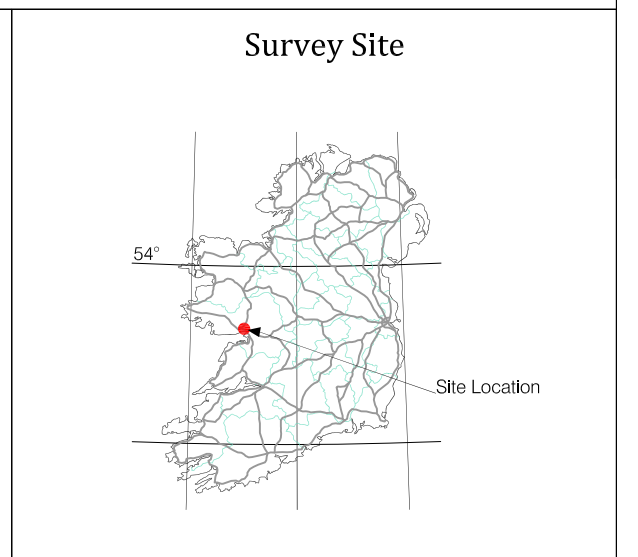
REVISION:  
Rev.00

LEGEND:

**SB5** Electrical Resistivity Sounding Location

**S1** Seismic Refraction Profile

Indicates location that relates to APPENDIX C in Geophysical Report



## APPENDIX B: SOIL RESISTIVITY SOUNDINGS

P16177 - Derreenacrinnig Wind Farm		
Date:	13/12/2016	
T1		
Easting [ITM]	510915	
Northing [ITM]	551849	
Elevation [OD Malin]	373.1	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	99.1	311.3
1	74.0	464.9
2	76.8	965.1
5	39.4	1237.8
10	30.1	1891.2
20	15.2	1905.0
40	4.8	1208.8

P16177 - Derreenacrinnig Wind Farm		
Date:	13/12/2016	
T2		
Easting [ITM]	511134	
Northing [ITM]	551873	
Elevation [OD Malin]	394.3	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	158.8	498.9
1	128.3	806.1
2	92.1	1157.3
5	84.9	2667.1
10	29.9	1878.6
20	11.3	1420.0
40	5.2	1294.3

P16177 - Derreenacrinnig Wind Farm		
Date:	13/12/2016	
T3		
Easting [ITM]	511370	
Northing [ITM]	551919	
Elevation [OD Malin]	397.5	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	59.2	186.0
1	54.8	344.3
2	55.5	697.4
5	38.4	1206.3
10	24.8	1558.2
20	16.3	2042.0
40	12.0	3018.4

P16177 - Derreenacrinnig Wind Farm		
Date:	14/12/2016	
T4		
Easting [ITM]	511595	
Northing [ITM]	551958	
Elevation [OD Malin]	381.0	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	125.8	395.2
1	107.3	674.2
2	107.7	1353.4
5	48.5	1523.6
10	30.4	1910.0
20	21.4	2689.1
40	14.7	3686.9



P16177 - Derreenacrinnig Wind Farm		
Date:	14/12/2016	
T5		
Easting [ITM]	511853	
Northing [ITM]	552050	
Elevation [OD Malin]	359.7	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	242.0	760.2
1	191.7	1204.5
2	106.6	1339.5
5	46.2	1451.4
10	43.7	2745.7
20	22.7	2852.5
40	13.5	3392.8

P16177 - Derreenacrinnig Wind Farm		
Date:	13/12/2016	
T6		
Easting [ITM]	511556	
Northing [ITM]	552131	
Elevation [OD Malin]	374.3	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	235.0	738.3
1	159.8	1004.0
2	106.4	1337.0
5	64.5	2026.3
10	21.3	1338.3
20	11.7	1470.2
40	6.9	1739.1

P16177 - Derreenacrinnig Wind Farm		
Date:	13/12/2016	
T7		
Easting [ITM]	511768	
Northing [ITM]	552187	
Elevation [OD Malin]	358.1	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	119.2	374.5
1	127.5	801.1
2	74.7	938.7
5	39.0	1225.2
10	20.7	1300.6
20	10.2	1281.7
40	7.5	1889.9

P16177 - Derreenacrinnig Wind Farm		
Date:	14/12/2016	
SB1 - Orientation North-South		
Easting [ITM]	511144	
Northing [ITM]	551224	
Elevation [OD Malin]	241.7	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	164.9	518.0
1	88.9	558.6
2	43.7	549.1
5	31.8	999.0
10	13.0	818.0
20	14.0	1759.2
40	7.9	1995.5

P16177 - Derreenacrinnig Wind Farm		
Date:	14/12/2016	
SB2 - Orientation North West-South East		
Easting [ITM]	511132	
Northing [ITM]	551210	
Elevation [OD Malin]	241.6	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	311.0	977.0
1	91.2	573.0
2	122.2	1535.6
5	45.6	1432.5
10	23.3	1463.9
20	10.4	1311.9
40	8.4	2098.5

P16177 - Derreenacrinnig Wind Farm		
Date:	14/12/2016	
SB3 - Orientation South West-North East		
Easting [ITM]	511156	
Northing [ITM]	551214	
Elevation [OD Malin]	241.5	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	416.0	1306.9
1	248.0	1558.2
2	106.0	1332.0
5	30.4	955.0
10	16.8	1057.4
20	10.4	1300.6
40	5.8	1447.6

P16177 - Derreenacrinnig Wind Farm		
Date:	14/12/2016	
SB4 - Orientation North West-South East		
Easting [ITM]	511157	
Northing [ITM]	551239	
Elevation [OD Malin]	242.2	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	985.0	3094.4
1	414.0	2601.2
2	99.8	1254.1
5	78.8	2475.5
10	32.4	2035.7
20	18.6	2337.3
40	8.7	2194.0

P16177 - Derreenacrinnig Wind Farm		
Date:	14/12/2016	
SB5 - Orientation South West-North East		
Easting [ITM]	511133	
Northing [ITM]	551234	
Elevation [OD Malin]	243.6	
Electrode Spacing	Direct resistivity ( $\Omega$ )	Soil resistivity ( $\Omega$ m)
0.5	100.2	314.8
1	98.0	615.7
2	77.3	971.4
5	49.3	1548.8
10	31.5	1979.1
20	16.7	2093.5
40	13.2	3322.5

<b>P16177 - Derreenacrinnig Wind Farm</b>		
<b>Date:</b>	<b>14/12/2016</b>	
<b>SB1 - Orientation West-East</b>		
<b>Easting [ITM]</b>	<b>511144</b>	
<b>Northing [ITM]</b>	<b>551224</b>	
<b>Elevation [OD Malin]</b>	<b>241.7</b>	
<b>Electrode Spacing</b>	<b>Direct resistivity (<math>\Omega</math>)</b>	<b>Soil resistivity (<math>\Omega</math>m)</b>
0.5	121.9	382.9
1	111.5	700.6
2	46.1	579.3
5	20.1	631.4
10	14.6	916.7
20	11.5	1445.1
40	7.4	1859.8

## APPENDIX C: SEISMIC PROFILE SOUNDING RESULTS

### P-Wave Geophysical Interpretation Summary Sheets

Below are the results from Seismic Refraction (Vp) and generated MASW (Vs) data combined with the engineering moduli. A geophysical interpretation and estimated excavatability has been included with the results.

**Position:** S1  
**Easting:** 510914.7  
**Northing:** 551850.4  
**Elevation:** 373.4

Depth [m bgl]		P Wave	S Wave	Density	Poissons	K Bulk	E	Small	Geophysical Interpretation	Excavatability
From	To	[m/s]	① [m/s]	② [kg/m <sup>3</sup> ]	Ratio ③	Modulus [MPa]	Youngs Modulus [MPa]	Strain Shear Modulus [MPa]		
0	0.4	409	136	1394	0.44	198.67	74.50	25.91	Peat	Diggable
0.4	1	968	323	1729	0.44	1380.27	517.58	180.03	Highly fractured SILTSTONE	Probable Rippable
1	1.5	1529	510	1938	0.44	3860.66	1447.68	503.54	Fractured SILTSTONE	Probable Rippable
1.5	2.4	2194	731	2122	0.44	8700.16	3262.42	1134.75	Slightly fractured SILTSTONE	Marginal Rippable
2.4	-	3480	1160	2381	0.44	24563.94	9211.08	3203.85	Fresh SILTSTONE	Non Rippable

① S Wave estimated from p-wave velocity on a 1:3 ratio

② Density computed from p-wave velocity

③ Poissons Ratio derived from computed s-wave velocity so should be ignored



**Position:** S2  
**Easting:** 511134.3  
**Northing:** 551873.3  
**Elevation:** 394.3

Depth [m bgl]		P Wave	S Wave ①	Density ②	Poissons Ratio ③	K Bulk Modulus	E Youngs Modulus	Small Strain Shear Modulus	Geophysical Interpretation	Excavatability
From	To	[m/s]	[m/s]	[kg/m <sup>3</sup> ]		[MPa]	[MPa]	[MPa]		
0	0.4	837	279	1667	0.44	995.12	373.16	129.79	Highly fractured SANDSTONE	Probable Rippable
0.4	1.3	1464	488	1918	0.44	3501.16	1312.88	456.65	Fractured SANDSTONE	Probable Rippable
1.3	1.9	2006	669	2075	0.44	7111.96	2666.87	927.61	Slightly fractured SANDSTONE	Probable Rippable
1.9	2.6	2653	884	2225	0.44	13339.93	5002.26	1739.91	Slightly fractured SANDSTONE	Marginal Rippable
2.6	-	3748	1249	2426	0.44	29026.44	10884.44	3785.89	Fresh SANDSTONE	Non Rippable

- ① S Wave estimated from p-wave velocity on a 1:3 ratio
- ② Density computed from p-wave velocity
- ③ Poissons Ratio derived from computed s-wave velocity so should be ignored

**Position:** S3  
**Easting:** 511370.5  
**Northing:** 551918.1  
**Elevation** 397.5

<b>Depth [m bgl]</b>		<b>P Wave</b>	<b>S Wave</b>	<b>Density</b>	<b>Poissons</b>	<b>K Bulk</b>	<b>E</b>	<b>Small</b>		
<b>From</b>	<b>To</b>	<b>[m/s]</b>	<b>①</b>	<b>②</b>	<b>Ratio</b>	<b>Modulus</b>	<b>Youngs</b>	<b>Strain</b>	<b>Geophysical Interpretation</b>	<b>Excavatability</b>
			<b>[m/s]</b>	<b>[kg/m<sup>3</sup>]</b>	<b>③</b>	<b>[MPa]</b>	<b>[MPa]</b>	<b>Modulus</b>		
								<b>[MPa]</b>		
0	0.4	409	136	1394	0.44	198.67	74.50	25.91	Peat	Diggable
0.4	1	968	323	1729	0.44	1380.27	517.58	180.03	Firm Overburden	Diggable
1	1.5	1529	510	1938	0.44	3860.66	1447.68	503.54	Fractured SILTSTONE	Probable Rippable
1.5	2.4	2194	731	2122	0.44	8700.16	3262.42	1134.75	Slightly fractured SILTSTONE	Marginal Rippable
2.4	-	3480	1160	2381	0.44	24563.94	9211.08	3203.85	Fresh SILTSTONE	Non Rippable

- ① S Wave estimated from p-wave velocity on a 1:3 ratio
- ② Density computed from p-wave velocity
- ③ Poissons Ratio derived from computed s-wave velocity so should be ignored

**Position:** S4  
**Easting:** 511591.9  
**Northing:** 551961.0  
**Elevation** 381.0

<b>Depth [m bgl]</b>		<b>P Wave</b>	<b>S Wave</b>	<b>Density</b>	<b>Poissons</b>	<b>K Bulk</b>	<b>E Youngs</b>	<b>Small</b>		
<b>From</b>	<b>To</b>	<b>[m/s]</b>	<b>①</b>	<b>②</b>	<b>Ratio</b>	<b>Modulus</b>	<b>Modulus</b>	<b>Strain</b>	<b>Geophysical Interpretation</b>	<b>Excavatability</b>
			<b>[m/s]</b>	<b>[kg/m<sup>3</sup>]</b>	<b>③</b>	<b>[MPa]</b>	<b>[MPa]</b>	<b>Shear</b>		
								<b>Modulus</b>		
								<b>[MPa]</b>		
0	0.4	1681	560	1985	0.44	4778.28	1791.78	623.23	Fractured SILTSTONE	Probable Rippable
0.4	0.7	2798	933	2255	0.44	15036.68	5638.51	1961.22	Slightly fractured SILTSTONE	Marginal Rippable
0.7	1	3473	1158	2380	0.44	24452.90	9169.44	3189.37	Fresh SILTSTONE	Non Rippable
1	-	3761	1254	2428	0.44	29253.45	10969.57	3815.50	Fresh SILTSTONE	Non Rippable

- ① S Wave estimated from p-wave velocity on a 1:3 ratio
- ② Density computed from p-wave velocity
- ③ Poissons Ratio derived from computed s-wave velocity so should be ignored

**Position:** S5  
**Easting:** 511852.2  
**Northing:** 552050.2  
**Elevation** 359.7

<b>Depth [m bgl]</b>		<b>P Wave</b>	<b>S Wave</b>	<b>Density</b>	<b>Poissons</b>	<b>K Bulk</b>	<b>E</b>	<b>Small</b>		
<b>From</b>	<b>To</b>	<b>[m/s]</b>	<b>①</b>	<b>②</b>	<b>Ratio</b>	<b>Modulus</b>	<b>Youngs</b>	<b>Strain</b>	<b>Geophysical Interpretation</b>	<b>Excavatability</b>
			<b>[m/s]</b>	<b>[kg/m<sup>3</sup>]</b>	<b>③</b>	<b>[MPa]</b>	<b>[MPa]</b>	<b>Modulus</b>		
								<b>[MPa]</b>		
0	0.4	1088	363	1780	0.44	1795.39	673.24	234.17	Highly fractured SILTSTONE	Probable Rippable
0.4	0.9	2031	677	2081	0.44	7312.94	2742.23	953.82	Slightly fractured SILTSTONE	Probable Rippable
0.9	2.3	2641	880	2222	0.44	13204.55	4951.49	1722.26	Slightly fractured SILTSTONE	Marginal Rippable
2.3	2.8	2740	913	2243	0.44	14344.43	5378.93	1870.93	Fresh SILTSTONE	Marginal Rippable
2.8	-	3269	1090	2344	0.44	21339.20	8001.85	2783.25	Fresh SILTSTONE	Non Rippable

- ① S Wave estimated from p-wave velocity on a 1:3 ratio
- ② Density computed from p-wave velocity
- ③ Poissons Ratio derived from computed s-wave velocity so should be ignored



**Position:** S6  
**Easting:** 511557.4  
**Northing:** 552129.5  
**Elevation** 374.3

Depth [m bgl]		P Wave	S Wave ①	Density ②	Poissons Ratio ③	K Bulk Modulus	E Youngs Modulus	Small Strain Shear Modulus	Geophysical Interpretation	Excavatability
From	To	[m/s]	[m/s]	[kg/m <sup>3</sup> ]		[MPa]	[MPa]	[MPa]		
0	0.4	959	320	1725	0.44	1351.56	506.81	176.28	Highly fractured SILTSTONE	Probable Rippable
0.4	0.7	1792	597	2017	0.44	5517.66	2069.03	719.66	Fractured SILTSTONE	Probable Rippable
0.7	1	2279	760	2142	0.44	9476.97	3553.71	1236.07	Slightly fractured SILTSTONE	Probable Rippable
1	1.3	2810	937	2257	0.44	15182.17	5693.07	1980.20	Fresh SILTSTONE	Marginal Rippable
1.3	1.5	3310	1103	2351	0.44	21946.11	8229.44	2862.41	Fresh SILTSTONE	Non Rippable
1.5	-	3736	1245	2424	0.44	28817.75	10806.19	3758.67	Fresh SILTSTONE	Non Rippable

- ① S Wave estimated from p-wave velocity on a 1:3 ratio
- ② Density computed from p-wave velocity
- ③ Poissons Ratio derived from computed s-wave velocity so should be ignored

**Position:** S7  
**Easting:** 511769.3  
**Northing:** 552190.0  
**Elevation** 347.5

<b>Depth [m bgl]</b>		<b>P Wave</b>	<b>S Wave</b>	<b>Density</b>	<b>Poissons Ratio</b>	<b>K Bulk Modulus</b>	<b>E Youngs Modulus</b>	<b>Small Strain Shear Modulus</b>	<b>Geophysical Interpretation</b>	<b>Excavatability</b>
<b>From</b>	<b>To</b>	<b>[m/s]</b>	<b>① [m/s]</b>	<b>② [kg/m<sup>3</sup>]</b>	<b>③</b>	<b>[MPa]</b>	<b>[MPa]</b>	<b>[MPa]</b>		
0	0.7	563	188	1510	0.44	407.74	152.90	53.18	Firm OVERBURDEN	Diggable
0.7	1.2	1236	412	1838	0.44	2392.14	897.01	312.00	Fractured SILTSTONE	Probable Rippable
1.2	1.8	1816	605	2024	0.44	5685.33	2131.90	741.53	Fractured SILTSTONE	Probable Rippable
1.8	2.4	2407	802	2171	0.44	10716.82	4018.63	1397.79	Slightly fractured SILTSTONE	Marginal Rippable
2.4	-	3480	1160	2381	0.44	24563.94	9211.08	3203.85	Fresh SILTSTONE	Non Rippable

- ① S Wave estimated from p-wave velocity on a 1:3 ratio
- ② Density computed from p-wave velocity
- ③ Poissons Ratio derived from computed s-wave velocity so should be ignored

## **APPENDIX D: SEISMIC REFRACTION PROFILE CROSS SECTIONS**

All profiles are displayed from west towards east. The interpreted top of rock has been given as a thick black line on the cross sections. See APPENDIX A for location map of all profiles collected.

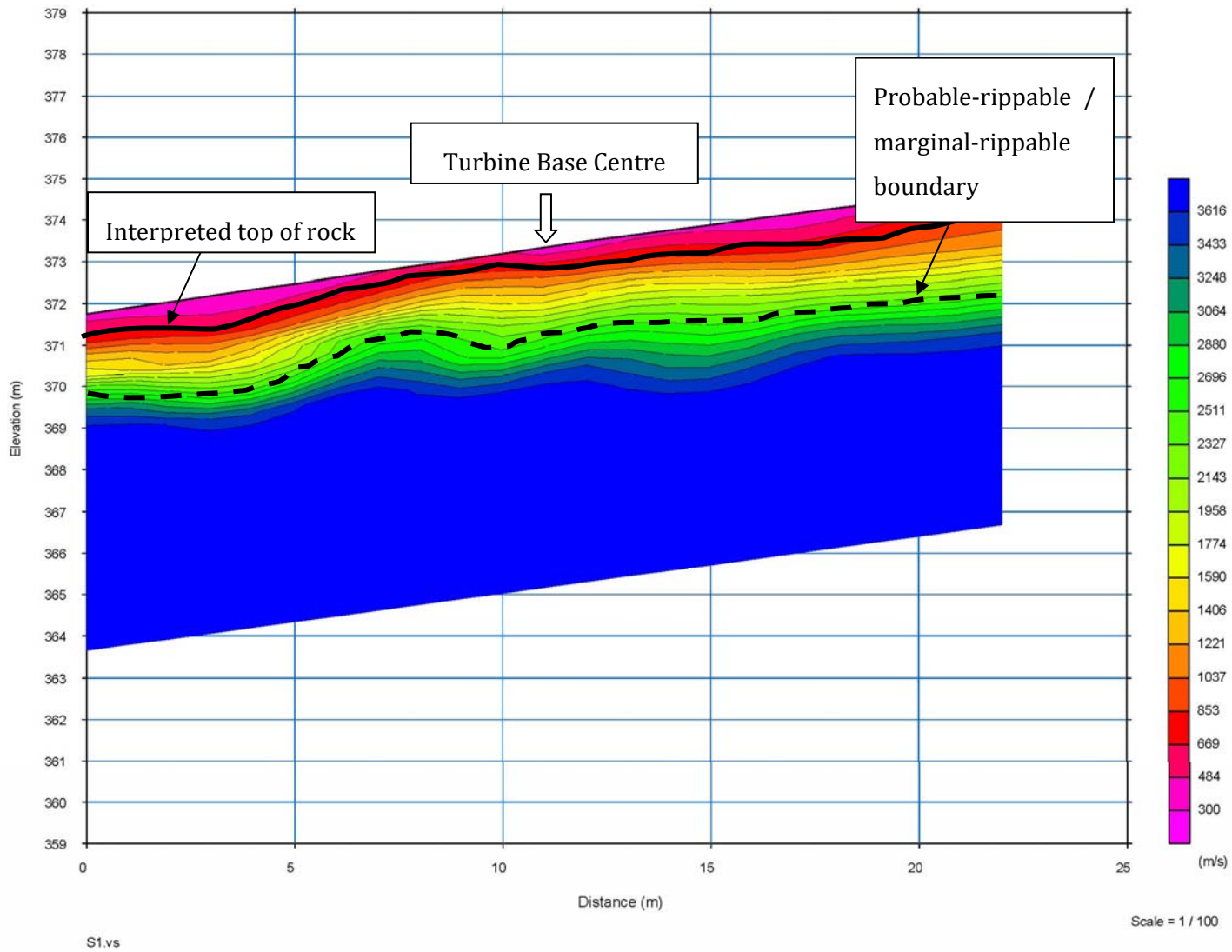


Figure AB.1: P-Wave Seismic Velocity Cross Section for Turbine Base T1.



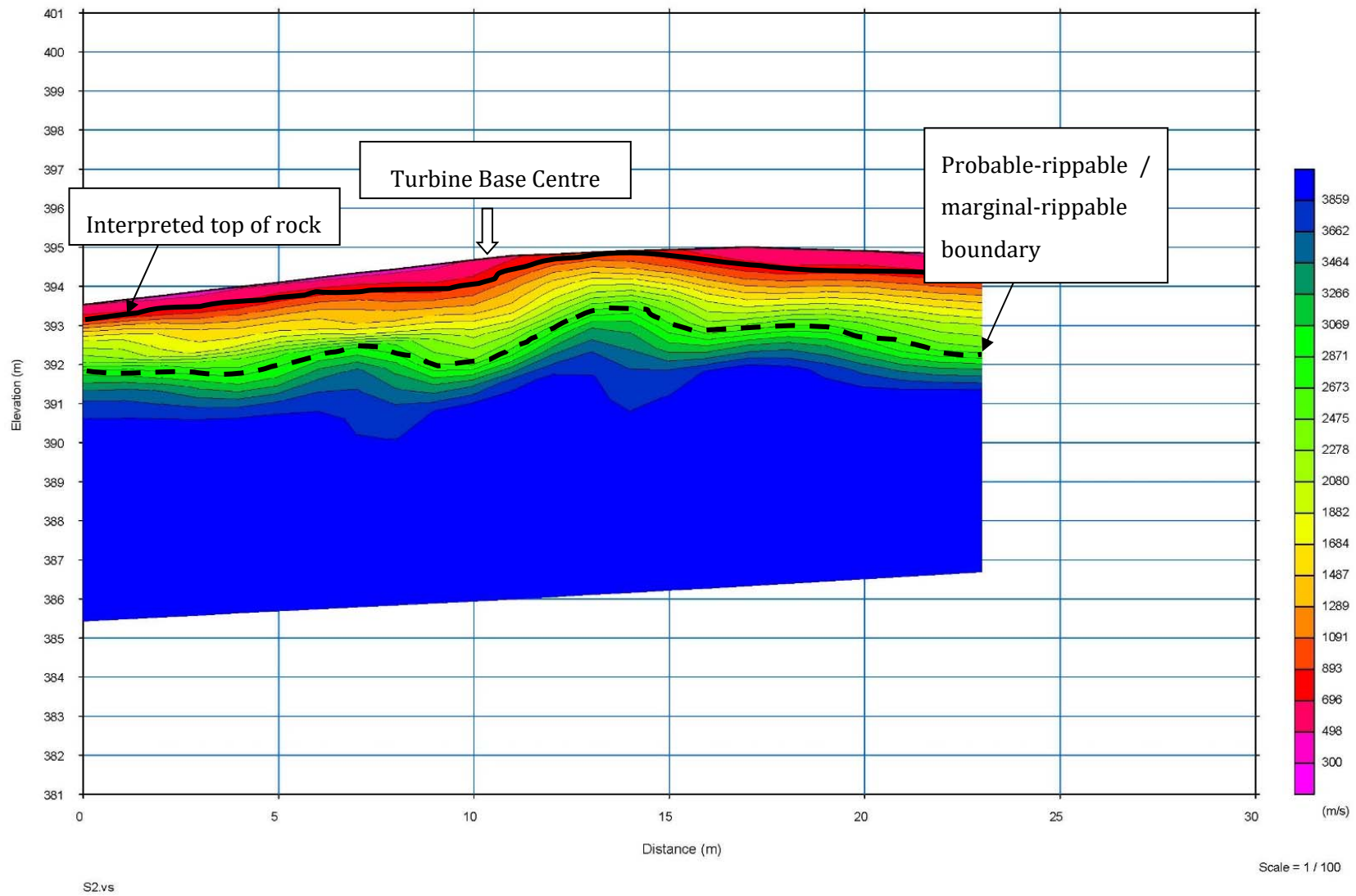


Figure AB.2: P-Wave Seismic Velocity Cross Section for Turbine Base T2.

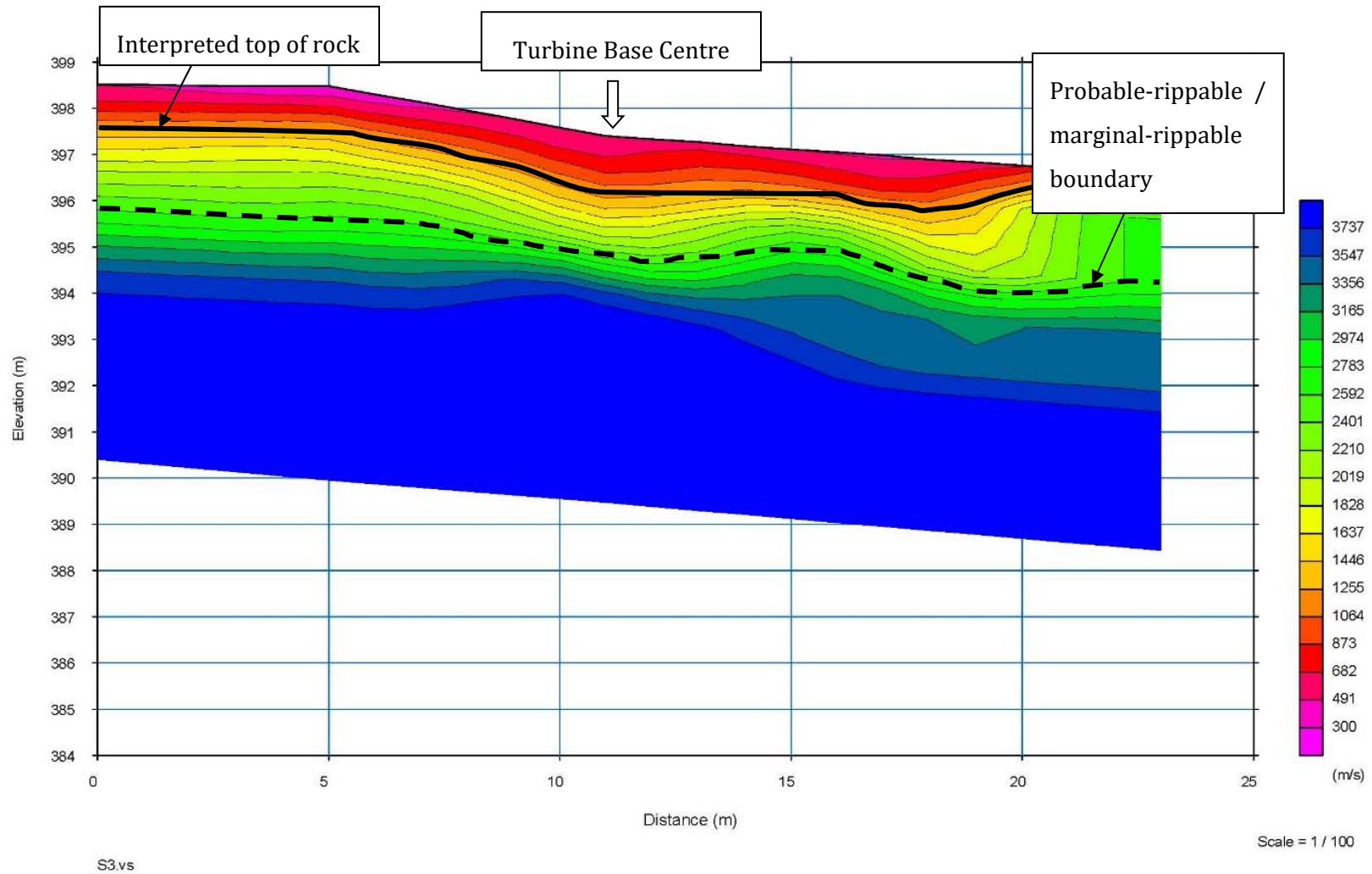


Figure AB.3: P-Wave Seismic Velocity Cross Section for Turbine Base T3.

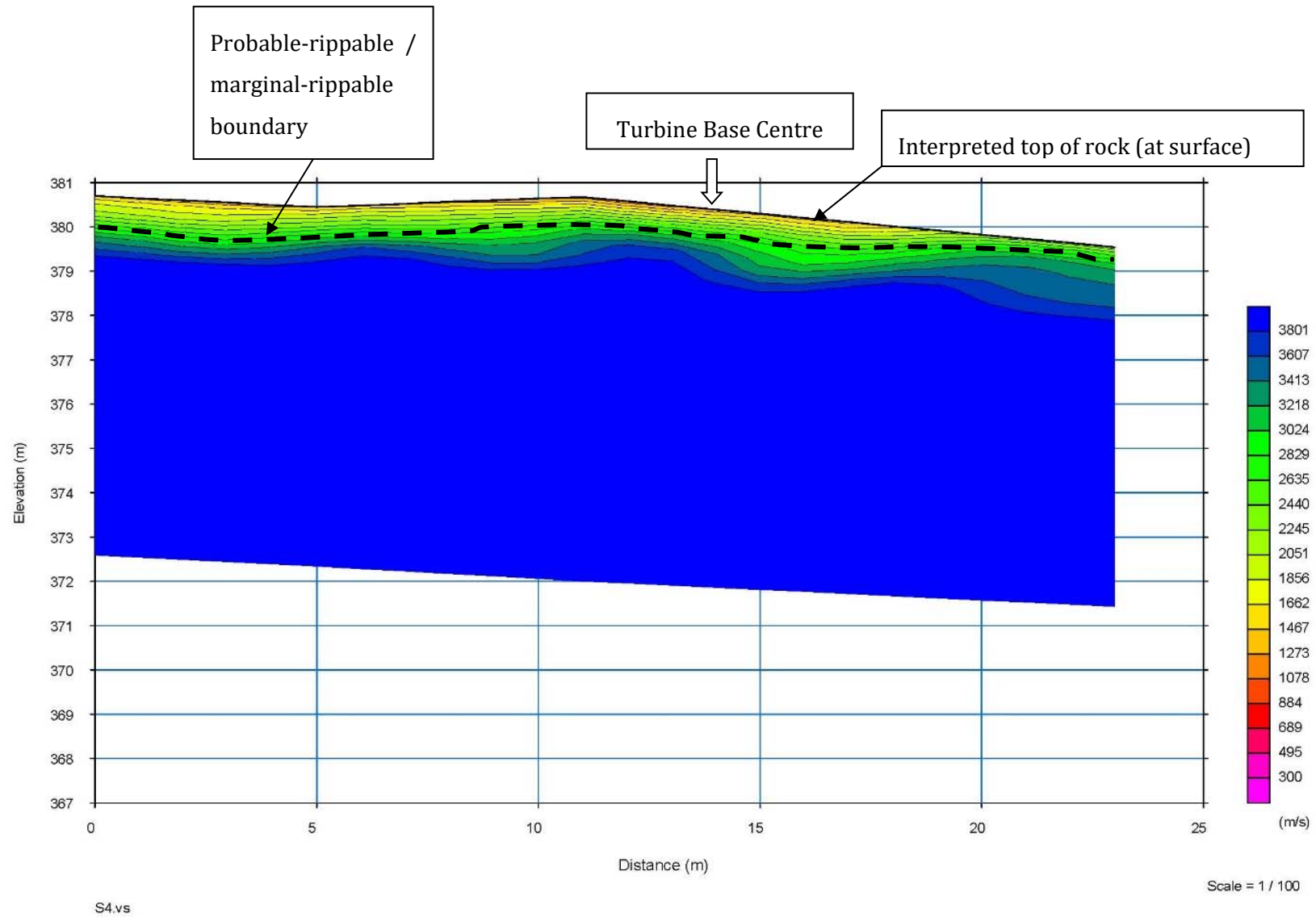


Figure AB.4: P-Wave Seismic Velocity Cross Section for Turbine Base T4.

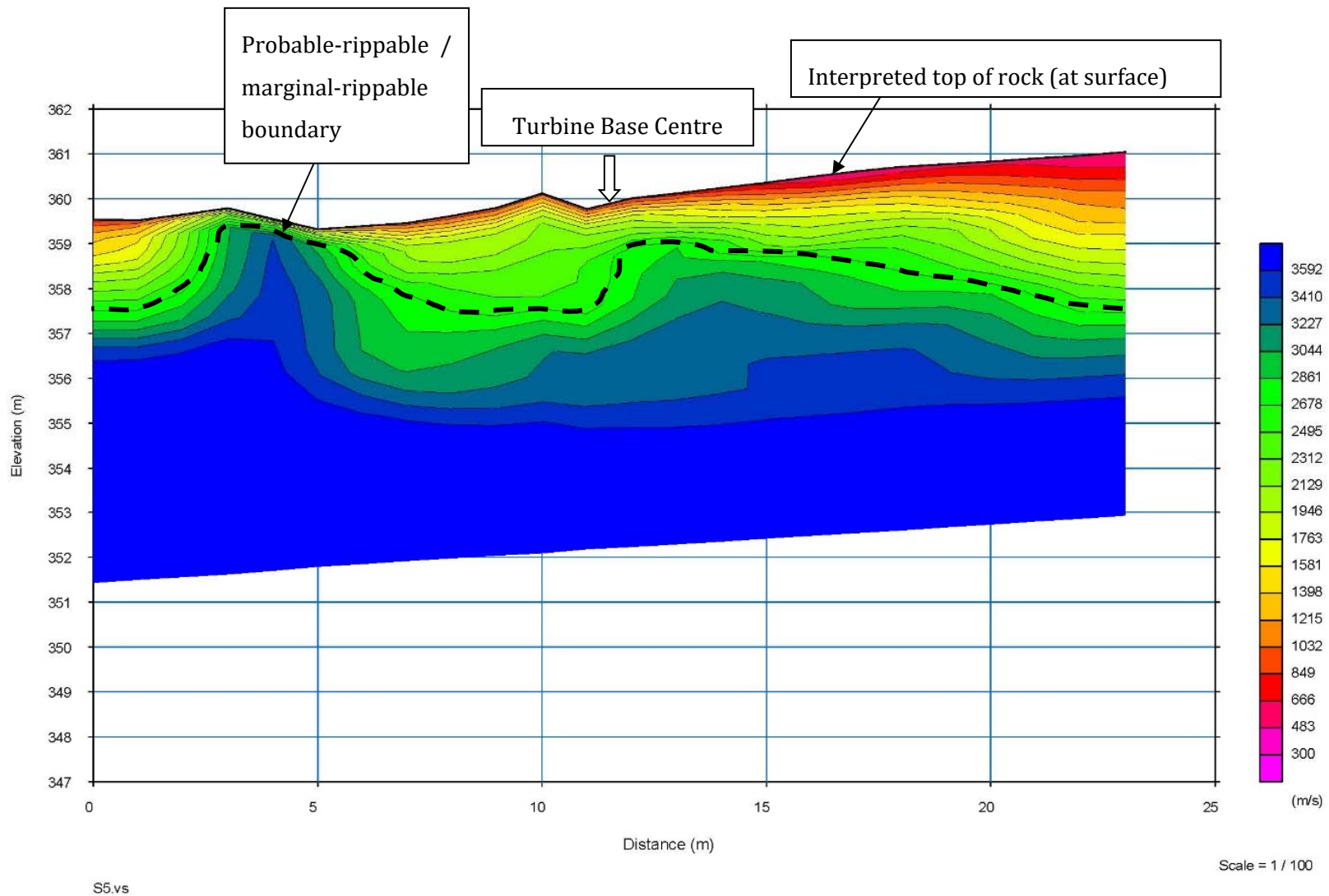


Figure AB.5: P-Wave Seismic Velocity Cross Section for Turbine Base T5.



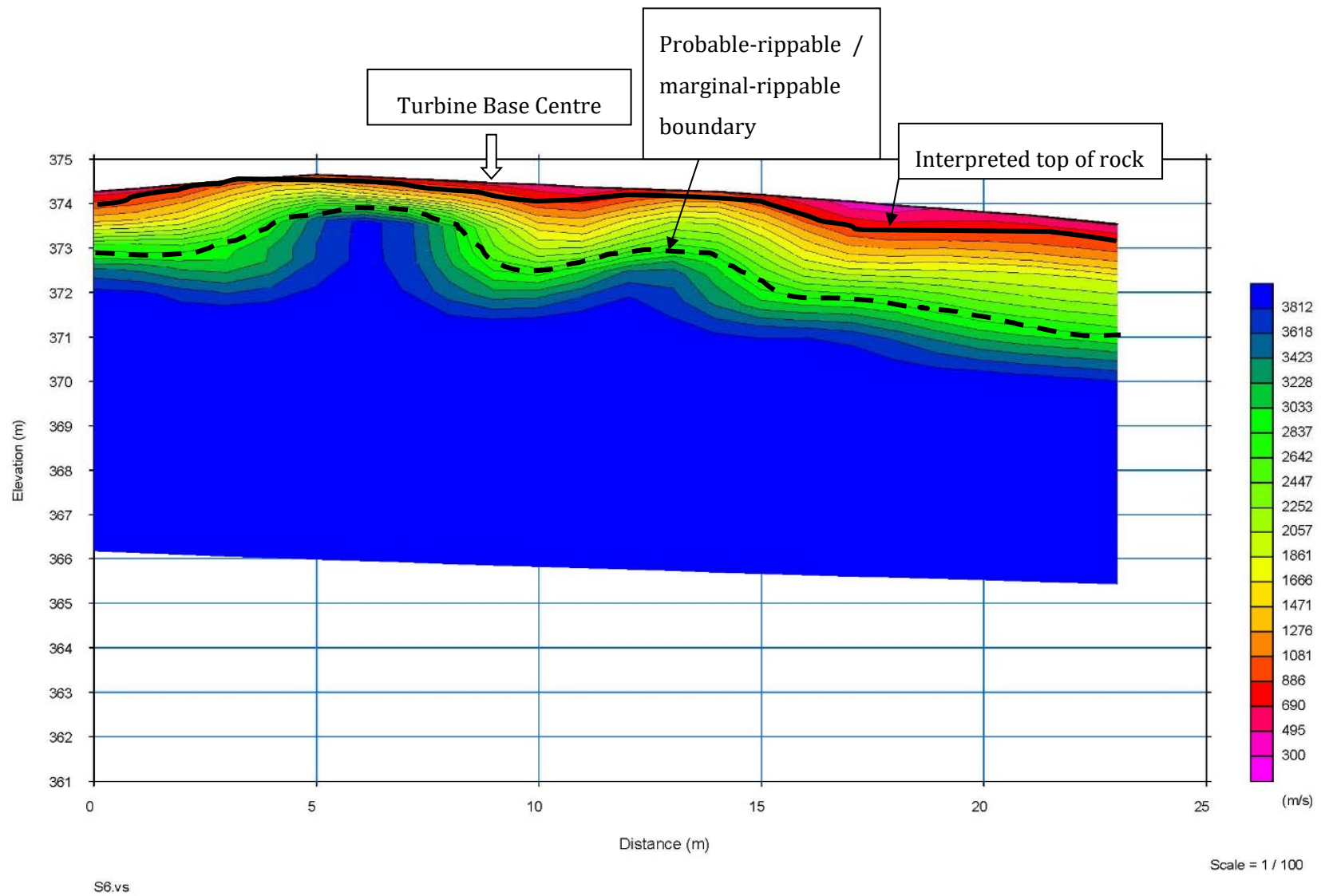


Figure AB.6: P-Wave Seismic Velocity Cross Section for Turbine Base T6.

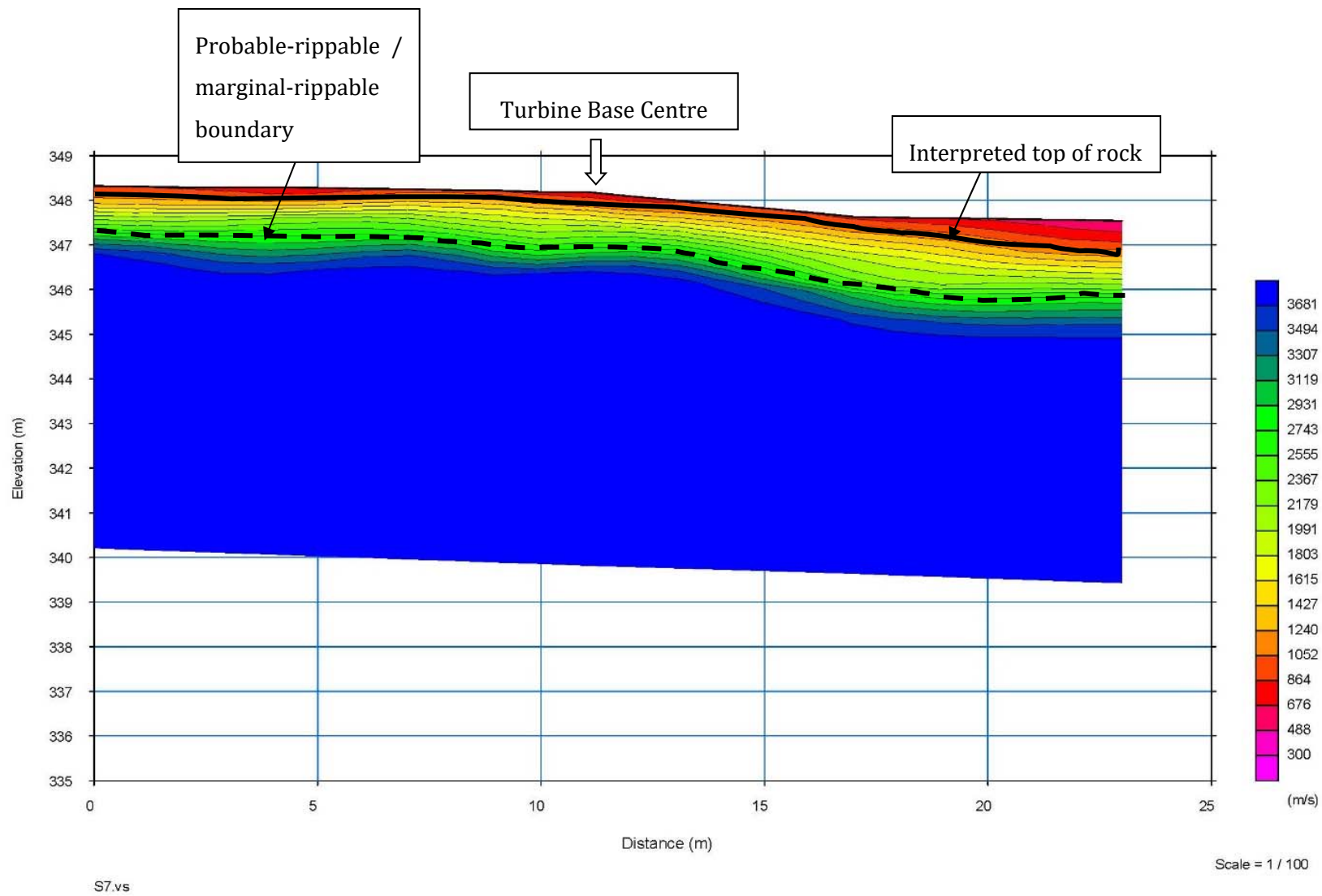


Figure AB.7: P-Wave Seismic Velocity Cross Section for Turbine Base T7.

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## APPENDIX C

### LABORATORY RESULTS

Natural Moisture Content

Atterberg Limits

Particle Size Distribution (grading)

pH

SO<sub>4</sub> water soluble

SO<sub>4</sub> acid soluble

Loss on ignition

Proctor compaction (Moisture content/dry density relationship)

California Bearing Ratio, CBR

CBR Moisture content relationship

UCS with Young's Modulus and Poisson's Ratio

Point Load Test ( $I_{p50}$ )

Magnesium sulphate soundness value MSSV,  
pH

SO<sub>4</sub> water soluble

---



## KEY TO SYMBOLS - LABORATORY TEST RESULT

U	Undisturbed Sample	
P	Piston Sample	
TWS	Thin Wall Sample	
B	Bulk Sample - Disturbed	
D	Jar Sample - Disturbed	
W	Water Sample	
pH	Acidity/Alkalinity Index	
SO <sub>3</sub>	% - Total Sulphate Content (acid soluble)	
SO <sub>3</sub>	g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract)	
+	Calcareous Reaction	
Cl	Chloride Content	
PI	Plasticity Index	
<425	% of material in sample passing 425 micron sieve	
LL	Liquid Limit	
PL	Plastic Limit	
MC	Water Content	
NP	Non Plastic	
Y <sub>b</sub>	Bulk Density	
Y <sub>d</sub>	Dry Density	
Ps	Particle Density	
U/D	Undrained/Drained Triaxial	
U/C	Unconsolidated/Consolidated Triaxial	
T/M	Single Stage/Multistage Triaxial	
100/38	Sample Diameter (mm)	
REM	Remoulded Triaxial Test Specimen	
TST	Triaxial Suction Test	
V	Vane Test	
DSB	Drained Shear Box	
RSB	Residual Shear Box	
RS	Ring Shear	
σ <sub>3</sub>	Cell Pressure	
σ <sub>1</sub> -σ <sub>3</sub>	Deviator Stress	
c	Cohesion	
c <sub>e</sub>	Effective Cohesion Intercept	
φ	Angle of Shearing Resistance - Degrees	
φ <sub>e</sub>	Effective Angle of Shearing Resistance	
ε <sub>f</sub>	Strain at Failure	
*	Failed under 1 <sup>st</sup> Load	
**	Failed under 2 <sup>nd</sup> Load	
#	Unstable	
##	Excessive Strain	
p <sub>o</sub>	Effective Overburden Pressure	
m <sub>v</sub>	Coefficient of Volume Decrease	
c <sub>v</sub>	Coefficient of Consolidation	
Opt	Optimum	
Nat	Natural	
Std	Standard Compaction - 2.5kg Rammer	(¶ CBR)
Hvy	Heavy Compaction - 4.5kg Rammer	(§ CBR)
Vib	Vibratory Compaction	
CBR	California Bearing Ratio	
Sat m.c.	Saturation Moisture Content	
MCV	Moisture Condition Value	



# Natural Moisture Content/Atterberg Limits Summary

Job Ref

BS 1377 : Part 2 : 1990 : Clause 3

Location

Dereenacrinnig Windfarm

P16177

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
TP01	1	0.3	B	Silty sandy GRAVEL with medium cobble content		84	61	23	39.3
TP01	2	0.3	D	Silty sandy GRAVEL	18				
TP02	3	0.9	B	Very silty very sandy GRAVEL with low cobble content		32	24	8	46.1
TP02	4	0.9	D	Very silty very sandy GRAVEL	10				
TP03	4	0.4	D	Slightly sandy gravelly SILT	16				
TP03	5	1.4	B	Silty very sandy GRAVEL with medium cobble content		32	23	9	40.1
TP03	6	1.4	D	Silty very sandy GRAVEL	9.2				
TP04	2	0.4	D	Slightly gravelly sandy SILT	9.6				
TP04	3	1	B	Silty very sandy GRAVEL with medium cobble content		34	26	8	40
TP04	4	1	D	Slightly sandy gravelly SILT	28				
TP05	1	0.4	B	Slightly sandy gravelly SILT with high cobble content		187	102	85	49.5
TP05	2	0.4	D	Slightly sandy gravelly SILT	38				
TP06	2	0.4	D	Slightly gravelly sandy SILT	45				
TP06	3	0.75	B	Slightly sandy slightly gravelly SILT		29	NP	NP	62.2
TP06	4	0.75	B	Slightly sandy slightly gravelly SILT	15				
TP07	2	0.6	D	Slightly gravelly sandy SILT	15				
TP07	4	1.3	D	Slightly gravelly sandy SILT	32				
TP08	2	0.5	D	Slightly sandy slightly gravelly SILT	248				
TP08	4	0.8	B	Very silty very sandy GRAVEL with low cobble content	52	34	24	10	51.4
TP09	3	0.4	B	Slightly sandy slightly gravelly SILT	14				
TP10	4	0.9	D	Slightly sandy gravelly SILT	11				
TP11	2	0.4	D	Slightly sandy slightly gravelly SILT	32				



# Natural Moisture Content/Atterberg Limits Summary

Job Ref

BS 1377 : Part 2 : 1990 : Clause 3

Location

Dereenacrinnig Windfarm

P16177

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
TP11	4	0.9	D	Slightly gravelly sandy SILT	11				
TP12	2	1	B	PEAT	765				
TP13	4	0.35	D	Slightly sandy gravelly SILT	25				
TP14	2	0.5	D	Slightly sandy slightly gravelly SILT	20				
TP15	2	0.5	D	Slightly sandy gravelly SILT	36				
TP15	4	1.1	D	Slightly sandy gravelly SILT	15				
TP15	6	2.1	D	Slightly sandy gravelly SILT	12				
TP16	2	0.3	D	Slightly sandy slightly gravelly SILT	18				
TP17	2	0.25	D	Slightly sandy slightly gravelly SILT	27				
TP18	2	0.5	D	Slightly sandy gravelly SILT	38				
TP18	3	0.8	B	Slightly sandy gravelly SILT with medium cobble content		31	24	7	62.3
TP18	4	0.8	D	Slightly sandy gravelly SILT	12				
TP19	2	0.9	D	Slightly sandy gravelly SILT	39				
TP20	2	0.55	D	Slightly sandy gravelly SILT	20				
TP03A	2	0.6	D	Slightly gravelly sandy SILT	28				
TP03A	4	1.3	D	Slightly sandy gravelly SILT	12				
TP06A	2	0.2	D	Slightly sandy slightly gravelly SILT	18				
TP07A	2	0.3	D	Slightly sandy gravelly SILT	15				
TP15A	4	0.8	D	Slightly sandy gravelly SILT	12				
TPS1	1	0.55	B	Silty sandy GRAVEL with medium cobble content		30	23	7	46.6
TPS1	2	0.55	D	Silty sandy GRAVEL	13				
TPS1	4	1.5	D	Silty sandy GRAVEL	13				



# Natural Moisture Content/Atterberg Limits Summary

Job Ref

BS 1377 : Part 2 : 1990 : Clause 3

Location

Dereenacrinnig Windfarm

P16177

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
TPS2	4	1	D	Slightly sandy gravelly SILT	13				
TPS3	1	0.5	B	Slightly sandy GRAVEL with high cobble content		60	38	22	57.9
TPS3	2	0.5	D	Slightly sandy GRAVEL	42				
TPS3	3	1.1	B	Slightly sandy gravelly SILT low cobble content		26	21	5	65.2
TPS3	4	1.1	D	Slightly sandy gravelly SILT	21				





# PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref

P16177

Borehole / Pit No

TP01

Location

Dereenacrinnig Windfarm

Sample No

1

Depth

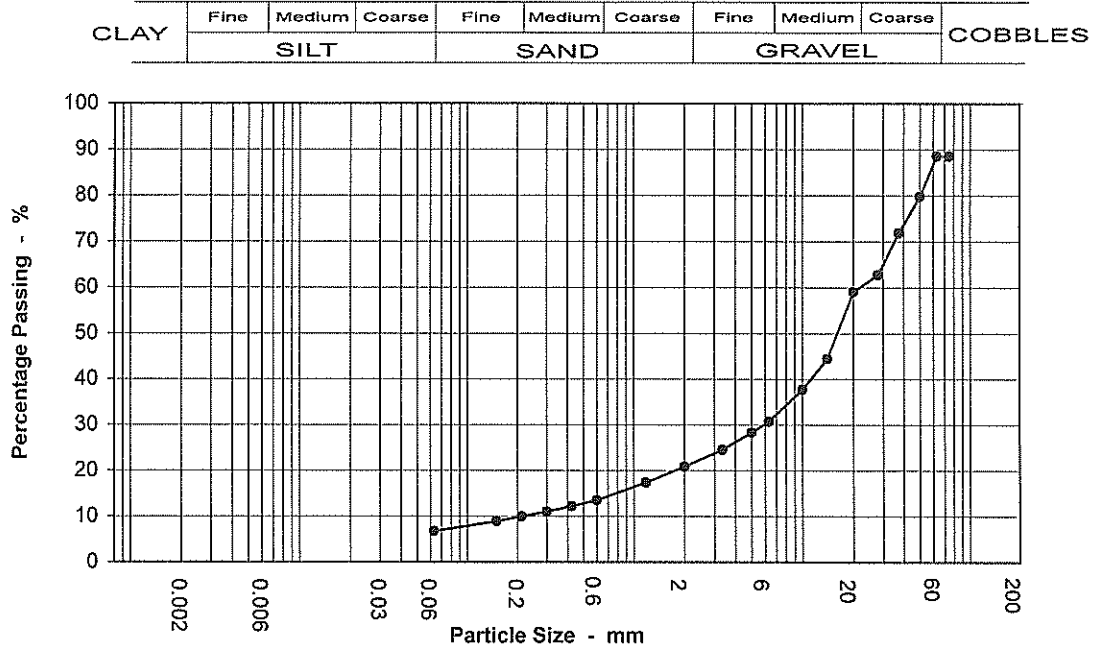
0.30 m

Soil Description

Silty sandy GRAVEL with medium cobble content

Sample type

B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	89		
63	89		
50	80		
37.5	72		
28	63		
20	59		
14	44		
10	38		
6.3	31		
5	28		
3.35	25		
2	21		
1.18	17		
0.6	14		
0.425	12		
0.3	11		
0.212	10		
0.15	9		
0.063	7		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	13.5
Gravel	65.6
Sand	14.1
Silt & Clay	6.7

Grading Analysis	
D100	90.000
D60	22.186
D10	0.217
Uniformity Coefficient	102



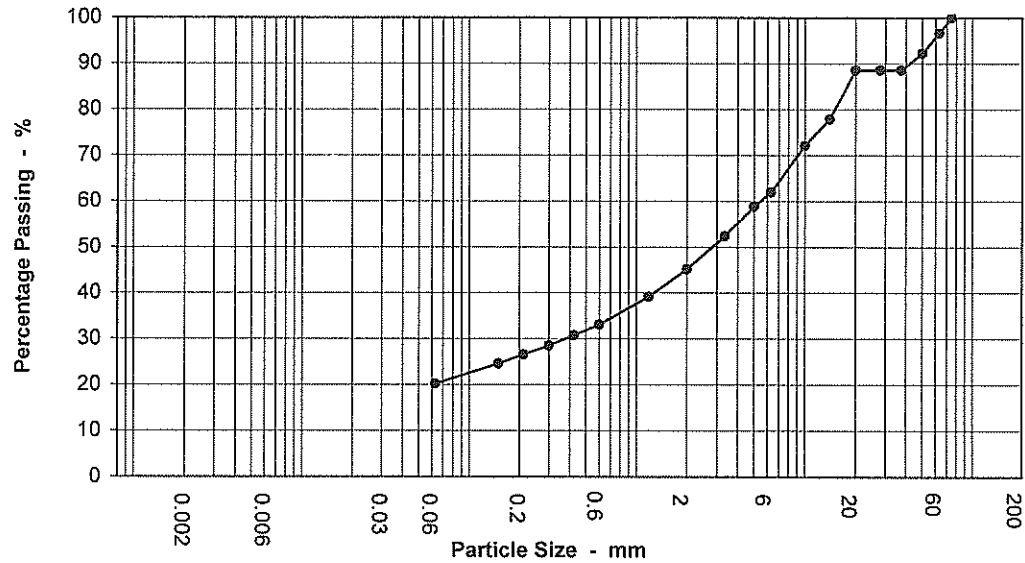
# PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

<b>Job Ref</b>	P16177
Borehole / Pit No	TP02
Sample No	3
Depth	0.90 m
Sample type	B

<b>Location</b>	Dereenacrinnig Windfarm
<b>Soil Description</b>	Very silty very sandy GRAVEL with low cobble content

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	97		
50	92		
37.5	89		
28	89		
20	89		
14	78		
10	72		
6.3	62		
5	59		
3.35	52		
2	45		
1.18	39		
0.6	33		
0.425	31		
0.3	28		
0.212	27		
0.15	25		
0.063	20		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	4.4
Gravel	50.5
Sand	24.9
Silt & Clay	20.2

Grading Analysis	
D100	75.000
D60	5.499
D10	
Uniformity Coefficient	N/A



# PARTICLE SIZE DISTRIBUTION

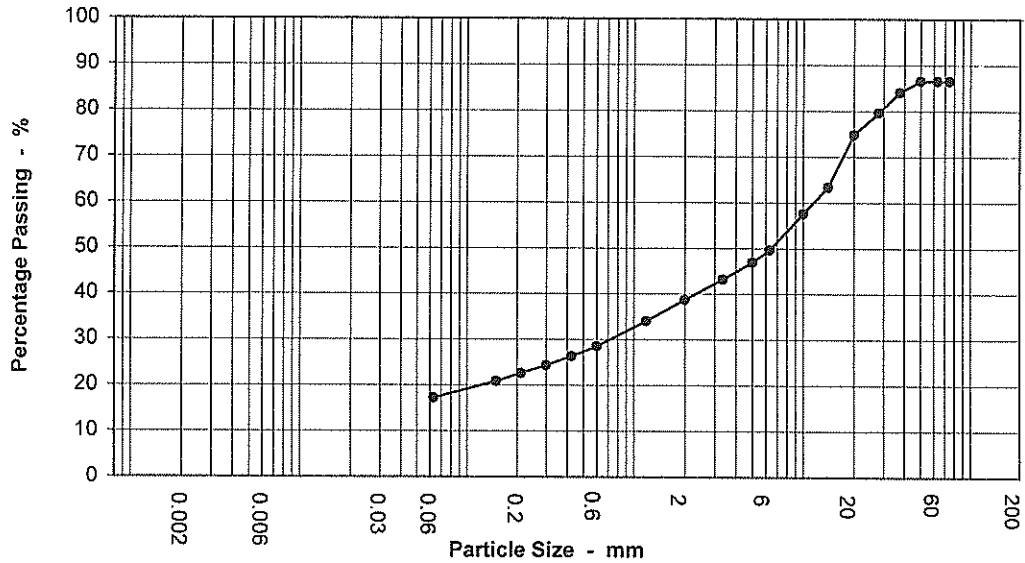
BS 1377 : Part 2 : 1990 : Clause 9

<b>Job Ref</b>	P16177
Borehole / Pit No	TP03
Sample No	5
Depth	1.40 m
Sample type	B

Location: **Dereenacrinnig Windfarm**

Soil Description: **Silty very sandy GRAVEL with medium cobble content**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	86		
63	86		
50	86		
37.5	84		
28	80		
20	75		
14	63		
10	58		
6.3	50		
5	47		
3.35	43		
2	39		
1.18	34		
0.6	28		
0.425	26		
0.3	24		
0.212	23		
0.15	21		
0.063	17		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	13.5
Gravel	47.8
Sand	21.5
Silt & Clay	17.2

Grading Analysis	
D100	90.000
D60	11.702
D10	
Uniformity Coefficient	N/A



# PARTICLE SIZE DISTRIBUTION

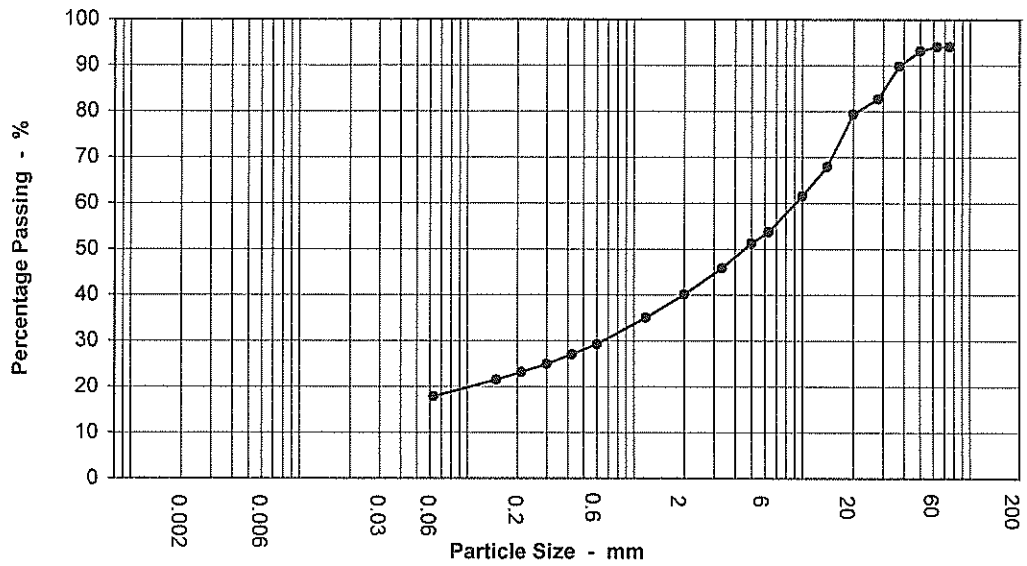
BS 1377 : Part 2 : 1990 : Clause 9

<b>Job Ref</b>	P16177
Borehole / Pit No	TP04
Sample No	3
Depth	1.00 m
Sample type	B

**Location** Dereenacrinnig Windfarm

**Soil Description** Silty very sandy GRAVEL with medium cobble content

<b>CLAY</b>	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	<b>COBBLES</b>
	<b>SILT</b>			<b>SAND</b>			<b>GRAVEL</b>			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	94		
63	94		
50	93		
37.5	90		
28	83		
20	79		
14	68		
10	62		
6.3	54		
5	51		
3.35	46		
2	40		
1.18	35		
0.6	29		
0.425	27		
0.3	25		
0.212	23		
0.15	21		
0.063	18		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	6.2
Gravel	53.7
Sand	22.2
Silt & Clay	17.9

Grading Analysis	
D100	90.000
D60	9.278
D10	
Uniformity Coefficient	N/A





# PARTICLE SIZE DISTRIBUTION

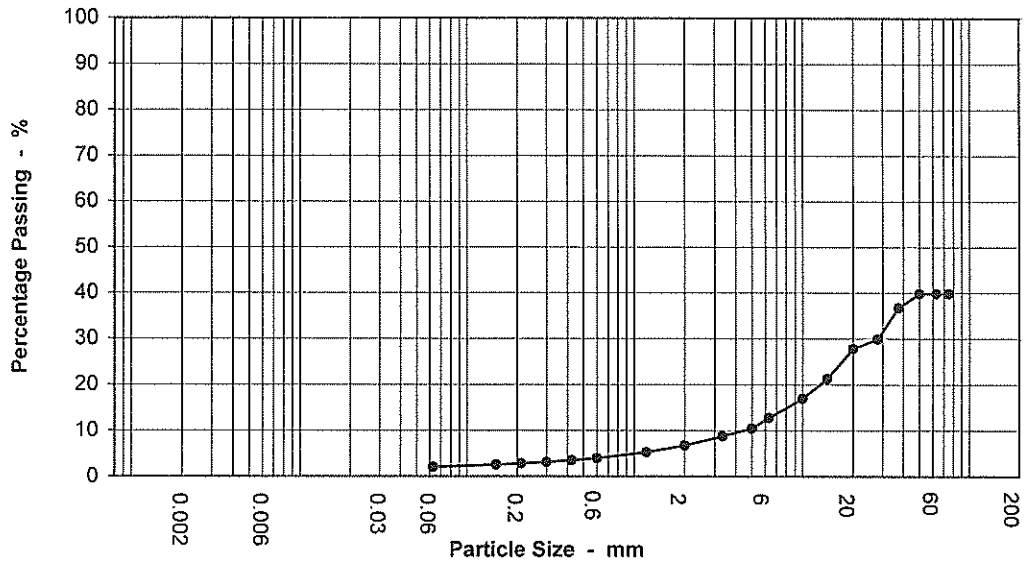
BS 1377 : Part 2 : 1990 : Clause 9

<b>Job Ref</b>	P16177
Borehole / Pit No	TP05
Sample No	1
Depth	0.40 m
Sample type	B

**Location** Dereenacrinnig Windfarm

**Soil Description** Slightly sandy gravelly SILT with high cobble content

<b>CLAY</b>	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	<b>COBBLES</b>
	<b>SILT</b>			<b>SAND</b>			<b>GRAVEL</b>			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	60		
90	40		
75	40		
63	40		
50	40		
37.5	37		
28	30		
20	28		
14	21		
10	17		
6.3	13		
5	10		
3.35	9		
2	7		
1.18	5		
0.6	4		
0.425	3		
0.3	3		
0.212	3		
0.15	3		
0.063	2		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	20.2
Gravel	33.1
Sand	4.7
Silt & Clay	42.0

Grading Analysis	
D100	125.000
D60	125.000
D10	4.608
Uniformity Coefficient	27



# PARTICLE SIZE DISTRIBUTION

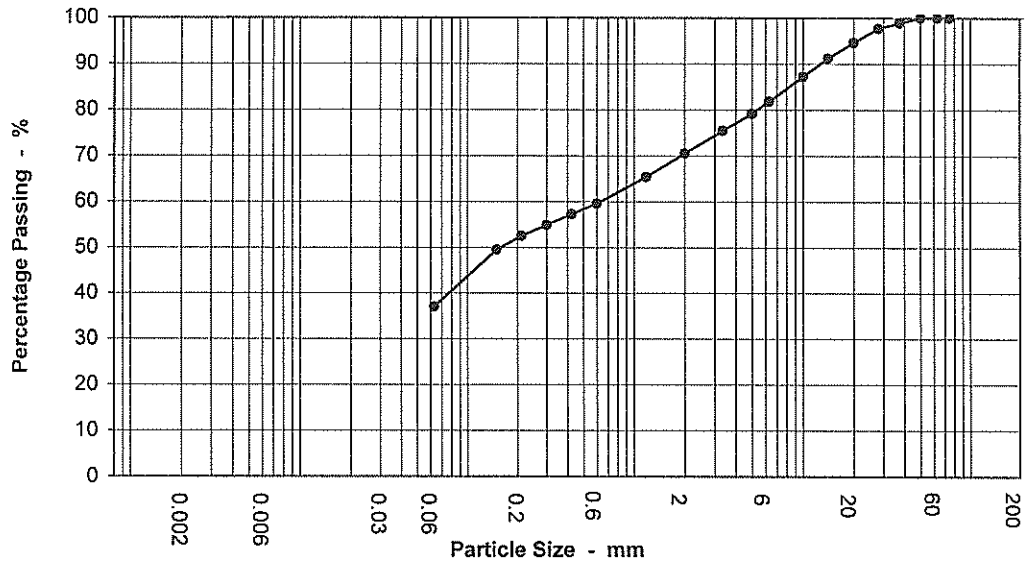
BS 1377 : Part 2 : 1990 : Clause 9

<b>Job Ref</b>	P16177
Borehole / Pit No	TP06
Sample No	3
Depth	0.75 m
Sample type	B

Location: **Dereenacrinnig Windfarm**

Soil Description: **Slightly sandy slightly gravelly SILT**

<b>CLAY</b>	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	<b>COBBLES</b>
	<b>SILT</b>			<b>SAND</b>			<b>GRAVEL</b>			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	99		
28	98		
20	95		
14	91		
10	87		
6.3	82		
5	79		
3.35	75		
2	70		
1.18	65		
0.6	60		
0.425	57		
0.3	55		
0.212	53		
0.15	49		
0.063	37		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	29.5
Sand	33.5
Silt & Clay	37.0

Grading Analysis	
D100	50.000
D60	0.646
D10	
Uniformity Coefficient	N/A



# PARTICLE SIZE DISTRIBUTION

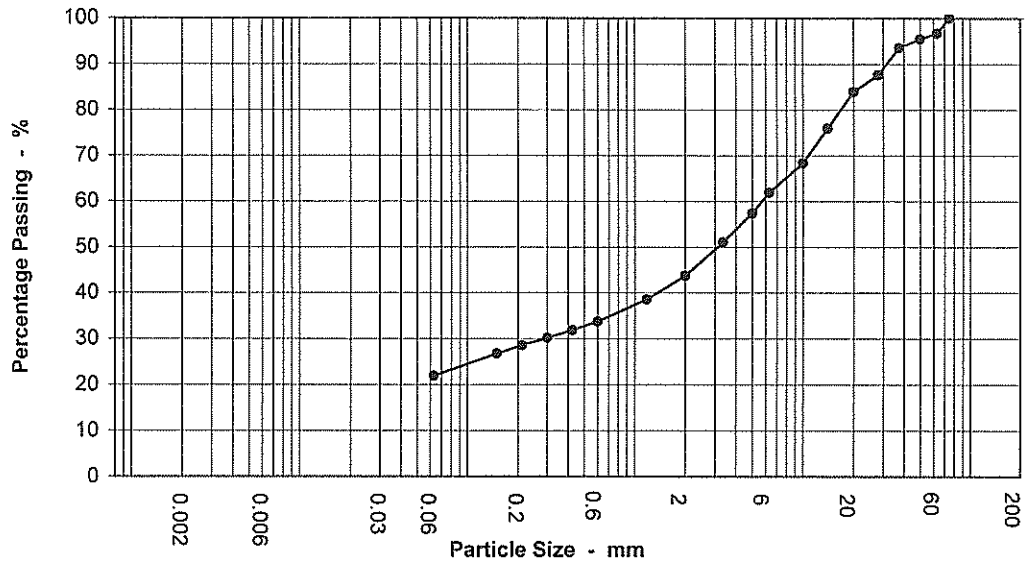
BS 1377 : Part 2 : 1990 : Clause 9

<b>Job Ref</b>	P16177
Borehole / Pit No	TP08
Sample No	4
Depth	0.80 m
Sample type	B

Location: **Dereenacrinnig Windfarm**

Soil Description: **Very silty very sandy GRAVEL with low cobble content**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	97		
50	95		
37.5	94		
28	88		
20	84		
14	76		
10	68		
6.3	62		
5	57		
3.35	51		
2	44		
1.18	39		
0.6	34		
0.425	32		
0.3	30		
0.212	29		
0.15	27		
0.063	22		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	3.6
Gravel	52.7
Sand	21.8
Silt & Clay	21.9

Grading Analysis	
D100	75.000
D60	5.771
D10	
Uniformity Coefficient	N/A



# PARTICLE SIZE DISTRIBUTION

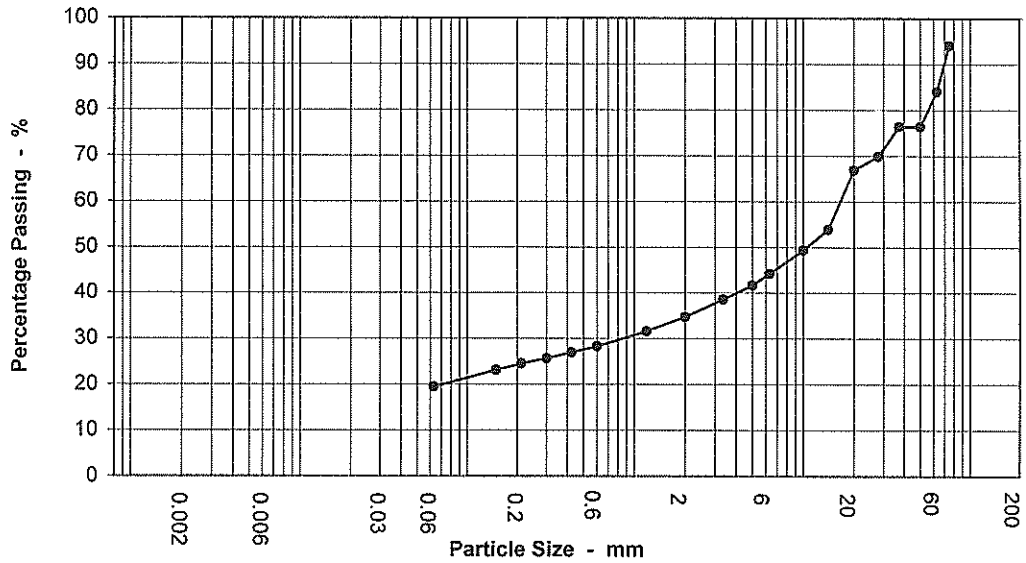
BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	P16177
Borehole / Pit No	TP10
Sample No	3
Depth	0.90 m
Sample type	B

Location: Dereenacrinnig Windfarm

Soil Description: Very silty sandy GRAVEL with medium cobble content

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	94		
63	84		
50	76		
37.5	76		
28	70		
20	67		
14	54		
10	49		
6.3	44		
5	42		
3.35	39		
2	35		
1.18	32		
0.6	28		
0.425	27		
0.3	26		
0.212	24		
0.15	23		
0.063	19		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	17.8
Gravel	47.5
Sand	15.3
Silt & Clay	19.4

Grading Analysis	
D100	90.000
D60	16.853
D10	
Uniformity Coefficient	N/A



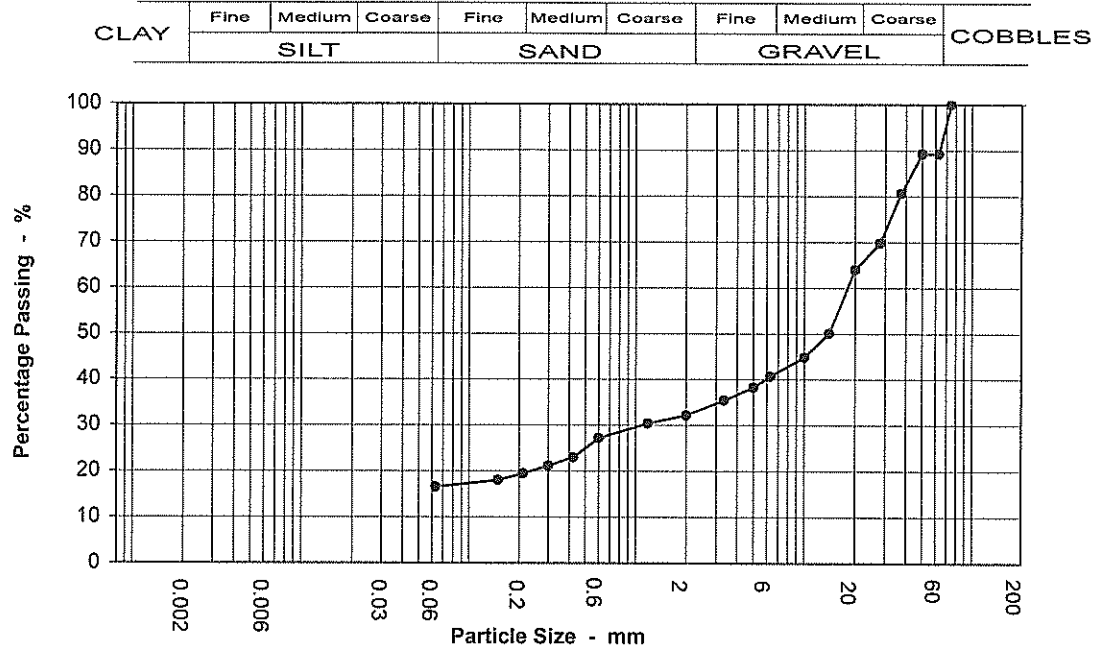


# PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

<b>Job Ref</b>	P16177
Borehole / Pit No	TP15
Sample No	1
Depth	0.50 m
Sample type	B

<b>Location</b>	Dereenacrinnig Windfarm
<b>Soil Description</b>	Silty sandy GRAVEL with medium cobble content



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	89		
50	89		
37.5	81		
28	70		
20	64		
14	50		
10	45		
6.3	41		
5	38		
3.35	35		
2	32		
1.18	30		
0.6	27		
0.425	23		
0.3	21		
0.212	19		
0.15	18		
0.063	17		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	10.8
Gravel	57.1
Sand	15.6
Silt & Clay	16.5

Grading Analysis	
D100	75.000
D60	18.294
D10	
Uniformity Coefficient	N/A



# PARTICLE SIZE DISTRIBUTION

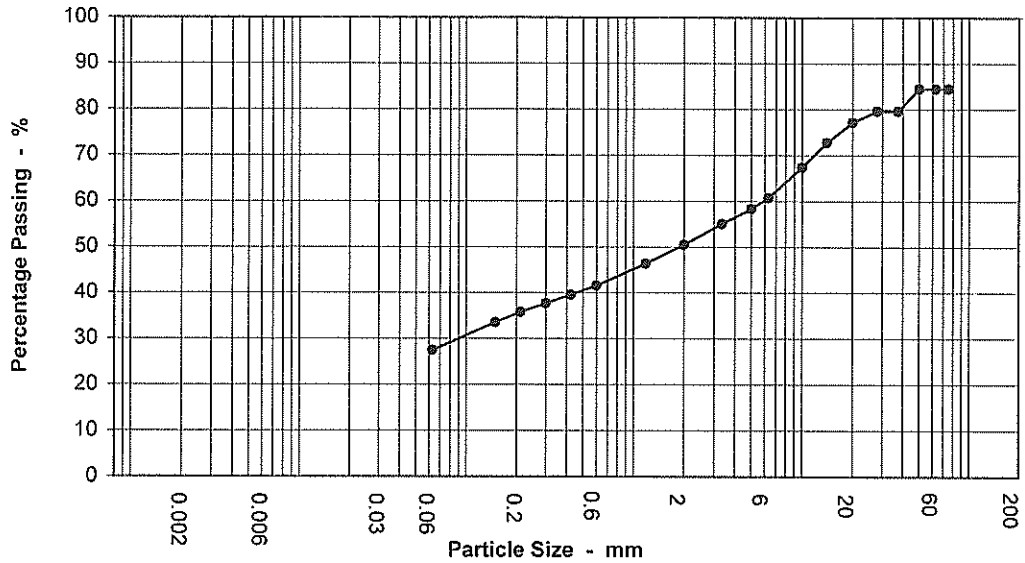
BS 1377 : Part 2 : 1990 : Clause 9

<b>Job Ref</b>	P16177
Borehole / Pit No	TP15
Sample No	3
Depth	1.10 m
Sample type	B

**Location** Dereenacrinnig Windfarm

**Soil Description** Very silty very sandy GRAVEL with medium cobble content

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	84		
63	84		
50	84		
37.5	80		
28	80		
20	77		
14	73		
10	67		
6.3	61		
5	58		
3.35	55		
2	50		
1.18	46		
0.6	42		
0.425	40		
0.3	38		
0.212	36		
0.15	34		
0.063	27		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	15.6
Gravel	34.0
Sand	23.0
Silt & Clay	27.4

Grading Analysis	
D100	90.000
D60	5.921
D10	
Uniformity Coefficient	N/A



# PARTICLE SIZE DISTRIBUTION

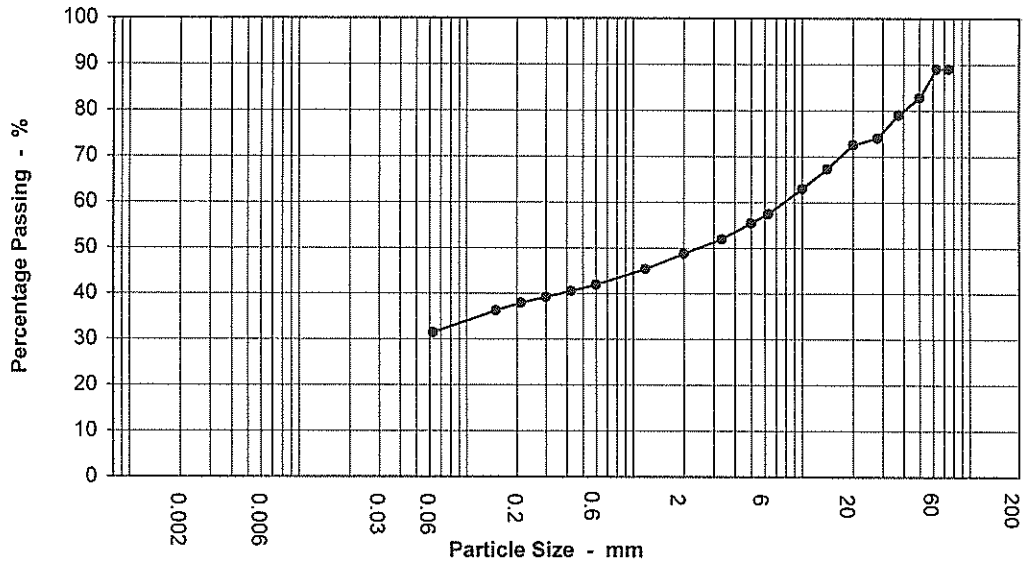
BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	P16177
Borehole / Pit No	TP18
Sample No	3
Depth	0.80 m
Sample type	B

Location: Dereenacrinnig Windfarm

Soil Description: Slightly sandy gravelly SILT with medium cobble content

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	89		
63	89		
50	83		
37.5	79		
28	74		
20	73		
14	67		
10	63		
6.3	57		
5	55		
3.35	52		
2	49		
1.18	45		
0.6	42		
0.425	41		
0.3	39		
0.212	38		
0.15	36		
0.063	31		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	12.4
Gravel	38.9
Sand	17.3
Silt & Clay	31.4

Grading Analysis	
D100	90.000
D60	8.036
D10	
Uniformity Coefficient	N/A

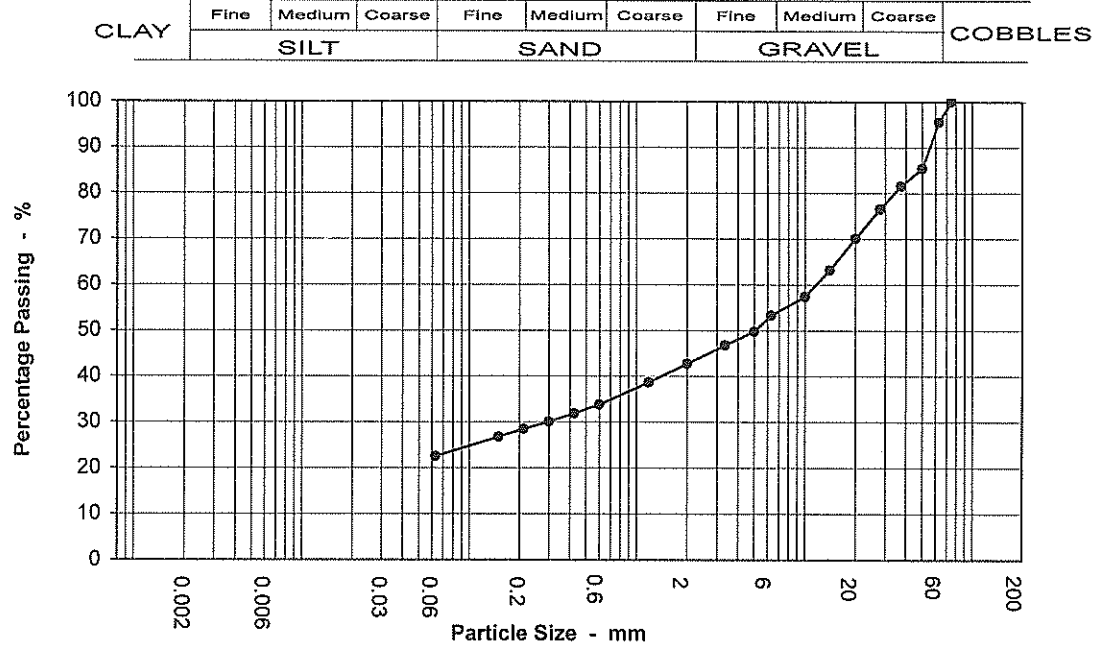


# PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

<b>Job Ref</b>	P16177
Borehole / Pit No	TP19
Sample No	1
Depth	0.90 m
Sample type	B

<b>Location</b>	Dereenacrinnig Windfarm
<b>Soil Description</b>	Very silty very sandy GRAVEL with medium cobble content



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	96		
50	85		
37.5	82		
28	76		
20	70		
14	63		
10	57		
6.3	53		
5	50		
3.35	47		
2	43		
1.18	39		
0.6	34		
0.425	32		
0.3	30		
0.212	28		
0.15	27		
0.063	23		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	6.8
Gravel	50.5
Sand	20.2
Silt & Clay	22.5

Grading Analysis	
D100	75.000
D60	11.864
D10	
Uniformity Coefficient	N/A





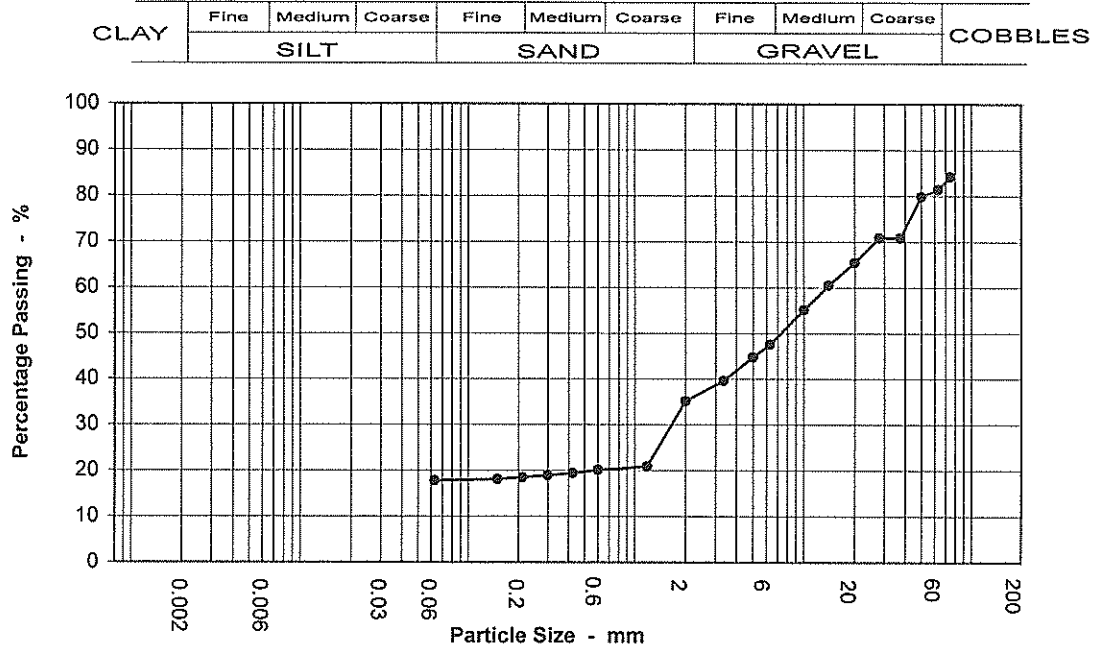
# PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref	P16177
Borehole / Pit No	TPS1
Sample No	1
Depth	0.55 m
Sample type	B

Location: Dereenacrinnig Windfarm

Soil Description: Silty sandy GRAVEL with medium cobble content



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	87		
75	84		
63	81		
50	80		
37.5	71		
28	71		
20	65		
14	60		
10	55		
6.3	47		
5	45		
3.35	40		
2	35		
1.18	21		
0.6	20		
0.425	19		
0.3	19		
0.212	18		
0.15	18		
0.063	18		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	19.0
Gravel	45.9
Sand	17.4
Silt & Clay	17.8

Grading Analysis	
D100	125.000
D60	13.664
D10	
Uniformity Coefficient	N/A



# PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref P16177

Borehole / Pit No TPS3

Location

Dereenacrinnig Windfarm

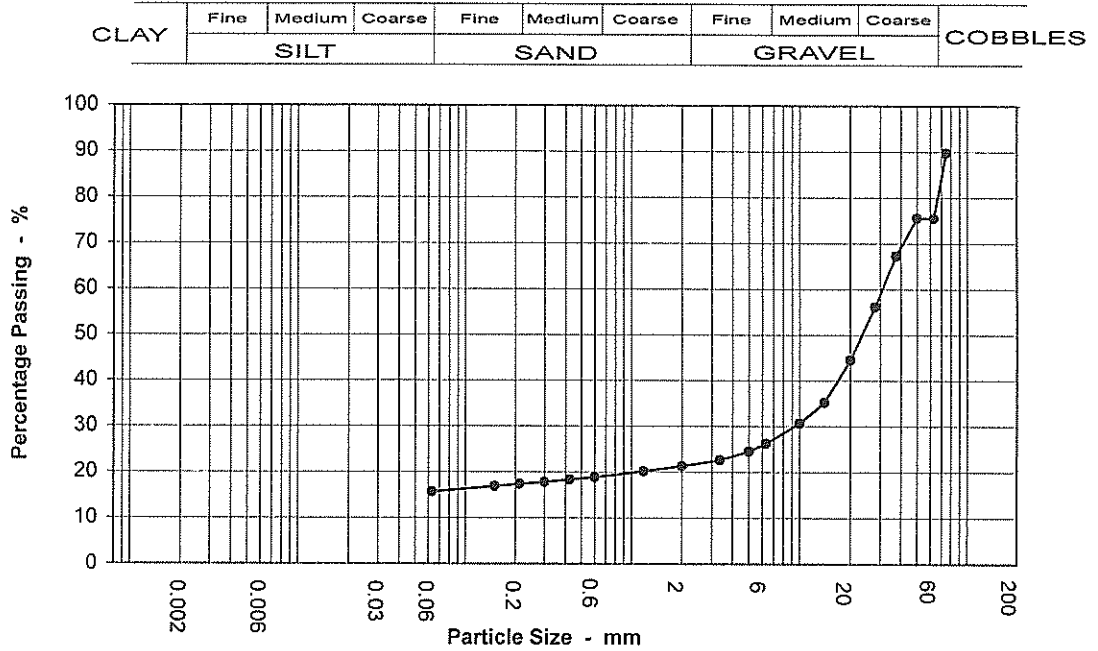
Sample No 1

Depth 0.50 m

Soil Description

Slightly sandy GRAVEL with high cobble content

Sample type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	90		
75	90		
63	76		
50	76		
37.5	67		
28	56		
20	44		
14	35		
10	31		
6.3	26		
5	24		
3.35	23		
2	21		
1.18	20		
0.6	19		
0.425	18		
0.3	18		
0.212	17		
0.15	17		
0.063	16		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	24.5
Gravel	54.2
Sand	5.6
Silt & Clay	15.7

Grading Analysis	
D100	125.000
D60	31.307
D10	
Uniformity Coefficient	N/A



# PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

Job Ref P16177

Borehole / Pit No TPS3

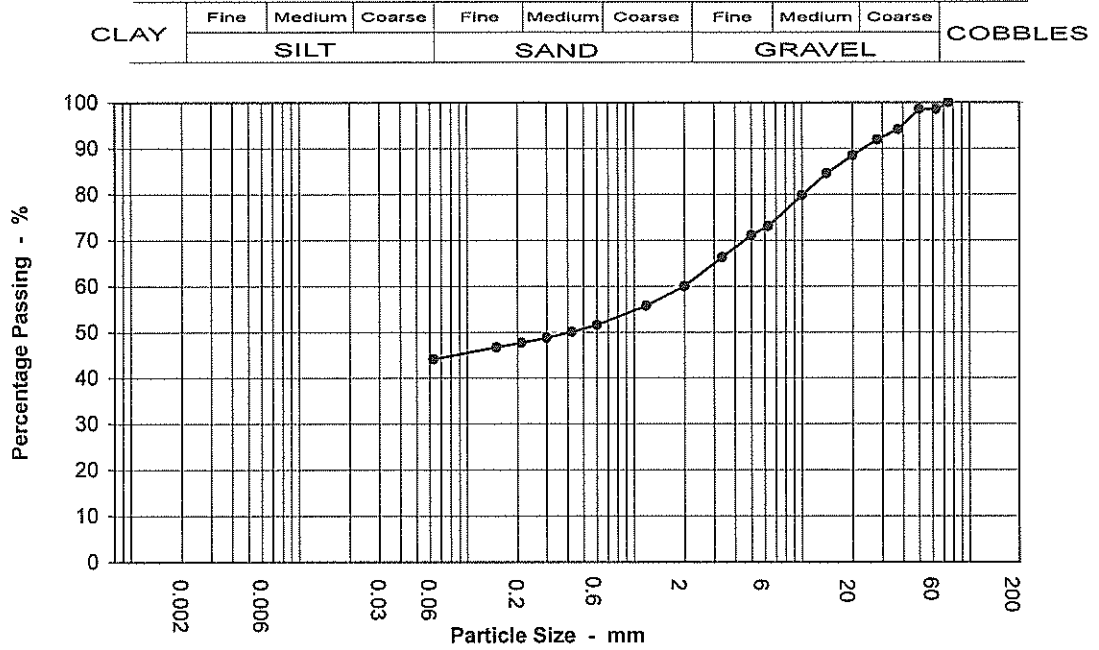
Location Dereenacrinnig Windfarm

Sample No 3

Depth 1.10 m

Soil Description Slightly sandy gravelly SILT low cobble content

Sample type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	99		
50	99		
37.5	94		
28	92		
20	88		
14	85		
10	80		
6.3	73		
5	71		
3.35	66		
2	60		
1.18	56		
0.6	52		
0.425	50		
0.3	49		
0.212	48		
0.15	47		
0.063	44		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	1.5
Gravel	38.5
Sand	15.9
Silt & Clay	44.1

Grading Analysis	
D100	75.000
D60	1.999
D10	
Uniformity Coefficient	N/A

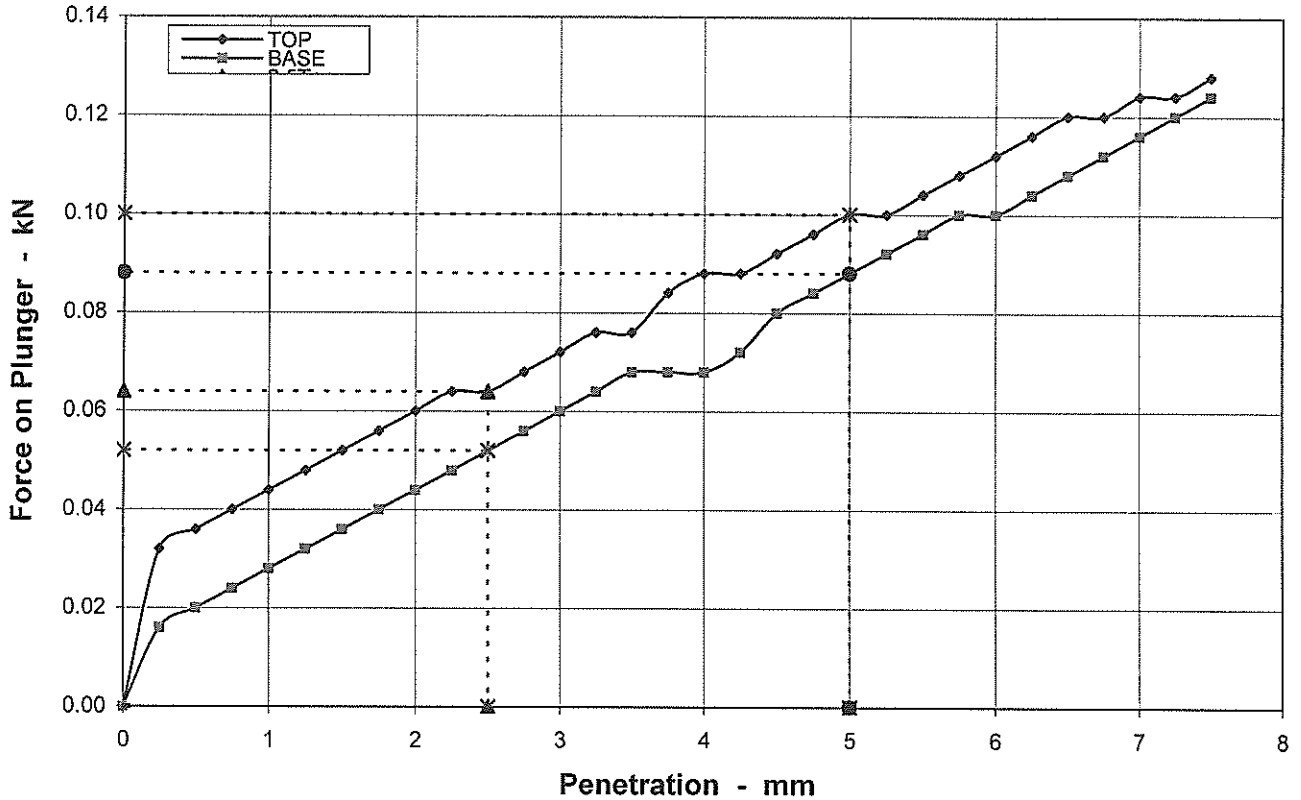


# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref	P16177
Borehole / Pit No	TP02
Sample No	1
Depth	0.2 m

Site Name	Dereenacrinnig Windfarm
Soil Description	Slightly sandy slightly gravelly SILT



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	24
Moisture Content - TOP	%	24
Moisture Content - BASE	%	23
Bulk Density	Mg/m <sup>3</sup>	2.01
Dry Density	Mg/m <sup>3</sup>	1.62

Test Conditions		
Sample Retained on 20 mm sieve	%	19.8
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.5	0.4
5.0	0.5	0.4
<b>Accepted CBR</b>	<b>0.5</b>	<b>0.4</b>

			Remarks	





# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP02

Site Name

Dereenacrinnig Windfarm

Sample No

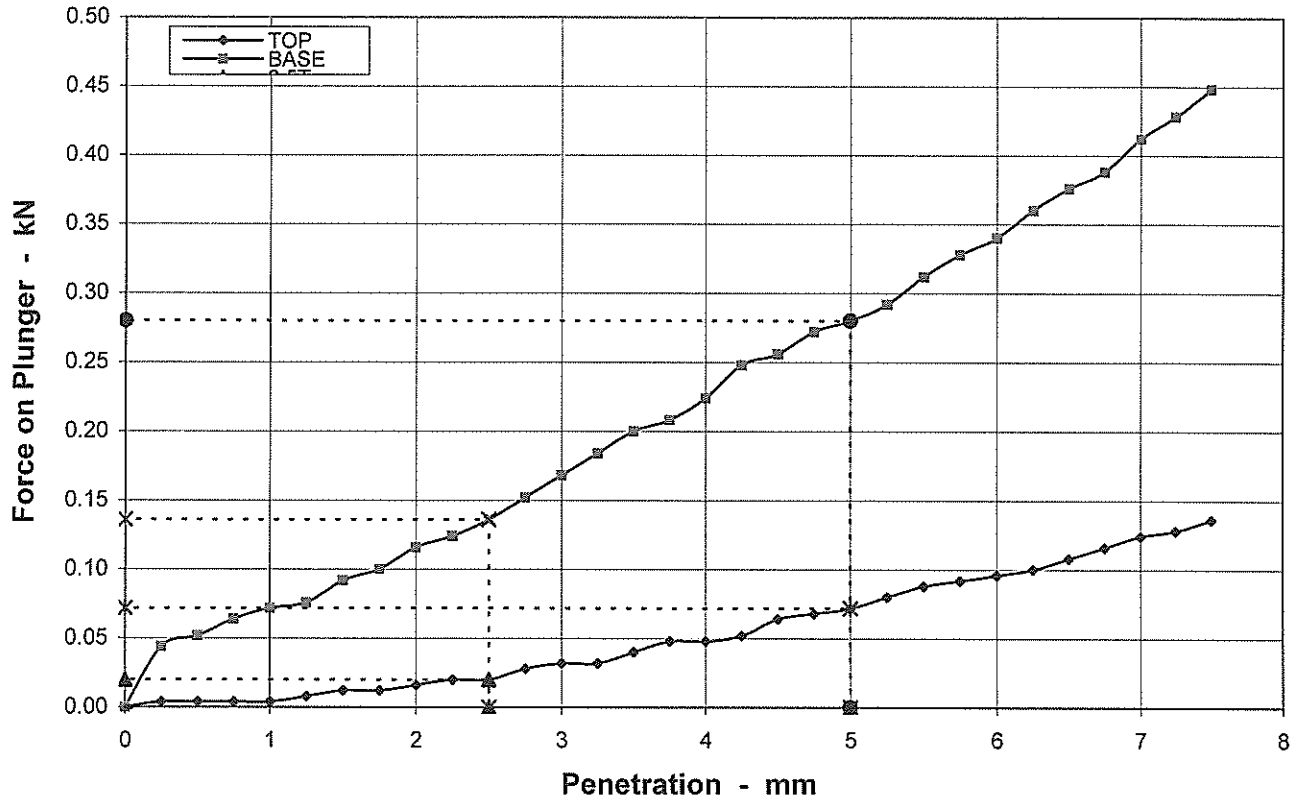
3

Depth

0.9 m

Soil Description

Very silty very sandy GRAVEL with low cobble content



Method of Compaction		
Preparation	Rammer compaction with specified effort	
	Hammer type	N/A
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	15
Moisture Content - TOP	%	15
Moisture Content - BASE	%	11
Bulk Density	Mg/m <sup>3</sup>	2.25
Dry Density	Mg/m <sup>3</sup>	1.95

Test Conditions		
Sample Retained on 20 mm sieve	%	10.4
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.2	1.0
5.0	0.4	1.4
<b>Accepted CBR</b>	<b>0.4</b>	<b>1.4</b>

			Remarks

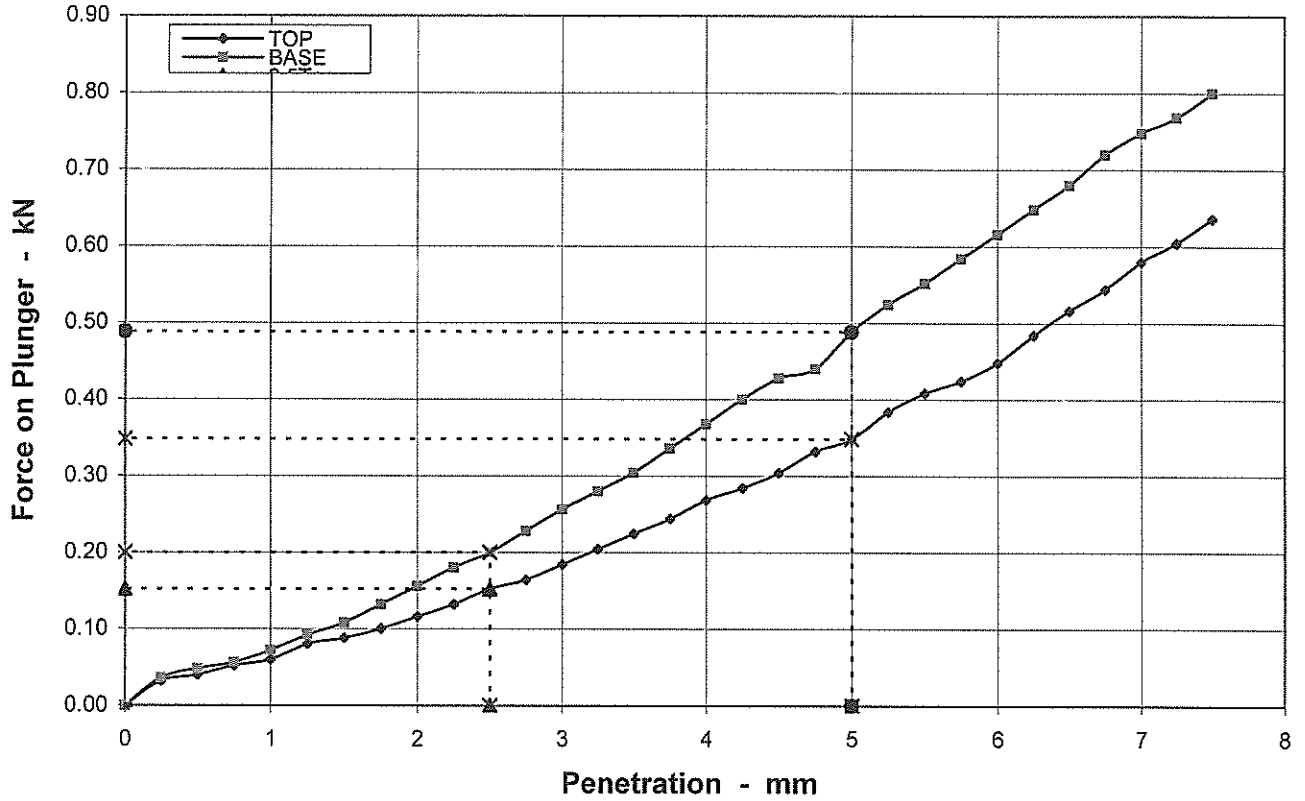


# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref	P16177
Borehole / Pit No	TP04
Sample No	3
Depth	1 m

Site Name	Dereenacrinnig Windfarm
Soil Description	Silty very sandy GRAVEL with medium cobble content



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	13
Moisture Content - TOP	%	13
Moisture Content - BASE	%	12
Bulk Density	Mg/m <sup>3</sup>	2.29
Dry Density	Mg/m <sup>3</sup>	2.03

Test Conditions		
Sample Retained on 20 mm sieve	%	19.9
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	1.2	1.5
5.0	1.7	2.4
<b>Accepted CBR</b>	<b>1.7</b>	<b>2.4</b>

Remarks		

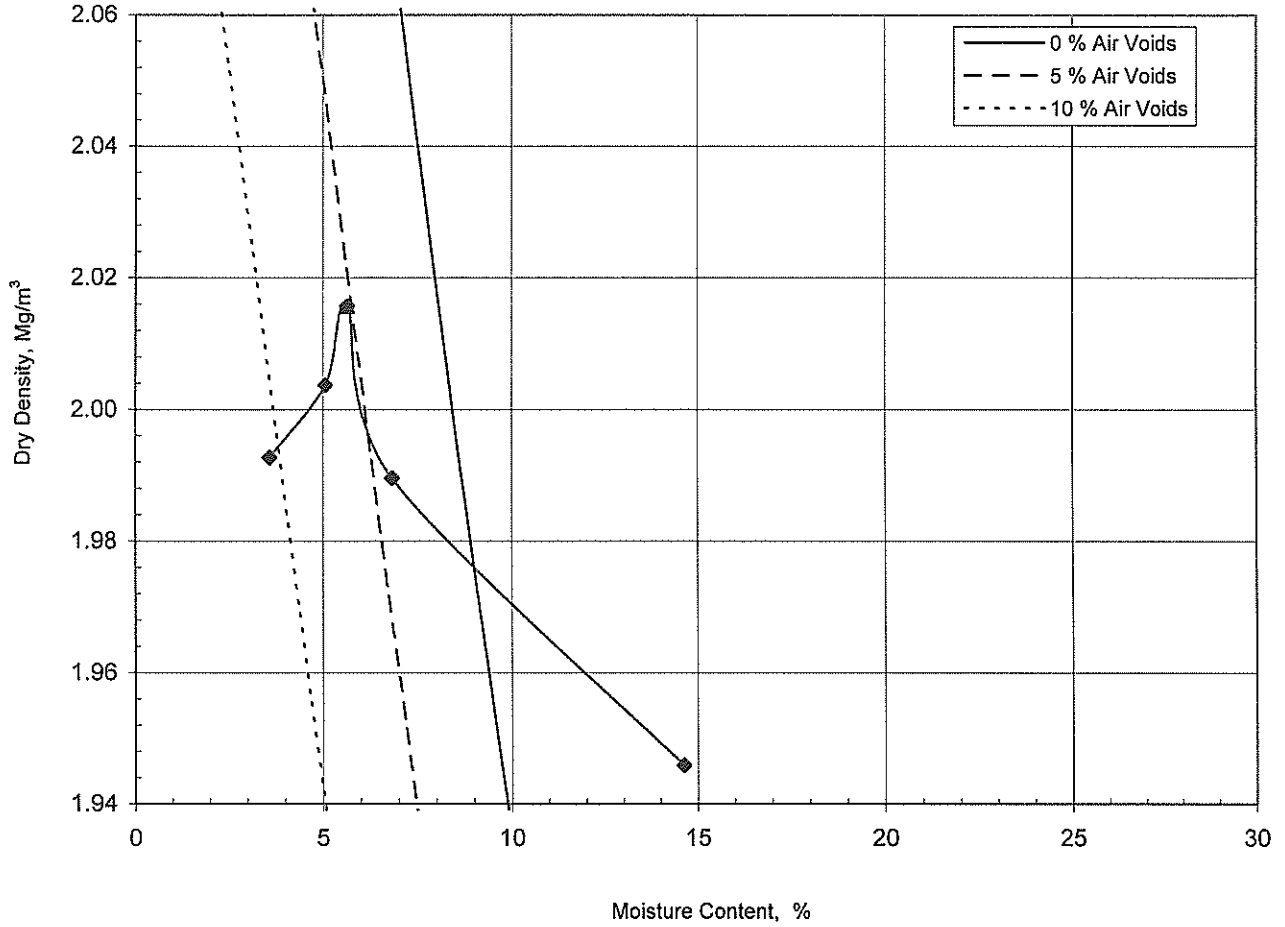


## Dry Density / Moisture Content Relationship

BS 1377 : Part 4 : 1990 : Clause 3

Job Ref	P16177
Borehole / Pit No	TP06
Sample No	3
Depth	0.75 m
Sample Type	B

Site Name	Dereenacrinnig Windfarm
Soil Description	Slightly sandy slightly gravelly SILT



Preparation	3.2
Test Method	2.5 kg Rammer
Mould Type	CBR
Samples Used	Single Sample
Mass Retained on 37.5 mm Sieve	1 %
Mass Retained on 20.0 mm Sieve	5 %
Grading Zone	4
Particle Density - Assumed	2.40 Mg/m³
Maximum Dry Density	2.02 Mg/m³
Optimum Moisture Content	5.7 %
Natural Moisture Content	14.63 %



# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP06

Site Name

Dereenacrinnig Windfarm

Sample No

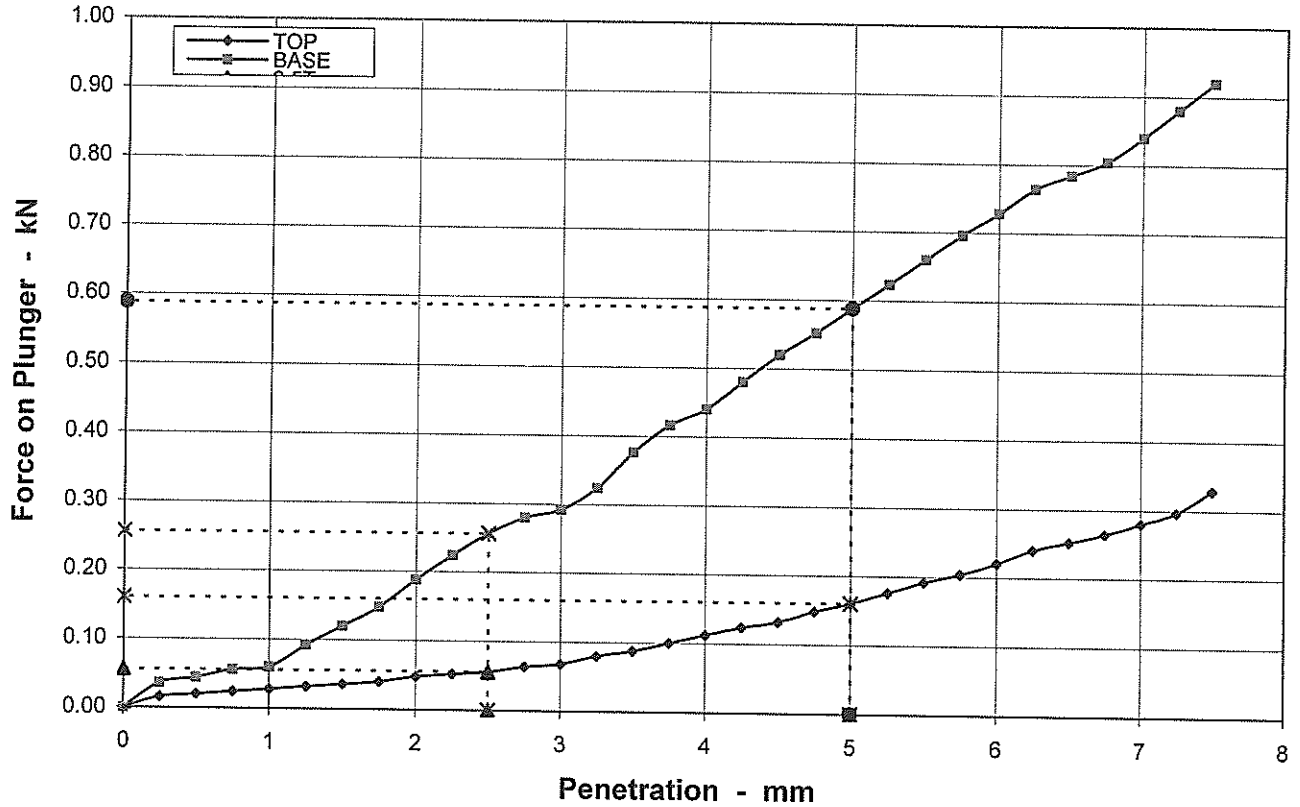
3

Soil Description

Slightly sandy slightly gravelly SILT

Depth

0.75 m



Method of Compaction	
Rammer compaction with specified effort	
Hammer type	2.5kg Rammer
Soaking Period	days
Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	15
Moisture Content - TOP	%	15
Moisture Content - BASE	%	13
Bulk Density	Mg/m <sup>3</sup>	2.23
Dry Density	Mg/m <sup>3</sup>	1.95

Test Conditions		
Sample Retained on 20 mm sieve	%	2.3
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.4	1.9
5.0	0.8	2.9
<b>Accepted CBR</b>	<b>0.8</b>	<b>2.9</b>

			Remarks



# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP06

Site Name

Dereenacrinnig Windfarm

Sample No

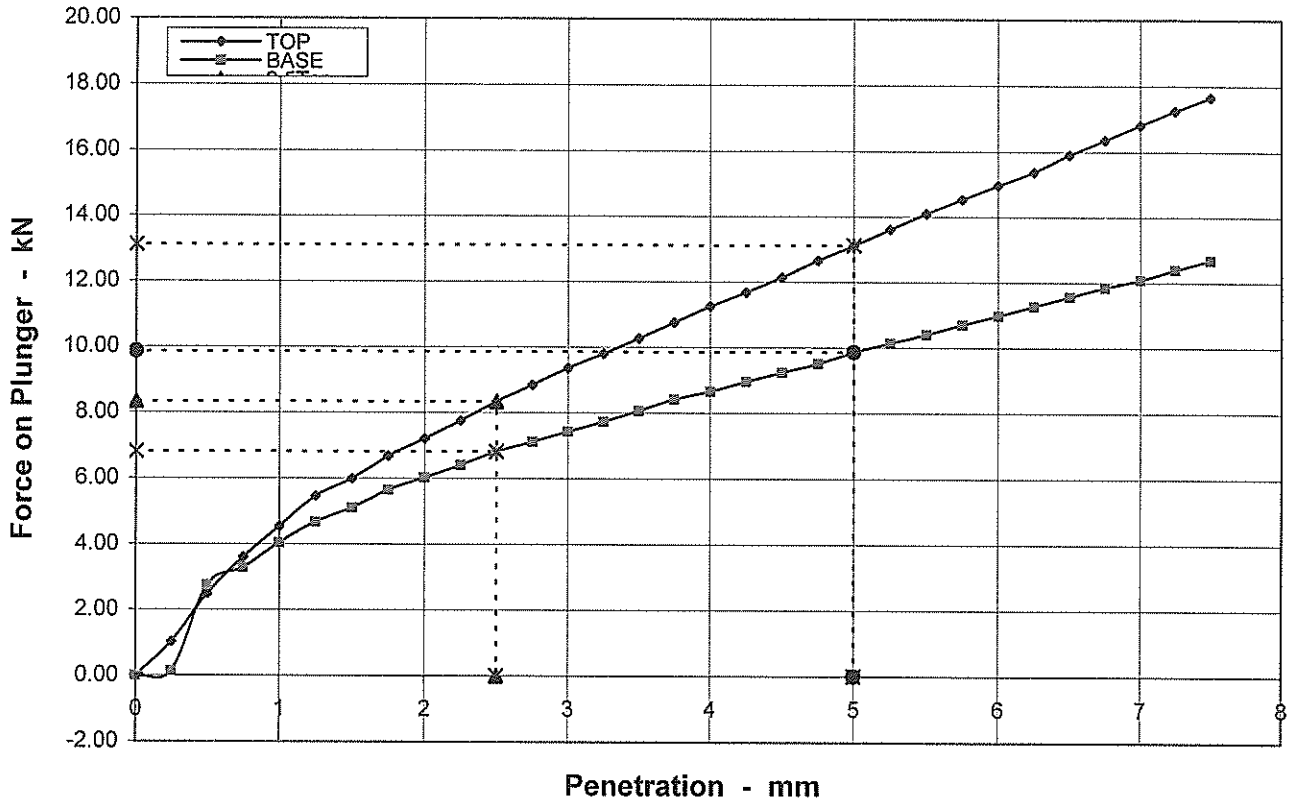
3

Soil Description

Slightly sandy slightly gravelly SILT

Depth

0.75 m



Method of Compaction	
Rammer compaction with specified effort	
Preparation Hammer type	2.5kg Rammer
Soaking Period	days
Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	15
Moisture Content - TOP	%	4.8
Moisture Content - BASE	%	4.9
Bulk Density	Mg/m <sup>3</sup>	2.11
Dry Density	Mg/m <sup>3</sup>	1.84

Test Conditions		
Sample Retained on 20 mm sieve	%	2.3
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	63.1	51.6
5.0	65.6	49.2
<b>Accepted CBR</b>	<b>65.6</b>	<b>51.6</b>

			Remarks	





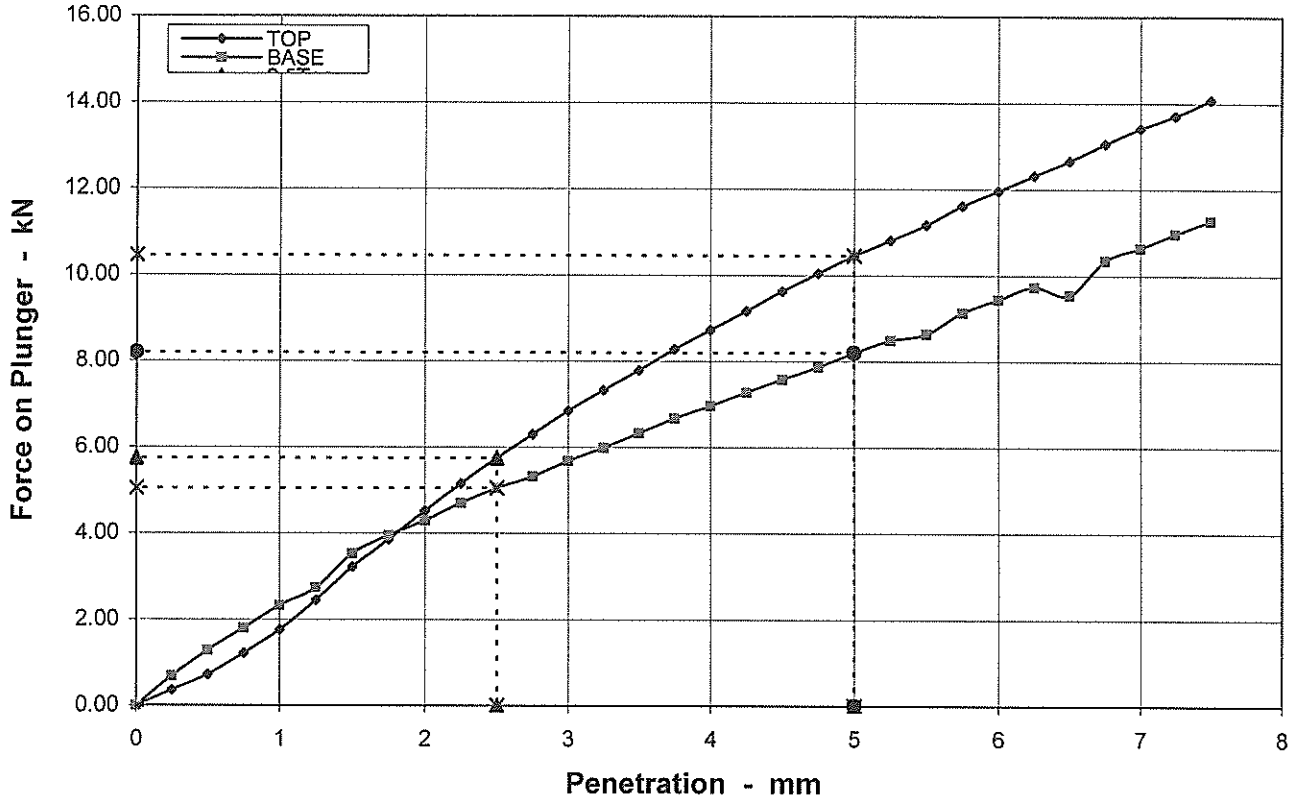


# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref	P16177
Borehole / Pit No	TP06
Sample No	3
Depth	0.75 m

Site Name	Dereenacrinnig Windfarm
Soil Description	Slightly sandy slightly gravelly SILT



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	15
Moisture Content - TOP	%	3.7
Moisture Content - BASE	%	4.3
Bulk Density	Mg/m <sup>3</sup>	2.06
Dry Density	Mg/m <sup>3</sup>	1.80

Test Conditions		
Sample Retained on 20 mm sieve	%	2.3
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	43.5	38.2
5.0	52.2	41.0
<b>Accepted CBR</b>	<b>52.2</b>	<b>41.0</b>

Remarks		



# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP06

Site Name

Dereenacrinnig Windfarm

Sample No

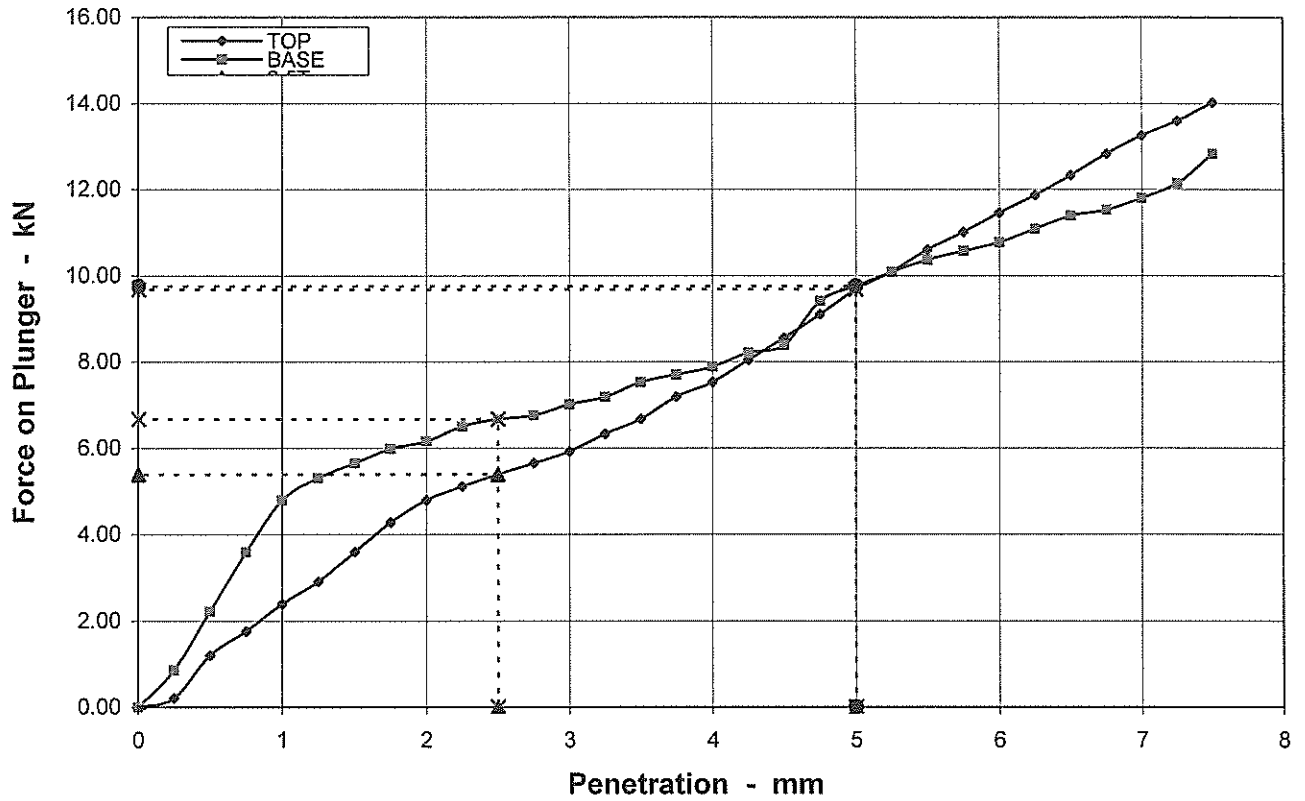
3

Soil Description

Slightly sandy slightly gravelly SILT

Depth

0.75 m



Method of Compaction	
Rammer compaction with specified effort	
Hammer type	2.5kg Rammer
Soaking Period	days
Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	6.5
Moisture Content - TOP	%	6.5
Moisture Content - BASE	%	6.0
Bulk Density	Mg/m <sup>3</sup>	2.13
Dry Density	Mg/m <sup>3</sup>	2.00

Test Conditions		
Sample Retained on 20 mm sieve	%	2.3
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	40.8	50.5
5.0	48.4	48.7
<b>Accepted CBR</b>	<b>48.4</b>	<b>50.5</b>

			Remarks	



# CALIFORNIA BEARING RATIO RELATIONSHIP

BS 1377 : Part 4 : 1990 Clause 5

Job Ref

P16177

Borehole / Pit No

TP06

Location

Dereenacrinning Windfarm

Sample No

3

Soil Description

Slightly sandy slightly gravelly SILT

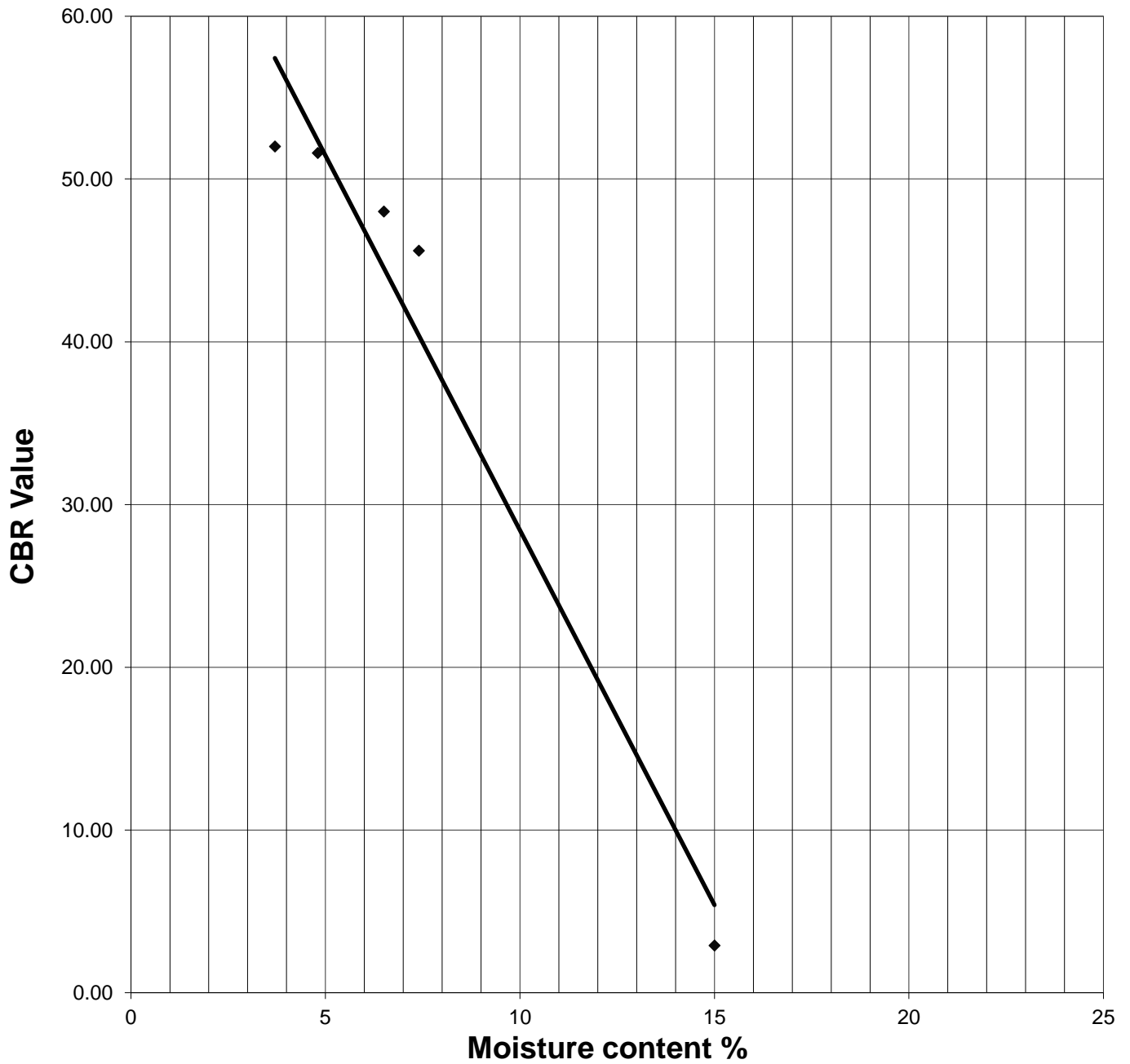
Sample Type

B

Depth

0.75 m

## CBR/ Moisture Content Relationship



Operator

Checked

Approved

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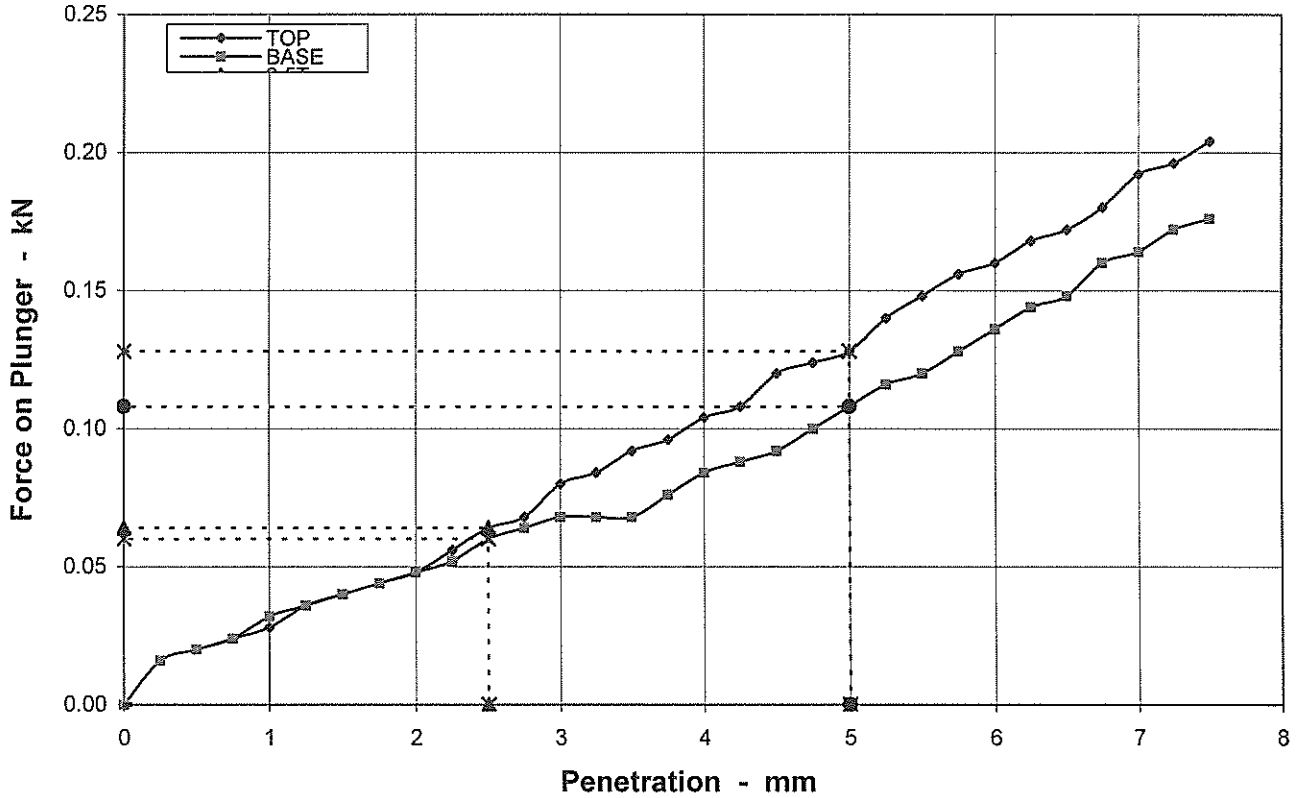


# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref	P16177
Borehole / Pit No	TP07
Sample No	1
Depth	0.6 m

Site Name	Dereenacrinnig Windfarm
Soil Description	Slightly gravelly sandy SILT



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	15
Moisture Content - TOP	%	15
Moisture Content - BASE	%	13
Bulk Density	Mg/m <sup>3</sup>	2.21
Dry Density	Mg/m <sup>3</sup>	1.92

Test Conditions		
Sample Retained on 20 mm sieve	%	13.3
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.5	0.5
5.0	0.6	0.5
<b>Accepted CBR</b>	<b>0.6</b>	<b>0.5</b>

Remarks		





# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP08

Site Name

Dereenacrinnig Windfarm

Sample No

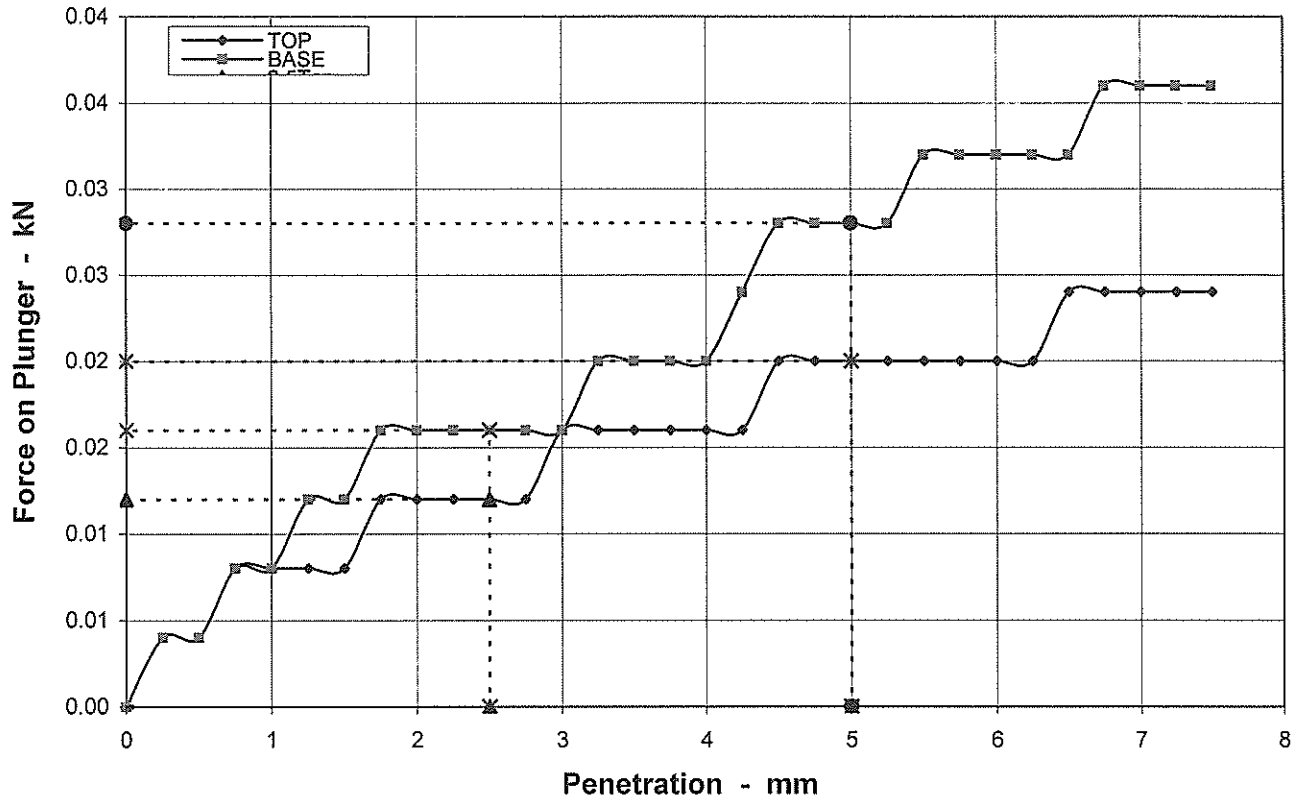
1

Soil Description

Slightly sandy slightly gravelly SILT

Depth

0.5 m



Method of Compaction	
Rammer compaction with specified effort	
Hammer type	2.5kg Rammer
Soaking Period	days
Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	116
Moisture Content - TOP	%	116
Moisture Content - BASE	%	125
Bulk Density	Mg/m <sup>3</sup>	1.42
Dry Density	Mg/m <sup>3</sup>	0.66

Test Conditions		
Sample Retained on 20 mm sieve	%	12.7
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.1	0.1
5.0	0.1	0.1
<b>Accepted CBR</b>	<b>0.1</b>	<b>0.1</b>

			Remarks	

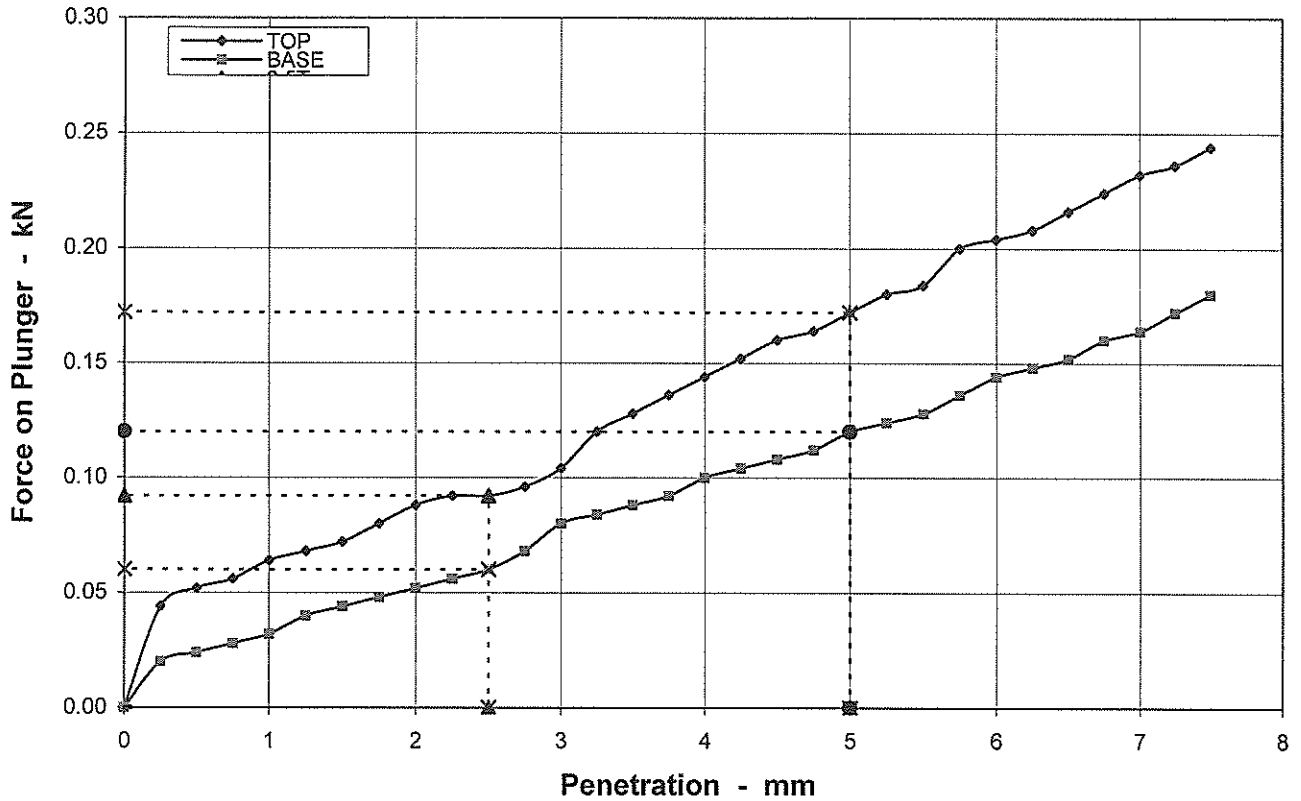


# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref	P16177
Borehole / Pit No	TP08
Sample No	4
Depth	0.8 m

Site Name	Dereenacrinnig Windfarm
Soil Description	Very silty very sandy GRAVEL with low cobble content



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	17
Moisture Content - TOP	%	17
Moisture Content - BASE	%	15
Bulk Density	Mg/m <sup>3</sup>	2.19
Dry Density	Mg/m <sup>3</sup>	1.87

Test Conditions		
Sample Retained on 20 mm sieve	%	15.6
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.7	0.5
5.0	0.9	0.6
<b>Accepted CBR</b>	<b>0.9</b>	<b>0.6</b>

Remarks		



# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP10

Site Name

Dereenacrinnig Windfarm

Sample No

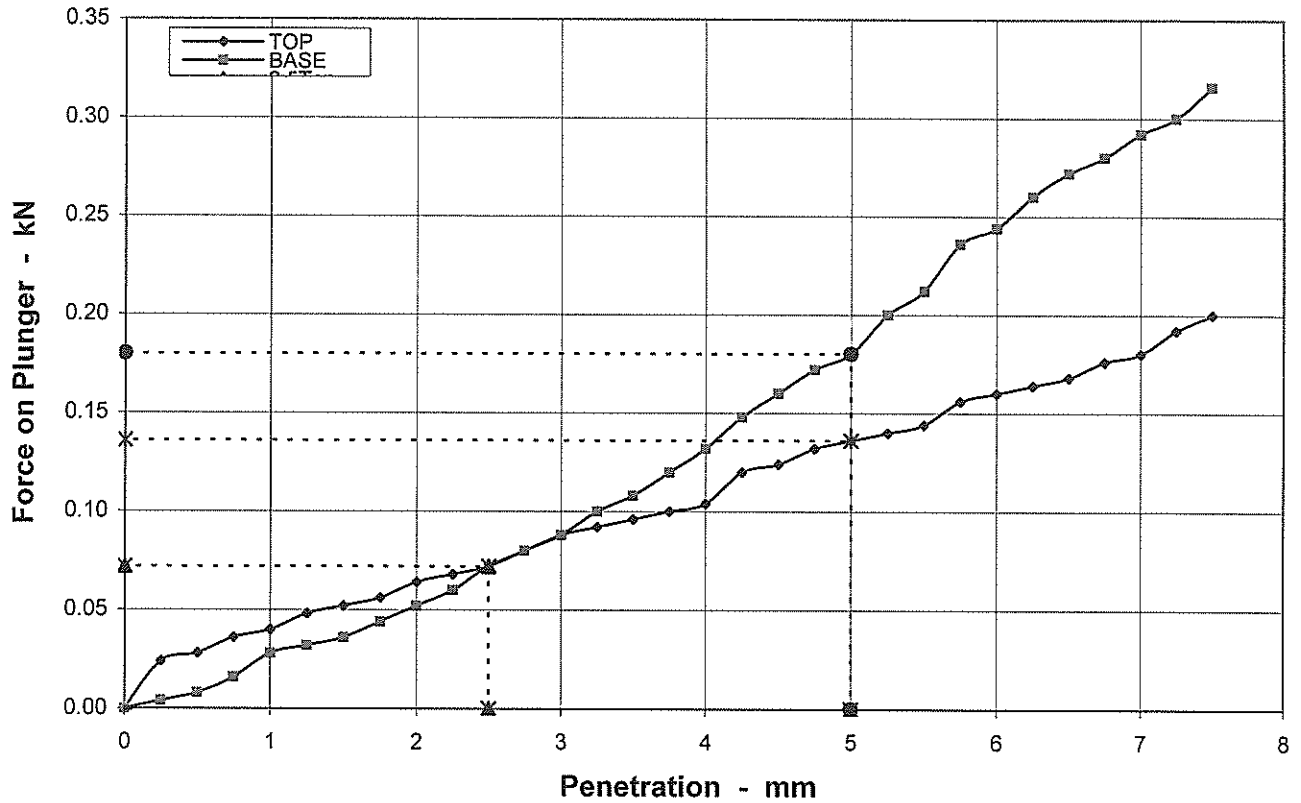
3

Soil Description

Very silty sandy GRAVEL with medium cobble content

Depth

0.9 m



Preparation		Method of Compaction	
		Rammer compaction with specified effort	
Hammer type		2.5kg Rammer	
Soaking Period	days		
Amount of Swell	mm		

Sample Conditions		
Natural Moisture Content	%	10
Moisture Content - TOP	%	10
Moisture Content - BASE	%	13
Bulk Density	Mg/m <sup>3</sup>	2.29
Dry Density	Mg/m <sup>3</sup>	2.07

Test Conditions		
Sample Retained on 20 mm sieve	%	31.3
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.5	0.5
5.0	0.7	0.9
<b>Accepted CBR</b>	<b>0.7</b>	<b>0.9</b>

			Remarks	



# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP14

Site Name

Dereenacrinnig Windfarm

Sample No

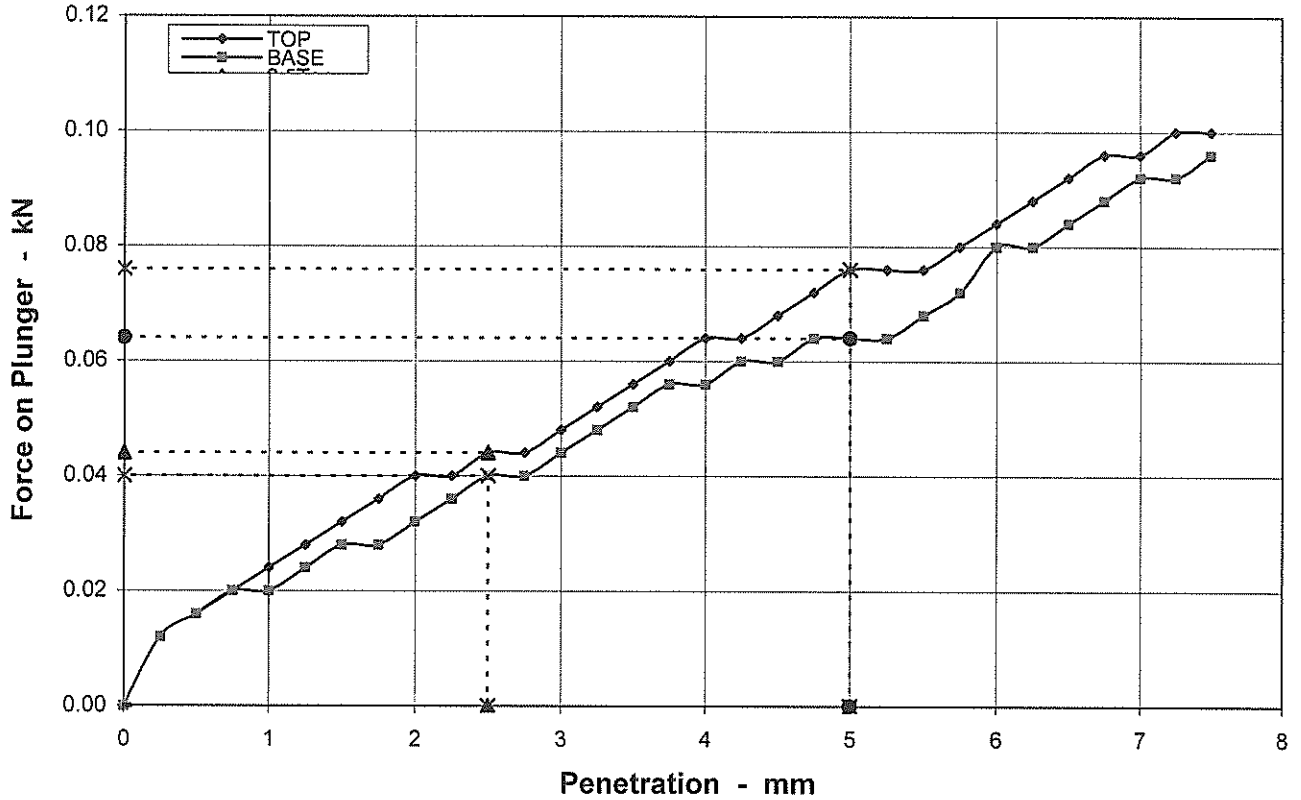
1

Depth

0.5 m

Soil Description

Slightly sandy slightly gravelly SILT



Method of Compaction	
Rammer compaction with specified effort	
Hammer type	2.5kg Rammer
Soaking Period	days
Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	37
Moisture Content - TOP	%	37
Moisture Content - BASE	%	35
Bulk Density	Mg/m <sup>3</sup>	1.82
Dry Density	Mg/m <sup>3</sup>	1.33

Test Conditions		
Sample Retained on 20 mm sieve	%	10.0
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.3	0.3
5.0	0.4	0.3
<b>Accepted CBR</b>	<b>0.4</b>	<b>0.3</b>

			Remarks	



# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP15

Site Name

Dereenacrinnig Windfarm

Sample No

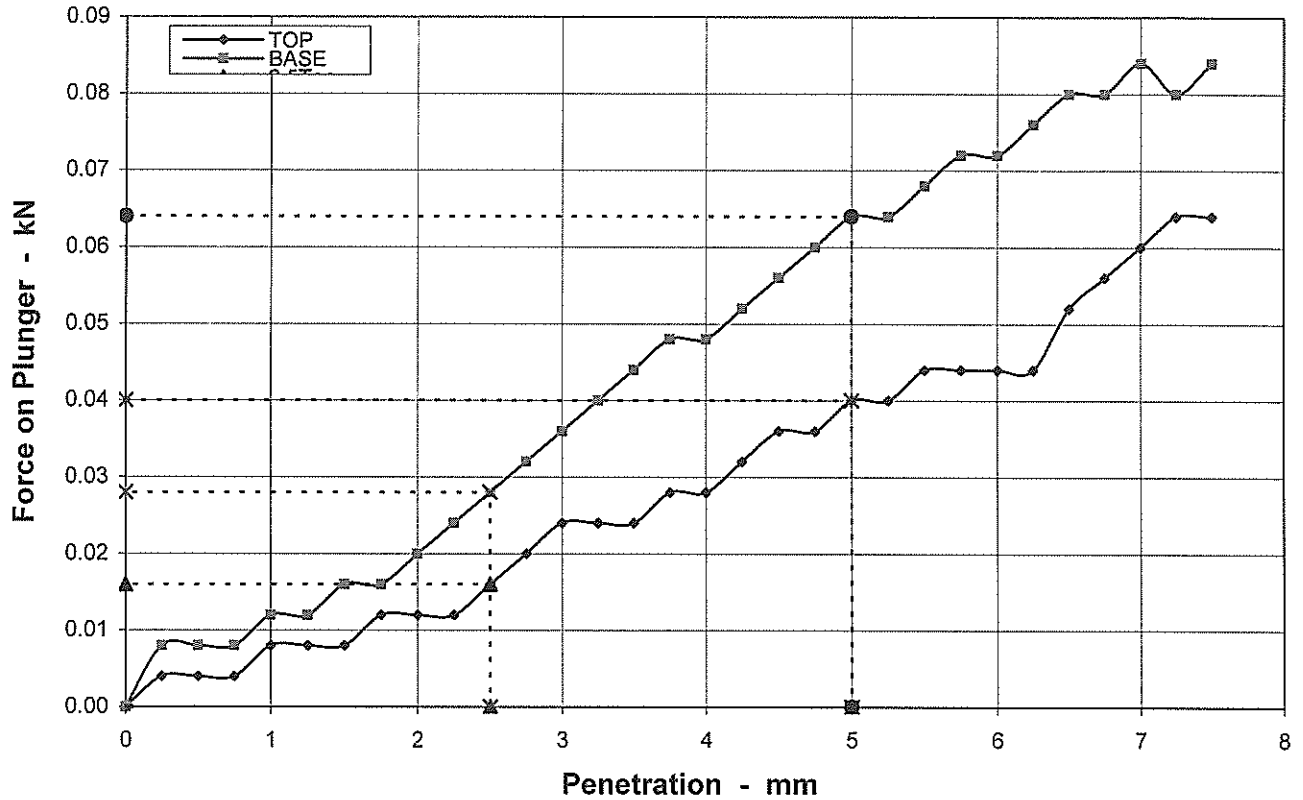
3

Depth

1.1 m

Soil Description

Very silty very sandy GRAVEL with medium cobble content



Method of Compaction	
Rammer compaction with specified effort	
Hammer type	2.5kg Rammer
Soaking Period	days
Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	17
Moisture Content - TOP	%	17
Moisture Content - BASE	%	16
Bulk Density	Mg/m <sup>3</sup>	2.17
Dry Density	Mg/m <sup>3</sup>	1.86

Test Conditions		
Sample Retained on 20 mm sieve	%	9.3
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.1	0.2
5.0	0.2	0.3
<b>Accepted CBR</b>	<b>0.2</b>	<b>0.3</b>

			Remarks	





# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP18

Site Name

Dereenacrinnig Windfarm

Sample No

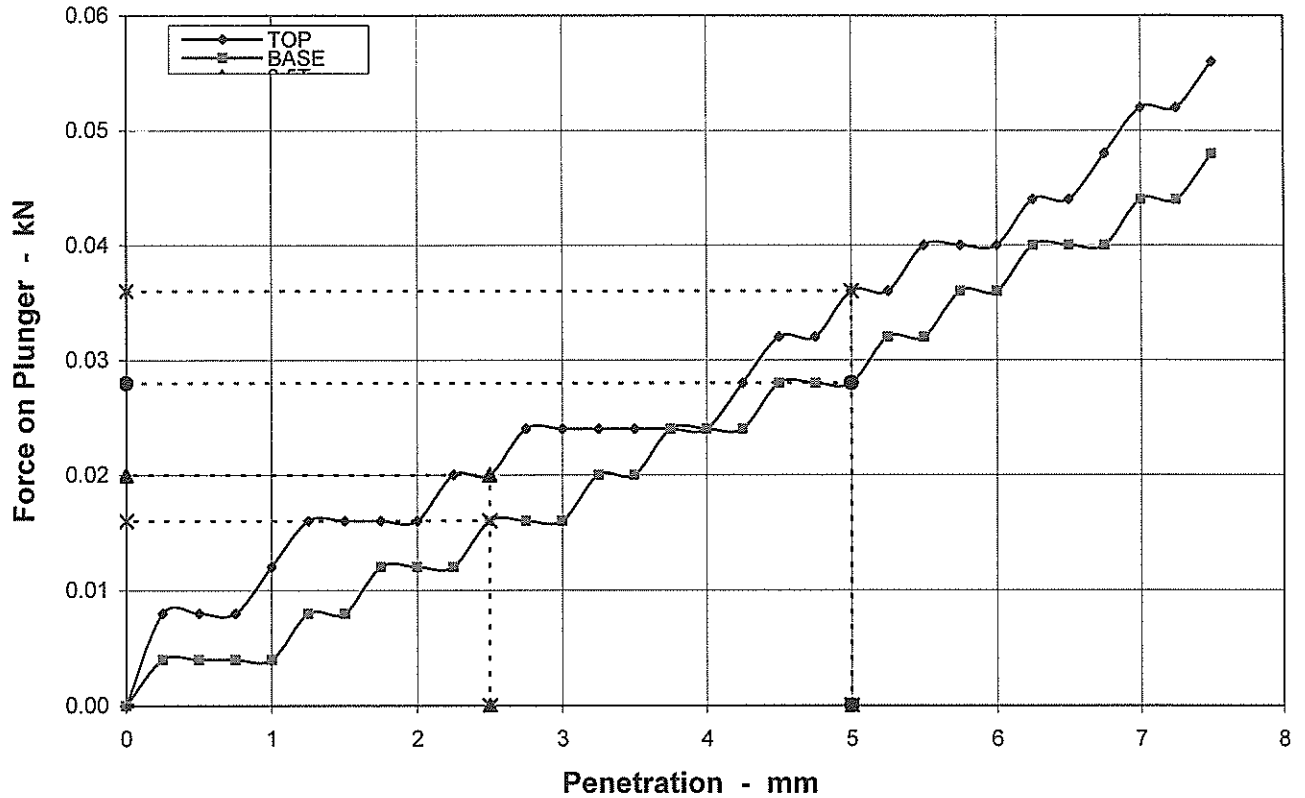
1

Depth

0.5 m

Soil Description

Slightly sandy gravelly SILT



Method of Compaction	
Rammer compaction with specified effort	
Hammer type	2.5kg Rammer
Soaking Period	days
Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	39
Moisture Content - TOP	%	39
Moisture Content - BASE	%	45
Bulk Density	Mg/m <sup>3</sup>	1.76
Dry Density	Mg/m <sup>3</sup>	1.27

Test Conditions		
Sample Retained on 20 mm sieve	%	15.7
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.2	0.1
5.0	0.2	0.1
<b>Accepted CBR</b>	<b>0.2</b>	<b>0.1</b>

			Remarks	



# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP19

Site Name

Dereenacrinnig Windfarm

Sample No

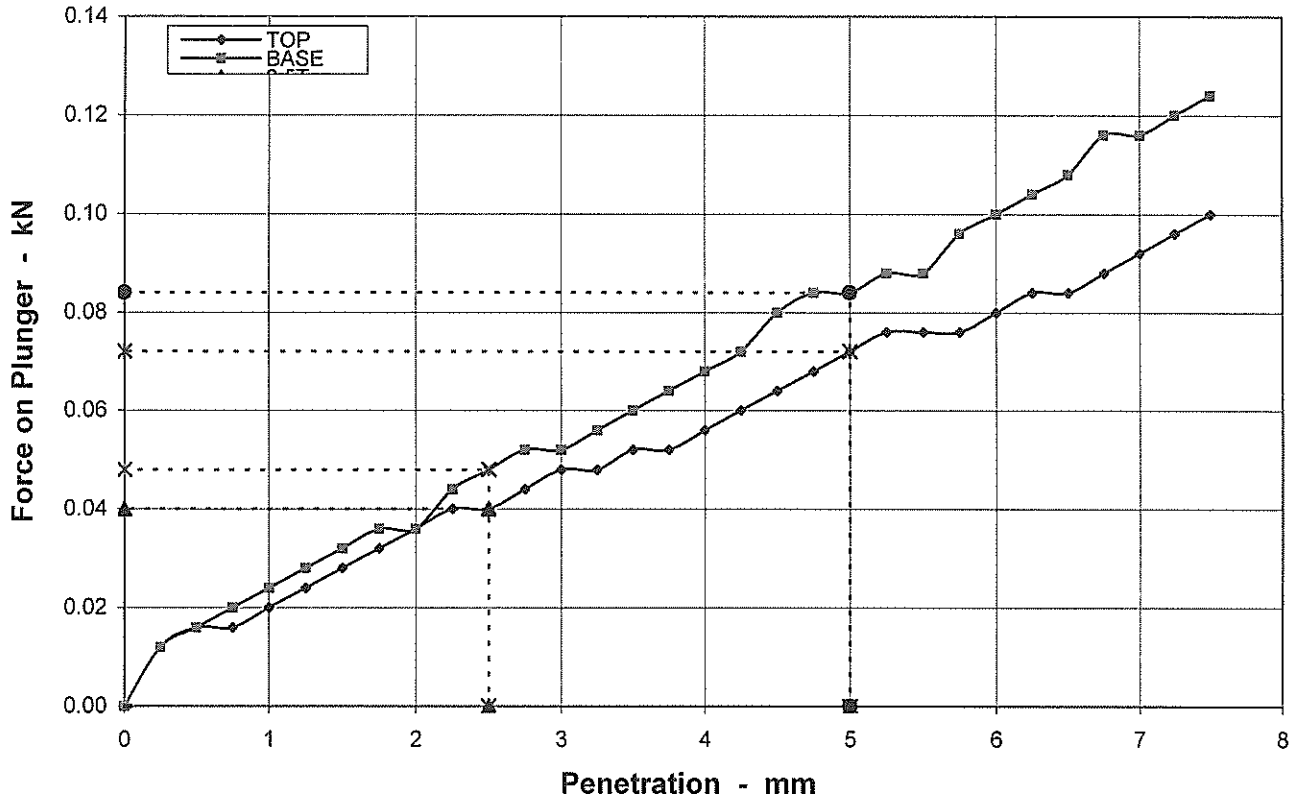
1

Depth

0.9 m

Soil Description

Very silty very sandy GRAVEL with medium cobble content



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	36
Moisture Content - TOP	%	36
Moisture Content - BASE	%	31
Bulk Density	Mg/m <sup>3</sup>	1.82
Dry Density	Mg/m <sup>3</sup>	1.34

Test Conditions		
Sample Retained on 20 mm sieve	%	24.1
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.3	0.4
5.0	0.4	0.4
<b>Accepted CBR</b>	<b>0.4</b>	<b>0.4</b>

			Remarks	



# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TP22

Site Name

Dereenacrinnig Windfarm

Sample No

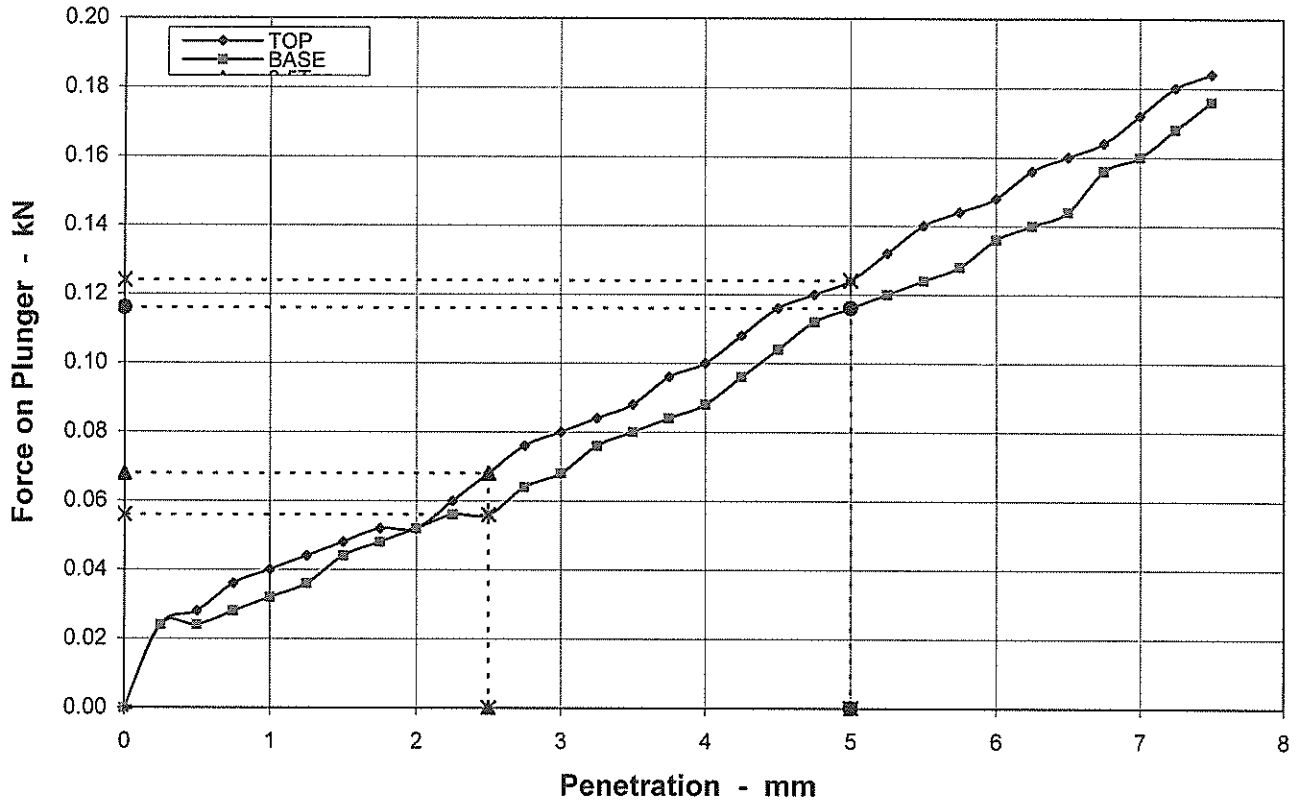
1

Soil Description

Slightly gravelly sandy SILT

Depth

0.2 m



Preparation		Method of Compaction	
		Rammer compaction with specified effort	
Hammer type		2.5kg Rammer	
Soaking Period	days		
Amount of Swell	mm		

Sample Conditions		
Natural Moisture Content	%	18
Moisture Content - TOP	%	18
Moisture Content - BASE	%	19
Bulk Density	Mg/m <sup>3</sup>	2.13
Dry Density	Mg/m <sup>3</sup>	1.80

Test Conditions		
Sample Retained on 20 mm sieve	%	26.9
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.5	0.4
5.0	0.6	0.6
<b>Accepted CBR</b>	<b>0.6</b>	<b>0.6</b>

			Remarks	



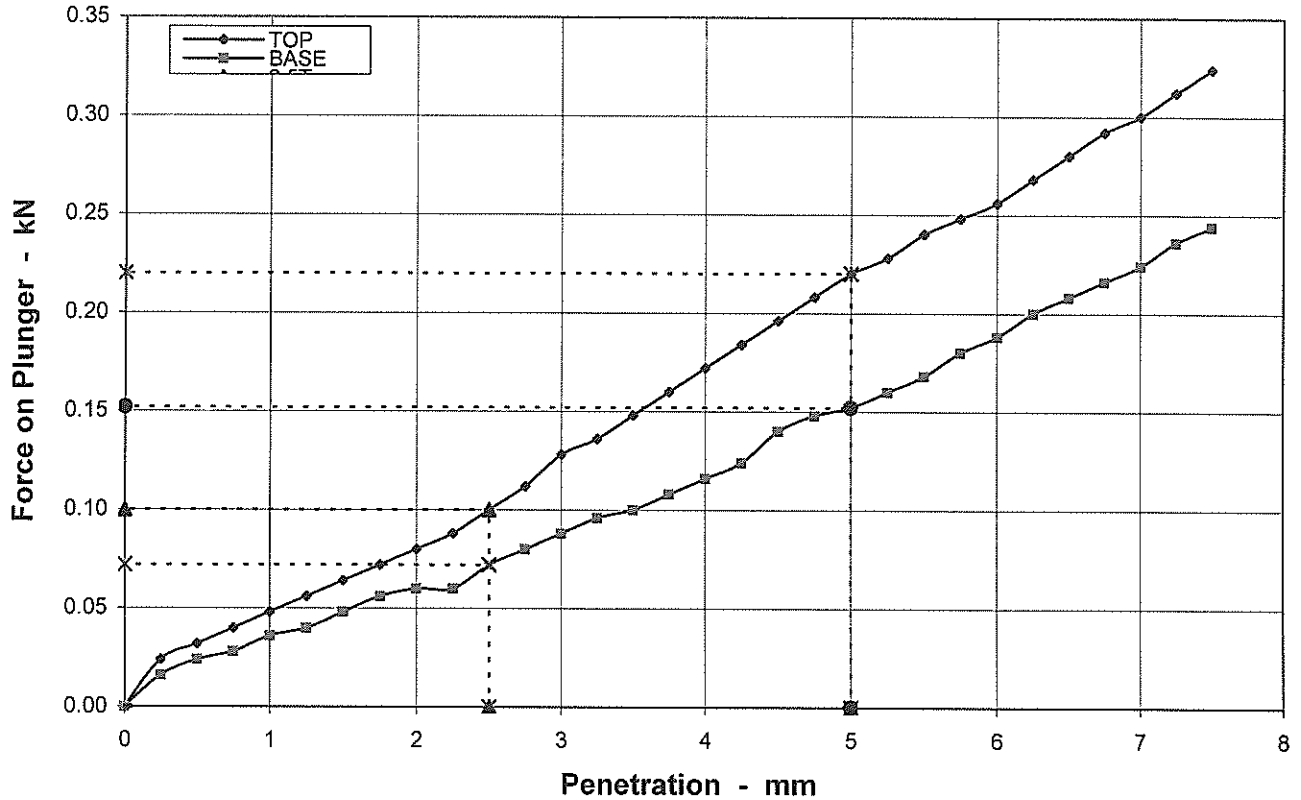


# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref	P16177
Borehole / Pit No	TP15A
Sample No	3
Depth	0.8 m

Site Name	Dereenacrinnig Windfarm
Soil Description	Slightly sandy gravelly SILT



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	17
Moisture Content - TOP	%	17
Moisture Content - BASE	%	16
Bulk Density	Mg/m <sup>3</sup>	2.18
Dry Density	Mg/m <sup>3</sup>	1.87

Test Conditions		
Sample Retained on 20 mm sieve	%	10.4
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.8	0.5
5.0	1.1	0.8
<b>Accepted CBR</b>	<b>1.1</b>	<b>0.8</b>

Remarks		
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# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TPS1

Site Name

Dereenacrinnig Windfarm

Sample No

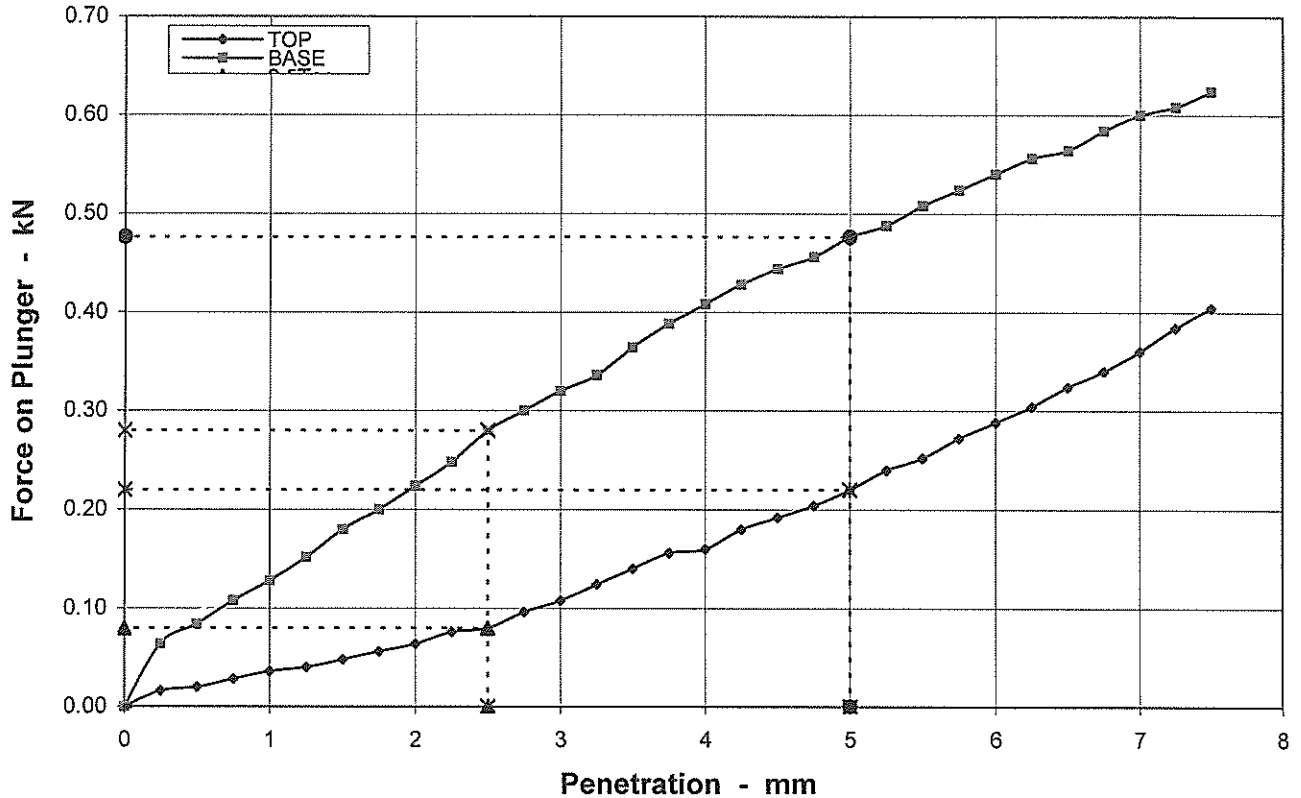
1

Depth

0.55 m

Soil Description

Silty sandy GRAVEL with medium cobble content



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	14
Moisture Content - TOP	%	14
Moisture Content - BASE	%	11
Bulk Density	Mg/m <sup>3</sup>	2.01
Dry Density	Mg/m <sup>3</sup>	1.76

Test Conditions		
Sample Retained on 20 mm sieve	%	33.0
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	9

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.6	2.1
5.0	1.1	2.4
<b>Accepted CBR</b>	<b>1.1</b>	<b>2.4</b>

			Remarks



# CALIFORNIA BEARING RATIO

BS 1377 : Part 4 : 1990 Clause 7.4

Job Ref

P16177

Borehole / Pit No

TPS3

Site Name

Dereenacrinnig Windfarm

Sample No

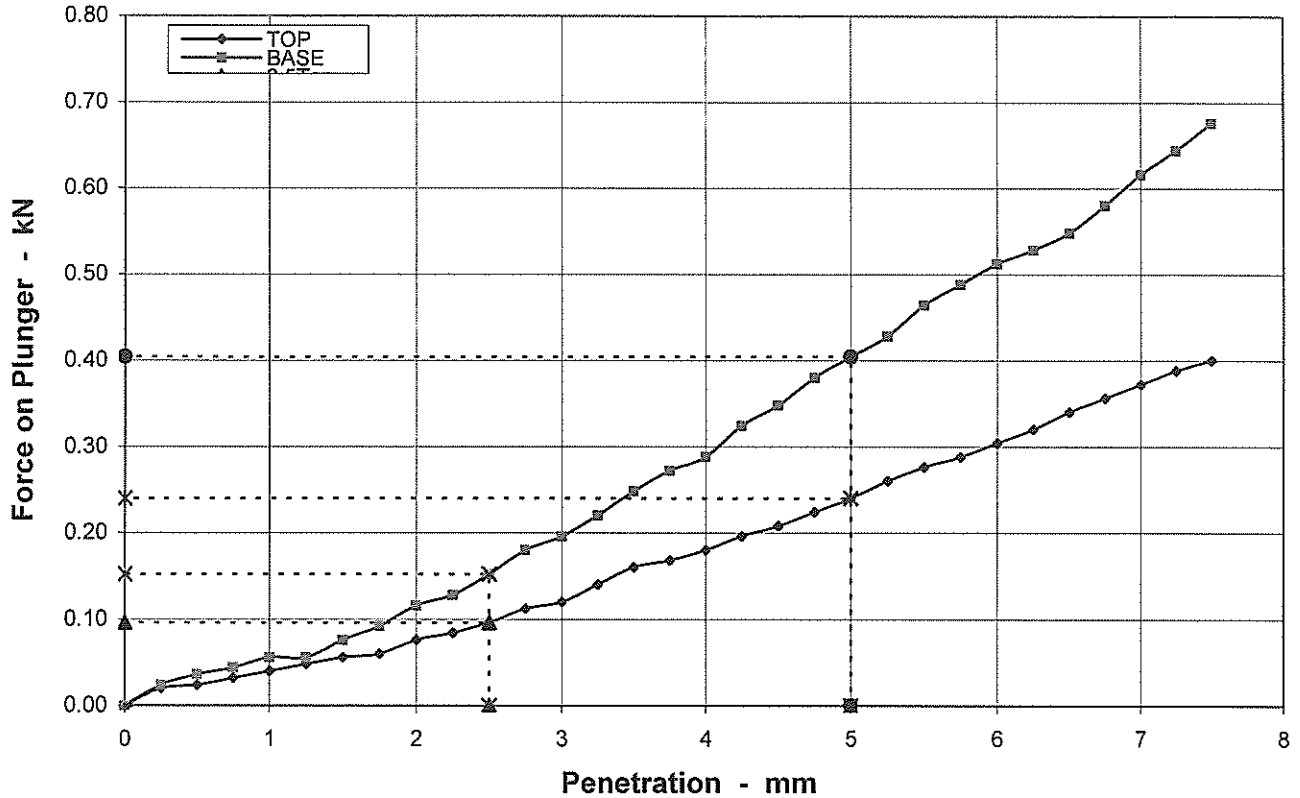
3

Depth

1.1 m

Soil Description

Slightly sandy gravelly SILT low cobble content



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days
	Amount of Swell	mm

Sample Conditions		
Natural Moisture Content	%	15
Moisture Content - TOP	%	15
Moisture Content - BASE	%	12
Bulk Density	Mg/m <sup>3</sup>	2.19
Dry Density	Mg/m <sup>3</sup>	1.91

Test Conditions		
Sample Retained on 20 mm sieve	%	10.7
Seating Load - TOP	N	
Seating Load - BASE	N	
Surcharge	kg	8

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.7	1.2
5.0	1.2	2.0
<b>Accepted CBR</b>	<b>1.2</b>	<b>2.0</b>

			Remarks	



## Final Report

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**Report No.:** 17-02390-1

**Initial Date of Issue:** 03-Feb-2017

**Client:** Priority Geotechnical Ltd

**Client Address:** Unit 12  
Owenacurra Business Park  
Midleton  
County Cork  
Ireland

**Contact(s):** Colette Kelly

**Project:** P16177 Derreenacrinnig Wind Farm

**Quotation No.:** **Date Received:** 01-Feb-2017

**Order No.:** 9262 **Date Instructed:** 01-Feb-2017

**No. of Samples:** 3

**Turnaround (Wkdays):** 3 **Results Due:** 03-Feb-2017

**Date Approved:** 03-Feb-2017

**Approved By:**  


**Details:** Glynn Harvey, Laboratory Manager

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Client: Priority Geotechnical Ltd		Chemtest Job No.:			17-02390	17-02390	17-02390
Quotation No.:		Chemtest Sample ID.:			406144	406145	406146
		Client Sample ID.:			TP19	TPS1	TPS3
		Sample Type:			SOIL	SOIL	SOIL
		Top Depth (m):			0.9	0.55	1.1
		Date Sampled:			31-Jan-2017	31-Jan-2017	31-Jan-2017
Determinand	Accred.	SOP	Units	LOD			
Moisture	N	2030	%	0.020	27	9.9	9.3
pH	U	2010		N/A		7.8	
Sulphate (2:1 Water Soluble) as SO <sub>4</sub>	U	2120	g/l	0.010		0.013	
Sulphate (Acid Soluble)	U	2430	%	0.010		< 0.010	
LOI	U	2610	%	0.10	5.1	0.86	0.73

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.



## **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](mailto:customerservices@chemtest.co.uk)



2183

## Final Report

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**Report No.:** 17-01935-1

**Initial Date of Issue:** 30-Jan-2017

**Client:** Priority Geotechnical Ltd

**Client Address:** Unit 12  
Owenacurra Business Park  
Midleton  
County Cork  
Ireland

**Contact(s):** Colette Kelly

**Project:** P16177 Derreenacrinn in WF

<b>Quotation No.:</b>		<b>Date Received:</b>	26-Jan-2017
<b>Order No.:</b>	9262	<b>Date Instructed:</b>	26-Jan-2017
<b>No. of Samples:</b>	3		
<b>Turnaround (Wkdays):</b>	3	<b>Results Due:</b>	30-Jan-2017

**Date Approved:** 30-Jan-2017

**Approved By:**  


**Details:** Glynn Harvey, Laboratory Manager

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**Project: P16177 Derreenacrinn in WF**

Client: Priority Geotechnical Ltd	Chemtest Job No.:				17-01935	17-01935	17-01935
Quotation No.:	Chemtest Sample ID.:				404041	404042	404043
Order No.: 9262	Client Sample Ref.:				TP15	TP3A	TP12
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				2.1	1.3	1.0
	Date Sampled:				24-Jan-2017	24-Jan-2017	24-Jan-2017
Determinand	Accred.	SOP	Units	LOD			
Moisture	N	2030	%	0.020	8.5	11	93
pH	U	2010		N/A	8.1	7.4	
Sulphate (2:1 Water Soluble) as SO <sub>4</sub>	U	2120	g/l	0.010	< 0.010	< 0.010	
Sulphate (Acid Soluble)	U	2430	%	0.010	< 0.010	< 0.010	
LOI	U	2610	%	0.10			81

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.

## Report Information

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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](mailto:customerservices@chemtest.co.uk)





## Results - Soil

<b>Client: Priority Geotechnical Ltd</b>	<b>Chemtest Job No.:</b>		17-01080		
Quotation No.:	<b>Chemtest Sample ID.:</b>		400067		
Order No.: 9296	Client Sample Ref.:		BHT01		
	Sample Type:		SOIL		
	Top Depth (m):		5.80		
	Date Sampled:		13-Jan-2017		
<b>Determinand</b>	<b>Accred.</b>	<b>SOP</b>	<b>Units</b>	<b>LOD</b>	
Moisture	N	2030	%	0.020	1.5
pH	U	2010		N/A	8.7
Sulphate (2:1 Water Soluble) as SO <sub>4</sub>	U	2120	g/l	0.010	< 0.010

<b>SOP</b>	<b>Title</b>	<b>Parameters included</b>	<b>Method summary</b>
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES

## **Report Information**

### **Key**

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- N/E not evaluated
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- > "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

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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

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2788

# Laboratory Report



GEO Site & Testing Services Ltd

## Contract Number: 33821

Client's Reference: **P16177 PO 9290**

Report Date: **06-02-2017**

Client **Priority Geotechnical Limited**  
**Unit 12**  
**Owenacurra Business Park**  
**Midleton**  
**Co. Cork.**

Contract Title: **Derreenacrinnin WF**  
For the attention of: **Colette Kelly**

Date Received: **18-01-2017**  
Date Commenced: **18-01-2017**  
Date Completed: **06-02-2017**

Test Description	Qty
<b>Youngs modulus &amp; possions Ratio including UCS</b> - @ Non Accredited Test	1
<b>Magnesium sulfate test soundness value.</b> BS 812/Part BS EN 1367-2:1998 - * UKAS	4
<b>Ten percent fines value (TFV)</b> BS 812-111:1990 - @ Non Accredited Test	4
<b>Disposal of Samples on Project</b>	1

**Notes:** Observations and Interpretations are outside the UKAS Accreditation  
\* - denotes test included in laboratory scope of accreditation  
# - denotes test carried out by approved contractor  
@ - denotes non accredited tests

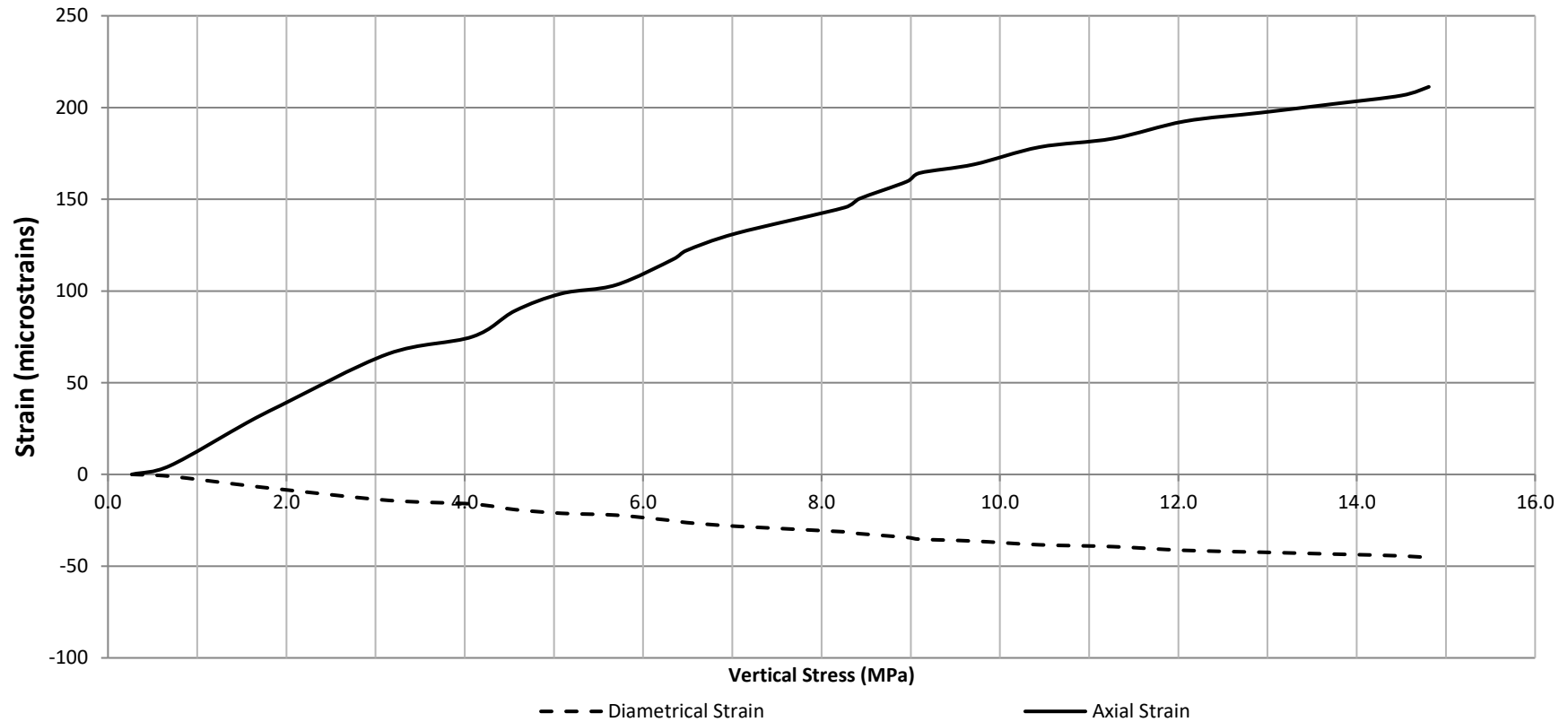
This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

**Approved Signatories:**

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager)  
Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Vaughan Edwards (Managing Director)



Youngs Modulus and Poissons Ratio  
 ISRM: R .Ulusay & J.A. Hudson 2007



Youngs Modulus      55.7 GPa      Method of Calculation = Secant      Poissons Ratio=      0.215      Range =      0-16.2      MPa

*D P Evans*

Checked and Approved  
 D P Evans (Quality/Technical Manager)



Derreenacrinnin WF

Contract Number      33821  
 BH/Sample No      BHT03  
 Depth      3.70

**Test Report: Determination of Thermal Weathering Properties of Aggregates  
Magnesium Sulfate Test  
BS EN 1367-2:1998**

**Client:** Priority Geotechnical Limited  
**Client Ref:** P16177  
**Date Sampled:** unknown  
**Date tested:** 01/02/2017  
**Contract Number:** 05/08/1992  
**Location:** Derreenacrinnin WF  
**Hole Number:** BHT01  
**Sample Number:**  
**Depth (m):** 5.35 to 6.45  
**Sample Type:** Core  
**Method of Sampling:** n/a  
**Sampled By:** unknown  
**Test Condition:** Soaked  
**Target Specification:** N/A  
**Test Portion Size Fraction:** 10 – 14 mm  
**Mass of test Portions:** 420 – 430 g  
**Description:**

---

Magnesium sulfate value (Test 1)	Magnesium sulfate value (Test 2)
6	7
<b>Magnesium Sulfate Value (MS) - %</b>	<b>7</b>

---

**Remarks:**

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**For and behalf of GEO Site & Testing Services Ltd**

Authorised By:  
Wayne Honey (Office/Quality Assistant)

*W. Honey*

**Date:** 6.2.17



**Test Report: Determination of Thermal Weathering Properties of Aggregates  
Magnesium Sulfate Test  
BS EN 1367-2:1998**

**Client:** Priority Geotechnical Limited  
**Client Ref:** P16177  
**Date Sampled:** unknown  
**Date tested:** 01/02/2017  
**Contract Number:** 05/08/1992  
**Location:** Derreenacrinnin WF  
**Hole Number:** BHT02  
**Sample Number:**  
**Depth (m):** 5.7 to  
**Sample Type:** Core  
**Method of Sampling:** n/a  
**Sampled By:** unknown  
**Test Condition:** Soaked  
**Target Specification:** N/A  
**Test Portion Size Fraction:** 10 – 14 mm  
**Mass of test Portions:** 420 – 430 g  
**Description**

---

Magnesium sulfate value (Test 1)	Magnesium sulfate value (Test 2)
9	9
<b>Magnesium Sulfate Value (MS) - %</b>	<b>9</b>

---

**Remarks:**

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**For and behalf of GEO Site & Testing Services Ltd**

Authorised By:  
Wayne Honey (Office/Quality Assistant)

*W. Honey*

**Date:** 6.2.17





**Test Report: Determination of Thermal Weathering Properties of Aggregates  
Magnesium Sulfate Test  
BS EN 1367-2:1998**

**Client:** Priority Geotechnical Limited  
**Client Ref:** P16177  
**Date Sampled:** unknown  
**Date tested:** 01/02/2017  
**Contract Number:** 05/08/1992  
**Location:** Derreenacrinnin WF  
**Hole Number:** BHT03  
**Sample Number:**  
**Depth (m):** 5.9 to 6.8  
**Sample Type:** Core  
**Method of Sampling:** n/a  
**Sampled By:** unknown  
**Test Condition:** Soaked  
**Target Specification:** N/A  
**Test Portion Size Fraction:** 10 – 14 mm  
**Mass of test Portions:** 420 – 430 g  
**Description:**

---

Magnesium sulfate value (Test 1)	Magnesium sulfate value (Test 2)
5	6
<b>Magnesium Sulfate Value (MS) - %</b>	<b>6</b>

---

**Remarks:**

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**For and behalf of GEO Site & Testing Services Ltd**

Authorised By:  
Wayne Honey (Office/Quality Assistant)

*W. Honey*

**Date:** 6.2.17



**Test Report: Determination of Thermal Weathering Properties of Aggregates  
Magnesium Sulfate Test  
BS EN 1367-2:1998**

**Client:** Priority Geotechnical Limited  
**Client Ref:** P16177  
**Date Sampled:** unknown  
**Date tested:** 01/02/2017  
**Contract Number:** 05/08/1992  
**Location:** Derreenacrinnin WF  
**Hole Number:** BHT04  
**Sample Number:**  
**Depth (m):** 5.6 to 6.7  
**Sample Type:** Core  
**Method of Sampling:** n/a  
**Sampled By:** unknown  
**Test Condition:** Soaked  
**Target Specification:** N/A  
**Test Portion Size Fraction:** 10 – 14 mm  
**Mass of test Portions:** 420 – 430 g  
**Description**

---

Magnesium sulfate value (Test 1)	Magnesium sulfate value (Test 2)
7	7
<b>Magnesium Sulfate Value (MS) - %</b>	<b>7</b>

---

**Remarks:**

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**For and behalf of GEO Site & Testing Services Ltd**

Authorised By:  
Wayne Honey (Office/Quality Assistant)

*W. Honey*

**Date:** 6.2.17



**Test Report: Determination of Ten Percent Value(TFV).**

BS 812 : Part 111 : 1990.

**Client:** Priority Geotechnical Limited  
**Date Sampled:** unknown  
**Date tested:** 02/02/2017  
**Contract Number:** 33821  
**Location:** Derreenacrinnin WF  
**Sample Number:** BHT01  
**Depth (m):** 1.65-6.45  
**Method of Sampling:** n/a  
**Sampled By:** unknown  
**Test Condition:** Soaked  
**Target Specification:** N/A  
**Test Portion Size Fraction** 10 – 14 mm  
**Mass of test Portions** 425 –430 g  
**Description**

---

The Average Ten Percent Fines  
value (kN) **TFV** :

**110**

---

Remarks:

**For and behalf of GEO Site & Testing Services Ltd**

Wayne Honey - Office/Quality Assistant  
Emma Williams - Office Manager

● W. Honey  
○



Date Approved: **6.2.17**

**Test Report: Determination of Ten Percent Value(TFV).**

BS 812 : Part 111 : 1990.

**Client:** Priority Geotechnical Limited  
**Date Sampled:** unknown  
**Date tested:** 02/02/2017  
**Contract Number:** 33821  
**Location:** Derreenacrinnin WF  
**Sample Number:** BHT02  
**Depth (m):** 1.55-7.00  
**Method of Sampling:** n/a  
**Sampled By:** unknown  
**Test Condition:** Soaked  
**Target Specification:** N/A  
**Test Portion Size Fraction** 10 – 14 mm  
**Mass of test Portions** 425 –430 g  
**Description**

---

The Average Ten Percent Fines  
value (kN) **TFV** :

**117**

---

Remarks:

**For and behalf of GEO Site & Testing Services Ltd**

Wayne Honey - Office/Quality Assistant  
Emma Williams - Office Manager

● W. Honey  
○

**GSTL**  
GEO SITE & TESTING SERVICES LTD

Date Approved: **6.2.17**

**Test Report: Determination of Ten Percent Value(TFV).**

BS 812 : Part 111 : 1990.

**Client:** Priority Geotechnical Limited  
**Date Sampled:** unknown  
**Date tested:** 02/02/2017  
**Contract Number:** 33821  
**Location:** Derreenacrinnin WF  
**Sample Number:** BHT03  
**Depth (m):** 1.55-6.8  
**Method of Sampling:** n/a  
**Sampled By:** unknown  
**Test Condition:** Soaked  
**Target Specification:** N/A  
**Test Portion Size Fraction** 10 – 14 mm  
**Mass of test Portions** 425 –430 g  
**Description**

---

The Average Ten Percent Fines  
value (kN) **TFV** :

**109**

---

Remarks:

**For and behalf of GEO Site & Testing Services Ltd**

Wayne Honey - Office/Quality Assistant  
Emma Williams - Office Manager

● W. Honey  
○

**GSTL**  
GEO SITE & TESTING SERVICES LTD

Date Approved: **6.2.17**



**Test Report: Determination of Ten Percent Value(TFV).**

BS 812 : Part 111 : 1990.

**Client:** Priority Geotechnical Limited  
**Date Sampled:** unknown  
**Date tested:** 02/02/2017  
**Contract Number:** 33821  
**Location:** Derreenacrinnin WF  
**Sample Number:** BHT04  
**Depth (m):** 1.6-6.7  
**Method of Sampling:** n/a  
**Sampled By:** unknown  
**Test Condition:** Soaked  
**Target Specification:** N/A  
**Test Portion Size Fraction** 10 – 14 mm  
**Mass of test Portions** 425 –430 g  
**Description**

---

The Average Ten Percent Fines  
value (kN) **TFV** :

**102**

---

Remarks:

**For and behalf of GEO Site & Testing Services Ltd**

Wayne Honey - Office/Quality Assistant  
Emma Williams - Office Manager

● W. Honey  
○

**GSTL**  
GEO SITE & TESTING SERVICES LTD

Date Approved: **6.2.17**

---

## APPENDIX D

### EXPLORATION LOCATION PLANS & SURVEY DATA

Exploration Location Layout

P16177-SI-A

Exploration Location Plans

P16177-SI-01 to P16177-SI-06

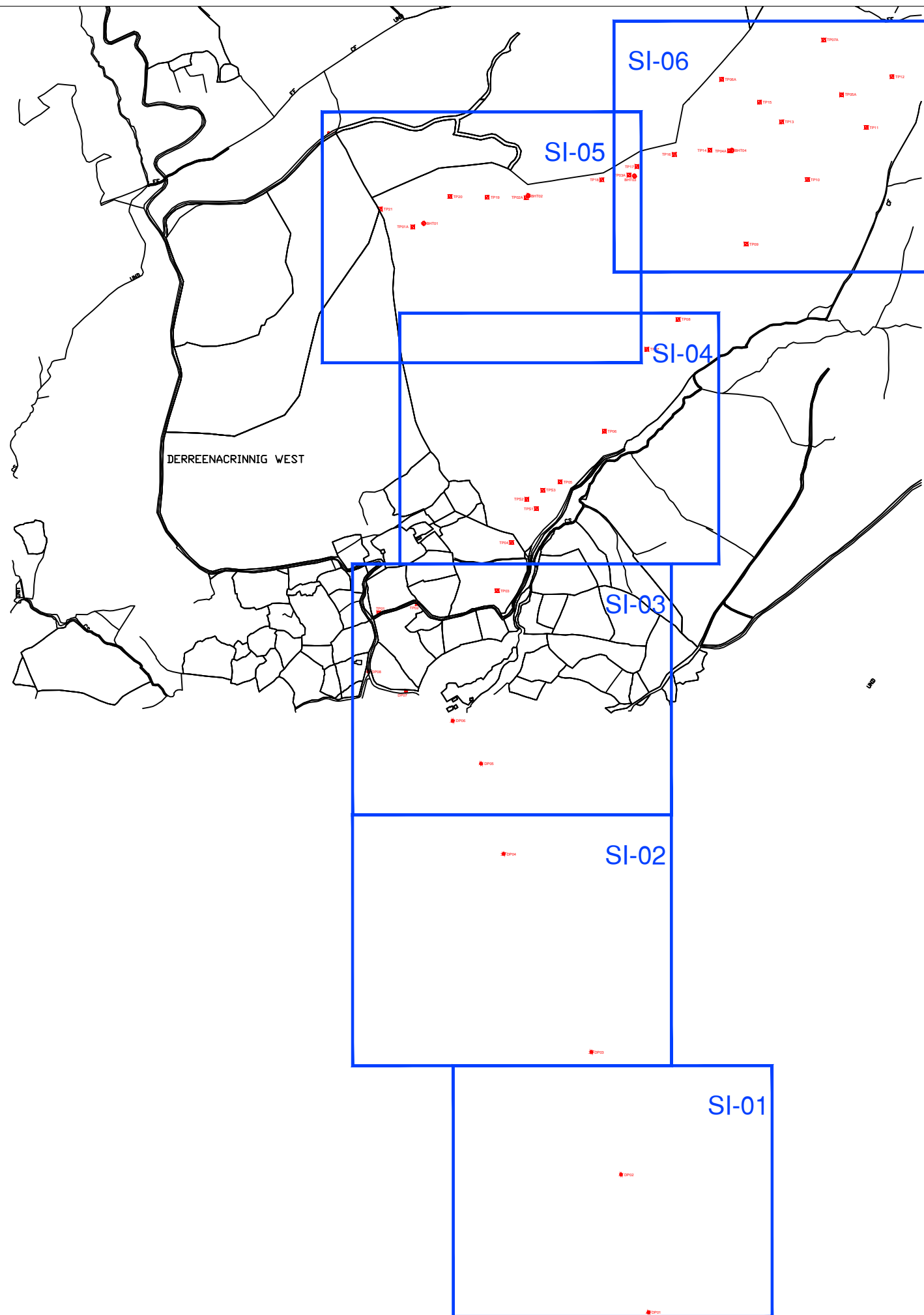
Exploratory Location	Easting	Northing	Elevation, mOD Malin	Final Depth, m bgl	Start date, dd/mm/yyyy
BHT01	510905.77	551801.88	375.64	7.10	28/11/2016
BHT02	511129.07	551861.03	395.70	7.00	25/11/2016
BHT03	511356.15	551903.01	398.85	6.80	25/11/2016
BHT04	511564.53	551957.93	384.06	6.70	23/11/2016
DP01	511386.11	549475.14	142.98	3.30	22/12/2016
DP02	511327.39	549769.63	145.55	1.90	22/12/2016
DP03	511264.03	550031.30	156.43	1.40	22/12/2016
DP04	511076.27	550454.73	174.95	1.20	22/12/2016
DP05	511028.37	550647.52	186.97	1.20	22/12/2016
DP06	510967.71	550739.18	191.63	1.10	22/12/2016
DP07	510868.00	550802.05	198.34	2.00	22/12/2016
DP08	510787.80	550844.01	202.37	0.60	22/12/2016
TP01	510809.58	550969.85	216.32	0.90	24/11/2016
TP01A	510882.03	551794.23	372.69	1.25	22/12/2016
TP02	510891.98	550989.76	225.10	2.10	24/11/2016
TP02A	511125.00	551856.90	396.25	0.70	22/12/2016
TP03	511062.64	551016.87	233.01	2.30	24/11/2016
TP03A	511344.22	551904.85	399.99	1.70	25/11/2016
TP04	511093.42	551120.27	235.97	1.70	24/11/2016
TP04A	511559.33	551956.84	384.52	1.05	25/11/2016
TP05	511197.23	551249.71	243.22	1.30	23/11/2016
TP05A	511798.49	552076.53	358.72	1.50	22/11/2016
TP06	511291.55	551357.60	256.13	1.20	23/11/2016
TP06A	511542.07	552109.44	377.39	0.80	24/11/2016
TP07	511382.47	551532.85	286.25	2.10	23/11/2016
TP07A	511760.44	552193.89	348.45	1.20	24/11/2016
TP08	511449.24	551596.66	293.53	1.60	23/11/2016
TP09	511594.68	551757.68	312.98	1.40	23/11/2016
TP10	511725.65	551895.24	329.09	1.90	23/11/2016
TP11	511851.30	552006.60	338.63	1.15	23/11/2016
TP12	511906.36	552114.95	349.14	2.00	23/11/2016
TP13	511670.28	552018.67	375.78	0.75	22/11/2016

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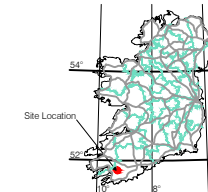
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<b>Exploratory Location</b>	<b>Easting</b>	<b>Northing</b>	<b>Elevation, mOD Malin</b>	<b>Final Depth, m bgl</b>	<b>Start date, dd/mm/yyyy</b>
TP14	511517.09	551958.43	385.00	1.30	25/11/2016
TP15	511623.30	552060.49	371.22	3.20	24/11/2016
TP16	511441.37	551948.82	396.17	0.65	25/11/2016
TP17	511360.97	551923.09	399.98	0.55	25/11/2016
TP18	511286.32	551894.88	398.18	1.60	25/11/2016
TP19	511041.42	551857.42	386.64	1.10	22/12/2016
TP20	510961.96	551859.11	377.72	1.40	22/12/2016
TP21	510813.20	551832.17	349.93	2.40	22/12/2016
TP22	510701.89	551995.91	311.55	0.95	22/12/2016
TPS1	511146.34	551192.30	239.83	2.10	22/12/2016
TPS2	511125.90	551212.43	243.24	2.20	22/12/2016
TPS3	511160.14	551231.59	242.44	1.90	22/12/2016

---



Priority Geotechnical Site



JOB NAME:

**Derreenacrinnig Wind Farm  
Drimoleague**

Sheet Title:

**EXPLORATORY LOCATION  
LAYOUT**

JOB NUMBER:

**P16177**

DRAWING NUMBER:

**P16177-SI-A**

DRAWN BY:

**Gary Curtin**

DATE:

**27/02/2017**

SCALE:

**1:10000 ON A3**

APPROVED:

**GH**

REVISION:

**D01**



KEY:

- TP00 Denotes Trial Pit location
- BH00 Denotes Borehole location
- # DP00 Denotes Dynamic Probe location

# DP02

# DP01



JOB NAME:

Derreenacrinnig Wind Farm  
Drimoleague

Sheet Title:

EXPLORATION LOCATION  
PLAN

JOB NUMBER:

P16177

DRAWING NUMBER:

P16177-SI-01

DRAWN BY:

Gary Curtin

DATE:

27/02/2017

SCALE:

1:2,000 ON A3

APPROVED:

GH




REVISION:

D01





KEY:

-  TP00 Denotes Trial Pit location
-  BH00 Denotes Borehole location
-  DP00 Denotes Dynamic Probe location

# DP04

JOB NAME:

Derreenacrinnig Wind Farm  
Drimoleague

Sheet Title:

EXPLORATION LOCATION  
PLAN

JOB NUMBER:

P16177

DRAWING NUMBER:

P16177-SI-02

DRAWN BY:

Gary Curtin

DATE:

27/02/2017

SCALE:

1:2,000 ON A3

APPROVED:

GH

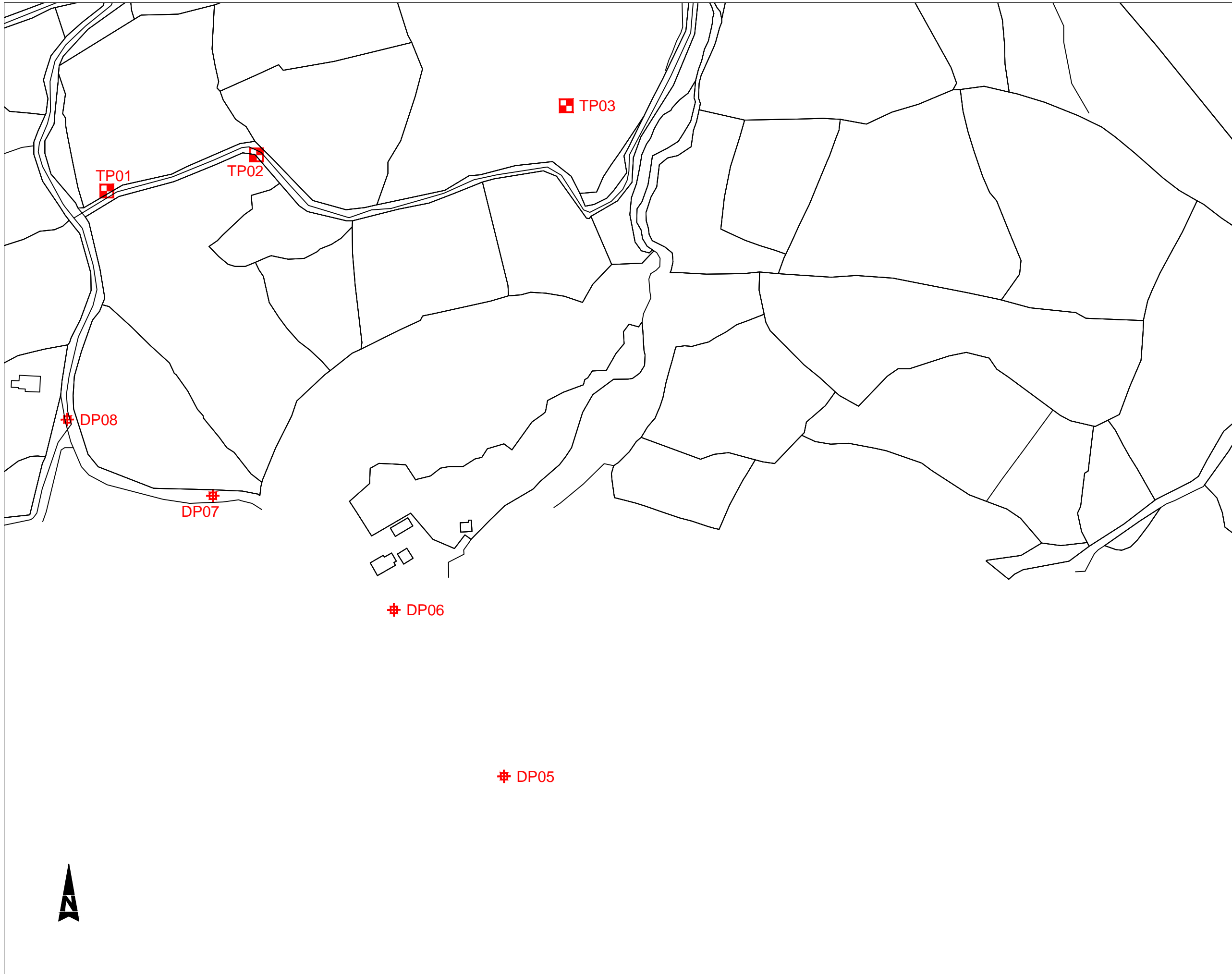
REVISION:

D01



# DP03





KEY:  
■ TP00 Denotes Trial Pit location  
● BH00 Denotes Borehole location  
# DP00 Denotes Dynamic Probe location

JOB NAME:  
Derreenacrinnig Wind Farm  
Drimoleague

Sheet Title:  
EXPLORATION LOCATION  
PLAN

JOB NUMBER:  
P16177

DRAWING NUMBER:  
P16177-SI-03

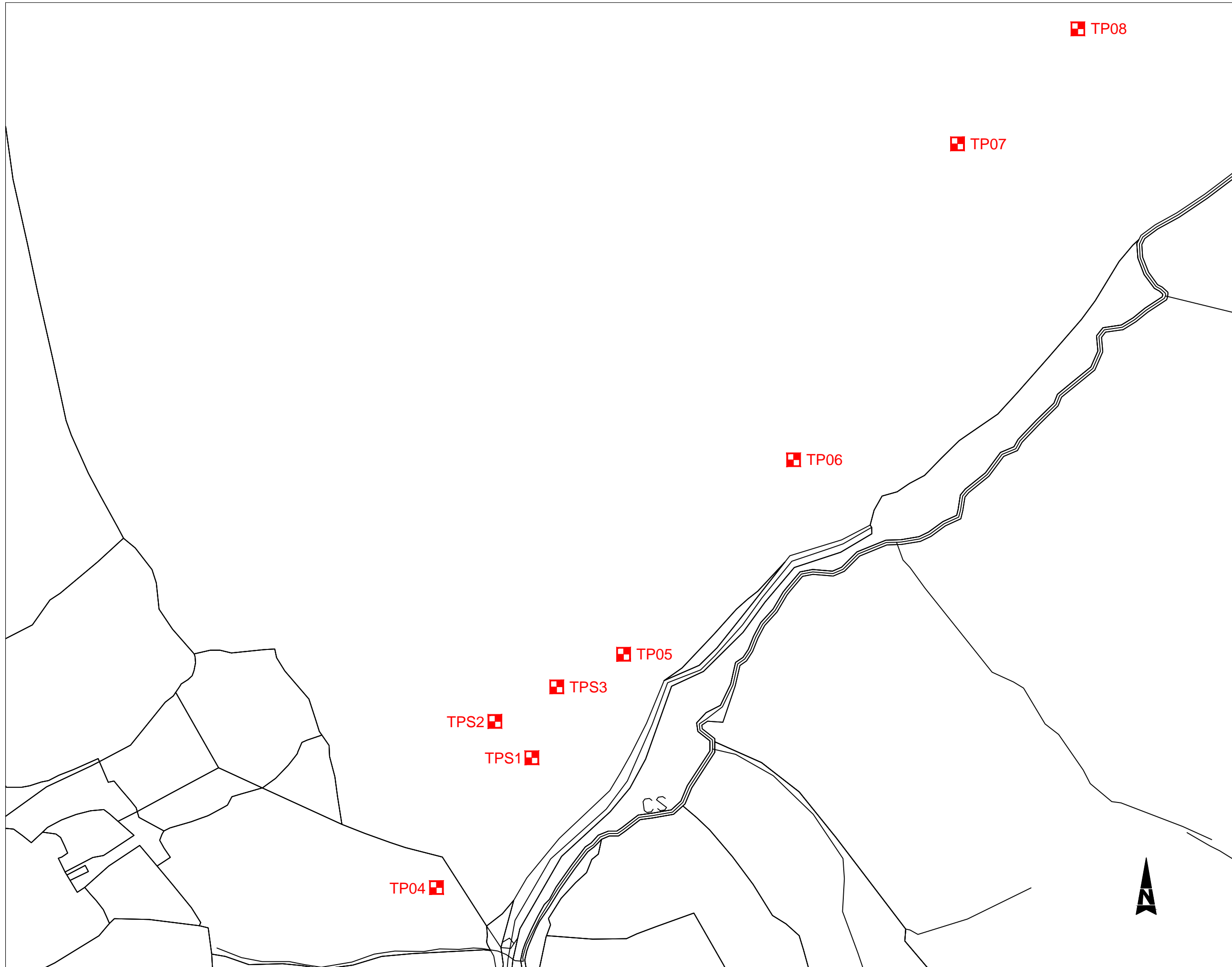
DRAWN BY:  
Gary Curtin

DATE:  
27/02/2017

SCALE: 1:2,000 ON A3	APPROVED: GH
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REVISION:  
D01





KEY:  
 TP00 Denotes Trial Pit location  
 BH00 Denotes Borehole location  
 DP00 Denotes Dynamic Probe location

JOB NAME:  
 Derreenacrinnig Wind Farm  
 Drimoleague

Sheet Title:  
 EXPLORATION LOCATION  
 PLAN

JOB NUMBER:  
 P16177

DRAWING NUMBER:  
 P16177-SI-04

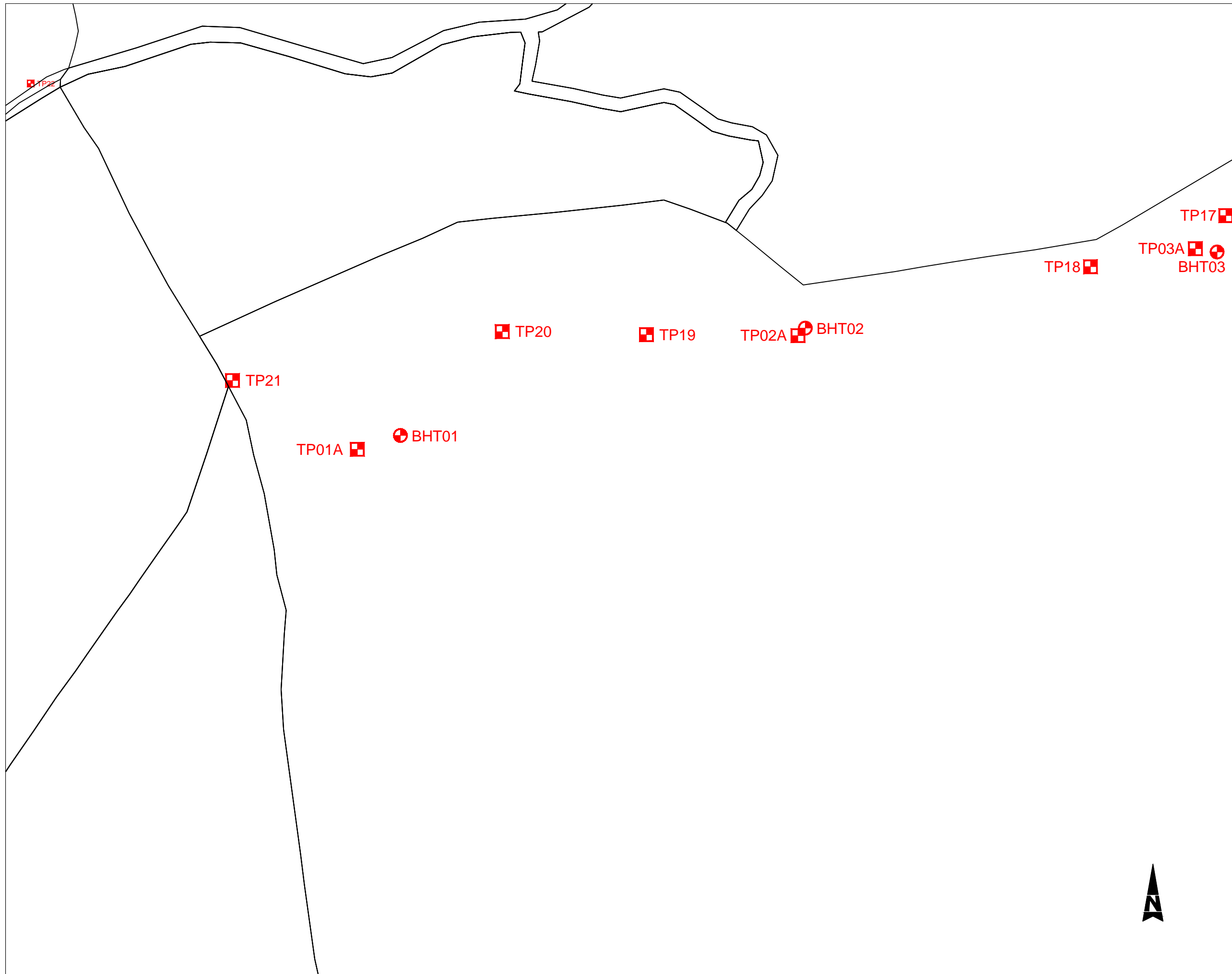
DRAWN BY:  
 Gary Curtin

DATE:  
 27/02/2017

SCALE: 1:2,000 ON A3	APPROVED: GH
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REVISION:  
 D01





KEY:  
 TP00 Denotes Trial Pit location  
 BH00 Denotes Borehole location  
 DP00 Denotes Dynamic Probe location

JOB NAME:  
 Derreenacrinnig Wind Farm  
 Drimoleague

Sheet Title:  
 EXPLORATION LOCATION  
 PLAN

JOB NUMBER:  
 P16177

DRAWING NUMBER:  
 P16177-SI-05

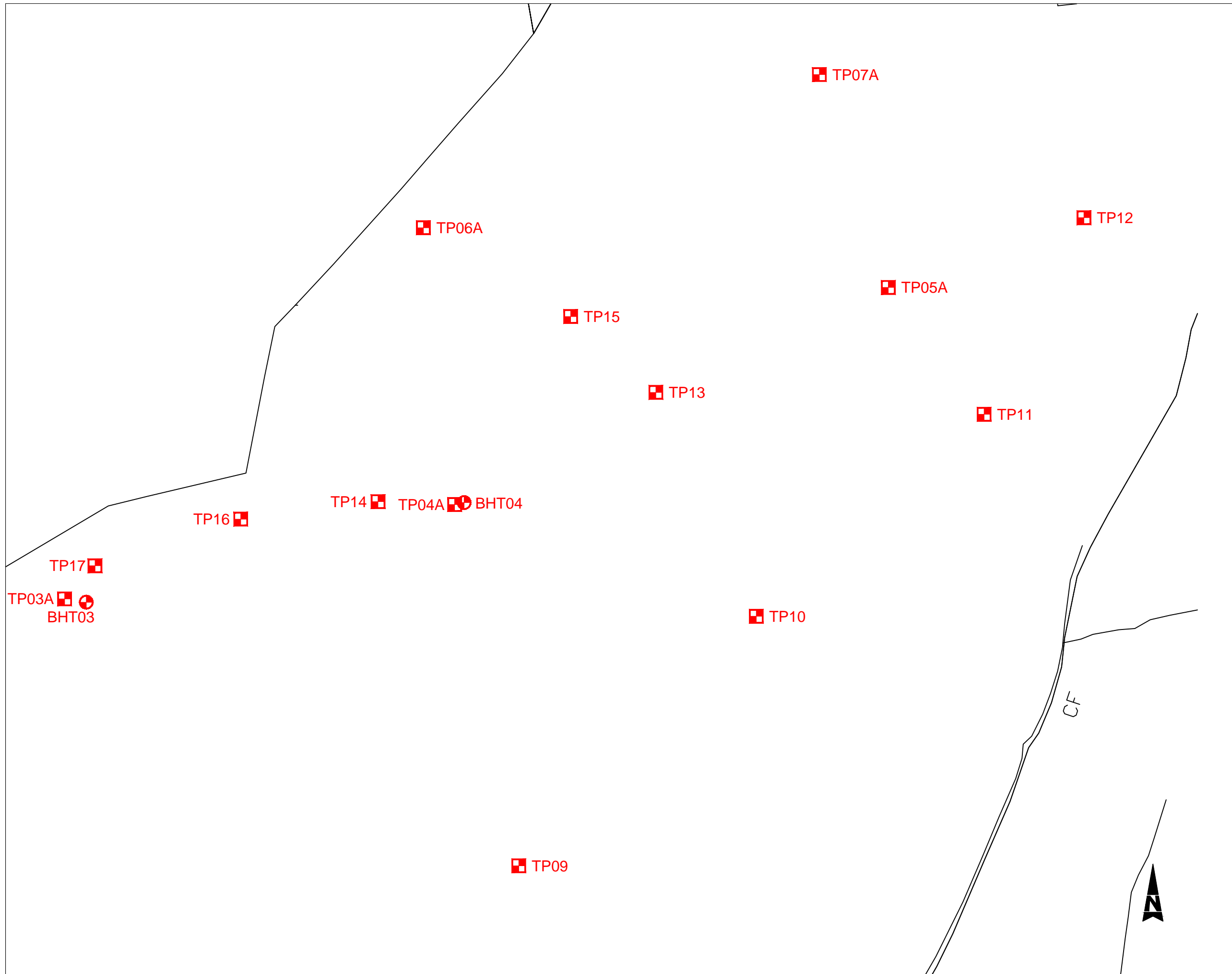
DRAWN BY:  
 Gary Curtin

DATE:  
 27/02/2017

SCALE: 1:2,000 ON A3	APPROVED: GH
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REVISION:  
 D01





KEY:  
 TP00 Denotes Trial Pit location  
 BH00 Denotes Borehole location  
 DP00 Denotes Dynamic Probe location

JOB NAME:  
 Derreenacrinig Wind Farm  
 Drimoleague

Sheet Title:  
 EXPLORATION LOCATION  
 PLAN

JOB NUMBER:  
 P16177

DRAWING NUMBER:  
 P16177-SI-06

DRAWN BY:  
 Gary Curtin

DATE:  
 27/02/2017

SCALE: 1:2,000 ON A3	APPROVED: GH
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REVISION:  
 D01





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**APPENDIX E**

**CALIFORNIA BEARING RATIO, CBR ASSESSMENT**

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Summary of California bearing ratio, CBR data								
Location	CBR, % (unadjusted)	CBR, % (adjusted)	CBR, % (Lab)	Depth, m bgl	Stratum	Capping thickness, mm	Sub- base, mm	w/PL
<b>Turbines</b>								
TP01A	22	11		0.4	Slightly sandy slightly gravelly SILT	200	150	
TP02A	22	11		0.2	Slightly sandy slightly gravelly SILT	200	150	
TP03A	8	4	1	0.6	Slightly gravelly sandy SILT	300	150	
TP04A	2	1		0.2	Slightly sandy slightly gravelly SILT	<b>600</b>	150	
TP05A	9	5	1	0.8	Slightly sandy gravelly SILT	250	150	
TP06A	5	3		0.6	Slightly sandy slightly gravelly SILT	600	150	
TP07A	9	5		0.6	Slightly sandy gravelly SILT	250	150	

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Summary of California bearing ratio, CBR data								
Location	CBR, % (unadjusted)	CBR, % (adjusted)	CBR, % (Lab)	Depth, m bgl	Stratum	Capping thickness, mm	Sub- base, mm	w/PL
<b>Sub-station</b>								
TPS1	9	5	3	0.4	Silty sandy GRAVEL	350	150	
TPS2	9	5		0.4	Slightly sandy gravelly SILT	250	150	
TPS3	5	3	2	0.9	Slightly sandy gravelly SILT	<b>600</b>	150	<b>1.0</b>

---

Summary of California bearing ratio, CBR data								
Location	CBR, % (unadjusted)	CBR, % (adjusted)	CBR, % (Lab)	Depth, m bgl	Stratum	Capping thickness, mm	Sub- base, mm	w/PL
<b>Access road</b>								
TP01	9	5		0.75	Silty sandy GRAVEL	250	150	
TP02	22	11	2	0.6	Very silty very sandy GRAVEL	200	150	
TP03	9	5		0.8	Slightly sandy gravelly SILT	250	150	
TP04	3	2	2	1.0	Slightly sandy gravelly SILT	<b>600</b>	150	<b>1.1</b>
TP05	5	3		1.0	Slightly sandy gravelly SILT	<b>600</b>	150	<b>1.5</b>
TP06	9	5	3	0.8	Slightly sandy slightly gravelly SILT	350	150	
TP07	7	4		1.3	Slightly gravelly sandy SILT	<b>600</b>	150	<b>1.2</b>
TP08	5	3	1	0.9	Slightly sandy gravelly SILT	<b>600</b>	150	<b>2.2</b>
TP09	22	11		0.4	Slightly sandy slightly gravelly SILT	200	150	
TP10	5	3	1	0.9	Slightly sandy gravelly SILT	<b>600</b>	150	
TP11	5	3		1.3	Slightly sandy slightly gravelly SILT	<b>600</b>	150	<b>1.2</b>
TP12	0	0		2.3	Clayey PEAT	600 **	150	w = 745%
TP13	9	5		0.7	Slightly gravelly sandy SILT	250	150	
TP14	9	5	1	0.8	Slightly sandy slightly gravelly SILT	250	150	
TP15	5	3		1.2	Slightly sandy gravelly SILT	350	150	
TP16	22	11		0.45	Slightly sandy gravelly SILT	200	150	
TP17	22	11		0.45	Slightly sandy slightly gravelly SILT	200	150	
TP18	22	11		0.6	Slightly sandy gravelly SILT	200	150	
TP19	4	2	1	0.9	Slightly sandy gravelly SILT	<b>600</b>	150	<b>1.5</b>
TP20	16	8		0.45	Slightly sandy gravelly SILT	200	150	
TP21	9	5		0.6	Slightly gravelly sandy SILT	250	150	
TP22	9	5	<b>1</b>	0.9	Slightly gravelly sandy SILT	<b>600</b>	150	