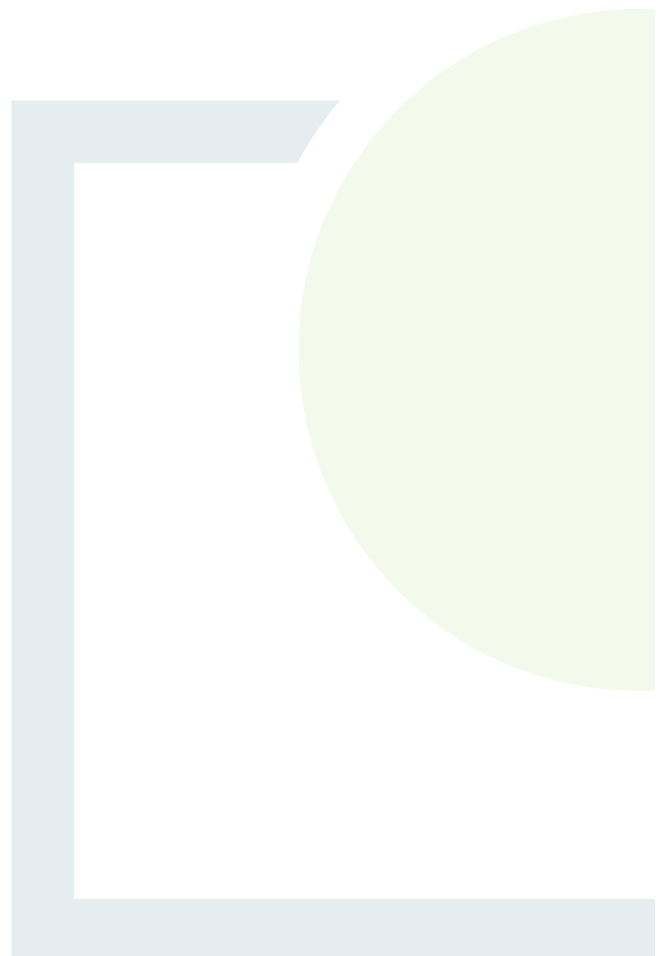




DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

Appendix 11.2

Karst Assessment Report



SHANCLOON WIND FARM

Karst Assessment Report

Prepared for:

RWE Renewables Ireland Ltd



RWE

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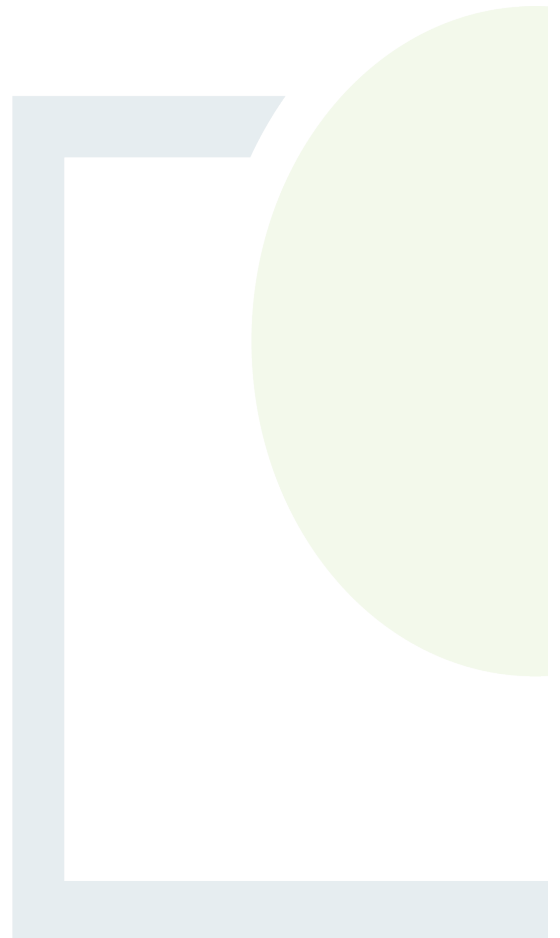


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1. INTRODUCTION

Karst features can be formed from the dissolution of soluble carbonate rocks such as limestone. The process by which limestone is dissolved is known as karstification and in Ireland typically produces features such as sinkholes, caves, enclosed depressions (dolines)¹ and turloughs.

To aid in the identification of potential surface and sub-surface karst features across the Proposed Development a series of ground investigation and field reconnaissance surveys were undertaken. These comprised the following activities:

- Fehily Timoney and Company (FT) undertook a desk study to identify mapped karst features on or adjacent to the Site. This study also incorporated a review of available aerial photographs, orthorectified photographs and digital terrain models to identify surface anomalies that may be attributed to karst features (information sources are prescribed in Section 2).
- FT undertook site reconnaissance between 18th and 21st January 2022 and on 4th and 5th April 2023 to ground truth findings from the desk study and to inform the need for further investigation.
- Apex Geophysics undertook geophysical surveys (ERT profiles) between the 26th May and 1st June 2022.
- Ground Investigations Ireland (GII) undertook intrusive ground investigation (trial pits and boreholes) between March and June 2023 to characterise ground and groundwater conditions and to target potential karst features.

¹ A doline, also known as “Dropout” or “Cover Collapse” is a subsidence features limited to overburden deposits (soils) overlying the bedrock – see Section 6 for further details.



2. DESK STUDY

2.1 Information Sources

Prior to undertaking the site walkovers and ground investigations, a desk study was undertaken in January 2022 and again in March 2023 by FT Principal Geologist Aaron Clarke (BSc, MSc, MCSM, EurGeol, PGeo). The purpose of the study was to determine the baseline conditions within the Site to provide relevant background information. The desk study involved an examination of the following sources of information:

- Geology of South Mayo ^[Ref 1]
- The Geological Heritage of County Mayo ^[Ref 2]
- Aerial imagery ^[Ref 3]
- Site specific orthorectified photography (supplied by the Client, captured by Murphy Geospatial between May and September 2022)
- Site specific Digital Terrain Model (supplied by the Client, captured by Murphy Geospatial between May and September 2022)
- Current and historical (6 inch and 25 inch) Ordnance Survey maps ^[Ref 4]
- Mapping data of the area produced by the Geological Survey Ireland (GSI) ^[Ref 5]
 - *Quaternary subsoil geology*
 - *100k bedrock geology*
 - *Karst features*
 - *Geological heritage features*
 - *Aggregate potential*
 - *Landslide susceptibility*
 - *Catchment & Management Units*
 - *Groundwater Bodies Status and Risk*
 - *Drinking Water Protection Areas*
 - *Groundwater Resources (Aquifers)*
 - *Groundwater Wells and Springs*
 - *Groundwater Vulnerability*
- Datasets from the EPA ^[Ref 6]
- Clare-Corrib Groundwater Body (GWB) Description ^[Ref 7]
- GSI Groundwater Programme: Enclosed Depression ^[Ref 8]

2.2 Geological Mapping

2.2.1 Quaternary Geology

Quaternary mapping indicates the Site is predominantly underlain by a mantle of cut over raised peat (peat). The remaining areas of the Site are underlain by till derived from limestones (till). In general, the peat deposits are located in areas of slightly lower elevation when compared to the till deposits.



2.2.2 Bedrock Geology

Bedrock mapping indicates the Site is entirely underlain by mid Carboniferous limestone. The Site is predominantly underlain by the Ardnasillagh Formation comprising dark cherty calcarenites (limestone) and thin shales. The northern extent of the Site, at the location of turbine T10 is underlain by the thick bedded pure limestone of the Cong Limestone Formation. The Cong Canal Limestone, comprising medium to thick bedded pure limestone, is mapped to the immediate north of turbine T2; however, this formation is not mapped as being present beneath the Site.

The Ardnasillagh Formation would not be considered to be as susceptible to karstification processes, when compared to the paler, cleaner limestone of the Cong Limestone Formation or the Cong Canal Formation. This is due to the presence of darker, muddier units within Ardnasillagh Formation. These muddier units both reduce the percentage of CaCO_3 available to be dissolved and act as an aquitard, thereby reducing both lateral and vertical movement of groundwater within the formation.

Numerous bedrock outcrops are mapped to the north and south of the Site. However, there are limited mapped outcrops in the vicinity of the Site, with no outcrops mapped within the Site.

2.2.3 Structural Geology

Structural mapping indicates the presence of a single northeast-southwest trending regional fault. This fault, which is the result of mountain building (orogenic) processes that occurred during the late Carboniferous (Variscan) period, juxtaposes younger Cong Canal and Cong Limestone Formations against older Ardnasillagh Formation. This fault spurs into two separate faults to the west of the Site, just north of the proposed substation location. Total vertical displacements along these faults are unknown.

There are no GSI regional cross-sections available for the Site. The closest cross-section is the Benwee Head to Carnsore Point section, located approximately 27km to the northwest.

Structural measurements of bedding taken from outcrop locations by the GSI, indicate bedding dips range from 2 to 20°. Dip directions are varied.

2.2.4 Bedrock Aquifer

Groundwater mapping indicates that the entire Site is underlain by a Regionally Important Aquifer – Karstified (conduit). This is important in the context of the Site as the bedrock aquifer indicates the potential for karst processes. Groundwater monitoring was undertaken by FT as part of the intrusive ground investigation. Monitoring results are discussed in Section 5.2.

2.2.5 Groundwater Body (GWB) Report

The Site lies within the Clare-Corrib GWB¹, which covers an area of approx. 1,422 km². The main aquifer lithologies of this GWB are pure bedded limestone (such as the Cong Limestone Formation). However, this is not the case for the Site, which is predominantly underlain by muddy limestone lithologies containing shale interbeds (Ardnasillagh Formation).

Karstification within the Clare-Corrib GWB is described as being widespread. Recorded karst features within this GWB, which number 219, are considered by the GSI to represent only a fraction of actual karst features. 74 no. (34%) of these features were recorded as enclosed depressions (dolines). The next most prolific recorded karst features within this GWB are springs (46 no.), turloughs (46 no.) and swallow holes (43 no.).



There is no transmissivity data available for the Clare-Corrib GWB. However, the adjacent Cong Robe GWB, which shares similar geological properties, has a reported transmissivity range of 1-250m²/day. Given the nature of the underlying bedrock geology (i.e. a predominantly muddy impermeable limestone with no karst features mapped), it is anticipated that the transmissivity values within the Site are relatively low.

2.2.6 Wells and Springs

There are no mapped wells or springs within the Site. There are four wells mapped within 1km of the Site and are summarised in Table 2-1. All the wells are mapped within the Ardnasillagh Formation. The closest spring is mapped 1.5km north of turbine T10 and is located within the Cong Limestone Formation. Details of this spring are summarised in Table 2-2.

Table 2-1: Summary of well locations

Location ID	Easting	Northing	Type	Total Depth (m bgl)	Current Use	Yield Class (yield m ³ /day)	GSI Location Accuracy (m)	Approx. Distance to Nearest Infrastructure Element (m) ^{Note 1}
1125SEW006	535682	754913	Borehole	12.80	Agri & domestic use	Moderate (50.1)	50	T11 (765m)
1125SEW014	535695	754911	Borehole	9.10	Unknown	Good (328)	50	T11 (775m)
1125SEW011	528747	752044	Borehole	18.90	Agri & domestic use	Moderate (98)	100	Substation access road (927m)
1125SEW113	529308	754077	Borehole	15.20	Agri & domestic use	Good (109)	109	Substation (300m)

Note 1 – measured from the edge of the well boundary.

Table 2-2: Summary of spring locations

Location ID	Easting	Northing	Yield Class	Yield (m ³ /day)	GSI Location Accuracy (m)	Distance to Nearest Infrastructure Element (m)
1125SEW004	532265	757092	Low Spring	327	20	T10 (1500m)

Yield within the wells range from moderate to good (50.10 to 328m³ per day). The yield recorded at the spring location is 327m³ per day. These yields suggest that the underlying bedrock is productive.

2.2.7 Mapped Karst Features

GSI Groundwater karst mapping indicates there are no karst features located within 1km of the Site. However, there are several karst features located within an approximate 5km distance of the Site. Table 2-3 summarises these mapped karst features:



Table 2-3: Summary of mapped karst features within 5km of the Site.

Mapped Karst Feature	Easting	Northing	Underlying Bedrock Geology	Approx. Distance to Nearest Infrastructure Element (m)
Enclosed Depression	525017	753852	Oakport Limestone Formation	Substation (4,930m)
Enclosed Depression	525277	753734	Oakport Limestone Formation	Substation (4,650m)
Enclosed Depression	525440	753919	Oakport Limestone Formation	Substation (4,530m)
Enclosed Depression	525490	753903	Oakport Limestone Formation	Substation (4,480m)
Enclosed Depression	525509	753772	Oakport Limestone Formation	Substation (4,430m)
Enclosed Depression	525408	753537	Oakport Limestone Formation	Substation (4,477m)
Turlough	526287	754291	Ardnasillagh Formation	Substation (3,841m)
Swallow Hole	526521	754051	Illeaunagappul Formation	Substation (3,540m)
Swallow Hole	526342	753800	Illeaunagappul Formation	Substation (3,630m)
Enclosed Depression	527564	752602	Ardnasillagh Formation	Substation (2,300m)
Turlough	526729	752241	Illeaunagappul Formation	Substation (3,200m)
Turlough	526775	752182	Illeaunagappul Formation	Substation (3,150m)
Swallow Hole	527076	752032	Illeaunagappul Formation	Substation (2,860m)
Swallow Hole	525969	750974	Illeaunagappul Formation	Substation (4,300m)
Enclosed Depression	530563	750203	Ardnasillagh Formation	Substation (2,750m)
Swallow Hole	530363	748555	Ardnasillagh Formation	Substation (4,300m)
Turlough	534024	751912	Ardnasillagh Formation	T5 (2,350m)
Turlough	534533	750872	Coranellistrum Formation	T5 (3,500m)
Turlough	537514	752152	Coranellistrum Formation	T7 (3,900m)
Spring ^{Note 1}	529787	758613	Cong Canal Formation	T10 (4,330m)
Spring ^{Note 1}	532037	759053	Cong Canal Formation	T10 (3,370m)
Spring ^{Note 1}	532699	758580	Cong Limestone Formation	T10 (2,750m)
Enclosed Depression	532389	759726	Cong Canal Formation	T10 (3,930m)
Enclosed Depression	532493	759746	Cong Canal Formation	T10 (3,940m)
Enclosed Depression	532584	759835	Cong Canal Formation	T10 (4,010m)
Enclosed Depression	533337	760520	Cong Canal Formation	T10 (4,660m)
Enclosed Depression	533412	760494	Cong Canal Formation	T10 (4,640m)



Mapped Karst Feature	Easting	Northing	Underlying Bedrock Geology	Approx. Distance to Nearest Infrastructure Element (m)
Enclosed Depression	533401	760408	Cong Canal Formation	T10 (4,550m)
Turlough	534605	759780	Cong Limestone Formation	T10 (4,180m)
Turlough	534344	759172	Cong Limestone Formation	T10 (3,520m)
Enclosed Depression	534484	758971	Cong Limestone Formation	T10 (3,390m)
Turlough	536376	759137	Cong Limestone Formation	T10 (4,600m)

Note 1 – these springs are not included in the GSI's Wells and Springs data set.

In summary, a total 32 no. karst features are mapped by GSI within a 5km distance of the Site. These include:

- 15 no. (47%) enclosed depressions (dolines),
- 9 no. (28%) turloughs,
- 5 no. (16%) swallow holes; and
- 3 no. (9%) springs

10 no. of these features are mapped within the same rock formations that underly the Site (highlighted in grey - Table 2-3). The majority of these karst features relate to dolines, which make up 47% of the overall karst features mapped within 5km of the Site.

2.3 Review of Aerial Photography and Digital Terrain Model (DTM)

A combined review of the aerial photography and DTM for the Site and wider area was undertaken to identify landforms that may represent potential surface karst features. In total, 56 no. individual landforms suspected of being attributed to karst processes were identified as part of this review. The distribution of their locations is presented in Figure 2-1. None of the features identified as part of this review are included in GSI's karst mapping ^[Ref 5]. Where possible, these locations were visited as part of the site reconnaissance (discussed in Section 3).

All of the landforms identified as part of this review were observed as having a broadly circular to oval shape. These sometimes form as clusters while other times forming in smaller numbers or as isolated occurrences. Examples of such landforms are presented in Figure 2-2 to Figure 2-4. These broadly circular features display varying diameters, typically ranging from 10m across to 35m across. Their morphology suggests that these features are most likely enclosed depressions (dolines).

No landforms were observed within areas of mapped peat deposits. However, it is possible that any subsidence of the underlying till deposits is masked by these peat deposits.

In general, these features appear to follow broadly linear trends (Figure 2-1), which are often parallel or perpendicular to the main fault line that passes near the north of the Site. The most notable of these occur at two locations, to the north and east of the Site (Figure 2-1), where these features form in an almost straight line. One of these lines runs north-east along the main fault. The second line runs perpendicular to the same fault in a north-west direction. The significance of these linear patterns indicates a direct correlation between the Site's structural geology and the formation of karst features.



Potential karst features identified in the aerial photography and DTM review were later assessed on Site through reconnaissance surveys and ground investigation (discussed in Sections 3 and 5).

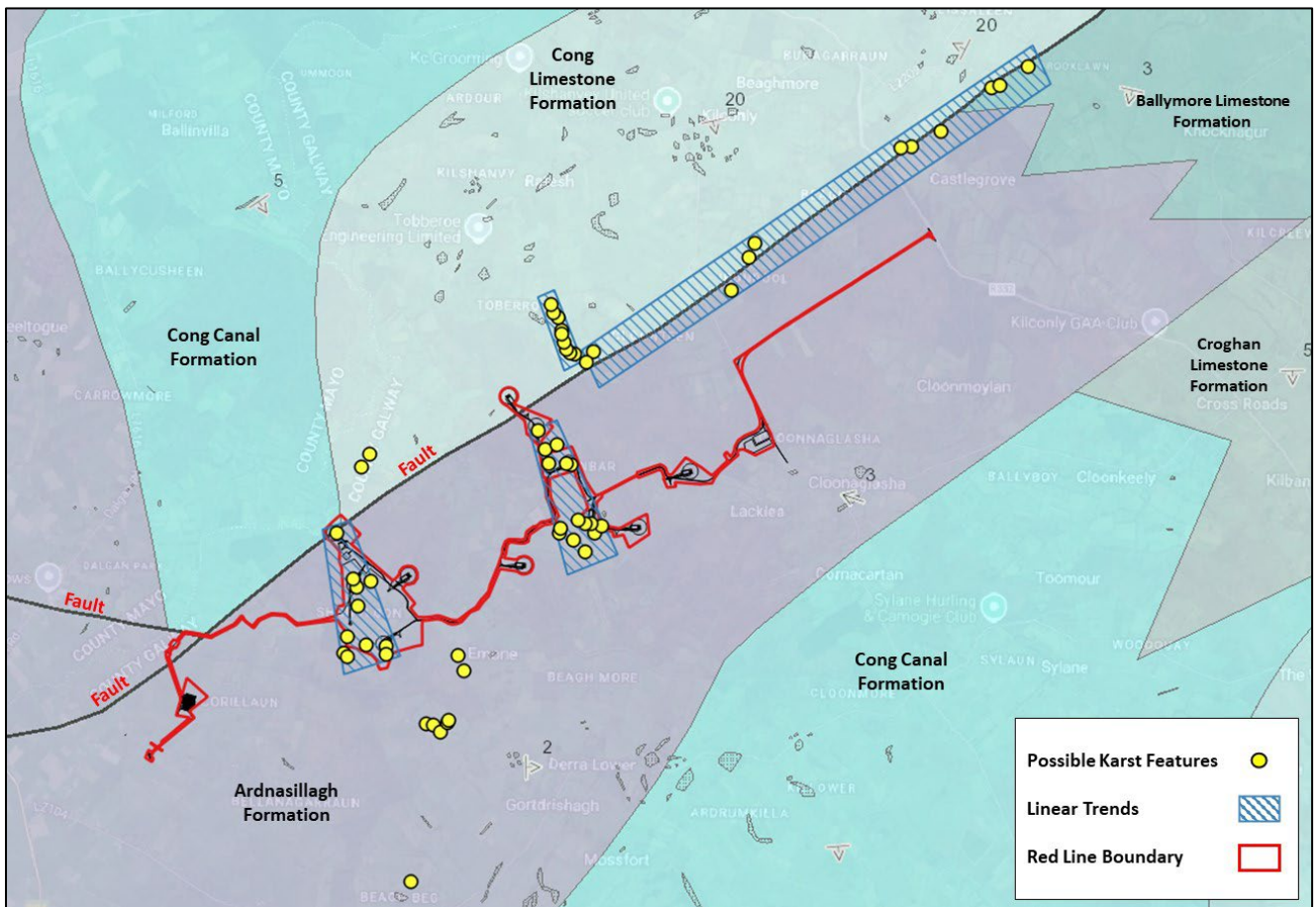


Figure 2-1: Distribution of possible karst features observed on aerial photography and DTM mapping

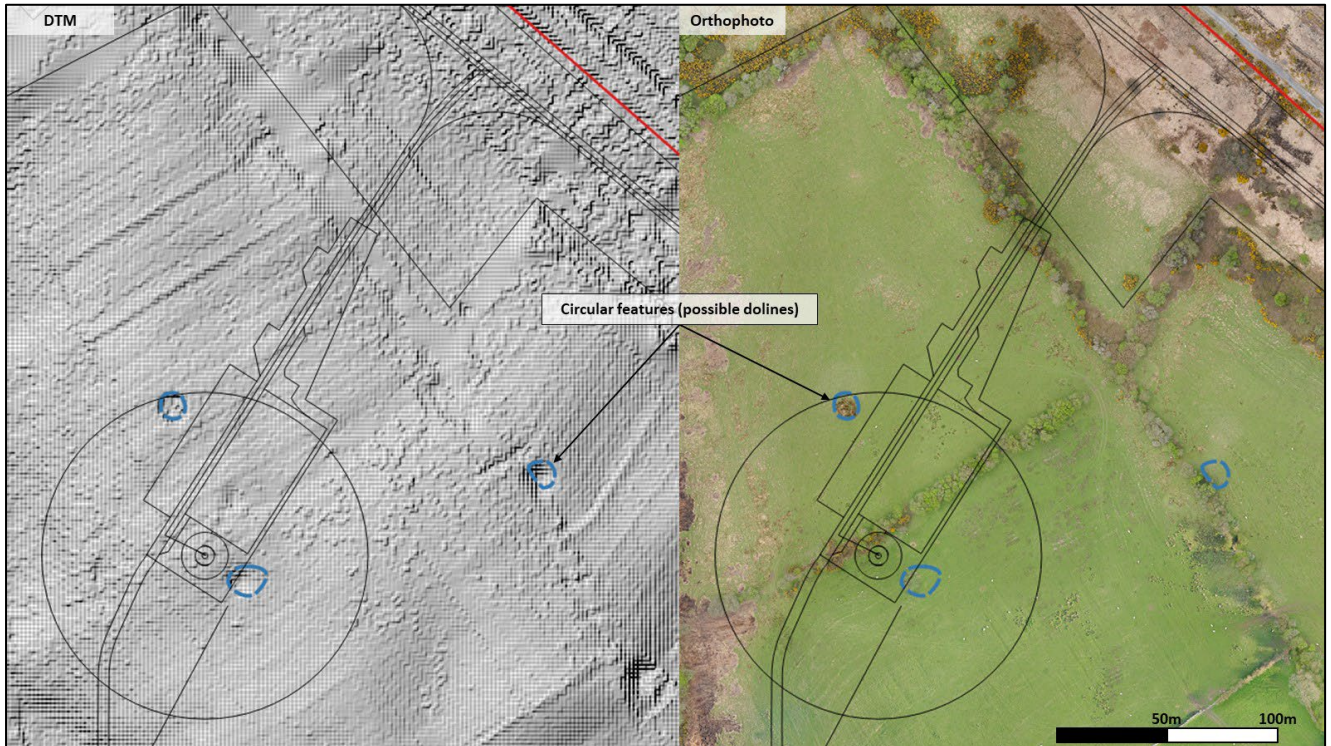


Figure 2-2: Three circular landforms (possible dolines) adjacent to proposed turbine T3

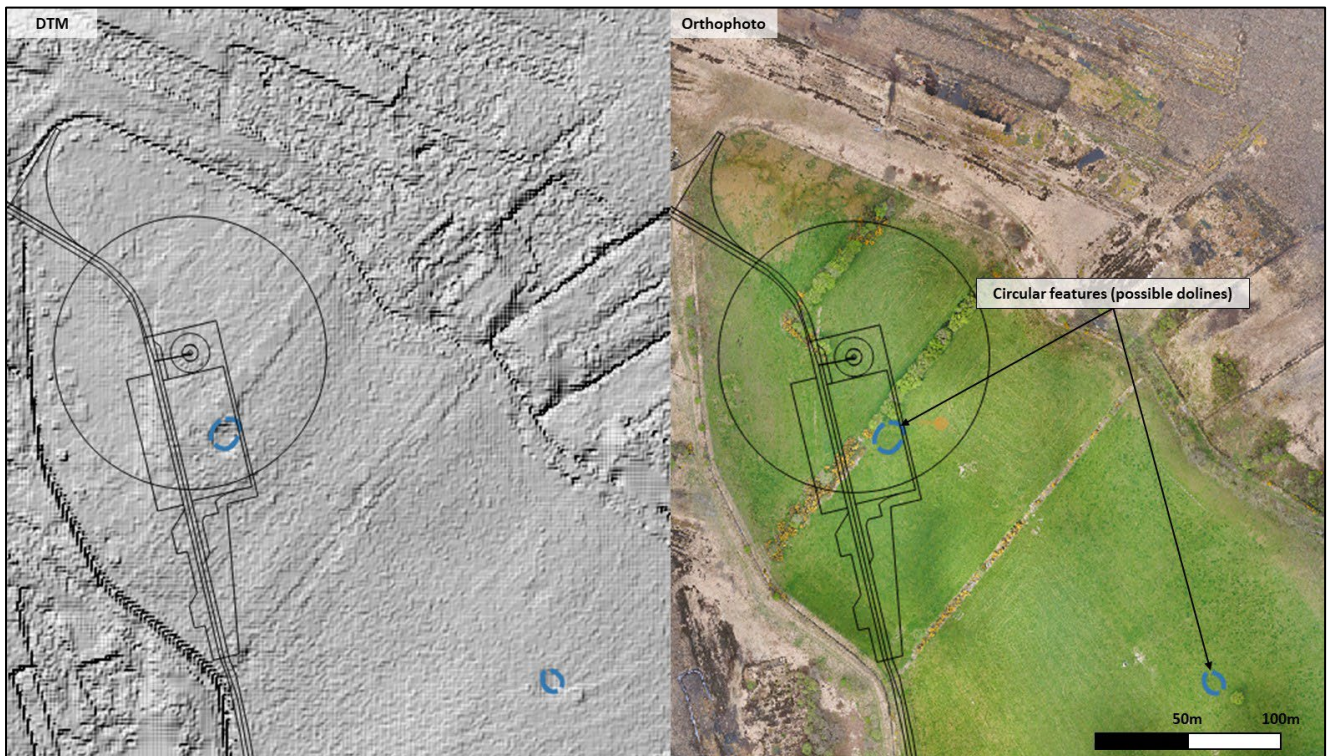


Figure 2-3: Two circular landforms (possible dolines) southeast of proposed turbine T9

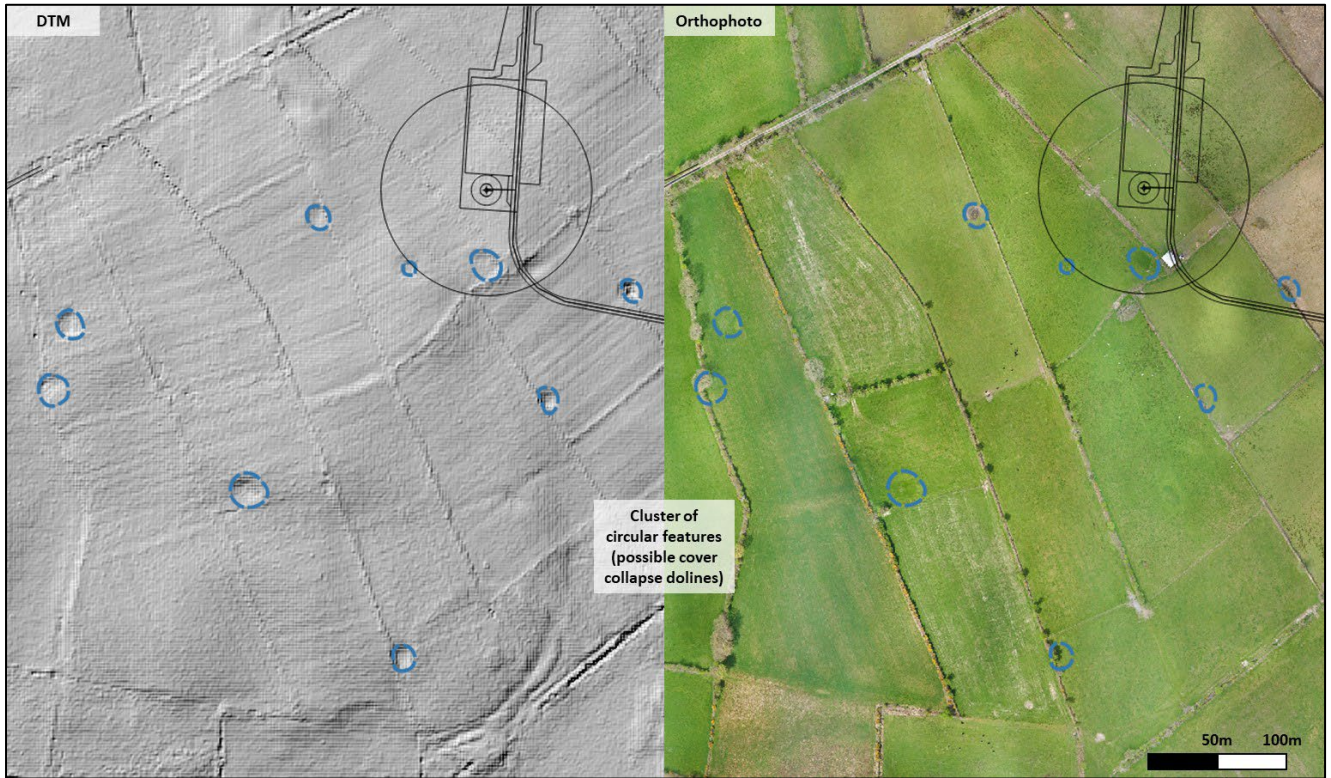


Figure 2-4: Cluster of circular landforms (enclosed depressions) located south and west of turbine T6



3. SITE RECONNAISSANCE

A site reconnaissance survey was undertaken between 18th and 21st January 2022 and the 4th and 5th April 2023. The survey work was completed by FT Principal Geologist Aaron Clarke (BSc, MSc, MCSM, PGeo, EurGeol) who has over 20 years' professional experience. The purpose of the survey was to:

- verify the presence of potential surface karst features identified as part of the aerial photography and DTM review; and
- where possible, to identify additional karst features not visible on aerial photography or DTM.

In total 26 no. out of the 56 no. features identified during the desk study were visited. An additional 9 no. potential surface karst features that weren't identified during the desk study stage were recorded during the survey. The remaining 30 no. locations were not accessible during the time of the survey. However, it should be noted that evidence from the DTM strongly suggest that these unvisited locations are enclosed depressions (dolines). No surface features were identified in the area of the proposed substation.

Findings from the Site visit are summarised in Table 3-1 and the distribution of these features are presented in Figure 11.7b, Volume IV of the EIAR. Site photographs of representative karst landforms are presented in Appendix A.

Table 3-1: Karst features identified during the Site reconnaissance

Karst type	Loc. ID	ITM Coordinate		Visible on aerial photos or DTM (Y/N)	Approx. Distance (m) to Nearest Infrastructure Element	Comments
		E	N			
Possible Enclosed Depression	001	531412	754499	Y	15 (T2)	Subtle shallow oval shaped depression. This may also be a result of non-karst related processes.
Enclosed Depression	002	531581	754047	Y	70 (T3)	Well defined approx. 12m diameter circular depression (approx. 0.5m deep) containing abundant hydrophilic vegetation (rush). The sides of this feature display a stepped vertical drop of approximately 0.3 to 0.5m (see Appendix A – Photo 1)
Enclosed Depression	003	531616	753964	Y	20 (T3)	Well defined approx. 12m diameter circular depression (approx. 0.7m deep) containing hydrophilic vegetation (rush) (see Appendix A – Photo 2)
Enclosed Depression	004	531756	754015	Y	165 (T3)	Obvious broadly semi-circular depression (1-1.5m deep). Limited hydrophilic vegetation. Abundant tree/shrub vegetation.
Possible Enclosed Depression	005	531634	753770	Y	210 (T3)	Subtle circular depression. Potential doline or other geomorphological feature.
Possible Turlough	006	531520	753463	Y	370 (T4)	Subtle linear feature that shows signs of previous flooding. Dry at time of visit.



Karst type	Loc. ID	ITM Coordinate		Visible on aerial photos or DTM (Y/N)	Approx. Distance (m) to Nearest Infrastructure Element	Comments
		E	N			
Karstified Limestone Boulder	007	531578	753473	N	315 (T4)	1.8m high fossiliferous dark grey limestone boulder displaying dissolution weathering features. Does not appear to be glacially transported i.e. not an erratic (see Appendix A – Photo 3)
Possible Turlough	008	531485	753303	Y	410 (T4)	Subtle egg-shaped depression. Partially filled with water. Contains hydrophilic vegetation.
Enclosed Depression	009	531484	753268	N	420 (T4)	Cluster of 3 no. circular depressions (early development dolines) approx. 1-1.5m diameter and 0.3m deep.
Enclosed Depression	010	531488	753266	N	420 (T4)	Cluster of 3 no. circular depressions (early development dolines) approx. 1-1.5m diameter and 0.3m deep.
Enclosed Depression	011	531491	753253	N	420 (T4)	Cluster of 3 no. circular depressions (early development dolines) approx. 1-1.5m diameter and 0.3m deep.
Enclosed Depression	012	531519	753260	Y	390 (T4)	Water filled well defined circular depression with hydrophilic vegetation. Depth unknown. (see Appendix A – Photo 4)
Enclosed Depression	013	531717	753383	Y	170 (T4)	Well defined circular bowl-shaped depression about (approx. 1m deep) (see Appendix A – Photo 5)
Possible Enclosed Depression	014	531911	753375	Y	30 (T4)	Circular depression at the base of a shallow valley feature. Possible karst or glacial erosional feature. Pronounced hydrophilic vegetation within circular feature (see Appendix A – Photo 6)
Possible Enclosed Depression	015	531911	753287	Y	110 (T4)	Heavy gorse and bramble vegetation over a circular depression. Depth of depression unknown.
Possible Turlough	016	533293	753362	N	800 (T5)	Irregularly shaped water filled depression. No vegetation beneath water. Sharp waterline against adjacent planted grass. (see Appendix A – Photo 7)
Possible Turlough	017	533299	753339	N	800 (T5)	Broadly circular shaped water filled depression. No vegetation beneath water. Sharp waterline against adjacent planted grass.
Possible Turlough	018	533370	753393	N	800 (T5)	Broadly oval shaped water filled depression. Water level in depression displays a sharp edge and no vegetation growing within depression
Possible Turlough	019	533392	753422	N	800 (T5)	Broadly circular shaped water filled depression. No vegetation beneath water.



Karst type	Loc. ID	ITM Coordinate		Visible on aerial photos or DTM (Y/N)	Approx. Distance (m) to Nearest Infrastructure Element	Comments
		E	N			
Enclosed Depression	020	533892	754308	Y	345 (T6)	Could not access field but circular depression clearly visible from roadside/adjacent fields.
Enclosed Depression	021	533779	754430	Y	280 (T6)	Could not access field but circular depression clearly visible from roadside/adjacent fields.
Enclosed Depression	022	533636	754503	Y	340 (T6)	Could not access field but circular depression clearly visible from roadside/adjacent fields.
Enclosed Depression	023	533649	754549	Y	315 (T6)	Could not access field but circular depression clearly visible from roadside/adjacent fields.
Enclosed Depression	024	533996	754496	Y	165 (T6)	Could not access field but circular depression clearly visible from roadside/adjacent fields.
Enclosed Depression	025	534058	754575	Y	130 (T6)	Could not access field but circular depression clearly visible from roadside/adjacent fields.
Enclosed Depression	026	533952	754593	Y	55 (T6)	Could not access field but circular depression clearly visible from roadside/adjacent fields.
Enclosed Depression	027	533895	754591	Y	80 (T6)	Could not access field but circular depression clearly visible from roadside/adjacent fields.
Enclosed Depression	028	533830	754629	Y	125 (T6)	Could not access field but circular depression clearly visible from roadside/adjacent fields.
Enclosed Depression	029	533755	755181	Y	30 (T8)	Subtle circular depression (0.5-0.7m deep and 22m across) with borehole drilled near centre. More obvious on orthophotograph (see Appendix A – Photo 8)
Possible Enclosed Depression	030	533706	755195	Y	30 (T8)	Subtle circular depression (0.3-0.5m deep) with borehole at centre.
Possible Enclosed Depression	031	533527	755165	N	210 (T8)	Subtle circular depression (0.4m deep) - possible early-stage doline.
Possible Enclosed Depression	032	533529	755188	Y	205(T8)	Obvious roughly oval depression (1.5-2m deep). Partially vegetated with deciduous trees with brambles and nettles at base. Possible doline or historic excavation (see Appendix A – Photo 9)
Enclosed Depression	033	533502	755328	Y	260 (T9)	Circular depression (0.5m deep) with deciduous tree growing within.
Enclosed Depression	034	533612	755383	Y	220 (T8)	Well defined circular depression (0.3m deep) with dock leaves growing within (see Appendix A – Photo 10)



Karst type	Loc. ID	ITM Coordinate		Visible on aerial photos or DTM (Y/N)	Approx. Distance (m) to Nearest Infrastructure Element	Comments
		E	N			
Enclosed Depression	035	533428	755523	Y	50 (T9)	Well defined circular depression (0.7m deep) (see Appendix A – Photo 11)

Of the 35 no. locations visited:

- 28 no. were recorded as enclosed depressions (8 no. of which are located within 100m of a turbine location)
- 6 no. were recorded as turloughs and
- 1 no. was recorded as a boulder displaying karst weathering.

Representative photos of these features are presented in Appendix A.

In general, the enclosed depressions (dolines) were circular in shape, had a bowl like morphology, and were typically between 0.5 and 1m in depth. However, the doline recorded at Location ID 002 (Appendix A – Photo 1) showed a pronounced stepped vertical drop of approximately 0.3 to 0.5m along its perimeter. This may indicate the enclosed depression at this location is younger, relative to the other dolines as its sides have not yet had time to erode to form gently sloping edges.

Where the surface expressions of these features were considered to be inconclusive or where the feature may be a result of other processes (e.g. glacial landform or potentially man-made) they were recorded as “possible” karst features.

As part of the GSI’s Heritage Programme an audit of County Geological Sites was undertaken in County Mayo ^[Ref 2]. The findings of the audit, although not Specific to the Site, does indicate the high frequency of doline features within the region. The Site borders County Mayo and shares the same bedrock formations and geological history, as such the findings from this audit are considered relevant.

The report states that:

“Eighteen hundred and fifty five enclosed depressions (dolines) were mapped, with none of these recorded previously in the Geological Survey Ireland Karst Database”

This statement mirrors the findings of the desk study and site reconnaissance (discussed in Sections 2 and 3 respectively), where several karst features, which are currently unmapped by the GSI ^[Ref 8] were encountered throughout the Site.



4. GEOPHYSICAL SURVEY & REPROCESSING OF DATA

4.1 General

Based on the findings of the desk study a geophysical survey was undertaken by Apex Geophysics to identify and delineate potential sub-surface karst features at 13 no. potential turbine locations (T01 to T13) that were being considered for the proposed Development as part of the initial Design Iteration. The investigation was undertaken between the 26th of May and 1st June 2022 and comprised the following survey methods:

- 26 no. Electrical Resistivity Tomography (ERT) profiles (two orthogonal ERT profiles at each of the 13 no. turbine locations under consideration)
- Accompanying soft ground (peat) probing along each ERT profile to determine the thickness of soft peat deposits (to a maximum probe depth of 5m bgl)

The objectives of the survey was to:

- assess the depth to bedrock
- identify the type of bedrock
- identify any potential karst features faults/fissure zones within the bedrock and Quaternary deposits.
- propose follow-up borehole locations to target geophysical anomalies

Based on the findings of the geophysical survey an intrusive ground investigation was undertaken to target geophysical anomalies associated with potential sub-surface karst features within the underlying limestone bedrock formations. The scope and findings of this intrusive investigation is discussed in Section 5. The data captured during the geophysical survey was subsequently reprocessed using the intrusive ground investigation findings. The updated geophysical survey report is presented in Appendix B.

4.2 Report Findings

Of the 13 no. potential turbine locations that were surveyed (noting that final turbine layout was informed by this assessment), anomalies within the limestone bedrock were recorded at 3 no. potential turbine locations (T08, T10 and T11 (renamed to T12 post-date of geophys and later descoped)). These anomalies are described in the geophysical survey report as MUDSTONE/SHALE or possible weathered/karstified LIMESTONE.

It is important to note the since this survey, the following changes have been made to the turbine locations where potential anomalies were identified:

- T08 – relocated approximately 20m southwest of its initial proposed location. ERT survey line T8-R1 still transects the updated turbine base location.
- T10 – relocated approximately 70m to the south of its initial proposed location.
- T11 (renamed to T12 post-date of geophys) – descoped i.e. removed from the turbine array design.



The anomalies identified at T8 (R1/R2), T10 (R1/R2) and T11 (R1/R2) (renamed to T12 post-date of geophys and descope) present as sub-vertical columnar features which propagate down through interpreted limestone bedrock. The widths of these anomalies range from approximately 5 to 20m across. It is not known from the survey results whether these anomalies represent a circular or linear feature in plan. An example of one of these interpreted features, taken from the geophysical survey report (Appendix B) is presented in Figure 4-1.

Results of this survey are further discussed in *Sections 4 and 5* of the geophysical survey report and illustrated within *Appendix B: Drawings* of the same report (presented in Appendix B).

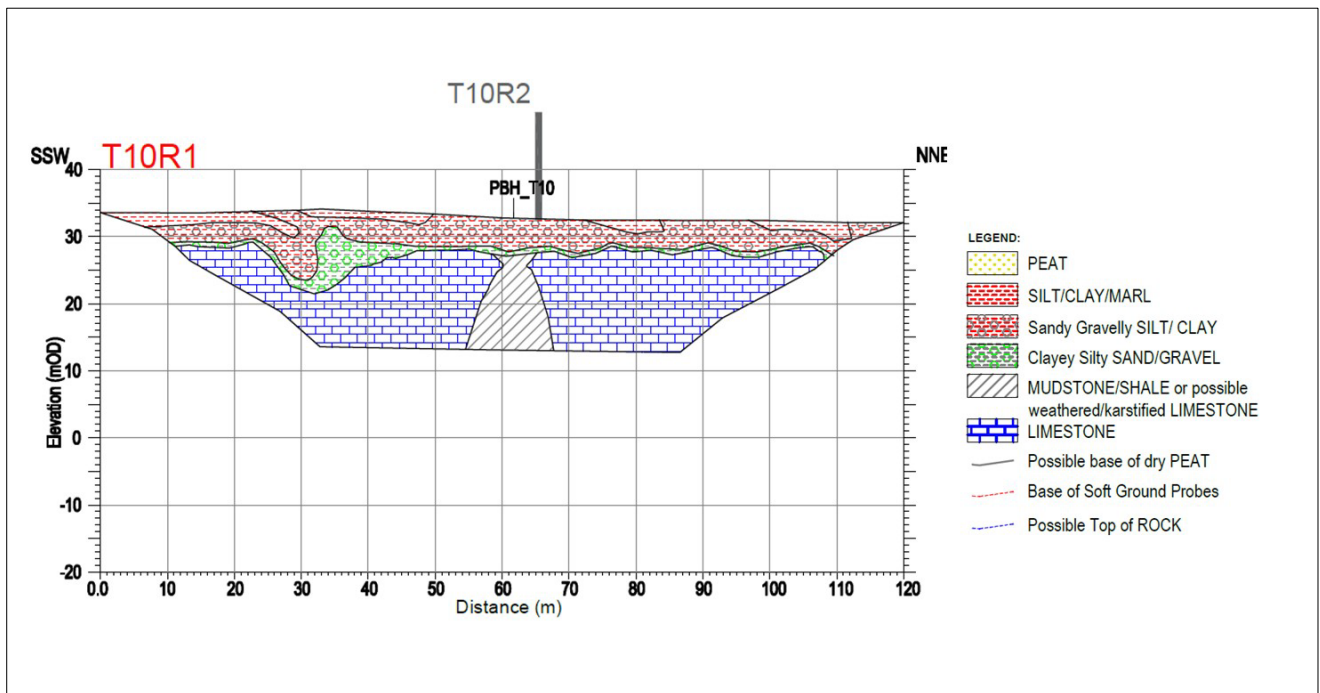


Figure 4-1: ERT Profile T10R2 showing interpreted karst feature (grey hatched area in centre of image)



5. INTRUSIVE GROUND INVESTIGATION

An intrusive ground investigation (GI) was undertaken between March and June 2023 by Ground Investigations Ireland (GII). The investigation comprised 22 no. trial pits and 22 no. rotary cored boreholes. The Ground Investigation Factual Report is presented in Appendix C.

The purpose of the GI was to:

- determine ground and groundwater conditions at the turbine and substation locations; and
- to verify the presence of potential karst features identified through the desk study and the resulting geophysical survey.

Data derived from the geophysical survey was subsequently reprocessed using findings from the intrusive ground investigation. The results from the reprocessing works are discussed in Section 4.

In general, ground conditions encountered during the ground investigation correspond with published GSI mapping ^[Ref 5]. A summary of the ground investigation findings are presented in the following sections. Where potential karst features are identified they are highlighted and discussed.

An interpretation of the combined desk study, site reconnaissance, geophysical survey and ground investigation findings is presented in Section 6.

5.1 Trial Pitting

Findings from the trial pitting are summarised in Table 5-1.

Table 5-1: Summary of ground and groundwater conditions within the trial pits

Hole ID	Peat		Soft to firm Clay [A] / Very soft Marl [B]		Coarse-Grained Till		Firm to very stiff Fine-Grained Till		Groundwater Strike (mbgl)	Infrastructure Element Tested
	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)		
PTP-01					0.00	3.70			0.50	T02
PTP-02			0.00 [A]	0.80 [A]	0.80	3.00	3.00	4.50		T02
PTP-03			0.00 [A]	0.50 [A]			0.50	5.10		T04
PTP-04			0.00 [A]	0.70 [A]			0.70	3.10 ^[Note 1]	3.10	T04
PTP-05	Exploratory hole location was descope									
PTP-06			0.00 [A]	0.60 [A]	0.60	1.20	1.20	3.30 ^[Note 1]		T06
PTP-07					0.00	1.00	1.00	4.20 ^[Note 1]	3.20 & 4.20	T08
PTP-08			0.00 [A]	0.60 [A]			0.60	3.80 ^[Note 1]	1.50 & 1.80	T09
PTP-09			0.00 [A]	0.90 [A]			0.90	4.00 ^[Note 1]	1.30 & 2.60	T09
PTP-10	0.00	3.10	3.10 [B]	4.50 [B] ^[Note 1]					4.50	T10
PTP-11	0.00	0.70	0.70 [B]	3.80 [B]					2.70	Substation A (descope)
PTP-12			0.00 [A]	2.30 [A] ^[Note 1]					2.00	Substation A (descope)



Hole ID	Peat		Soft to firm Clay [A] / Very soft Marl [B]		Coarse-Grained Till		Firm to very stiff Fine-Grained Till		Groundwater Strike (mbgl)	Infrastructure Element Tested
	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)		
PTP-13							0.00	3.00 [Note 1]	1.80 & 2.30	Substation A (descope)
PTP-14							0.00	3.00 [Note 1]	1.90	Substation A (descope)
PTP-15	0.00	0.60					0.60	3.30 [Note 1]	2.10	Substation B
PTP-16			0.00 [A]	1.90 [A]			1.90	3.20	1.90	Substation B
PTP-17							0.00	3.50 [Note 1]	1.70	Substation B
PTP-18			0.00 [A]	1.20 [A]	1.20	2.40	2.40	3.70 [Note 1]	1.80	Substation B
PTP-19	0.00	1.60	1.60 [B]	2.30 [B]			2.30	3.00 [Note 1]	0.70 & 2.30	Substation B
PTP-20			0.00 [A]	1.20 [A]			1.20	4.00 [Note 1]	2.70	Substation B
PTP-21	0.00	1.30	1.30 [B]	2.90 [B]	2.90	3.80			3.20	Substation B
PTP-22			0.00 [A]	1.30 [A]	1.30	3.50 [Note 1]			2.30	Substation B
PTP-23							0.00	3.00 [Note 1]		Black River Crossing (South)

Note 1 – possible bedrock encountered at base of trial pit.

Key findings from the trial pitting are presented below:

- No evidence of karst features (such as voiding or piping within the superficial deposits) were recorded within the trial pits.
- The most dominant strata type recorded was fine-grained (cohesive) till, which was encountered in 15 no. trial pits.
- Coarse-grained till was encountered in 7 no. trial pits; these deposits were typically underlain by fine-grained till.
- Possible bedrock was recorded at the base of 16 no. trial pits at depths ranging from 2.30 to 4.00m bgl.
- Groundwater strikes (typically described as seepages) were recorded in 18 no. trial pits at depths ranging from 0.50 to 4.50m bgl. These seepages are likely the result of a perched water table².

5.2 Rotary Boreholes

Findings from the rotary boreholes are summarised in Table 5-2 and results from the groundwater monitoring programme are presented in Table 5-3.

² A perched water table (or perched aquifer) is an aquifer that occurs above the regional water table. This occurs when there is an impermeable layer of rock or sediment (aquiclude) or relatively impermeable layer (aquitard) above the main water table/aquifer but below the land surface.



Table 5-2: Summary of ground conditions within the rotary boreholes

Hole ID	Peat		Soft to firm Clay ^[A] / Very soft Marl ^[B]		Medium dense to dense Coarse-Grained Till		Firm to very stiff Fine-Grained Till		Bedrock		Possible karst feature recorded (Y/N)	Element Tested
	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)	From (mbgl)	To (mbgl)		
PBH-01	0.00	3.50	3.50 ^[B]	6.50 ^[B]	6.50	14.60			14.60	18.50	N	T01
PBH-02	0.00	0.20	0.20 ^[A]	2.00 ^[A]	2.00	6.50	6.50	10.60	10.60	15.30	N	T02
PBH-03			0.00 ^[A]	0.90 ^[A]	0.90	4.10	4.10	10.10	10.10	14.70	N	T03
PBH-03A					0.00	3.50	3.50 ^{Note 1}	9.50 ^{Note 1}	9.50	16.00	Y	Near T03, investigating potential karst
PBH-04							0.00	5.90	5.90	10.70	N	T04
PBH-05	0.00	5.50	5.50 ^[B]	6.75 ^[B]	6.75	8.90			8.90	14.50	N	T05
PBH-06							0.00	12.90	12.90	20.00	N	T06
PBH-07	0.00	3.50	3.50 ^[B]	7.50 ^[B]			7.50	8.10	8.10	14.00	N	T07
PBH-08							0.00	14.00	14.00	19.10	N	Near T08 investigating potential karst
PBH-09							0.00	15.50	15.50	21.50	N	Near T08 investigating potential karst
PBH-10							0.00	14.50	14.50	22.00	N	T08
PBH-11							0.00	15.95	15.95	23.00	N	Near T08 investigating potential karst
PBH-12					13.80	14.80	0.00	13.80	14.80	18.50	N	Near T08 investigating potential karst
PBH-13							0.00	13.20	13.20 ^{Note 2}	23.00 ^{Note 2}	N	T09
PBH-14	0.00	1.00			1.00	3.40	3.40	7.90	7.90	13.00	N	T11 (renamed to T12 post GI) (descope)
PBH-15	0.00	2.80	2.80 ^[B]	6.50 ^[B]	12.30	13.00	6.50	12.30	13.00	17.00	N	T10
PBH-16	0.00	5.50			5.50	7.40	7.40	10.50	10.50 ^{Note 3}	22.00 ^{Note 3}	N	T12 (renamed to T11 post SI)
PBH-17	0.00	3.50	3.50 ^[B]	11.0 ^[B]	11.00	12.85			12.85	17.00	N	T13 (descope)
PBH-18					7.00	8.50	0.00	7.00	8.50 ^{Note 4}	20.50 ^{Note 4}	Y	Substation A (descope)
PBH-19			0.00	0.90	0.90	3.50	3.50	6.05	6.05	11.50	N	120m west of Substation
PBH-20	0.00	2.30			2.30	6.10			6.10	12.50	N	Substation
PBH-21	0.00	0.15					0.15	5.20	5.20	10.00	N	Black River Crossing (North)

Note 1 – Loss of flush and reduction in core recovery recorded within the fine-grained till in PBH-03A. Possible void within superficial deposits.

Note 2 – Possible fault rock recorded between 16.60 and 17.00m (0.40m thick) in PBH-13.

Note 3 – Possible fault rock recorded between 14.40 and 16.20m (1.80m thick) in PBH-16.

Note 4 – Possible weathered limestone bedrock / Karst Zone recorded between 8.50 and 14.80m bgl (6.30m thick) in PHB-18.



Table 5-3: Summary of Groundwater Monitoring Findings

BH No.	Elevation (mAOD)	Location	Groundwater Levels (mbgl)											
			30/10/23	28/11/23	19/12/23	30/01/24	27/02/24	20/03/24	17/04/24	29/05/24	25/06/24	30/07/24	27/08/24	24/09/24
PBH01	28.07	T1	0.74	1.02	0.86	1.07	1.04	0.94	1.02	1.46	1.73	1.84	0.96	1.67
PBH02	29.92	T2	1.38	1.84	1.38	1.61	1.57	1.5	1.55	2.38	3.63	2.8	2.19	2.54
PBH03	37.15	T3	3.28	9.02	8.21	6.21	8.56	8.42	8.59	9.77	Note 1	Note 1	Note 1	Note 1
PBH04	33.39	T4	3.92	4.24	3.61	3.92	4.04	4.25	4.16	5.03	Note 1	Note 1	5.54	Note 1
PBH06	30.58	T5	4.1	2.975	2.74	3.03	2.99	2.91	2.97	3.53	4.02	4.45	n/a	3.82
PBH07	37.04	T6	2.56	0.15	0.05	0.1	0.07	0.06	0.08	0.19	0.46	0.59	0.3	0.44
PBH09	30.64	T7	0.1	3.12	2.88	3.14	3.1	3.01	3.05	4.08	4.85	5.35	3.66	4.38
PBH12	37.19	T8	2.76	1.08	0.79	0.99	0.96	0.71	0.91	1.69	3.38	3.17	0.86	2.02
PBH13	37.99	T9	0.67	2.1	1.82	1.82	2.04	1.94	1.96	Note 1	Note 1	4.26	2.56	Note 1
PBH14	34.43	120m east of Black River.	1.5	0.31	Note 1	0.31	0.25	0.13	0.25	0.31	0.66	0.89	0.07	0.55
PBH15	35.37	T10	0	1.27	1.52	0.52	1.57	1.55	1.56	Note 1	Note 1	1.81	1.59	Note 1
PBH16	35.57	T11	1.85	0.25	0.14	0.32	0.25	0.15	0.18	0.46	0.49	0.52	0.02	Note 1
PBH17	30.22	150m SE of Black River.	0	0.32	0.07	0.21	0.2	0.09	0.21	0.41	0.68	0.83	0.26	0.7
PBH18	27.28	Outside RLB.	0	Note 1	0.07	0.24	0.19	0.11	0.18	0.97	Note 1	Note 1	Note 1	1.27
PBH19	29.44	120m west of substation.	0.7	0.81	0.74	0.89	0.83	0.78	0.83	1.22	1.5	1.66	0.75	1.31
PBH20	28.28	Substation.	Artesian	0.04	Artesian	Artesian	Artesian	Artesian	Artesian	Note 2	Note 2	Note 2	Note 2	Note 2
PBH21	25.68	North of Black River.	0.3	0.53	0.36	0.53	0.48	0.44	0.45	0.96	Note 1	1.52	Note 1	Note 1
Note 1 – No access to field due to livestock.														
Note 2 – Standpipe cover rusted shut. Could not access.														



Key findings from the rotary boreholes are presented below:

- The most dominant soil type recorded was fine-grained (cohesive) till, which was encountered in 18 no. boreholes.
- Bedrock is typically described as medium strong to very strong, thin to medium bedded, dark grey to black, fine grained argillaceous limestone. Fresh to slightly weathered to occasionally moderately weathered. This stratum is dominated by two main joint sets which run sub-horizontally and sub-vertically through the core. These descriptions broadly correspond to the mapped geology and suggest that the limestone encountered within the boreholes belongs to the Ardnasillagh Formation. The only exception to this is within PBH-18, which encountered a thin to medium bedded dark bluish-grey fine grained fossiliferous limestone which is recorded as being slightly to moderately weathered. The lithological description of this unit suggests it does not belong Ardnasillagh Formation but rather a purer limestone such as the Cong Canal Formation. This location was scoped out for infrastructure development (originally considered as a potential substation location).
- With the exception of borehole PBH-18, the abundance of shaley/argillaceous material within the encountered bedrock suggests low levels of calcium carbonate (CaCO_3) within the limestone. This is significant with respect to its susceptibility to karstification. Limestone with a lower percentage of CaCO_3 is less prone to dissolution by karst processes and is significantly less likely to host features such as large interconnected sub-surface cavities (i.e. cave systems). Bedrock in borehole PBH-18 was logged as having no argillaceous material and is therefore likely has a higher CaCO_3 content, making it more susceptible to karstification.
- The abundance of shaley/argillaceous material within the encountered bedrock suggests low levels of calcium carbonate (CaCO_3) within the limestone. This is significant with respect to its susceptibility to karstification. Limestone with a lower percentage of CaCO_3 is less prone to dissolution by karst processes and is significantly less likely to host features such as large interconnected sub-surface cavities (i.e. cave systems).
- Possible fault rock ³ was recorded in two boreholes (PBH-13 from 16.60-17.00m bgl and PBH-16 from 14.40-16.20m bgl). According to GSI fault mapping ^[Ref 5]:
 - **PBH-13** is located approximately 240m southeast of the nearest mapped fault
 - **PBH-16** is located approximately 1.4km southeast of the nearest mapped fault (turbine at this location was subsequently descoped)
- No evidence of karst was recorded within the rotary boreholes with the exception of boreholes PBH-3A and PBH-18:
 - **PBH-3A** – the driller recorded a loss of flush returns between 7.10 and 8.00m bgl within the Quaternary deposits. In addition, the engineers' logs record 17% total core recovery (TCR) between 8.00m and 9.50m bgl. Both loss of flush returns and lack of core recovery indicate the presence of a void within the fine-grained till deposits. It should be noted that borehole PBH-3A was drilled within an existing circular depression, thought to be a doline.

³ a rock that consists of fragments produced by the crushing and grinding which accompany a dislocation and is often found along the fault plane



- **PBH-18** – a 6.30m thick possible weathered limestone / karst zone has been recorded. This is located between 8.50 and 14.80m bgl and directly overlies slightly to moderately weathered limestone. PBH-18 represents one of the substation locations initially under consideration for the Proposed Development, which was subsequently descope.
- Groundwater monitoring wells were installed in 17 no. boreholes (Table 5-3). Readings were taken at monthly intervals over a period of 12 months between October 2023 and September 2024. In general, groundwater levels across the Site are shallow with a mean value of 1.81m bgl. The predominant Quaternary deposits across the Site comprise low permeability fine grained till which attain a minimum, maximum and mean depth of 5.20, 15.95 and 10.79m bgl. This suggests that the groundwater encountered in the monitoring wells lies within a confined aquifer (i.e. the limestone bedrock), which is subject to sub-artesian ⁴ conditions.
- Artesian groundwater was encountered in borehole PBH-20 (proposed substation). At this location, a slow but continuous flow of water was observed coming out of the top of the installation well (approximately 0.2m above the existing ground level).

⁴ (of water) rising naturally in a well to a height appreciably above that of the surrounding water table but not flowing out of the well



6. INTERPREATION OF FINDINGS

Findings from the intrusive ground investigation indicate the underling bedrock of the Ardnasillagh Formation is not readily susceptible to karstification. No karst features or voids were identified within the recovered rock core samples of the Ardnasillagh Formation⁵.

Taking this into consideration, the anomalies identified as part of the Electrical Resistivity Tomography (ERT) profiles (Appendix B) are confirmed by drilling not to be features resulting from karstification. These anomalies may be indicative of weathered zones within the limestone generated by faulting. Faults have the potential to create linear zones of fractured and weakened rock. They also create pathways for groundwater flow through otherwise low permeability rock. Fault rock was recorded in boreholes PBH-13 and PBH-16 in areas where no faults are mapped by the GSI ^[Ref 5]. This may indicate faulting is more extensive than the mapped structural geology indicates and gives more credence to the ERT anomalies being fault related.

The occurrence of sub-artesian and artesian conditions encountered in several of the boreholes across the Site (Table 5-3) coupled with the lack of significant groundwater flow within the low permeability Quaternary deposits found within the trial pits indicate the presence of a confined aquifer. It is thought that fractured rock within the Ardnasillagh Formation is creating pathways for groundwater movement. The fracturing is thought to be associated with faulting and indicates these pathways are likely linear and near vertical in nature coinciding with high angled normal and thrust fault systems, which dominate this region ^[Ref 1].

Notwithstanding the above, findings from the walkover surveys do indicate the presence of surface karst features. These typically present as clusters of oval or circular shallow bowl-shaped depressions, which broadly follow linear trends. These linear patterns occur both parallel and perpendicular to mapped faults, suggesting they are a surface expression of the Site's structural geology. The morphology of these features and the geological environment in which they occur suggest they are collapse dolines.

The following description of collapse dolines (also known as dropout dolines) is taken from the GSI Groundwater Programme ^[Ref 8]:

"Collapse dolines usually occur very suddenly where the bedrock or subsoil material collapse into and underlying void. Cover collapse dolines, sometimes known as dropout dolines are very common in Ireland. They occur in karst areas covered by unconsolidated material, such as glacial till. They form by the sudden downward movement of the overburden and usually form in areas where the overburden is somewhat cohesive. They occur in a process called 'piping', where a soil or subsoil arch, which has formed due to removal of material at the bottom of a layer of overburden, suddenly gives way (White, 1988). Although there must be a highly efficient pathway established for sediment transportation in order for the soil arch to form and grow, a large bedrock hollow is not necessary for their development. Cover collapse dolines are characterised by vertical or steep-sided collapses, with a very sharp break in slope and often have stepped sides, where soil is exposed. Over time, however, their slopes may degrade and infilling sediment may build up giving these dolines the morphology of solution dolines."

⁵ PBH-18 is believed to lie within the Cong Canal Formation. It is distinctly different to the rocks of the Ardnasillagh Formation. PBH-3A encountered a void within the Quaternary Deposits and not the bedrock.



The formation of a cover collapse doline is described below and presented in Figure 6-1:

- A. Solational openings in the bedrock wash material downward,
- B. A small arch forms in the subsoil where the material is being washed away from
- C. The void grows in size as more material is being down washed until it reaches a critical point and starts to rupture
- D. The arch suddenly collapses as it can no longer support its own weight,
- E. Overtime the vertical sides will degrade and the hole will become less deep.

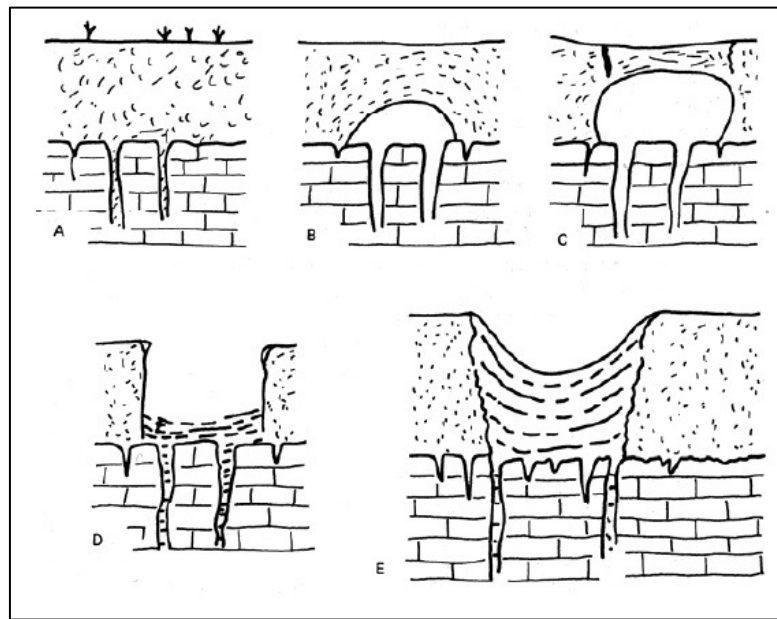


Figure 6-1: Formation of a cover collapse doline (GSI Groundwater Programme ^[Ref 8])

From data and site observations attained as part of this assessment, it is believed that cover collapse dolines are the main geological process producing surface karst features across the Site. Faulting and resulting fracturing of the limestone within the underlying Ardnasillagh Formation has allowed for piping to occur resulting in sub-surface voids within the glacial till (as recorded in borehole PBH-3A) and subsequent formation of collapse dolines. Their formation occurs along strike of the underlying fault as illustrated in Figure 6-2 and as evidenced by Figure 2-1.

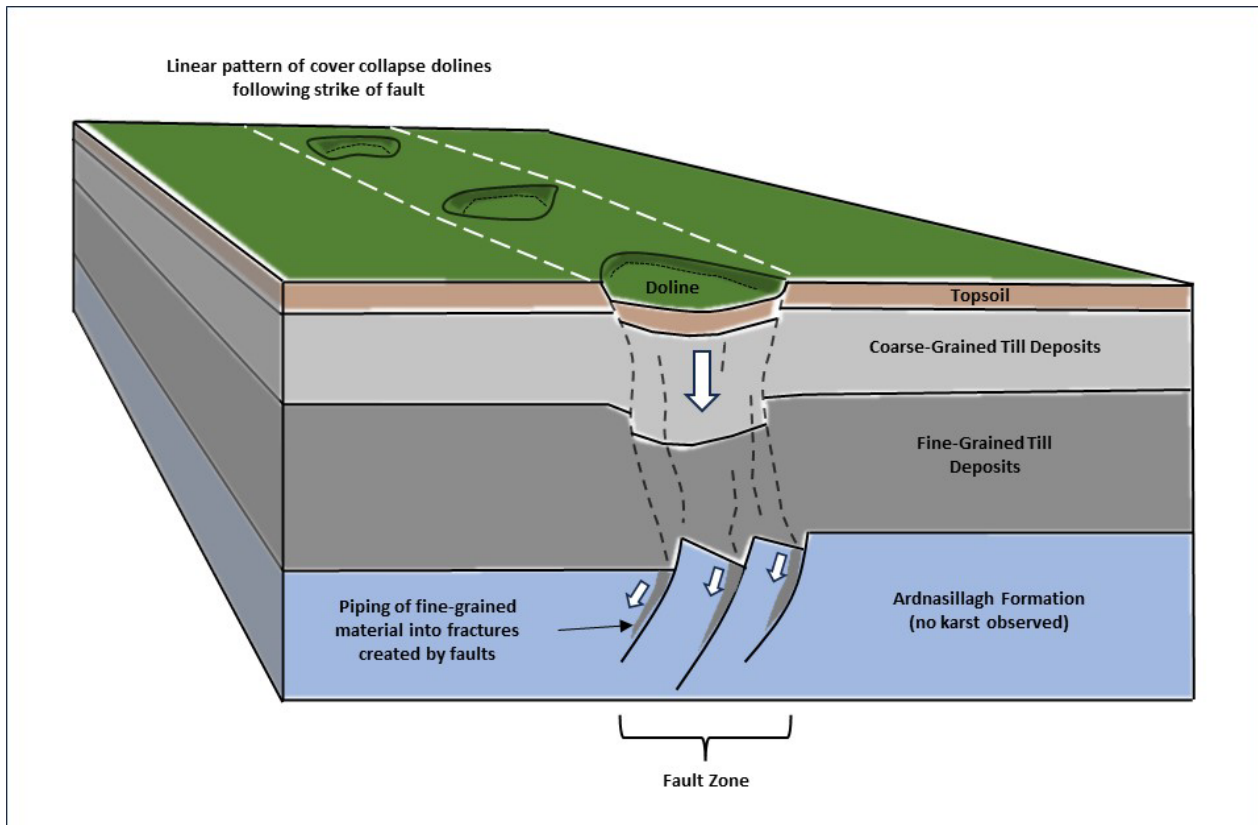


Figure 6-2: Schematic of cover collapse dolines mirroring underlying faults.

Observations from the site reconnaissance indicate that the cover collapse dolines display varying degrees of development. This ranges from well-formed enclosed depressions with vertical steep sided collapse faces (historic features) to subtle circular depressions (newly forming features) and suggests karst is actively occurring across the Site.

The possible karst encountered in PBH-18 should be considered separately to the rest of the Site. Borehole logs indicate PBH-18 lies outside of the Ardnasillagh Formation and is likely underlain by the limestone of the Cong Canal Formation. It is not conclusive that the 6.3m zone encountered above the underlying component bedrock is a result of karst processes. However, GSI karst mapping ^[Ref 5] indicates a significant number of mapped karst features within this formation to the north of the Site. Due to the higher CaCO_3 content of this limestone, it is more likely that these features are a result of karstification of the underlying bedrock rather than voiding within the overlying superficial deposits. Notwithstanding, the proposals to locate the 110kV substation at this location was dropped and the substation relocated to a suitable site nearby within the Ardnasillagh Formation.



7. SUMMARY, CONCLUSIONS & RECOMMENDATIONS

7.1 Summary

The Site is entirely underlain by mid-Carboniferous Limestone, predominantly of the Ardnasillagh Formation. However, peripheral areas of the Site are underlain to the north and northwest by the Cong Limestone Formation and Cong Canal Formation respectively. Several potential surface karst features were identified throughout the Site as part of a desktop study. A site reconnaissance was undertaken to ground truth these features. The site reconnaissance also identified potential surface karst features not recorded as part of the desktop study.

To aid in the karst assessment, a combined non-intrusive (ERT survey) and intrusive (boreholes and trial pits) ground investigation was carried out. Findings from the geophysical investigation identified a number of interpreted sub-surface anomalies within the underlying limestone bedrock. The follow-on intrusive ground investigation did not identify karst within the Ardnasillagh Formation. However, potential karst weathering was recorded in borehole PBH-18, which is believed to have tested the limestone of the Cong Canal Formation.

Results from the combined desktop study, site reconnaissance and ground investigations suggest that, with the exception of PBH-18, karst within the Site is confined to the Quaternary deposits overlying the limestone. PBH-18 represents one of the substation locations initially under consideration for the Proposed Development, which was subsequently descope due to the risk of karst.

7.2 Conclusions

Surface karst features (predominantly collapse dolines) are present throughout the Site. These features are believed to form along unmapped fault lines that create zones of weakened and fractured rock beneath the overlying Quaternary deposits (predominantly Glacial Till). The fault zones allow for piping of the fine-grained portion of the Glacial Till, through fractured rock, resulting in voiding and eventual collapse of the soils overlying the limestone bedrock. The result is a broadly circular bowl-shaped depression of varying widths and depths.

The formation of these collapse dolines is actively occurring across the site with newly forming depression observed during the site reconnaissance. Their formation is due to the washing out of material within the overlying Quaternary deposits through underlying fractured fault rock.

With the exception of PBH-18 (thought to be within the Cong Canal Formation), no karst features were observed within the underlying shaley limestones of the Ardnasillagh Formation. No evidence of significant karst features such as caves were noted within the Site as part of this assessment.

7.3 Recommendations

As dolines are considered to be actively occurring within the site, the design of the wind farm infrastructure should account for this geology. Foundations for the larger infrastructure elements such as the turbine bases should be piled into the underlying bedrock and not founded on the overlying Glacial Till deposits as there is potential for unrecorded voids within these soils. While gravity foundations for the larger infrastructure elements is a potential option, it would necessitate the excavation of substantial overburden to allow for founding directly onto bedrock.



Any surface depressions or suspected doline features within the footprint of the hardstands, construction compounds, met mast foundations or access roads should be removed by excavation of the existing soils and replacement with engineered fill.

The construction of the wind farm main infrastructural elements should be overseen by either a geotechnical engineer or engineering geologist with experience in identifying surface karst features.



8. REFERENCES

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**FEHILY
TIMONEY**

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APPENDIX A

Site Photos

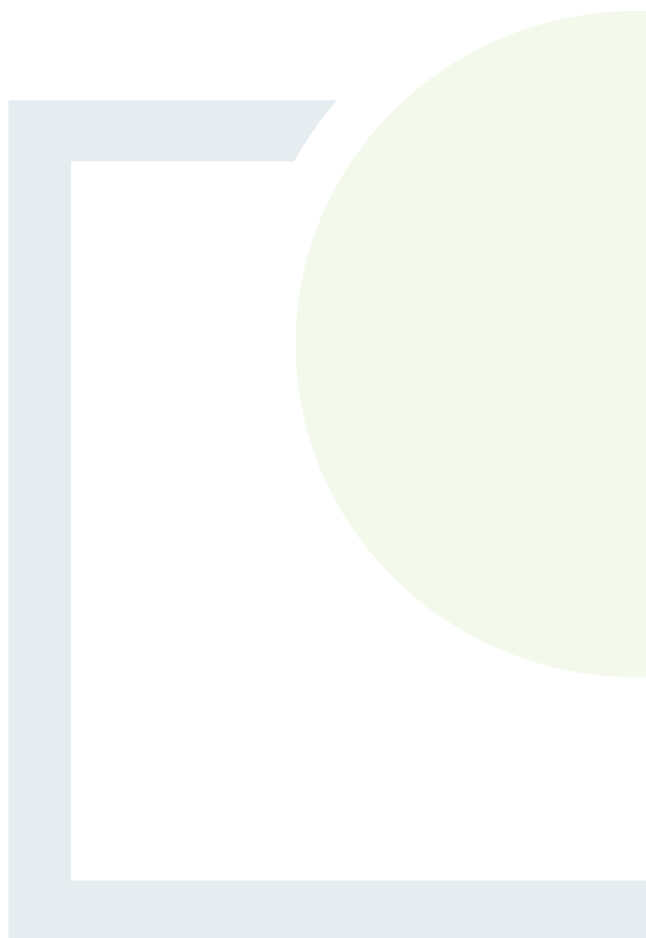




Photo 1 Location ID 002 – Well defined Enclosed Depression



Photo 2 Location ID 003 – Well defined Enclosed Depression



Photo 3 Location ID 007 – Limestone boulder displaying dissolution weathering features



Photo 4 Location ID 012 – Well defined water filled Enclosed Depression



Photo 5 Location ID 013 – Well defined Enclosed Depression



Photo 6 Location ID 014 – Possible Enclosed Depression



Photo 7 Location ID 016 – Possible Turlough (part of a cluster of irregularly shaped water filled depressions)



Photo 8 Location ID 029 – Enclosed Depression (subtle circular shaped depression)



Photo 9 Location ID 032 – Possible Enclosed Depression (oval shaped depression ~ 1.5-2m deep).



Photo 10 Location ID 034 – Well defined Enclosed Depression



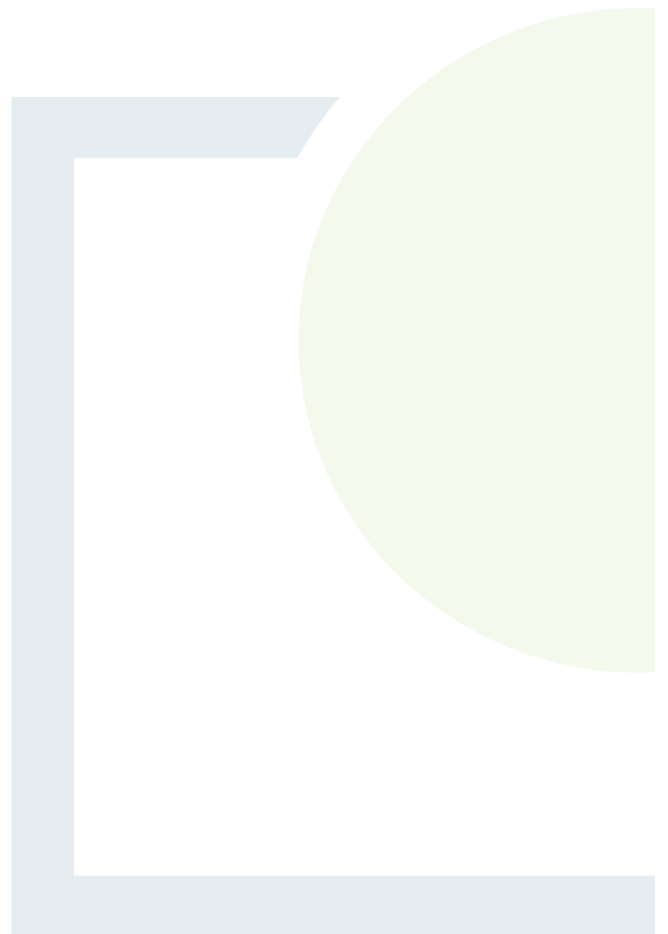
Photo 11 Location ID 035 – Well defined Enclosed Depression



DESIGNING AND DELIVERING
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APPENDIX **B**

Ground Investigation
Factual Report





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Ground Investigations Ireland Shancloon Wind Farm Phase 1 Fehily Timoney and Company Ground Investigation Report October 2023





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DOCUMENT CONTROL SHEET

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Engineer	Fehily Timoney and Company
Client	RWE Renewables
Project No	12499-01-23
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Final	J Cashen	B Sexton	F McNamara	Dublin	14 July 2023
B	Final	J Cashen	B Sexton	F McNamara	Dublin	06 October 2023

Ground Investigations Ireland Ltd. present the results of the fieldworks and laboratory testing in accordance with the specification and related documents provided by or on behalf of the client. The possibility of variation in the ground and/or groundwater conditions between or below exploratory locations or due to the investigation techniques employed must be taken into account when this report and the appendices inform designs or decisions where such variation may be considered relevant. Ground and/or groundwater conditions may vary due to seasonal, man-made or other activities not apparent during the fieldworks and no responsibility can be taken for such variation. The data presented and the recommendations included in this report and associated appendices are intended for the use of the client and the client's geotechnical representative only and any duty of care to others is excluded unless approved in writing.



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GROUND INVESTIGATIONS IRELAND

Geotechnical & Environmental

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APPENDICES

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Appendix 2	Trial Pit Records
Appendix 3	Rotary Borehole Records
Appendix 4	Groundwater Monitoring
Appendix 5	Laboratory Testing

1.0 Preamble

On the instructions of Fehily Timoney and Company, a site investigation was carried out by Ground Investigations Ireland Ltd. (GII) between March and June 2023 at the site of the proposed wind farm in Shancloon, County Galway.

2.0 Overview

2.1. Background

Construction of a new wind farm with associated substation, cabling and access road network is proposed at the site in Shancloon, County Galway. The site is located between 8km and 12km west of Tuam, County Galway. At the time of the site investigation the site was greenfield and consisted of a mixture of agricultural land and peatland.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 22 No. Trial Pits to a maximum depth of 4.50m BGL
- Carry out 22 No. Rotary Core Boreholes to a maximum depth of 23.00m BGL
- Installation of 18 No. Groundwater monitoring wells
- Geotechnical & Chemical Laboratory testing
- Factual Report

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing were undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling. The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015+A1:2020.

3.2. Trial Pits

The trial pits were excavated using a 13-tonne tracked excavator in agricultural lands, and a 13 tonne wide tracked excavator in areas of peatland. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered, and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Rotary Boreholes

The rotary coring was carried out by track mounted T44 and T41 Beretta rigs at the locations shown on the site plans included in appendix 1. The rotary boreholes were completed from the ground surface.

The T44 and T41 Berettas are equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The rigs utilise a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the “overshoot” recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids.

It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 3 of this Report.

3.4. Surveying

The exploratory hole locations have been recorded using a KQGeo M8 GNSS System which records the coordinates and elevation of the locations to ITM as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.5. Groundwater Monitoring Installations

Groundwater Monitoring Installations were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm uPVC/HDPE slotted pipe with a pea gravel response zone and bentonite

seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.6. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and chemical testing to assist in the classification of soils and to provide information for the proposed design.

Chemical testing as required by the specification, including pH, water soluble sulphate, and sulphate testing was carried out by Element Materials Technology Laboratory in the United Kingdom (UK).

Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), and hydrometer tests were carried out by Professional Soils Laboratory (PSL) in the UK.

Rock strength testing including Point Load (I_{s50}) and Unconfined Compressive Strength (UCS) testing was also carried out by Professional Soils Laboratory (PSL) in the UK.

The results of the laboratory testing are included in Appendix 5 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to in-situ and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were variable across the site but generally comprised;

- Topsoil / Peat
- Cohesive Deposits
- Granular Deposits
- Very Coarse Deposits/Weathered Bedrock
- Bedrock

TOPSOIL: Topsoil or peaty Topsoil was encountered at most exploratory holes and was present to a maximum depth of 0.30m BGL.

PEAT: Peat was encountered at PBH-01, PBH-02, PBH-05, PBH-07, PBH-14, PBH-15, PBH-16, PBH-17, PBH-20, PBH-21, PTP-10, PTP-11, and PTP-15 and were present to variable depths across the site. In the open peatland areas, the thickest deposits were recorded at PBH-05 and PBH-16 and were present to a depth of between 4.00m and 5.50m BGL., Reduced recovery in the rotary core runs made it difficult to accurately determine the depth at which the change in strata occurs. In the agricultural grassed areas,

the thickest deposits were recorded at PTP-19 and PTP21 and were present to a depth of 1.60m and 1.30m BGL, respectively.

MADE GROUND: Made Ground deposits were encountered from surface at PTP-01, and beneath the topsoil at PTP-20 and were present to a depth of 0.40m and 1.20m BGL, respectively. These deposits were described generally as *brown / dark brown slightly sandy slightly gravelly silty Clay / peaty Clay* and contained *rare fragments of string, ceramic, roots, and metal*.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the topsoil, made ground and/or peat at most locations. These deposits were predominantly described as *light brown/grey slightly sandy gravelly silty CLAY*. However, at peatland areas a *slightly sandy silty CLAY* was often recorded directly beneath the peat and was noted as a marl in the drilling records. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content, where noted on the exploratory hole logs.

GRANULAR DEPOSITS: Granular deposits were encountered below the made ground at PTP-01, and within or below the cohesive deposits at several other locations and were typically described as *grey silty sandy subangular to subrounded fine to coarse GRAVEL*. The secondary sand and fines constituents varied across the site and with depth, while low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content was also present, where noted on the exploratory hole logs.

VERY COARSE DEPOSITS / POSSIBLE WEATHERED BEDROCK: Very coarse soils consisting of COBBLES and BOULDERS of limestone with variable amounts of finer material were observed at many of the rotary borehole exploratory hole locations at depth. These deposits were often noted as possible weathered bedrock and preceded solid bedrock. The secondary constituents present within the deposit consisted of *clayey sandy Gravel*, with the mass of the constituents varying between a little (<5%), some (5%-20%) or much (20%-50%), where noted on the exploratory hole logs.

BEDROCK: The rotary core boreholes recovered *medium strong to very strong thinly bedded to thickly bedded dark grey fine grained fossiliferous argillaceous LIMESTONE*. This is typical of the Ardnasillagh Formation, which is noted on Geological Survey Ireland's (GSI) geological mapping of the site. The degree of weathering ranged from fresh to highly weathered. Rare visible pyrite veins were noted during logging which are often present in argillaceous limestones.

The depth to rock varies from 5.20m BGL in PBH-21 to a maximum of 17.00m BGL in PBH-09. The total core recovery is good, typically 100% with some of the uppermost runs dropping to 80 or 90%. The SCR and RQD both are relatively poor in the upper weathered zone, often recovered as non-intact, however both indices show an increase with depth in each of the boreholes.

Two features of note were observed. At PBH-16, a possible fault zone was recorded. Within the zone a limestone-derived dark grey/black cohesive gouge material was present and was persistent for 1.80m between intact portions of bedrock.

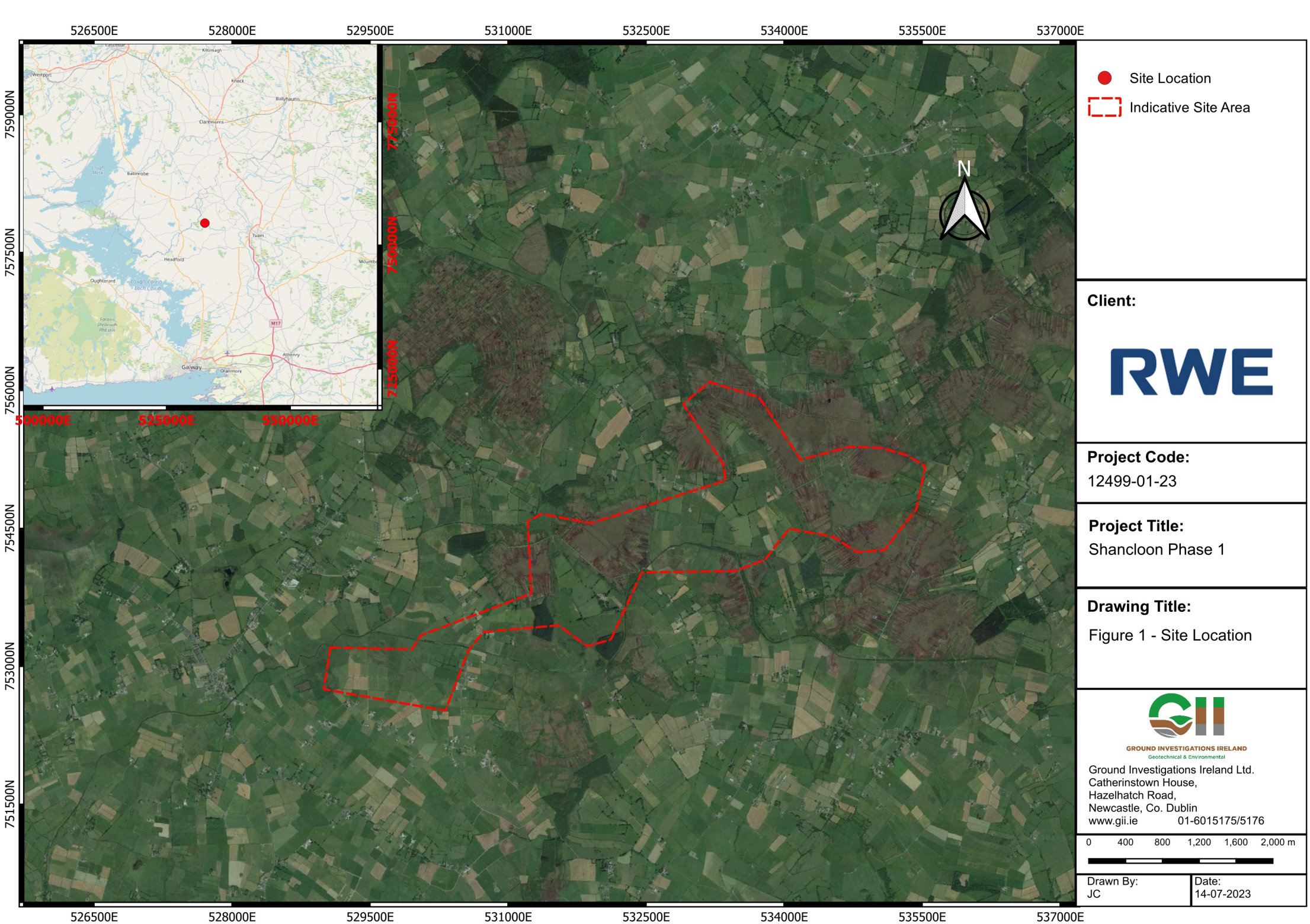
At PBH-18 a possible karst zone was noted between 8.50m to 14.80m BGL. The reduced recovery and brown clay infill are indicative of karst bedrock. Calcite veins and the bleaching of rock along fractures are indicative of faulting and associated hydrothermal activity. A large fault line is noted within 180m of the borehole on the GSI geological mapping of the site, while the nearest karst feature is recorded as an enclosed depression located 1.7km from the site.

4.2. Groundwater

Groundwater strikes are noted on the trial pit logs where they occurred. Water strikes were not able to be accurately identified during the rotary core drilling as water is added as part of the drilling process. Therefore, no remarks on groundwater are included on the rotary core logs. It should be noted that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed at most of the rotary borehole locations to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 4 of this Report.

APPENDIX 1 - Figures





526500E 528000E 529500E 531000E 532500E 534000E 535500E 537000E

759000N

757500N

756000N

754500N

753000N

751500N

526500E 528000E 529500E 531000E 532500E 534000E 535500E 537000E

● Site Location
▭ Indicative Site Area

Client:

RWE

Project Code:

12499-01-23

Project Title:

Shanclon Phase 1

Drawing Title:

Figure 1 - Site Location



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0 400 800 1,200 1,600 2,000 m

Drawn By:
JC

Date:
14-07-2023



-  Trial Pit
-  Rotary Borehole

Client:



Project Code:

12499-01-23

Project Title:

Shanclon Phase 1

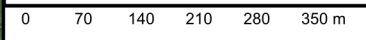
Drawing Title:

Figure 2 - Western Portion of Site



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Drawn By:
JC

Date:
14-07-2023



-  Trial Pit
-  Rotary Borehole

Client:



Project Code:

12499-01-23

Project Title:

Shancloon Phase 1

Drawing Title:

Figure 3 - Central Portion of Site



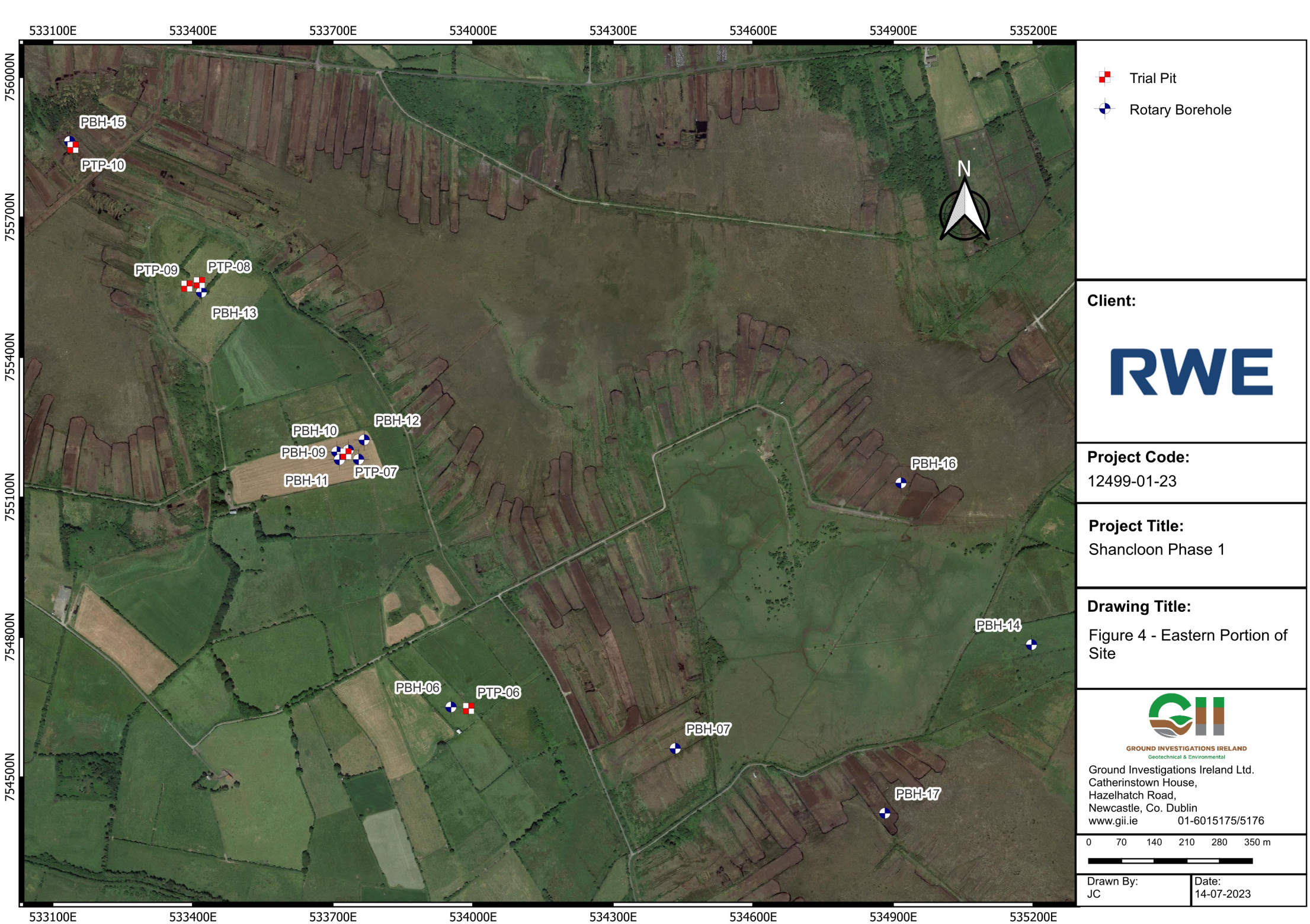
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0 70 140 210 280 350 m

Drawn By:
JC

Date:
14-07-2023



-  Trial Pit
-  Rotary Borehole

Client:



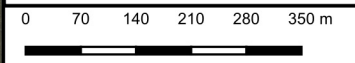
Project Code:
12499-01-23

Project Title:
Shancloon Phase 1

Drawing Title:
Figure 4 - Eastern Portion of Site



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Drawn By:
JC

Date:
14-07-2023



Trial Pit



Rotary Borehole

Client:

RWE

Project Code:

12499-01-23

Project Title:

Shancloon Phase 1

Drawing Title:

Figure 5 - Proposed Turbine 8 Area



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0 5 10 15 20 25 m

Drawn By:
JC

Date:
14-07-2023

APPENDIX 2 – Trial Pit Records





Site	Shancloon Phase 1
-------------	-------------------

**Trial Pit
Number**
PTP-01

Machine : 13T tracked excavator
Method : Trial Pit

Dimensions
5.20m x 4.00m x 3.70m
(L x W x D)

Ground Level (mOD)
29.64

Client	RWE Renewables
---------------	----------------

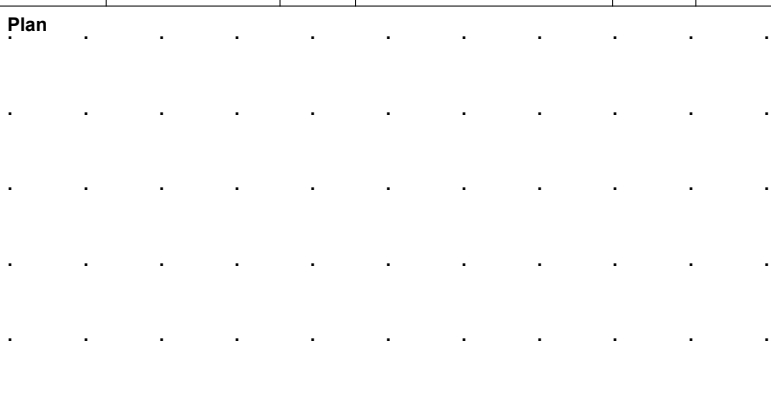
Job Number	12499-01-23
------------	-------------

Location	531412 2 E 754486 9 N
----------	-----------------------

Dates	13/03/2023
--------------	------------

Engineer
Fehily Timoney

Sheet
1/1

<div>Plan</div> 	Remarks		
	Groundwater encountered at 0.50m BGL; Seepage		
	Trial pit unstable; Side walls collapsed		
	Shear hand vanes not completed at all scheduled depths due to high granular content of material		
	Trial pit terminated due to side walls collapse		
	Trial pit backfilled upon completion		
	Scale (approx)	Logged By	Figure No.
1:40	CMP	12499-01-23.PTP-0	



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Site
Shancloon Phase 1

Trial Pit Number
PTP-02

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 5.20m x 3.20m x 4.50m (L x W x D)	Ground Level (mOD) 30.10	Client RWE Renewables	Job Number 12499-01-23
	Location 531445.6 E 754432 N	Dates 13/03/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50	B D			29.70	(0.40) 0.40	Possible MADE GROUND: Dark brown slightly sandy slightly gravelly peaty Clay with occasional roots		
				29.30	(0.40) 0.80	Soft dark grey slightly sandy gravelly CLAY with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
1.50 1.50	B D				(2.20)	Grey silty clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content. Visually assessed as loose to medium dense.		
2.50 2.50	B D			27.10	3.00	Firm grey slightly sandy very gravelly silty CLAY with high cobble and boulder		
3.50 3.50	B D				(1.50)			
4.50 4.50	B D			25.60	4.50	Terminated at 4.50m		

Plan .	Remarks No groundwater encountered Trial pit unstable; Side walls collapsed Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit terminated due to side walls collapse Trial pit backfilled upon completion		
	Scale (approx) 1:40	Logged By CMP	Figure No. 12499-01-23.PTP-02



Site	Shancloon Phase 1
-------------	-------------------

**Trial Pit
Number**
PTP-03

Machine : 13T tracked excavator
Method : Trial Pit

Dimensions
5.70m x 1.20m x 5.10m
(L x W x D)

Ground Level (mOD)	33.70
--------------------	-------

Client	RWE Renewables
---------------	----------------













Job Number 12499-01-23

Location	531871 3 E 753415 N
-----------------	---------------------

Dates	13/03/2023
--------------	------------

Engineer
Fehily Timoney

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50 0.70 0.70	HV 58.67kPa HVR 26.67kPa B D		60,48,68/Av. 58.67 28,20,32/Av. 26.67	33.50	(0.20) 0.20	MADE GROUND: Brown slightly sandy slightly gravelly Clay with rare fragments of string		
				33.20	(0.30) 0.50	Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse.		
					(0.70)	Firm brown slightly sandy gravelly CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
				32.50	1.20	Firm to stiff brownish grey slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
1.50 1.50	B D				(0.80)			
				31.70	2.00	Stiff to very stiff grey slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
2.50 2.50	B D				(1.30)			
				30.40	3.30	Very stiff grey slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
3.50 3.50	B D				(1.50)			
4.50 4.50	B D							
				28.90	4.80	Very stiff dark grey slightly sandy very gravelly CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
5.10 5.10	B D			28.60	(0.30) 5.10			
						Complete at 5.10m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Shear hand vanes not completed at all scheduled depths due to high granular content of material
Trial pit backfilled upon completion

Scale (approx)

1:40

Logged By

CMP

Figure No.

12499-01-23.PTP-03



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Site
Shancloon Phase 1

Trial Pit Number
PTP-04

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 5.40m x 1.20m x 3.10m (L x W x D)	Ground Level (mOD) 31.17	Client RWE Renewables	Job Number 12499-01-23
	Location 531859.8 E 753375.4 N	Dates 13/03/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50 0.50 0.50	HV 76.67kPa B HVR 33kPa D		90,76,64/Av. 76.67 38,30,31/Av. 33.00	30.97 30.47	(0.20) 0.20 (0.50) 0.70	TOPSOIL with occasional roots Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse. Firm to stiff grey slightly sandy gravelly CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.	 	
1.50 1.50	B D				(1.60)			
2.50 2.50	B D			28.87	2.30 (0.80)	Stiff to very stiff grey slightly sandy gravelly CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
			Seepage(1) at 3.10m.	28.07	3.10	Obstruction: Encountered possible Boulders/Bedrock Complete at 3.10m		▽1

Plan .	Remarks Groundwater encountered at 3.10m BGL; Seepage Trial pit unstable; Side walls spalling Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion		
	Scale (approx) 1:40		
	Logged By CMP		
	Figure No. 12499-01-23.PTP-04		



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Site
Shancloon Phase 1

Trial Pit Number
PTP-06

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.80m x 1.20m x 3.30m (L x W x D)	Ground Level (mOD) 37.30	Client RWE Renewables	Job Number 12499-01-23
	Location 533990.6 E 754645.4 N	Dates 14/03/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50	HV 76.67kPa HVR 33kPa		90,76,64/Av. 76.67 38,30,31/Av. 33.00	37.00	(0.30) 0.30 (0.30)	TOPSOIL Soft brown slightly sandy slightly gravelly CLAY		
1.00 1.00	B D			36.70	0.60 (0.60)	Brownish grey slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse. Assessed as loose to medium dense using a shovel on side wall.		
2.00 2.00	B D			36.10	1.20 (1.40)	Soft to firm brownish grey slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
3.00 3.00	B D			34.70	2.60 (0.70)	Very stiff dark grey slightly sandy gravelly CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
				34.00	3.30	Obstruction: Encountered possible Boulders/Bedrock Complete at 3.30m		

Plan 	Remarks No groundwater encountered Trial pit stable Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion		
	Scale (approx) 1:40	Logged By CMP	Figure No. 12499-01-23.PTP-06



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Site
Shancloon Phase 1

Trial Pit Number
PTP-07

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 5.00m x 2.10m x 4.20m (L x W x D)	Ground Level (mOD) 39.42	Client RWE Renewables	Job Number 12499-01-23
	Location 533727.7 E 755190.8 N	Dates 14/03/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50	B D			39.12	(0.30) 0.30	TOPSOIL		
					(0.70)	Grey slightly clayey gravelly fine to coarse SAND with medium cobble content and low boulder content. Assessed as loose to medium dense using a shovel on side wall.		
1.50 1.50	B D			38.42	1.00	Firm grey sandy gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
					(1.20)			
2.50 2.50	B D			37.22	2.20	Firm grey very sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
					(1.60)			
3.50 3.50	B D		Seepage(1) at 3.20m.	35.62	3.80	Stiff grey slightly sandy very gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		∇ ₁
					(0.40)			
4.20 4.20	B D		Seepage(2) at 4.20m.	35.22	4.20	Obstruction: Encountered possible Boulders/Bedrock		∇ ₂
						Complete at 4.20m		

Plan .	Remarks Groundwater encountered at 3.20m and 4.20m BGL; Seepage Trial pit unstable; Side walls spalling Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion		
	Scale (approx) 1:40	Logged By CMP	Figure No. 12499-01-23.PTP-07



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Site
Shancloon Phase 1

Trial Pit
Number
PTP-08

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 5.60m x 2.30m x 3.80m (L x W x D)	Ground Level (mOD) 37.78	Client RWE Renewables	Job Number 12499-01-23
	Location 533413.8 E 755557.9 N	Dates 14/03/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50 0.70 0.70	HV 54kPa HVR 24kPa B D		48,56,58/Av. 54.00 18,24,30/Av. 24.00	37.48 37.18	(0.30) 0.30 (0.30) 0.60	TOPSOIL Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse. Firm grey slightly sandy gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
1.50 1.50	B D		Seepage(1) at 1.50m. Medium Ingress(2) at 1.80m.		(1.70)			∇1 ∇2
2.50 2.50	B D			35.48 34.98	2.30 (0.50) 2.80 (0.60)	Stiff to very stiff grey slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded. Very stiff grey slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.	 	
3.50 3.50	B D			34.38 33.98	3.40 (0.40) 3.80	Very stiff dark grey slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded. Obstruction: Encountered possible Boulders/Bedrock Complete at 3.80m		

Plan	Remarks Groundwater encountered at 1.50m and 1.80m BGL; Seepage and Medium Ingress Trial pit unstable; Side walls spalling Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion						
	Scale (approx) 1:40		Logged By CMP		Figure No. 12499-01-23.PTP-07		



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Site
Shancloon Phase 1

Trial Pit Number
PTP-09

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.00m x 2.20m x 4.00m (L x W x D)	Ground Level (mOD) 37.41	Client RWE Renewables	Job Number 12499-01-23
	Location 533387 E 755550.5 N	Dates 14/03/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50 0.50 0.50	HV 56kPa B RV 20.67kPa D		62,52,54/Av. 56.00 24,24,14/Av. 20.67	37.11	(0.30) 0.30 (0.60)	TOPSOIL Soft to firm brown slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
1.50 1.50	B D		Seepage(1) at 1.30m.	36.51	0.90 (1.30)	Soft to firm greyish brown slightly sandy gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		V1
2.50 2.50	B D		Medium Ingress(2) at 2.60m.	35.21	2.20 (0.80)	Firm to stiff grey slightly sandy very gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		V2
3.50 3.50	B D			34.41	3.00 (1.00)	Stiff dark grey sandy very gravelly clayey SILT with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
				33.41	4.00	Obstruction: Encountered possible Boulders/Bedrock Complete at 4.00m		

Plan 	Remarks Groundwater encountered at 1.30m and 2.60m BGL; Seepage and Medium Ingress Trial pit unstable; Side walls collapsed Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion		
	Scale (approx) 1:40	Logged By CMP	Figure No. 12499-01-23.PTP-09



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Site
Shancloon Phase 1

Trial Pit
Number
PTP-10

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 3.00m x 1.50m x 4.50m (L x W x D)	Ground Level (mOD) 35.54	Client RWE Renewables	Job Number 12499-01-23
	Location 533142.9 E 755847.9 N	Dates 12/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.50 1.50	B D				(3.10)	Very soft brown clayey pseudo fibrous PEAT with rare fragments of wood		
3.50 3.50	B D			32.44	3.10 (1.40)	Very soft grey sandy gravelly silty CLAY with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
4.50 4.50	B D		Seepage(1) at 4.50m.	31.04	4.50	Obstruction: Encountered possible Boulders/Bedrock Complete at 4.50m		▽1

Plan	Remarks
.	Groundwater encountered at 4.50m BGL; Seepage Trial pit stable Shear hand vanes not completed at all scheduled depths due to high gravel content of material and pit safety Trial pit backfilled upon completion
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	Scale (approx) 1:40
	Logged By CMP
	Figure No. 12499-01-23.PTP-10



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Site
Shancloon Phase 1

Trial Pit Number
PTP-11

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 5.20m x 2.40m x 3.80m (L x W x D)	Ground Level (mOD) 25.35	Client RWE Renewables	Job Number 12499-01-23
	Location 529143.4 E 753118.2 N	Dates 04/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	HV 4.67kPa B RV 2.33kPa D		5,4,5/Av. 4.67 2,3,2/Av. 2.33		25.15 (0.20)	Peaty TOPSOIL		Σ1
1.00					0.20 (0.50)	Very soft dark brown clayey pseudo fibrous PEAT		
1.00					24.65 0.70	Very soft light brown slightly sandy clayey SILT with organic fibres. Gravel is subangular to subrounded fine to coarse.		
2.00	HV 10.33kPa B RV 6.67kPa D		12,9,10/Av. 10.33 9,5,6/Av. 6.67		23.65 1.70	Very soft brownish grey slightly sandy silty CLAY with organic fibres. Gravel is subangular to subrounded fine to coarse.		
2.00					22.85 2.50	Very soft grey slightly sandy silty CLAY with rare organic fibres. Gravel is subangular to subrounded fine to coarse.		
2.00								
3.00	HV 8.67kPa B RV 4.33kPa D		9,8,9/Av. 8.67 4,5,4/Av. 4.33		(1.30)			
3.00								
3.00								
			Fast Ingress(1) at 2.70m.		21.55 3.80	Terminated at 3.80m BGL due to excavator sinking		
						Terminated at 3.80m		

Plan	Remarks Groundwater encountered at 2.70m BGL; Fast Ingress Trial pit stable Trial pit backfilled upon completion							
Scale (approx) 1:40						Logged By CMP	Figure No. 12499-01-23.PTP-11	



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Site
Shancloon Phase 1

Trial Pit Number
PTP-12

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.10m x 2.40m x 2.30m (L x W x D)	Ground Level (mOD) 27.63	Client RWE Renewables	Job Number 12499-01-23
	Location 529142.4 E 752928.4 N	Dates 04/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	B			27.43	(0.20)	TOPSOIL		
1.00	D			27.03	(0.40)	Soft to firm grey mottled brown slightly sandy gravelly silty CLAY with high cobble and boulder. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
				26.23	(0.80)	Firm grey sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
2.00	B		Seepage(1) at 2.00m.	25.33	(0.90)	Grey slightly silty slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content. Cobbles and boulders are subangular to subrounded.		V1
2.00	D				2.30	Obstruction: Encountered possible Boulders/Bedrock		
						Complete at 2.30m		

Plan .	Remarks Groundwater encountered at 2.00m BGL; Seepage Trial pit unstable; side walls spalling Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion		
	Scale (approx) 1:40		
	Logged By CMP		
	Figure No. 12499-01-23.PTP-12		



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Site
Shancloon Phase 1

Trial Pit Number
PTP-13

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.50m x 1.60m x 3.00m (L x W x D)	Ground Level (mOD) 30.18	Client RWE Renewables	Job Number 12499-01-23
	Location 529251.1 E 752937.5 N	Dates 04/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00 1.00	B D			29.98	(0.20) 0.20	TOPSOIL		
					(1.70)	Firm to stiff greyish brown sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
2.50 2.50	B D		Seepage(1) at 1.80m.	28.28	1.90	Stiff brown slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		∇ ₁
3.00 3.00	B D		Medium Ingress(2) at 2.30m.		(1.10)			∇ ₂
				27.18	3.00	Obstruction: Encountered possible Boulders/Bedrock Complete at 3.00m		

Plan .					Remarks Groundwater encountered at 1.80m and 2.30m BGL; Seepage and Medium Ingress Trial pit unstable; side walls spalling Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion			
					Scale (approx) 1:40	Logged By CMP	Figure No. 12499-01-23.PTP-13	



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Site
Shancloon Phase 1
Trial Pit Number
PTP-14

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.10m x 1.40m x 3.00m (L x W x D)	Ground Level (mOD) 27.30	Client RWE Renewables	Job Number 12499-01-23
	Location 529257.3 E 753119.3 N	Dates 04/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70 0.70	B D			27.10	(0.20) 0.20	Peaty TOPSOIL		
1.70 1.70	B D		Seepage(1) at 1.90m.	25.90	(1.20) 1.40	Firm grey mottled brown sandy gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		V1
2.70 2.70	B D			24.70	(0.40) 2.60	Stiff to very stiff grey sandy gravelly silty CLAY with high cobble content and medium boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
				24.30	3.00	Obstruction: Encountered possible Boulders/Bedrock Complete at 3.00m		

Plan	Remarks Groundwater encountered at 1.90m BGL; Seepage Trial pit stable Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion							
Scale (approx) 1:40						Logged By CMP	Figure No. 12499-01-23.PTP-14	



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Site
Shancloon Phase 1

Trial Pit
Number
PTP-15

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.20m x 1.90m x 3.30m (L x W x D)	Ground Level (mOD) 26.21	Client RWE Renewables	Job Number 12499-01-23
	Location 529702.1 E 752993.6 N	Dates 03/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50	B D			26.01	(0.20) 0.20	Peaty TOPSOIL		
					(0.40)	Very soft black slightly clayey amorphous PEAT		
25.61 0.50				25.61	0.60	Firm to stiff grey slightly sandy gravelly silty CLAY with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
					(1.00)			
24.61 1.50	B D			24.61	1.60	Grey silty clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Cobbles are subangular to subrounded.		
				24.21	(0.40)			
					2.00	Stiff to very stiff grey slightly sandy gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		Σ1
2.50 2.50	B D		Medium Ingress(1) at 2.10m.		(1.30)			
				22.91	3.30	Obstruction: Encountered possible Boulders/Bedrock		
3.30 3.30	B D					Complete at 3.30m		

Plan	Remarks Groundwater encountered at 2.10m BGL; Medium Ingress Trial pit unstable; side walls spalling Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion							
Scale (approx) 1:40						Logged By CMP	Figure No. 12499-01-23.PTP-15	



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Site
Shancloon Phase 1

Trial Pit Number
PTP-16

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.60m x 1.90m x 3.20m (L x W x D)	Ground Level (mOD) 35.57	Client RWE Renewables	Job Number 12499-01-23
	Location 534916.6 E 755129 N	Dates 03/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50	B D			35.17 34.87	(0.40) 0.40 (0.30) 0.70	Peaty TOPSOIL Very soft light greyish brown slightly sandy clayey SILT with organic fibres Very soft grey slightly sandy silty CLAY with medium boulder content. Boulders are subangular to subrounded		
1.50 1.50	B D				(1.20)			
2.70 2.70	B D		Seepage(1) at 1.90m.	33.67 32.37	1.90 (1.30) 3.20	Stiff to very stiff grey slightly sandy gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded. Terminated at 3.20m		V ₁

Plan .	Remarks Groundwater encountered at 1.90m BGL; Seepage Trial pit unstable; side walls collapsed Shear hand vanes not completed at all scheduled depths due to pit safety Trial pit terminated due to side walls collapse Trial pit backfilled upon completion		
	Scale (approx) 1:40	Logged By CMP	Figure No. 12499-01-23.PTP-16



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Site
Shancloon Phase 1

Trial Pit
Number
PTP-17

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.50m x 2.40m x 3.50m (L x W x D)	Ground Level (mOD) 29.41	Client RWE Renewables	Job Number 12499-01-23
	Location 529709.4 E 752806.1 N	Dates 03/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.50 1.50	B D		Seepage(1) at 1.70m.	29.21	(0.20) 0.20	Peaty TOPSOIL		
					(1.60)	Firm grey mottled brown slightly sandy gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
2.50 2.50	B D			27.61	1.80	Firm to stiff grey sandy gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
					(0.90)	Encountered multiple gravel lens between 1.80m and 2.70m BGL		
2.50 2.50	B D			26.71	2.70	Very stiff grey slightly sandy gravelly silty CLAY with high cobble content and medium boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
					(0.80)			
3.50 3.50	B D			25.91	3.50	Obstruction: Encountered possible Boulders/Bedrock		
						Complete at 3.50m		

Plan



Site	Shancloon Phase 1
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**Trial Pit
Number**
PTP-18

Machine : 13T tracked excavator
Method : Trial Pit

Dimensions
4.80m x 2.40m x 3.70m
(L x W x D)

Ground Level (mOD)	29.07
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Client	RWE Renewables
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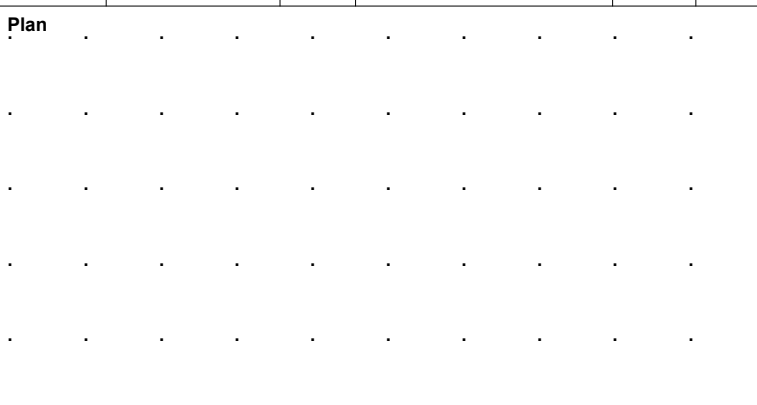
Job Number 12499-01-23

Location	529837 1 E 752825 1 N
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Dates	03/05/2023
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Engineer
Fehily Timoney

Sheet
1/1

<div>Plan</div> 	Remarks		
	Groundwater encountered at 1.80m BGL; Seepage Trial pit unstable; side walls collapsed Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion		
Scale (approx)	Logged By	Figure No.	
1:40	CMP	12499-01-23.PTP-1	



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Site
Shancloon Phase 1

Trial Pit Number
PTP-19

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.50m x 1.20m x 3.00m (L x W x D)	Ground Level (mOD) 26.96	Client RWE Renewables	Job Number 12499-01-23
	Location 530029.1 E 752907.3 N	Dates 03/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	B D		Seepage(1) at 0.70m.	26.76	(0.20) 0.20	Peaty TOPSOIL		V1
1.00						Very soft dark brown clayey pseudo fibrous PEAT with occasional fragments of wood		
2.50	B D		Medium Ingress(2) at 2.30m.	25.36	(1.40) 1.60	Very soft grey slightly sandy slightly gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		V2
2.50				24.66	(0.70) 2.30	Firm to stiff grey sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
3.00	B D			23.96	(0.70) 3.00	Obstruction: Encountered possible Boulders/Bedrock		
3.00						Complete at 3.00m		

Plan 	Remarks Groundwater encountered at 0.70m and 2.30m BGL; Seepage and Medium Ingress Trial pit unstable; side walls collapsed Shear hand vanes not completed at all scheduled depths due to pit safety Trial pit backfilled upon completion		
	Scale (approx) 1:40	Logged By CMP	Figure No. 12499-01-23.PTP-17



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Site
Shancloon Phase 1

Trial Pit Number
PTP-20

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.40m x 1.20m x 4.00m (L x W x D)	Ground Level (mOD) 29.41	Client RWE Renewables	Job Number 12499-01-23
	Location 529952.7 E 752736 N	Dates 02/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00 1.00	B D			29.21 0.20 28.91 0.50 28.71 0.20 0.70 28.21 1.20	(0.20) 0.20 (0.30) 0.50 (0.20) 0.70 (0.50)	Peaty TOPSOIL MADE GROUND: Brownish grey slightly sandy gravelly silty Clay with medium boulder content MADE GROUND: Brown slightly sandy slightly gravelly silty Clay MADE GROUND: Brown mottled grey slightly sandy gravelly silty Clay with rare fragments of metal		
2.00 2.00	B D			26.81 2.60	(1.40)	Firm grey slightly sandy gravelly silty CLAY with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
3.00 3.00	B D		Seepage(1) at 2.70m.	25.41 4.00	(1.40)	Very stiff light brownish grey slightly sandy gravelly silty CLAY with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		Σ1
4.00 4.00	B D				4.00	Obstruction: Encountered possible Boulders/Bedrock Complete at 4.00m		

Plan .	Remarks Groundwater encountered at 2.70m BGL; Seepage Trial pit unstable; side walls spalling Shear hand vanes not completed at all scheduled depths due to high granular content of material Trial pit backfilled upon completion		
	Scale (approx) 1:40	Logged By CMP	Figure No. 12499-01-23.PTP-20



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Site
Shancloon Phase 1

Trial Pit Number
PTP-21

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.80m x 1.20m x 3.80m (L x W x D)	Ground Level (mOD) 26.78	Client RWE Renewables	Job Number 12499-01-23
	Location 529920 E 752955.6 N	Dates 03/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B D			26.58	(0.20) 0.20	Peaty TOPSOIL		
0.50					(1.10)	Very soft dark brown clayey pseudo fibrous PEAT with occasional fragments of wood		
1.50	HV 13kPa B RV 6.33kPa D		12,14,13/Av. 13.00 6,7,6/Av. 6.33	25.48	1.30	Very soft brownish grey slightly sandy silty CLAY with organic fibres		
1.50					(1.00)			
1.50				24.48	2.30	Soft to firm grey slightly sandy slightly gravelly silty CLAY with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
2.70	HV 38kPa B RV 18kPa D		46,30,38/Av. 38.00 20,15,19/Av. 18.00 Medium Ingress(1) at 3.20m.	23.88	2.90	Grey silty clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content. Cobbles and boulders are subangular to subrounded.		V1
2.70					(0.90)			
2.70				22.98	3.80	Terminated at 3.80m BGL due to excavator sinking Terminated at 3.80m		

Plan 	Remarks Groundwater encountered at 3.20m BGL; Medium Ingress Trial pit unstable; side walls collapsed Shear hand vanes not completed at all scheduled depths due to pit safety Trial pit backfilled upon completion		
	Scale (approx) 1:40	Logged By CMP	Figure No. 12499-01-23.PTP-21



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Site
Shancloon Phase 1

Trial Pit Number
PTP-22

Machine : 13T tracked excavator Method : Trial Pit	Dimensions 4.60m x 2.40m x 3.50m (L x W x D)	Ground Level (mOD) 28.89	Client RWE Renewables	Job Number 12499-01-23
	Location 529846.5 E 752783.4 N	Dates 03/05/2023	Engineer Fehily Timoney	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70 0.70 0.70 0.70	HV 48.33kPa B RV 25.33kPa D		50,46,49/Av. 48.33 24,25,27/Av. 25.33	28.69	(0.20) 0.20	Peaty TOPSOIL		
					(1.10)	Firm grey mottled brown slightly sandy gravelly silty CLAY with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded.		
2.00 2.00	B D		Medium Ingress(1) at 2.30m.	27.59	1.30	Grey silty clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content. Cobbles and boulders are subangular to subrounded.		
3.00 3.00	B D				(2.20)			Σ1
				25.39	3.50	Obstruction: Encountered possible Boulders/Bedrock Complete at 3.50m		

Plan	Remarks Groundwater encountered at 2.30m BGL; Medium Ingress Trial pit unstable; side walls collapsed Shear hand vanes not completed at all scheduled depths due to high gravel content of material Trial pit backfilled upon completion							
Scale (approx) 1:40						Logged By CMP	Figure No. 12499-01-23.PTP-22	



**Trial Pit
Number**
PTP-23

Job Number	12499-01-23
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Sheet
1/1

12499-01-23.PTP-23

Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-01



PTP-01



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-01



PTP-01



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-02



PTP-02



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-02



PTP-02



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-02



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-03



PTP-03



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-03



PTP-03



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-03



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-04



PTP-04



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-04



PTP-04



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-04



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-06



PTP-06



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-06



PTP-06



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-06



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-07



PTP-07



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-07



PTP-07



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-07



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-08



PTP-08



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-08



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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-09



PTP-09



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-09



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-10



PTP-10



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-10



PTP-10



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-10



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-11



PTP-11



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-11



PTP-11



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-11



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-12



PTP-12

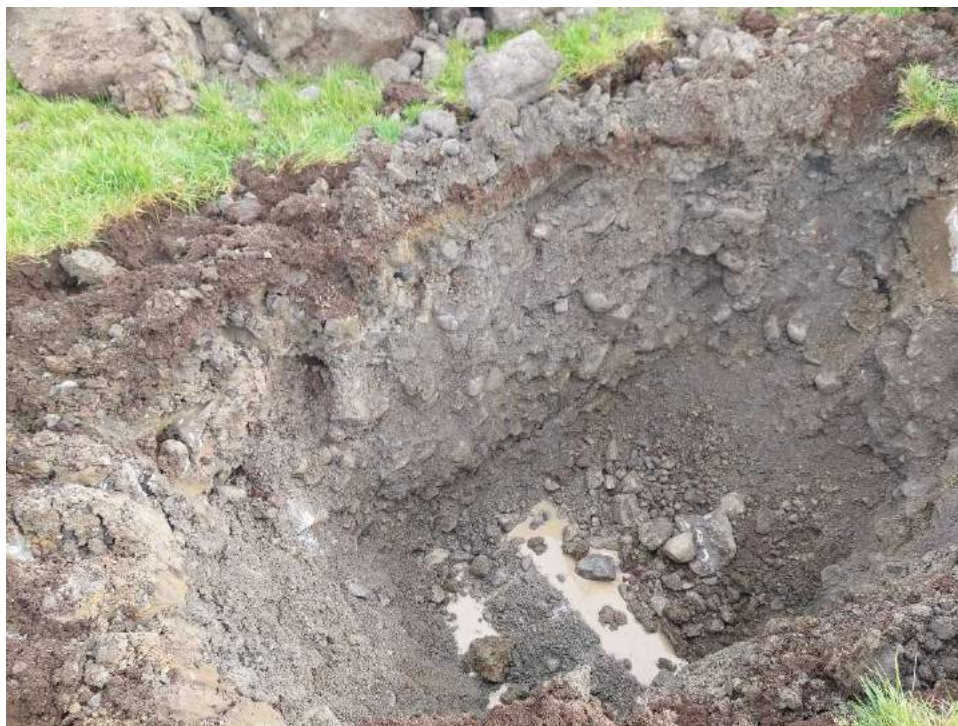


Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-12



PTP-12



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-12



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-13



PTP-13



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-13



PTP-13



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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PTP-14



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-14



PTP-14



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-14



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-15



PTP-15



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-15



PTP-15



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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PTP-16



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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Shancloon Wind Farm Phase 1 – Trial Pit Photographs

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PTP-23



Shancloon Wind Farm Phase 1 – Trial Pit Photographs

PTP-23



APPENDIX 3 – Rotary Borehole Records





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Site
Shancloon Phase 1

Borehole Number
PBH-01

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Method : Rotary Cored	Casing Diameter 146mm cased to 18.50m		Ground Level (mOD) 28.08	Client RWE Renewables	Job Number 12499-01-23
	Location 532143 E 754106.9 N		Dates 13/04/2023-17/04/2023	Engineer Fehily Timoney	Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00								Recovery consists of brown slightly clayey pseudo fibrous PEAT. Driller notes: PEAT			
2.00 2.00-2.45	15				1,0/0,1,0,0 SPT(C) N=1	26.08	2.00 (2.00)	Recovery consists of brown pseudo fibrous PEAT onto grey silty CLAY. Driller notes: PEAT onto soft Marl (Very soft)			
3.50 3.50-3.95	53				1,0/1,0,1,0 SPT(C) N=2	24.58	3.50 (1.50)	No recovery. Driller notes: soft wet Marl.			
5.00 5.00-5.45	0				0,0/1,0,0,0 SPT(C) N=1		(3.00)				
6.50 6.50-6.95	0				0,1/0,0,1,0 SPT(C) N=1	21.58	6.50 (1.50)	Recovery consists of grey subrounded smooth COBBLES of limestone. Driller notes: fine to medium Gravel with cobbles (Very loose)			
8.00 8.00-8.20	65				10,12/50 SPT(C) 50/50	20.08	8.00 (1.50)	Recovery consists of grey subangular to rounded medium to coarse GRAVEL with medium cobble content. Cobbles are subrounded smooth limestone. Driller notes: Cobbles and Gravels (Dense).			
9.50 9.50-9.55					25/50 SPT(C) 25*/50 50/0	18.58	9.50	Dense grey slightly clayey slightly sandy angular to subrounded fine to coarse GRAVEL with high cobble content. Cobbles are subrounded smooth limestone.			

Remarks Bentonite seal from 18.50m to 17.50m BGL. 50mm slotted standpipe with gravel surround installed from 17.50m to 14.00m BGL. 50mm plain standpipe with bentonite seal from 14.00m BGL to GL.Finished with a raised cover. Borehole complete at 18.50m BGL.	Scale (approx) 1:50	Logged By SB
	Figure No. 12499-01-23.PBH-01	



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Site
Shancloon Phase 1

Borehole
Number
PBH-01

Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Method : Rotary Cored	Casing Diameter 146mm cased to 18.50m	Ground Level (mOD) 28.08	Client RWE Renewables	Job Number 12499-01-23
	Location 532143 E 754106.9 N	Dates 13/04/2023- 17/04/2023	Engineer Fehily Timoney	Sheet 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.00	85						(1.50)				
11.00-11.05					25/50 SPT(C) 25*/50 50/0	17.08	11.00	Dense dark grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble content. Cobbles are subrounded smooth limestone.			
	87						(1.10)				
12.50					17.8/50 SPT(C) 25*/125 50/0	15.98	12.10	Dense grey subrounded smooth COBBLES and BOULDERS of limestone with some slightly clayey slightly sandy Gravel (possible weathered rock)			
12.50-12.63	100						(2.50)				
14.00											
14.60	100	60	53			13.48	14.60	Strong to very strong dark grey thinly to medium bedded fine grained argillaceous LIMESTONE. Fresh to slightly weathered.			
15.50											
	100	100	100	4			(3.90)				
17.00								(14.60 to 18.50m BGL) One fracture set. F1 0 to 20 degrees, very closely to medium spaced, planar, smooth with clay smearing			
	100	100	100								
18.50						9.58	18.50	Complete at 18.50m			

Remarks

Scale (approx)
1:50

Logged By
SB

Figure No.
12499-01-23.PBH-01



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Site
Shancloon Phase 1

Borehole
Number
PBH-02

Machine : Beretta T44 Flush : Water-Polymer Mix Core Dia: 102 mm Method : Rotary Cored	Casing Diameter 146mm cased to 15.30m		Ground Level (mOD) 29.93	Client RWE Renewables	Job Number 12499-01-23
	Location 531442.1 E 754454 N		Dates 10/03/2023- 14/03/2023	Engineer Fehily Timoney	Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00						29.73	(0.20) 0.20	Very soft brown clayey pseudo fibrous PEAT			
	50						(1.80)	Recovery consists of light grey sandy gravelly CLAY with medium cobble and boulder content. Driller notes: Clay onto Sand and Gravel.			
2.00 2.00-2.38					10,10/13,12,25 SPT(C) 50/225	27.93	2.00	Recovery consists of grey subrounded smooth COBBLES and BOULDERS of Limestone with some slightly sandy gravelly silty Clay. Driller notes: Sand and Gravel with cobbles (Dense)			
	47										
3.50 3.50-3.50					25/50 SPT(C) 25*/0 50/0		(4.50)				
	40										
5.00 5.00-5.15					13,12/50 SPT(C) 50/0						
	47										
6.50 6.50-6.75					10,16/35,15 SPT(C) 50/100	23.43	6.50	Very stiff light brownish grey slightly sandy gravelly silty CLAY with low cobble and boulder content. Cobbles are subrounded smooth limestone.			
	93										
8.00 8.00-8.08					25/50 SPT(C) 25*/50 50/25		(4.10)				
	70										
9.50 9.50-9.58					25/50 SPT(C) 25*/50 50/25						

Remarks Bentonite seal installed from 15.30m to 14.80m BGL. 50mm slotted standpipe installed from 14.80m to 11.80m BGL. 50mm plain standpipe with a bentonite seal installed from 11.80m BGL to GL with a raised cover. Borehole complete at 15.30m BGL.	Scale (approx)	Logged By
	1:50	AB
	Figure No. 12499-01-23.PBH-04	






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Site
Shancloon Phase 1

Borehole
Number
PBH-02

Machine : Beretta T44	Casing Diameter	Ground Level (mOD)	Client	Job Number
Flush : Water-Polymer Mix	146mm cased to 15.30m	29.93	RWE Renewables	12499-01-23
Core Dia: 102 mm	Location 531442.1 E 754454 N	Dates 10/03/2023-14/03/2023	Engineer Fehily Timoney	Sheet 2/2
Method : Rotary Cored				

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.60	100	27	27	8		19.33	10.60	Very strong thinly to medium bedded dark grey fine grained fossiliferous argillaceous LIMESTONE. Fresh to slightly weathered. 10.60m to 15.30m BGL - Two Fracture Sets - F1: 0 to 20 degrees, close to medium spaced, undulating, rough with occasional clay infill. F2: 60 to 80 degrees, closely spaced, undulating, rough with occasional brown staining.			
11.00											
12.50	100	70	60								
14.00	100	67	67				(4.70)				
15.30	100	100	77			14.63	15.30	Complete at 15.30m			

Remarks	Scale (approx)	Logged By
	1:50	AB
	Figure No. 12499-01-23.PBH-04	



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Site
Shancloon Phase 1

Borehole Number
PBH-03

Machine : Beretta T44	Casing Diameter 146mm cased to 14.70m	Ground Level (mOD) 37.16	Client RWE Renewables	Job Number 12499-01-23
Flush : Water				
Core Dia : 102 mm	Location 531596.3 E 753976.3 N	Dates 03/03/2023-06/03/2023	Engineer Fehily Timoney	Sheet 1/2
Method : Rotary Cored				

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00						36.96	(0.20) 0.20	TOPSOIL			
	100						(0.70)	Brown slightly sandy slightly gravelly silty CLAY			
1.10						36.26 36.06	0.90 (0.20) 1.10	Brownish grey clayey very sandy subangular to subrounded fine to coarse GRAVEL			
	61						(0.90)	Recovery consists of grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Cobbles are subrounded smooth limestone. Driller notes: GRAVEL.			
2.00 2.00-2.45					8,10/12,11,9,16 SPT(C) N=48	35.16	2.00	Very stiff light brownish grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.			
	87						(2.10)				
3.50 3.50-3.65					12,10/50 SPT(C) 50/0						
	100					33.06	4.10	Very stiff dark grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.			
							(0.90)				
5.00 5.00-5.00					25/50 SPT(C) 25*/0 50/0	32.16	5.00	Very stiff light brownish grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.			
	100						(0.70)				
						31.46	5.70	Very stiff dark grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.			
							(1.30)				
6.50 6.50-6.50					25/50 SPT(C) 25*/0 50/0	30.16	7.00	Very stiff light brownish grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.			
	100						(1.00)				
8.00 8.00-8.00					25/50 SPT(C) 25*/0 50/0	29.16	8.00	Very stiff brown sandy gravelly CLAY with low cobble content. Cobbles are subrounded smooth limestone.			
	80						(1.50)				
9.50 9.50-9.50					25/50 SPT(C) 25*/0 50/0	27.66	9.50	Very stiff brown slightly sandy slightly gravelly CLAY with medium cobble and boulder content. Cobbles and Boulders are subrounded smooth limestone.			
							(0.60)				

Remarks Bentonite seal installed from 14.70m to 14.00m BGL. 50mm slotted standpipe installed from 14.00m to 12.50m BGL. 50mm plain standpipe with a bentonite seal installed from 12.50m BGL to GL with a raised cover. Borehole complete at 14.70m BGL.									Scale (approx) 1:50	Logged By CMP
									Figure No. 12499-01-23.PBH-03	



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Site Shancloon Phase 1	Borehole Number PBH-03
Client RWE Renewables	Job Number 12499-01-23
Engineer Fehily Timoney	Sheet 2/2

Machine : Beretta T44 Flush : Water Core Dia : 102 mm Method : Rotary Cored	Casing Diameter 146mm cased to 14.70m	Ground Level (mOD) 37.16
	Location 531596.3 E 753976.3 N	Dates 03/03/2023- 06/03/2023

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.10	100	22	22	NI		27.06	10.10	Medium strong to very strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE. Slightly to moderately weathered. Partially recovered as dark grey clayey angular fine to coarse Gravel within fracture zones.			
11.00							(2.80)	10.10m to 12.90m BGL - Mostly Non-Intact			
12.50				7		24.26	12.90	Very strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE. Fresh to slightly weathered			
12.90	100	28	28				(1.80)	13.70m to 14.70m BGL - Two Fracture Sets - F1: 0 to 20 degrees, closely spaced, planar, smooth with partial clay infill and partial brown staining. F2: 60 to 80 degrees, closely spaced, undulating, smooth with partial brown staining.			
14.00	100	40	40			22.46	14.70	Complete at 14.70m			
14.70											

Remarks	Scale (approx) 1:50	Logged By CMP
	Figure No. 12499-01-23.PBH-03	



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Site
Shancloon Phase 1

Borehole Number
PBH-03A

Machine : Beretta T44	Casing Diameter 146mm cased to 12.50m 96mm cased to 16.00m	Ground Level (mOD) 37.01	Client RWE Renewables	Job Number 12499-01-23
Flush : Water-Polymer Mix				
Core Dia : 102 mm	Location 531610.3 E 753967.9 N	Dates 07/03/2023- 08/03/2023	Engineer Fehily Timoney	Sheet 1/2
Method : Rotary Cored				

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00	83					36.81	(0.20) 0.20	TOPSOIL		
							(1.00)	Brown slightly sandy slightly gravelly CLAY onto greyish brown silty clayey sandy subangular to subrounded fine to coarse GRAVEL		
1.20	100					35.81	1.20 (0.80)	Brown silty clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble content. Cobbles are subrounded smooth limestone.		
2.00						35.01	2.00 (1.50)	Recovery consists of brown silty clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble content. Cobbles are subrounded smooth limestone. Driller notes: Clayey GRAVEL.		
3.50	100					33.51	3.50 (0.40)	Brown slightly sandy gravelly silty CLAY		
						33.11	3.90 (2.40)	Dark grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.		
5.00	100									
						30.71	6.30 (1.70)	Recovery consists of light brownish grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone. Driller notes: Boulder CLAY.		
6.50	43									
						29.01	8.00 (1.50)	Recovery consists of light brownish grey slightly clayey sandy subangular to subrounded fine to coarse Gravel with low cobble content. Cobbles are subrounded smooth limestone. Driller notes: Boulder CLAY with loss of flush between 7.10m to 8.00m.		
8.00	17									
						27.51	9.50	Grey slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL with medium Cobble and Boulder content. Cobbles and boulders are subrounded smooth limestone. Clay recorded on granular		
9.50										

Remarks 12.50m to 16.00m BGL - Driller changed core from Geobore S to HQ reducing core diameter to 63.50mm.								Scale (approx) 1:50	Logged By CMP
								Figure No. 12499-01-23.PBH-03A	



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Site
Shancloon Phase 1

Borehole
Number
PBH-03A

Machine : Beretta T44		Casing Diameter 146mm cased to 12.50m 96mm cased to 16.00m		Ground Level (mOD) 37.01	Client RWE Renewables	Job Number 12499-01-23
Flush : Water-Polymer Mix		Location 531610.3 E 753967.9 N		Dates 07/03/2023- 08/03/2023	Engineer Fehily Timoney	Sheet 2/2
Core Dia: 102 mm						
Method : Rotary Cored						

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.90 11.00	83	7	7	NI		26.11	(1.40)	surfaces.		
							10.90	Medium strong to very strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE. Slightly weathered.		
12.50	87	20	17	6		24.51	(1.60)	10.90m to 12.50m BGL - Mostly Non-Intact		
							12.50	Very strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE with rare fossiliferous horizons. Fresh to slightly weathered.		
14.00	100	67	67	6			(3.50)	12.50m to 16.00m BGL - Two Fracture Sets - F1: 10 to 30 degrees, close to medium spaced, planar, smooth with clay infill. F2: 70 to 90 degrees, medium to widely spaced, undulating, rough with partial clay infill and brown staining.		
15.50	100	46	30							
16.00	100	90	90							
16.00						21.01	16.00	Complete at 16.00m		

Remarks	Scale (approx)	Logged By
	1:50	CMP
	Figure No. 12499-01-23.PBH-03A	



Borehole
Number
PBH-04

Job Number	12499-01-23
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Sheet
1/2


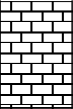

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	50				6,6/6,8,7,8 SPT(C) N=29	33.20	(0.20)	TOPSOIL			
		0.20					Recovery consists of brown slightly sandy slightly gravelly CLAY onto brown slightly sandy gravelly silty CLAY. Driller notes: sandy gravelly CLAY				
		(1.80)									
2.00	50		31.40				2.00	Recovery consists of light greyish brown slightly sandy gravelly silty CLAY. Driller notes: Grey gravelly SILT with cobbles (Stiff to very stiff)			
2.00-2.45							(1.50)				
3.50	67		29.90				3.50	Recovery consists of light greyish brown slightly sandy gravelly silty CLAY with medium boulder content. Boulders are subrounded smooth limestone. Driller notes: Glacial Till (Very stiff/Dense)			
3.50-3.95							(1.50)				
5.00	100	37	37				28.40	5.00	Very stiff light greyish brown slightly sandy gravelly silty CLAY		
5.00-5.23				(0.90)	Gravel lens encountered between 5.10m and 5.30m BGL						
5.90				6	9,12/50 SPT(C) 50/75	27.50	5.90	Very strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE. Fresh to slightly weathered with rare calcite veins			
6.50	100	100	100							5.90m to 10.70m BGL - Two Fracture Sets - F1: 0 to 20 degrees, medium spaced, undulating, rough with rare clay infill and rare brown staining. F2: 20 to 40 degrees, medium to widely spaced, undulating, rough with rare brown staining.	
8.00	100	97	93				(4.80)				
9.50											












Bentonite seal installed from 10.70m to 8.00m BGL. 50mm slotted standpipe installed from 8.00m to 7.00m BGL. 50mm plain standpipe with a bentonite seal installed from 7.00m BGL to GL with a raised cover.
Borehole complete at 10.70m BGL.

Logged
By

CMP

Figure No.
12499-01-23.PBH-04

<div></div> <div>Ground Investigations Ireland Ltd www.gii.ie</div>							Site Shancloon Phase 1			Borehole Number PBH-04	
Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Method : Rotary Cored			Casing Diameter 146mm cased to 10.70m		Ground Level (mOD) 33.40		Client RWE Renewables			Job Number 12499-01-23	
			Location 531885.9 E 753394.9 N		Dates 01/03/2023-02/03/2023		Engineer Fehily Timoney			Sheet 2/2	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.70	100	100	100			22.70	10.70	Complete at 10.70m			
Remarks									Scale (approx) 1:50	Logged By CMP	
									Figure No. 12499-01-23.PBH-04		

<div></div> <div>Ground Investigations Ireland Ltd www.gii.ie</div>							Site Shancloon Phase 1			Borehole Number PBH-05				
Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Inclination: 90° to the vertical Method : Rotary Cored			Casing Diameter 146mm cased to 14.50m		Ground Level (mOD) 30.58		Client RWE Renewables			Job Number 12499-01-23				
			Location 533365.8 E 754145.4 N		Dates 13/04/2023-17/04/2023		Engineer Fehily Timoney			Sheet 1/2				
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr			
0.00	87				0,0/1,0,0,0 SPT(C) N=1	30.58	(2.50)	Dark brown slightly clayey pseudo fibrous PEAT.						
1.50														
2.50 2.50-2.95	60											2.50	Recovery consists of very soft dark brown slightly clayey pseudo fibrous PEAT. Hydrocarbon odour at 4.60m BGL. Driller notes: PEAT onto MARL. (Very soft)	
4.00 4.00-4.45												(3.00)		
5.50 5.50-5.95	100				0,1/0,1,2,1 SPT(C) N=4	30.58	5.50	Very soft grey slightly sandy silty CLAY						
7.00 7.00-7.45							(1.25)							
8.50 8.50-8.95	53				1,0/2,4,3,4 SPT(C) N=13	30.58	6.75	Medium dense grey slightly sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Cobbles are subrounded smooth limestone.						
8.90							(1.75)							
8.50 8.50-8.95	100	43	27		8,5/7,10,15,13 SPT(C) N=45	30.58	8.50 (0.40)	Dense grey slightly sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Cobbles are subrounded smooth limestone.						
8.90								30.58	8.90	Strong to very strong thinly bedded to medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered.				
10.00														
Remarks Bentonite seal installed from 14.50m to 13.00m BGL. 50mm slotted standpipe installed from 13.00m to 10.00m BGL. 50mm plain standpipe with a bentonite seal installed from 10.00m BGL to GL with a raised cover. Borehole complete at 14.50m BGL									Scale (approx) 1:50	Logged By SB	Figure No. 12499-01-23.PBH-05			



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Site
Shancloon Phase 1

Borehole
Number
PBH-05

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored			Casing Diameter 146mm cased to 14.50m			Ground Level (mOD) 30.58		Client RWE Renewables			Job Number 12499-01-23	
			Location 533365.8 E 754145.4 N			Dates 13/04/2023- 17/04/2023		Engineer Fehily Timoney			Sheet 2/2	

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.50	100	80	80	6			(5.60)	(8.90m to 14.50m BGL) 2 fracture sets. F1: 0-20 degree fracture very closely to medium spaced, planar and rough. F2: 35-55 degrees, closely to widely spaced, undulating and rough.			
13.00	100	96	87								
14.50	100	100	92								
14.50						30.58	14.50	Complete at 14.50m			

Remarks	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12499-01-23.PBH-05	



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Site
Shancloon Phase 1

Borehole
Number
PBH-06

Machine : Beretta T44 Flush : Water Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored	Casing Diameter 146mm cased to 20.00m	Ground Level (mOD) 37.05	Client RWE Renewables	Job Number 12499-01-23
	Location (dGPS) 533952.6 E 754648.7 N	Dates 31/03/2023- 03/04/2023	Engineer Fehily Timoney	Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
2.00 2.00-2.45	42				6,4/6,7,9,9 SPT(C) N=31	37.05	2.00	Recovery consists of brown slightly sandy slightly gravelly CLAY onto grey slightly sandy gravelly CLAY with medium cobble content. Cobbles are subrounded smooth limestone. Driller notes: Boulder Clay			
3.50 3.50-3.95					10,7/6,12,11,14 SPT(C) N=43			Very stiff grey slightly sandy gravelly CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.			
5.00 5.00-5.45					25,25/50 SPT(C) N=50						
6.50 6.50-6.70					25,25/50 SPT(C) 50/50						
8.00 8.00-8.20					25,25/50 SPT(C) 50/50						
9.50 9.50-9.70					25,25/50 SPT(C) 50/50						

Remarks Bentonite seal from 20.00m to 17.00m BGL. 50mm slotted standpipe with gravel surround installed from 17.00m to 14.00m BGL. 50mm plain standpipe with bentonite seal from 14.00m BGL to GL. Finished with a raised cover. Borehole complete at 20.00m BGL	Scale (approx) 1:50	Logged By RH
	Figure No. 12499-01-23.PBH-06	



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Site
Shancloon Phase 1

Borehole
Number
PBH-06

Machine : Beretta T44 Flush : Water Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored	Casing Diameter 146mm cased to 20.00m	Ground Level (mOD) 37.05	Client RWE Renewables	Job Number 12499-01-23
	Location (dGPS) 533952.6 E 754648.7 N	Dates 31/03/2023- 03/04/2023	Engineer Fehily Timoney	Sheet 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.00 11.00-11.20	100				25.25/50 SPT(C) 50/50						
12.50 12.50-12.70	93				25.25/50 SPT(C) 50/50						
12.90	93	50	40			37.05	12.90	Medium strong to strong thinly bedded to medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Slightly weathered to fresh			
14.00	100	86	70	6				(13.80m to 20.00m BGL) Two fracture sets. F1: 0-20 degree fracture very close to medium spaced, planar to undulating and smooth. F2: 40-60 degree fracture widely spaced, undulating and rough			
15.50 15.70	100	100	87				(7.10)				
17.00	100	100	75	4							
18.50	100	100	93								
20.00						37.05	20.00				

Remarks

Scale (approx)
1:50

Logged By
RH

Figure No.
12499-01-23.PBH-06



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Site
Shancloon Phase 1

Borehole Number
PBH-07

Machine : Beretta T44
Flush : Water
Core Dia: 102 mm
Inclination: 90° to the vertical
Method : Rotary Cored

Casing Diameter
146mm cased to 21.50m

Ground Level (mOD)
30.65

Client
RWE Renewables

Job Number
12499-01-23

Location (dGPS)
534433 E 754559.9 N

Dates
04/05/2023

Engineer
Fehily Timoney

Sheet
1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
2.00								Recovery consists of dark brown pseudo fibrous spongy PEAT. Driller notes: PEAT			
2.00-2.45	29				1,0/0,0,1,0 SPT(C) N=1	30.65	2.00 (2.00)	Recovery consists of dark brown pseudo fibrous spongy PEAT. Driller notes: PEAT. (Very Soft)			
3.50											
3.50-3.95	62				1,0/0,0,0,1 SPT(C) N=1	30.65	3.50 (1.50)	No recovery. Driller notes: clayey SILT (Very Soft)			
5.00											
5.00-5.45	0				0,0/0,0,0,0 SPT(C) N=0						
6.50											
6.50-6.95	0				1,0/0,0,0,0 SPT(C) N=0						
8.00											
8.00-8.35											
8.10				NI	1,0/12,19,19 SPT(C) 50/200	30.65	7.50 (0.60)	Recovery consists of grey Cobbles. Cobbles are subrounded smooth limestone. Driller notes: cobbly clayey SILT (Very Soft)			
8.60	100	71	46	8			8.10	Strong very thinly bedded to thinly bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Slightly weathered to fresh			
9.50								(8.60m to 14.00m BGL) Two fracture sets. F1: 0-20 degree fracture extremely close to medium spaced, planar to undulating and smooth. F2: 70-90 degree fracture widely spaced, undulating to stepped and smooth			


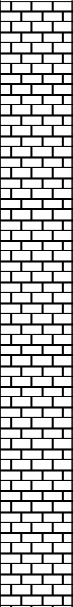


Remarks

Bentonite seal installed from 14.00m to 13.00m BGL. 50mm slotted standpipe installed from 13.00m to 9.50m BGL. 50mm plain standpipe with a bentonite seal installed from 9.50m BGL to GL with a raised cover.
Borehole complete at 14.00m BGL

Scale (approx)
1:50

Logged By
RH

Figure No.
12499-01-23.PBH-07

 <div> Ground Investigations Ireland Ltd www.gii.ie </div>							Site Shancloon Phase 1			Borehole Number PBH-07	
Machine : Beretta T44 Flush : Water Core Dia: 102 mm Inclination : 90° to the vertical Method : Rotary Cored			Casing Diameter 146mm cased to 21.50m		Ground Level (mOD) 30.65		Client RWE Renewables		Job Number 12499-01-23		
			Location (dGPS) 534433 E 754559.9 N		Dates 04/05/2023		Engineer Fehily Timoney		Sheet 2/2		
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.00	100	100	93	5			(5.90)				
	100	100	91								
12.50	100	100	85								
14.00						30.65	14.00	Complete at 14.00m			
Remarks									Scale (approx)	Logged By	
									1:50	RH	
									Figure No. 12499-01-23.PBH-07		



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Site
Shancloon Phase 1

Borehole Number
PBH-08

Machine : Beretta T44 Flush : Water Core Dia: 102 mm Inclination : 90° to the vertical Method : Rotary Cored	Casing Diameter 146mm cased to 19.10m	Ground Level (mOD) 38.39	Client RWE Renewables	Job Number 12499-01-23
	Location (dGPS) 533754.8 E 755179.4 N	Dates 21/03/2023	Engineer Fehily Timoney	Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.40-1.75	75				7,6/18,15,17 SPT(C) 50/200	38.39	1.40	Recovery consists of brown slightly sandy slightly gravelly CLAY with low cobble content onto brown slightly sandy gravelly CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone. Driller notes: CLAY with Boulders.		
2.00						38.39	2.00	Recovery consists of brown slightly sandy gravelly CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone. Driller notes: boulder CLAY (Very Stiff)		
3.50					25,25/50 SPT(C) 50/50	38.39	3.50	Recovery consists of brown slightly sandy gravelly CLAY with low cobble content. Cobbles are subrounded smooth limestone. Driller notes: boulder CLAY. (Very Stiff)		
3.50-3.70	100							Very stiff grey slightly sandy gravelly CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.		
5.00					25,25/50 SPT(C) 50/50					
5.00-5.20	80									
6.50					25,25/50 SPT(C) 50/50					
6.50-6.70	90									
8.00					25,25/50 SPT(C) 50/50					
8.00-8.20	100									
9.50					25,25/50 SPT(C) 50/50					
9.50-9.70										

Remarks Borehole complete at 19.00m BGL Borehole backfilled upon completion	Scale (approx) 1:50	Logged By RH
	Figure No. 12499-01-23.PBH-08	



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Site
Shancloon Phase 1

Borehole
Number
PBH-08

Machine : Beretta T44 Flush : Water Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored	Casing Diameter 146mm cased to 19.10m	Ground Level (mOD) 38.39	Client RWE Renewables	Job Number 12499-01-23
	Location (dGPS) 533754.8 E 755179.4 N	Dates 21/03/2023	Engineer Fehily Timoney	Sheet 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
11.00 11.00-11.20	100				25.25/50 SPT(C) 50/50					
12.50 12.50-12.70	100				25.25/50 SPT(C) 50/50					
14.00						38.39	14.00	Dense grey subrounded smooth Boulders of Limestone with much clayey Gravel.		
	100	9	9				(1.35)			
15.35 15.50						38.39	15.35	Strong thinly bedded to medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered. Rare grains of cubic pyrite noted.		
	100	100	83					(15.35m to 19.10m BGL) Two fracture sets. F1: 0-20 degree fracture very close to medium spaced, planar and rough. F2: 40-60 degree fracture medium to widely spaced, undulating to stepped and rough		
17.00				4			(3.75)			
	100	100	80							
18.50										
	100	100	80							
19.10						38.39	19.10	Complete at 19.10m		

Remarks	Scale (approx)	Logged By
	1:50	RH
	Figure No. 12499-01-23.PBH-08	



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Site
Shancloon Phase 1

Borehole
Number
PBH-09

Machine : Beretta T44 Flush : Water Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored	Casing Diameter 146mm cased to 21.50m	Ground Level (mOD) 38.85	Client RWE Renewables	Job Number 12499-01-23
	Location (dGPS) 533708.1 E 755195.8 N	Dates 27/03/2023- 28/03/2023	Engineer Fehily Timoney	Sheet 1/3

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
2.00 2.00-2.20	50				13,17/50 SPT(C) 50/50	38.85	(2.00)	Recovery consists of brown slightly sandy slightly gravelly CLAY onto brown slightly sandy gravelly CLAY with medium cobble content. Cobbles are subrounded smooth limestone. Driller notes: boulder CLAY			
	88						2.00	Very stiff grey slightly sandy gravelly CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.			
3.50 3.50-3.70	100				18,25/50 SPT(C) 50/50						
5.00 5.00-5.20	93				25,25/50 SPT(C) 50/50						
6.50 6.50-6.70	100				25,25/50 SPT(C) 50/50						
8.00 8.00-8.20	100				25,25/50 SPT(C) 50/50		(13.50)				
9.50 9.50-9.70					25,25/50 SPT(C) 50/50						

Remarks

Bentonite seal from 21.50m to 20.00m BGL. 50mm slotted standpipe with gravel surround installed from 20.00m to 19.00m BGL. 50mm plain standpipe with a bentonite seal installed from 19.00m to GL with a raised cover.
Borehole complete at 21.50m BGL

Scale (approx)
1:50

Logged By
RH

Figure No.
12499-01-23.PBH-09



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Site
Shancloon Phase 1

Borehole
Number
PBH-09

Machine : Beretta T44 Flush : Water Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored	Casing Diameter 146mm cased to 21.50m	Ground Level (mOD) 38.85	Client RWE Renewables	Job Number 12499-01-23
	Location (dGPS) 533708.1 E 755195.8 N	Dates 27/03/2023- 28/03/2023	Engineer Fehily Timoney	Sheet 2/3


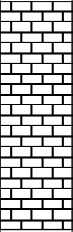
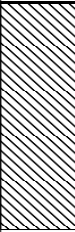
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.00 11.00-11.20	100				25,25/50 SPT(C) 50/50						
12.50 12.50-12.70	100				25,25/50 SPT(C) 50/50						
14.00 14.00-14.20	93				25,25/50 SPT(C) 50/50						
15.50 15.50-15.70	93				25,25/50 SPT(C) 50/50	38.85	15.50 (1.50)	Dense dark grey subrounded smooth COBBLES and BOULDERS of Limestone with some gravelly Clay.			
17.00	100	100	61	11		38.85	17.00	Medium strong to strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE. Slightly weathered to fresh. Rare grains of cubic pyrite noted. (17.00m to 21.50m BGL) 3 fracture sets. F1: 0-20 degree fracture very closely to medium spaced, planar and smooth. F2: 40-60 degree close to widely spaced, undulating and rough. F3: 70-90 degree fracture widely spaced, undulating to stepped and rough			
18.50	100	100	72				(4.50)				
19.60											
20.00											

Remarks

Scale (approx)
1:50

Logged By
RH

Figure No.
12499-01-23.PBH-09

 <div>Ground Investigations Ireland Ltd www.gii.ie</div>						Site Shancloon Phase 1			Borehole Number PBH-09		
Machine : Beretta T44 Flush : Water Core Dia: 102 mm Inclination : 90° to the vertical Method : Rotary Cored			Casing Diameter 146mm cased to 21.50m		Ground Level (mOD) 38.85		Client RWE Renewables		Job Number 12499-01-23		
			Location (dGPS) 533708.1 E 755195.8 N		Dates 27/03/2023-28/03/2023		Engineer Fehily Timoney		Sheet 3/3		
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
21.50	100	100	86	7		38.85	21.50	Complete at 21.50m			
Remarks									Scale (approx)	Logged By	
									1:50	RH	
									Figure No. 12499-01-23.PBH-09		



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Site
Shanclon Phase 1

Borehole Number
PBH-10

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Method : Rotary Cored	Casing Diameter 146mm cased to 22.00m	Ground Level (mOD) 39.23	Client RWE Renewables	Job Number 12499-01-23
	Location 533732.7 E 755199.3 N	Dates 22/03/2023- 23/03/2023	Engineer Fehily Timoney	Sheet 1/3

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00						39.08	(0.15)	TOPSOIL		
							0.15	Brown slightly sandy gravelly silty CLAY		
	55				10,10/12,38 SPT(C) 50/145		(1.25)			
1.40-1.70						37.83	1.40	Recovery consists of brown silty clayey sandy subangular to subrounded fine coarse GRAVEL with medium cobble content. Driller notes: Silty gravelly CLAY (Very stiff)		
							(0.60)			
2.00						37.23	2.00	Very stiff light brownish grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.		
	77									
					15,10/50 SPT(C) 50/0		(3.00)			
3.50-3.65										
	87									
					25/50 SPT(C) 25*/0 50/0	34.23	5.00	Very stiff grey slightly sandy gravelly silty CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.		
5.00-5.00										
	100									
					25/50 SPT(C) 25*/0 50/0					
6.50-6.50										
	100									
					25/50 SPT(C) 25*/0 50/0					
8.00-8.00										
	100									
					25/50 SPT(C) 25*/0 50/0					
9.50-9.50							(9.50)			

Remarks Borehole complete at 22.00m BGL Borehole backfilled upon completion	Scale (approx) 1:50	Logged By CMP
	Figure No. 12499-01-23.PBH-10	



Machine : Beretta T44	Casing Diameter 146mm cased to 22.00m	Ground Level (mOD) 39.23	Client RWE Renewables	Job Number 12499-01-23
Flush : Water-polymer mix	Location 533732.7 E 755199.3 N	Dates 22/03/2023- 23/03/2023	Engineer Fehily Timoney	Sheet 2/3
Core Dia : 102 mm				
Method : Rotary Cored				

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
11.00 11.00-11.00	100				25/50 SPT(C) 25*/0 50/0					
12.50 12.50-12.50	100				25/50 SPT(C) 25*/0 50/0					
14.00 14.00-14.00	100				25/50 SPT(C) 25*/0 50/0	24.73	14.50	Dense dark grey subrounded smooth COBBLES and BOULDERS of Limestone with much clayey angular to subangular fine to coarse GRAVEL (Possible highly weathered rock)		
15.50 15.50-15.50	100	7	7		25/50 SPT(C) 25*/0 50/0		(2.40)			
16.90 17.00						22.33	16.90	Medium strong to strong thinly to medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered		
18.50	100	63	63	11			(3.10)	16.90m to 20.00m BGL - Two Fracture Sets - F1: 10 to 30 degrees, close to medium spaced, planar, smooth with partial clay infill and brown staining. F2: 70 to 90 degrees, medium to widely spaced, undulating, rough with partial clay infill and brown staining.		
20.00	100	70	53							

Remarks

Scale (approx)
1:50

Logged By
CMP

Figure No.
12499-01-23.PBH-10



Borehole
Number
PBH-10

Job Number	12499-01-23
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Sheet
3/3

Remarks	Scale (approx)	Logged By
	1:50	CMP
	Figure No. 12499-01-23.PBH-10	



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Site
Shancloon Phase 1

Borehole Number
PBH-11

Machine : Beretta T44	Casing Diameter 146mm cased to 23.00m	Ground Level (mOD) 38.98	Client RWE Renewables	Job Number 12499-01-23
Flush : Water-polymer mix				
Core Dia: 102 mm				
Method : Rotary Cored	Location 533713.7 E 755178.9 N	Dates 22/03/2023- 23/03/2023	Engineer Fehily Timoney	Sheet 1/3

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00								Recovery consists of TOPSOIL onto light brown slightly sandy slightly gravelly CLAY with low cobble content. Cobbles are subrounded smooth limestone. Driller notes: CLAY onto cobbly CLAY		
2.00	55				4,5/7,10,12,21 SPT(C) N=50	36.98	2.00	Very stiff light greyish brown slightly sandy gravelly CLAY		
2.00-2.45										
	80									
3.50					6,8/8,13,18,11 SPT(C) 50/275					
3.50-3.93						34.98	4.00	Very stiff light brownish grey slightly sandy slightly gravelly CLAY with medium cobble content. Cobbles are subrounded smooth limestone.		
	100									
5.00					25/50 SPT(C) 25*/50 50/0					
5.00-5.05										
	100									
6.50					25/50 SPT(C) 25*/50 50/0					
6.50-6.55										
	95									
8.00					25/50 SPT(C) 25*/50 50/0					
8.00-8.05										
	100									
9.50					25/50 SPT(C) 25*/50 50/0					
9.50-9.55										

Remarks Borehole complete at 23.00m BGL Borehole backfilled upon completion	Scale (approx) 1:50	Logged By SB
	Figure No. 12499-01-23.PBH-11	



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Site
Shancloon Phase 1

Borehole
Number
PBH-11

Machine : Beretta T44		Casing Diameter 146mm cased to 23.00m		Ground Level (mOD) 38.98	Client RWE Renewables	Job Number 12499-01-23
Flush : Water-polymer mix		Location 533713.7 E 755178.9 N		Dates 22/03/2023- 23/03/2023	Engineer Fehily Timoney	Sheet 2/3
Core Dia : 102 mm						
Method : Rotary Cored						

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
11.00 11.00-11.05	100				25/50 SPT(C) 25*/50 50/0	27.98	11.00	Very stiff grey slightly sandy slightly gravelly CLAY with high cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.		
12.50 12.50-12.55	100				25/50 SPT(C) 25*/50 50/0		(3.00)			
14.00 14.00-14.05	100				25/50 SPT(C) 25*/50 50/0	24.98	14.00	Very stiff grey slightly sandy slightly gravelly CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.		
15.50 15.50-15.55					25/50 SPT(C) 25*/50 50/0		(1.95)			
15.95	100	16	6			23.03	15.95	Medium strong to strong dark grey thinly to medium bedded fine grained argillaceous LIMESTONE. Slightly to moderately weathered with clay infill.		
17.00				5			(1.75)	15.95m to 17.70m BGL - Two Fracture Sets - F1: 0 to 20 degrees, close to widely spaced, planar, smooth with partial clay infill. F2: 30 to 50 degrees widely spaced, planar, smooth with partial clay infill		
18.50	100	45	30			21.28	17.70	Strong dark grey thinly to medium bedded fine grained argillaceous LIMESTONE. Fresh to slightly weathered. Rare grains of cubic pyrite noted.		
20.00	100	97	87							

Remarks								Scale (approx)	Logged By
								1:50	SB
								Figure No. 12499-01-23.PBH-11	

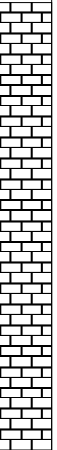


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Site
Shancloon Phase 1

Borehole
Number
PBH-11

Machine : Beretta T44		Casing Diameter 146mm cased to 23.00m		Ground Level (mOD) 38.98	Client RWE Renewables	Job Number 12499-01-23
Flush : Water-polymer mix		Location 533713.7 E 755178.9 N		Dates 22/03/2023- 23/03/2023	Engineer Fehily Timoney	Sheet 3/3
Core Dia: 102 mm						
Method : Rotary Cored						

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
21.50	100	100	97	3		15.98	(5.30)	17.70m to 23.00m BGL - Two Fracture Sets - F1: 0 to 20 degrees, close to widely spaced, planar, smooth with partial clay infill. F2: 30 to 50 degrees widely spaced, planar, smooth with partial clay infill		
	100	100	98							
23.00									23.00	Complete at 23.00m

Remarks	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12499-01-23.PBH-11	



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Site
Shancloon Phase 1

Borehole Number
PBH-12

Machine : Beretta T44	Casing Diameter	Ground Level (mOD)	Client	Job Number
Flush : Water-polymer mix	146mm cased to 18.50m	37.19	RWE Renewables	12499-01-23
Core Dia: 102 mm	Location	Dates	Engineer	Sheet
Method : Rotary Cored				

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00						37.04	(0.15)	TOPSOIL			
							(0.40)	Brown slightly sandy slightly gravelly CLAY			
	50					36.64	0.55	Recovery consists of light brownish grey slightly sandy slightly gravelly silty CLAY medium cobble content. Cobbles are subrounded smooth limestone. Driller notes: sandy CLAY			
							(1.45)				
2.00					5,7/7,18,25	35.19	2.00	Recovery consists of light brownish grey slightly sandy gravelly CLAY with low cobble and boulder content. Cobbles and boulders are subrounded smooth limestone. Driller notes: boulder CLAY (Very stiff)			
2.00-2.38	67				SPT(C) 50/225		(1.50)				
3.50					25/50	33.69	3.50	Very stiff light grey slightly sandy gravelly CLAY with medium cobble and low boulder content. Cobbles and boulders are subrounded smooth limestone.			
3.50-3.50	100				SPT(C) 25*/0 50/0						
5.00					25/50						
5.00-5.00	100				SPT(C) 25*/0 50/0						
6.50					25/50						
6.50-6.50	100				SPT(C) 25*/0 50/0						
8.00					25/50		(9.00)				
8.00-8.00	100				SPT(C) 25*/0 50/0						
9.50					25/50						
9.50-9.50					SPT(C) 25*/0 50/0						

Remarks Bentonite seal installed from 18.50m to 17.30m BGL. 50mm slotted standpipe installed from 17.30m to 14.30m BGL. 50mm plain standpipe with a bentonite seal installed from 14.30m BGL to GL with a raised cover. Borehole complete at 18.50m BGL									Scale (approx) 1:50	Logged By AB
									Figure No. 12499-01-23.PBH-12	



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Site
Shancloon Phase 1

Borehole
Number
PBH-12

Machine : Beretta T44	Casing Diameter 146mm cased to 18.50m	Ground Level (mOD) 37.19	Client RWE Renewables	Job Number 12499-01-23
Flush : Water-polymer mix				
Core Dia : 102 mm	Location 533766.7 E 755221.3 N	Dates 15/03/2023- 21/03/2023	Engineer Fehily Timoney	Sheet 2/2
Method : Rotary Cored				

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.00 11.00-11.00	100				25/50 SPT(C) 25*/0 50/0						
12.50 12.50-12.50	100				25/50 SPT(C) 25*/0 50/0	24.69	12.50	Very stiff dark grey slightly sandy gravelly CLAY with high cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.			
14.00						23.39	13.80	Dark grey subrounded smooth COBBLES and BOULDERS of Limestone with much clayey angular to subangular fine to coarse Gravel.			
14.80	100	46				22.39	14.80	Medium strong to strong thinly to medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered			
15.50											
17.00	100	100	80				(3.70)	15.50m to 18.50m BGL - Two Fracture Sets - F1: 0 to 10 degrees, close to medium spaced, undulating, rough with occasional clay infill and brown staining. F2: 70 to 90 degrees, close to medium spaced, undulating, rough with occasional brown staining.			
18.50	100	95	54			18.69	18.50	Complete at 18.50m			

Remarks

Scale (approx)
1:50

Logged By
AB

Figure No.
12499-01-23.PBH-12



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Site
Shancloon Phase 1

Borehole
Number
PBH-13

Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Method : Rotary Cored	Casing Diameter 146mm cased to 23.00m		Ground Level (mOD) 37.99	Client RWE Renewables	Job Number 12499-01-23
	Location 533418.1 E 755537.9 N		Dates 28/03/2023-30/03/2023	Engineer Fehily Timoney	Sheet 1/3

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00						37.79	(0.20) 0.20	TOPSOIL			
	30						(1.80)	Recovery consists of light brown slightly sandy gravelly silty CLAY. Driller notes: CLAY			
2.00 2.00-2.45					12,11/12,14,12,12 SPT(C) N=50	35.99	2.00	Very stiff light brownish grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.			
	93						(2.00)				
3.50 3.50-3.65					15,10/50 SPT(C) 50/0	33.99	4.00	Very stiff grey slightly sandy gravelly silty CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.			
	100										
5.00 5.00-5.00					25/50 SPT(C) 25*/0 50/0						
	100										
6.50 6.50-6.50					25/50 SPT(C) 25*/0 50/0						
	100										
8.00 8.00-8.00					25/50 SPT(C) 25*/0 50/0		(7.80)				
	100										
9.50 9.50-9.50					25/50 SPT(C) 25*/0 50/0						

Remarks Bentonite seal installed from 23.00m to 17.00m BGL. 50mm slotted standpipe installed from 17.00m to 12.50m BGL. 50mm plain standpipe with a bentonite seal installed from 12.50m BGL to GL with a raised cover. Borehole complete at 23.00m BGL	Scale (approx) 1:50	Logged By CMP
	Figure No. 12499-01-23.PBH-13	



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Site
Shancloon Phase 1

Borehole
Number
PBH-13

Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Method : Rotary Cored	Casing Diameter 146mm cased to 23.00m	Ground Level (mOD) 37.99	Client RWE Renewables	Job Number 12499-01-23
	Location 533418.1 E 755537.9 N	Dates 28/03/2023-30/03/2023	Engineer Fehily Timoney	Sheet 2/3


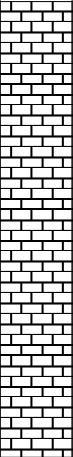
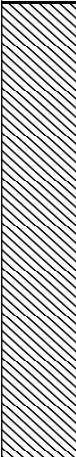
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.00	87										
11.00-11.00					25/50 SPT(C) 25*/0 50/0						
	100					26.19	11.80 (0.30)	Very stiff light brownish grey slightly sandy gravelly silty CLAY			
						25.89	12.10	Very stiff grey slightly sandy gravelly silty CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.			
12.50					25/50 SPT(C) 25*/0 50/0		(1.10)				
12.50-12.50											
13.20	100	41		41		24.79	13.20	Medium strong to strong thinly to medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Slightly weathered			
14.00											
	100	29	25	8			(3.40)	13.20m to 16.60m BGL - Two Fracture Sets - F1: 10 to 30 degrees, close to medium spaced, undulating, rough to smooth with clay infill and brown staining. F2: 70 to 90 degrees, close to medium spaced, undulating rough with clay infill and brown staining.			
15.50											
	100	50	41								
						21.39	16.60 (0.40)	POSSIBLE FAULT BRECCIA: Recovered as brown clayey angular fine to coarse Gravel with medium cobble content. Cobbles are subrounded smooth limestone.			
17.00						20.99	17.00	Strong to very strong thinly to medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered. Rare grains of cubic pyrite noted.			
	100	72	62								
18.50				6				17.00m to 20.00m BGL - One Fracture Set - F1: 10 to 30 degrees, very close to closely spaced, undulating, rough with clay infill.			
	100	91	75								
20.00											

Remarks

Scale (approx)
1:50

Logged By
CMP

Figure No.
12499-01-23.PBH-13

<div></div> <div>Ground Investigations Ireland Ltd www.gii.ie</div>							Site Shancloon Phase 1			Borehole Number PBH-13	
Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Method : Rotary Cored			Casing Diameter 146mm cased to 23.00m		Ground Level (mOD) 37.99		Client RWE Renewables			Job Number 12499-01-23	
			Location 533418.1 E 755537.9 N		Dates 28/03/2023-30/03/2023		Engineer Fehily Timoney			Sheet 3/3	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
21.50	100	100	100	4			(6.00)	20.00m to 23.00m BGL - One Fracture Set - F1: 0 to 20 degrees, medium to widely spaced, planar, smooth with partial clay infill.			
23.00	93	83	83			14.99	23.00				
Remarks									Scale (approx) 1:50	Logged By CMP	
									Figure No. 12499-01-23.PBH-13		




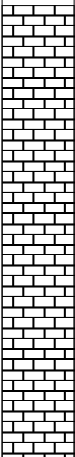


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Site Shancloon Phase 1		Borehole Number PBH-14
Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Method : Rotary Cored		Job Number 12499-01-23
Casing Diameter 146mm cased to 13.00m		Ground Level (mOD) 34.43
Location 535196.1 E 754782.3 N		Dates 15/06/2023- 19/06/2023
Client RWE Renewables		Engineer Fehily Timoney
		Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	30						(1.00)	Recovery consists of dark brown clayey pseudo fibrous PEAT. Driller notes: PEAT.			
1.00	27					33.43	1.00 (1.50)	Recovery consists of grey slightly sandy subangular to subrounded fine to coarse GRAVEL. Driller notes: GRAVEL			
2.50 2.50-2.95	80				4,6/6,8,8,10 SPT N=32	31.93	2.50 (0.90)	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Cobbles are subrounded smooth limestone.			
4.00 4.00-4.40	90				5,9/13,15,14,8 SPT 50/245	31.03	3.40 (2.10)	Very stiff brown slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.			
5.50 5.50-5.88	100				5,10/12,19,19 SPT 50/225	28.93	5.50 (2.40)	Very stiff dark grey slightly sandy gravelly silty CLAY with medium cobble content. Cobbles are subrounded smooth limestone.			
7.00	100	35	31			26.53	7.90	Strong to very strong dark grey fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered.			
8.50	100	50	35	7							
10.00											

Remarks Bentonite seal from 13.00m to 12.50m BGL. 50mm slotted standpipe with gravel surround installed from 12.50m to 9.50m BGL. 50mm plain standpipe with bentonite seal from 9.50m BGL to GL. Finished with a raised cover. Borehole complete at 13.00m BGL									Scale (approx) 1:50	Logged By SB
									Figure No. 12499-01-23.PBH-14	

<div></div> <div>Ground Investigations Ireland Ltd</div> <div>www.gii.ie</div>							<div>Site</div> <div>Shancloon Phase 1</div>		<div>Borehole Number</div> <div>PBH-14</div>		
<div>Machine : Beretta T44</div> <div>Flush : Water-polymer mix</div> <div>Core Dia: 102 mm</div> <div>Method : Rotary Cored</div>			<div>Casing Diameter</div> <div>146mm cased to 13.00m</div>			<div>Ground Level (mOD)</div> <div>34.43</div>		<div>Client</div> <div>RWE Renewables</div>		<div>Job Number</div> <div>12499-01-23</div>	
			<div>Location</div> <div>535196.1 E 754782.3 N</div>			<div>Dates</div> <div>15/06/2023-19/06/2023</div>		<div>Engineer</div> <div>Fehily Timoney</div>		<div>Sheet</div> <div>2/2</div>	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.50	100	93	87	5			(5.10)	(7.90m to 10.00m BGL) 2 fracture sets. F1: 0 to 20 degrees, very closely to closely spaced, planar and smooth with partial clay infill. F2: 70 to 90 degrees, closely to medium spaced, undulating and rough with partial sand infill			
		100	100				87	(10.00m to 13.00m BGL) 1 fracture set. F1: 0 to 20 degrees very closely to medium spaced, planar and smooth with partial clay infill.			
13.00						21.43	13.00	Complete at 13.00m			
Remarks									Scale (approx)	Logged By	
									1:50	SB	
									Figure No.		
		12499-01-23.PBH-14									



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Site
Shancloon Phase 1

Borehole
Number
PBH-15

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Method : Rotary Cored			Casing Diameter 146mm cased to 17.00m		Ground Level (mOD) 35.37	Client RWE Renewables	Job Number 12499-01-23
			Location (dGPS) 533135.9 E 755860.9 N		Dates 07/04/2023- 10/04/2023	Engineer Fehily Timoney	Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00								Recovery consists of dark brown pseudo fibrous spongy PEAT.			
2.00	19				1.0/0.0,1.0 SPT(C) N=1	33.37	2.00 (2.00)	Dark brown pseudo fibrous PEAT (Very soft)			
2.00-2.45	73					32.57	2.80 (0.80)	Very soft greyish brown slightly sandy slightly gravelly slightly organic silty CLAY			
3.50					1.0/1.0,0.1 SPT(C) N=2	31.87	3.50 (0.70)	Recovery consists of grey slightly sandy gravelly clayey SILT with low cobbles content. Cobbles are subrounded smooth limestone. Driller notes: clayey SILT (Very soft)			
3.50-3.95	30										
5.00					0.0/1.0,0.0 SPT(C) N=1		(3.00)				
5.00-5.45	60										
6.50					1.0/0.4,5.4 SPT(C) N=13	28.87	6.50 (1.50)	Firm to stiff grey slightly sandy slightly gravelly CLAY with low cobble content. Cobbles are subrounded smooth limestone.			
6.50-6.95	93										
8.00					25/50 SPT(C) 50/50	27.37	8.00	Very stiff dark grey slightly sandy gravelly CLAY with low cobble content. Cobbles are subrounded smooth limestone.			
8.00-8.20	96										
9.50					25/50 SPT(C) 50/40						
9.50-9.69											

Remarks Bentonite seal from 17.00m to 16.00m BGL. 50mm slotted standpipe with gravel surround installed from 16.00m to 13.00m BGL. 50mm plain standpipe with bentonite seal from 13.00m BGL to GL. Finished with a raised cover. Borehole complete at 17.00m BGL									Scale (approx) 1:50	Logged By RH
									Figure No. 12499-01-23.PBH-13	



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Site
Shancloon Phase 1

Borehole
Number
PBH-15

Machine : Beretta T44	Casing Diameter 146mm cased to 17.00m	Ground Level (mOD) 35.37	Client RWE Renewables	Job Number 12499-01-23
Flush : Water-polymer mix				
Core Dia : 102 mm	Location (dGPS) 533135.9 E 755860.9 N	Dates 07/04/2023-10/04/2023	Engineer Fehily Timoney	Sheet 2/2
Method : Rotary Cored				

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.00 11.00-11.05	96				25/50 SPT(C) 25*/50 50/0		(4.30)				
12.50 12.50-12.55	100				25/50 SPT(C) 25*/50 50/0	23.07	12.30 (0.70)	Dense grey subrounded smooth COBBLES and BOULDERS of Limestone with a little clayey Gravel.			
13.00	100	57	32	14		22.37	13.00	Strong very thinly bedded to thinly bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Slightly weathered to fresh			
14.00 14.00-14.05					25/50 SPT(C) 25*/50 50/0			(13.00m to 17.00m BGL) Two fracture sets. F1: 0-20 degree fracture very close to medium spaced, planar and smooth. F2: 40-60 degree fracture extremely close to medium spaced, undulating and rough.			
15.50	100	100	80	5			(4.00)	(14.60m to 14.70m BGL) Pyrite lens up to 5mm thick and 60mm vug cavity present			
17.00	100	100	95			18.37	17.00	Complete at 17.00m			

Remarks

Scale (approx)
1:50

Logged By
RH

Figure No.
12499-01-23.PBH-13



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Site
Shancloon Phase 1

Borehole
Number
PBH-16

Machine : Beretta T44			Casing Diameter 146mm cased to 13.00m			Ground Level (mOD) 35.57		Client RWE Renewables			Job Number 12499-01-23	
Flush : Water-polymer mix			Location 534916.6 E 755129 N			Dates 12/05/2023- 16/06/2023		Engineer Fehily Timoney			Sheet 1/3	
Core Dia: 102 mm												
Method : Rotary Cored												

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00								NO RECOVERY. Driller notes: PEAT.			
							(1.00)				
	12					34.57	1.00	Recovery consists of dark brown slightly clayey pseudo fibrous PEAT. Driller notes: PEAT.			
							(1.50)				
2.50					0.0/0.0,1.0 SPT(C) N=1	33.07	2.50	Very soft dark brown slightly clayey pseudo fibrous PEAT			
2.50-2.95	77						(1.50)				
4.00					1.0/0.0,4.6 SPT(C) N=10	31.57	4.00	Recovery consists of dark brown slightly clayey pseudo fibrous PEAT onto grey angular to subrounded fine to coarse GRAVEL. Driller notes PEAT onto GRAVEL (Medium dense to dense)			
4.00-4.45	47						(1.50)				
5.50					3.5/6.6,7.9 SPT(C) N=28	30.07	5.50	Medium dense to dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high boulder content. Boulders are subrounded smooth limestone.			
5.50-5.95	73						(1.50)				
7.00					25/50 SPT(C) 25*/0 50/0	28.57	7.00	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high boulder content. Boulders are subrounded smooth limestone.			
7.00-7.00	80					28.17	(0.40)				
							7.40	Very stiff light brownish grey slightly sandy gravelly silty CLAY with medium cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.			
8.50					25/50 SPT(C) 25*/0 50/0		(3.10)				
8.50-8.50	63										
10.00											

Remarks Bentonite seal installed from 22.00m to 17.00m BGL. 50mm slotted standpipe with gravel surround installed from 17.00m to 11.00m BGL. 50mm plain standpipe with bentonite seal from 11.00m BGL to GL. Finished with a raised cover. Borehole complete at 22.00m BGL.									Scale (approx) 1:50	Logged By SB
									Figure No. 12499-01-23.PBH-16	



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Site
Shancloon Phase 1

Borehole
Number
PBH-16

Machine : Beretta T44	Casing Diameter 146mm cased to 13.00m	Ground Level (mOD) 35.57	Client RWE Renewables	Job Number 12499-01-23
Flush : Water-polymer mix				
Core Dia : 102 mm	Location 534916.6 E 755129 N	Dates 12/05/2023- 16/06/2023	Engineer Fehily Timoney	Sheet 2/3
Method : Rotary Cored				


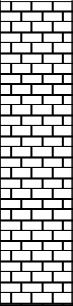
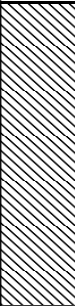
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr	
10.00-10.09	93				18,7/50 SPT(C) 25*/85 50/0	25.07	10.50					
			Strong to very strong medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Slightly weathered.									
11.50		87						(3.90)				
13.00	100											
14.50	93		15		21.17	14.40	Possible fault rock recovered as dark grey slightly sandy gravelly silty CLAY with low cobble content.					
						(1.80)						
16.00 16.20		93				30	20	19.37	16.20			Very strong medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered.
17.50	93	49			46			(16.20m to 19.00m BGL) 2 fracture sets. F1: 0 to 20 degrees, closely spaced, planar and smooth with partial clay infill. F2: 70 to 90 degrees, medium to widely spaced, undulating and rough with partial clay infill and brown staining (10.50m to 14.40m BGL) 2 fracture sets. F1: 0 to 20 degrees, closely spaced, planar and smooth with partial clay infill. F2: 70 to 90 degrees, medium to widely spaced, undulating and rough with partial clay infill and brown staining				
19.00	100	90	90				(5.80)					

Remarks

Scale (approx)
1:50

Logged By
SB

Figure No.
12499-01-23.PBH-16

<div></div> <div>Ground Investigations Ireland Ltd www.gii.ie</div>							Site Shancloon Phase 1			Borehole Number PBH-16	
Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Method : Rotary Cored			Casing Diameter 146mm cased to 13.00m		Ground Level (mOD) 35.57		Client RWE Renewables			Job Number 12499-01-23	
			Location 534916.6 E 755129 N		Dates 12/05/2023-16/06/2023		Engineer Fehily Timoney			Sheet 3/3	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
20.50				5							
	100	100	95					(19.00m to 22.00m BGL) 1 fracture set. F1: 0 to 20 degrees, closely to medium spaced, planar and smooth			
22.00						13.57	22.00	Complete at 22.00m			
Remarks									Scale (approx) 1:50	Logged By SB	
									Figure No. 12499-01-23.PBH-16		



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Site
Shancloon Phase 1

Borehole Number
PBH-17

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Method : Rotary Cored			Casing Diameter 146mm cased to 17.00m		Ground Level (mOD) 30.23	Client RWE Renewables	Job Number 12499-01-23
			Location 534881.9 E 754421.1 N		Dates 13/04/2023-17/04/2023	Engineer Fehily Timoney	Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00								Recovery consists of pseudofibrous PEAT. Driller notes: PEAT			
2.00	30				1.0/0.0,1.0 SPT(C) N=1	28.23	2.00 (2.00)	Recovery consists of pseudofibrous PEAT onto cream clayey SILT. Driller notes: PEAT (Very soft).			
2.00-2.45											
	40										
3.50					1.0/1.0,0.0 SPT(C) N=1	26.73	3.50 (3.00)	Recovery consists of cream clayey SILT. Driller notes: Marl (Very soft).			
3.50-3.95											
	50										
6.50					0.1/0.1,1.0 SPT(C) N=2	23.73	6.50 (3.00)	Recovery consists of grey slightly sandy slightly gravelly silty CLAY. Driller notes: Silt (Very Soft)			
6.50-6.95											
	25										
9.50					0.0/1.0,0.0 SPT(C) 0*/50 1/0	20.73	9.50	Recovery consists of grey subrounded smooth cobbles of limestone with a little Gravel. Driller notes: SILT washed away (Very Soft).			
9.50-9.55											

Remarks Bentonite seal from 17.00m to 16.00m BGL. 50mm slotted standpipe with gravel surround installed from 16.00m to 13.00m BGL. 50mm plain standpipe with bentonite seal from 13.00m BGL to GL. Finished with a raised cover. Borehole complete at 17.00m BGL									Scale (approx) 1:50	Logged By SB
									Figure No. 12499-01-23.PBH-01	



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Site Shancloon Phase 1	Borehole Number PBH-17
Client RWE Renewables	Job Number 12499-01-23
Engineer Fehily Timoney	Sheet 2/2

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Method : Rotary Cored	Casing Diameter 146mm cased to 17.00m	Ground Level (mOD) 30.23
	Location 534881.9 E 754421.1 N	Dates 13/04/2023- 17/04/2023

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.00	6				0.0/0.1,0.0 SPT(C) N=1		(1.50)				
11.00-11.45						19.23	11.00	Recovery consists of grey subrounded smooth COBBLES and BOULDERS of limestone with some clayey sandy gravel. Driller notes: Gravel onto possible bedrock (Very Loose).			
	63						(1.85)				
12.50											
12.85	90	87	60			17.38	12.85	Strong dark grey thinly to medium bedded fine grained argillaceous LIMESTONE . Fresh to slightly weathered.			
				6			(2.25)	(12.85m to 15.10m BGL) 2 fracture sets. F1: 0 to 20 degrees, closely to medium spaced , planar and rough with clay infill. F2: 60 to 90 degrees, medium to wide, planar and rough with clay infill			
14.00	100	80	70								
15.10						15.13	15.10	Medium strong to strong dark grey thinly to medium bedded fine grained argillaceous LIMESTONE. Slightly to moderately weathered.			
15.50				9			(1.90)	(15.10m to 17.00m BGL) 2 fracture sets. F1: 0 to 20 degrees, closely to medium spaced , planar and rough with clay infill. F2: 60 to 90 degrees, medium to wide, planar and rough with clay infill			
	93	60	17								
17.00						13.23	17.00	Complete at 17.00m			

Remarks	Scale (approx) 1:50	Logged By SB
	Figure No. 12499-01-23.PBH-01	



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Site Shancloon Phase 1	Borehole Number PBH-18
Client RWE Renewables	Job Number 12499-01-23
Engineer Fehily Timoney	Sheet 1/3

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored	Casing Diameter 146mm cased to 16.00m 96mm cased to 20.50m	Ground Level (mOD) 27.29
	Location 529207.9 E 753038.3 N	Dates 25/05/2023- 03/06/2023

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00								Recovery consists of brown slightly sandy gravelly CLAY. Driller notes: Topsoil onto Boulder CLAY.			
	30						(1.50)				
1.50						27.29	1.50	Recovery consists of grey slightly clayey slightly sandy Gravel with high cobble content. Cobbles are subrounded smooth limestone. Driller notes: Boulder CLAY.			
	40						(1.00)				
2.50 2.50-2.95					5,7/7,10,12,14 SPT(C) N=43	27.29	2.50	Very stiff brown slightly sandy gravelly CLAY with high cobble content. Cobbles are subrounded smooth limestone.			
	80						(3.00)				
4.00 4.00-4.43					8,9/10,13,15,12 SPT(C) 50/275						
	93										
5.50 5.50-5.79					6,10/21,29 SPT(C) 50/135	27.29	5.50	Very stiff dark grey slightly sandy slightly gravelly CLAY with medium cobble content. Cobbles are subrounded smooth limestone.			
	70						(1.50)				
7.00 7.00-7.13					10,15/50 SPT(C) 25*/125 50/0	27.29	7.00	Recovery consists of dark grey subrounded smooth Cobbles and Boulders with some dark grey slightly sandy slightly gravelly Clay			
	60						(1.50)				
8.50 8.50-8.87					8,10/12,13,25 SPT(C) 50/220	27.29	8.50	Possible WEATHERED BEDROCK / KARST ZONE recovered as subangular to subrounded smooth Cobbles and Boulders of limestone with a little Clay and Sand. Reduced recovery.			
	60										
10.00											

Remarks Bentonite seal installed from 20.50m to 13.00m BGL. 50mm slotted standpipe with pea gravel surround installed from 13.00m to 10.00m BGL. 50mm plain standpipe with a bentonite seal installed from 10.00m to GL. Finished with a raised cover. Borehole complete at 20.50m BGL	Scale (approx) 1:50	Logged By SB
	Figure No. 12499-01-23.PBH-18	



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Site
Shancloon Phase 1

Borehole
Number
PBH-18

Machine : Beretta T44
Flush : Water-polymer mix
Core Dia: 102 mm
Inclination : 90° to the vertical
Method : Rotary Cored

Casing Diameter
146mm cased to 16.00m
96mm cased to 20.50m

Ground Level (mOD)
27.29

Client
RWE Renewables

Job
Number
12499-01-23

Location
529207.9 E 753038.3 N

Dates
25/05/2023-
03/06/2023

Engineer
Fehily Timoney

Sheet
2/3




Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.00-10.00	97				25/50 SPT(C) 25*/0 50/0						
11.50 11.50-11.58	60				19,6/50 SPT(C) 25*/75 50/0		(6.30)				
13.00	73										
14.50 14.80	100	60	47	5		27.29	14.80	Medium strong to strong thinly to medium bedded dark bluish grey fine grained fossiliferous LIMESTONE. Slightly to moderately weathered with rare calcite vein and clay fracture infill. Bleaching of rock along fractures .			
16.00 16.50	93	53	53	NI							
17.50	93	53	43	6			(5.70)	(14.80m to 20.50m BGL) 3 fracture sets. F1: 0-20 degrees, closely to medium spaced, planar and rough with clay infill. F2: 35-55 degrees, closely to widely spaced, undulating and rough with clay infill. F3:80-90 degrees, closely to widely spaced, undulating and rough.			
19.00	100	60	30								

Remarks

Scale (approx)
1:50

Logged By
SB

Figure No.
12499-01-23.PBH-18

 <div> Ground Investigations Ireland Ltd www.gii.ie </div>							Site Shancloon Phase 1			Borehole Number PBH-18					
Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Inclination : 90° to the vertical Method : Rotary Cored			Casing Diameter 146mm cased to 16.00m 96mm cased to 20.50m		Ground Level (mOD) 27.29	Client RWE Renewables		Job Number 12499-01-23							
			Location 529207.9 E 753038.3 N		Dates 25/05/2023-03/06/2023	Engineer Fehily Timoney		Sheet 3/3							
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr				
20.50						27.29	20.50	Complete at 20.50m							
Remarks															
												Scale (approx) 1:50		Logged By SB	
												Figure No. 12499-01-23.PBH-18			



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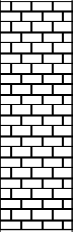

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Site Shancloon Phase 1	Borehole Number PBH-19
Client RWE Renewables	Job Number 12499-01-23
Engineer Fehily Timoney	Sheet 1/2

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored	Casing Diameter 146mm cased to 11.50m	Ground Level (mOD) 29.45
	Location 529761.1 E 752905.3 N	Dates 22/05/2023- 24/05/2023

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00						29.45	(0.20) 0.20	TOPSOIL			
	83						(0.70)	Brown slightly sandy slightly gravelly organic CLAY with many rootlets			
1.50	50					29.45	0.90	Grey slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Cobbles are subrounded smooth limestone.			
2.50							(1.60)				
2.50-2.95	100				5,7/8,8,9,11 SPT(C) N=36	29.45	2.50	Dense grey slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Cobbles are subrounded smooth limestone.			
							(1.00)				
4.00						29.45	3.50	Very stiff dark brownish grey slightly sandy gravelly CLAY with low cobble content. Cobbles are subrounded smooth limestone.			
4.00-4.10	87				12,13/50 SPT(C) 25*/100 50/0		(2.55)				
5.00-5.13											
5.50											
6.05	100	60	60		4,21/50 SPT(C) 25*/125 50/0	29.45	6.05	Strong to very strong thinly bedded to medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered.			
7.00	100	93	90								
8.50	100	97	90	5			(5.45)				
10.00								(6.05m to 11.50m BGL) 3 fracture sets. F1: 0-20 degrees, very closely to medium spaced, planar and rough with clay infill. F2: 30-50 degrees, very widely spaced, planar and			

Remarks Bentonite seal installed from 11.50m to 10.10m BGL. 50mm slotted standpipe with pea gravel surround installed from 10.10m to 7.10m BGL. 50mm plain standpipe with a bentonite seal installed from 7.10m to GL with a raised cover. Borehole complete at 11.50m BGL	Scale (approx) 1:50	Logged By SB
	Figure No. 12499-01-23.PBH-19	

 <div> Ground Investigations Ireland Ltd www.gii.ie </div>							Site Shancloon Phase 1			Borehole Number PBH-19	
Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Inclination : 90° to the vertical Method : Rotary Cored			Casing Diameter 146mm cased to 11.50m		Ground Level (mOD) 29.45		Client RWE Renewables		Job Number 12499-01-23		
			Location 529761.1 E 752905.3 N		Dates 22/05/2023- 24/05/2023		Engineer Fehily Timoney		Sheet 2/2		
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.50	100	97	97			29.45	11.50	rough. F3:80-90 degrees, closely to widely spaced, undulating and rough.			
								Complete at 11.50m			
Remarks									Scale (approx)	Logged By	
									1:50	SB	
									Figure No. 12499-01-23.PBH-19		




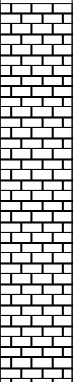

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Site Shancloon Phase 1	Borehole Number PBH-20
Client RWE Renewables	Job Number 12499-01-23
Engineer Fehily Timoney	Sheet 1/2

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored	Casing Diameter 146mm cased to 12.50m	Ground Level (mOD) 28.28
	Location 529940.3 E 752846.4 N	Dates 03/05/2023- 10/05/2023

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00								Recovery consists of slightly clayey pseudo fibrous PEAT onto light brown slightly sandy silty CLAY. Driller notes: PEAT.			
2.50	60				3,5/7,7,9,10 SPT(C) N=33	28.28	(2.30)				
2.50-2.95							2.30	Recovery consists of grey subrounded smooth cobbles and boulders of limestone. Driller notes Marl with boulders			
	40						(1.70)				
4.00					20,5/50 SPT(C) 25*/100 50/0	28.28	4.00	Dense grey slightly sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content. Cobbles and boulders are subrounded smooth limestone.			
4.00-4.10							(2.10)				
5.50					25/50 SPT(C) 25*/0 50/0						
5.50-5.50							6.10	Strong to very strong thinly bedded to medium bedded dark grey fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered.			
6.10	100	60	60								
7.00											
	100	93	90								
8.50				4							
	100	97	90				(6.40)				
10.00											

Remarks Bentonite seal installed from 12.50m to 10.00m BGL. 50mm slotted standpipe with pea gravel surround installed from 10.00m to 7.00m BGL. 50mm plain standpipe with a bentonite seal installed from 7.00m to GL with a raised cover. Borehole complete at 12.50m BGL	Scale (approx) 1:50	Logged By SB
	Figure No. 12499-01-23.PBH-19	

 <div> Ground Investigations Ireland Ltd www.gii.ie </div>							Site Shancloon Phase 1			Borehole Number PBH-20	
Machine : Beretta T44 Flush : Water-polymer mix Core Dia: 102 mm Inclination : 90° to the vertical Method : Rotary Cored			Casing Diameter 146mm cased to 12.50m		Ground Level (mOD) 28.28		Client RWE Renewables		Job Number 12499-01-23		
			Location 529940.3 E 752846.4 N		Dates 03/05/2023-10/05/2023		Engineer Fehily Timoney		Sheet 2/2		
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.50	100	97	97			28.28	12.50	(6.10m to 12.50m BGL) 2 fracture sets. F1: 0 to 20 degrees, close to medium spaced , planar and rough. F2: 30 to 50 degrees, widely spaced, planar and rough.			
	95	95	88								
12.50								Complete at 12.50m			
Remarks									Scale (approx)	Logged By	
									1:50	SB	
									Figure No. 12499-01-23.PBH-19		



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Site Shancloon Phase 1	Borehole Number PBH-21
Client RWE Renewables	Job Number 12499-01-23
Engineer Fehily Timoney	Sheet 1/1

Machine : Beretta T44 Flush : Water-polymer mix Core Dia : 102 mm Inclination : 90° to the vertical Method : Rotary Cored			Casing Diameter 146mm cased to 10.00m		Ground Level (mOD) 25.68						
			Location 530486.4 E 753263.3 N		Dates 12/06/2023- 14/06/2023						
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	85					25.68	(0.15)	Dark brown clayey pseudo fibrous PEAT			
							(0.15)	Brownish grey sandy silty CLAY			
1.00	53					25.68	1.00	Dark grey slightly sandy gravelly CLAY			
							(1.50)				
2.50	80				25/50 SPT(C) 25*/0 50/0	25.68	2.50	Very stiff dark grey slightly sandy gravelly CLAY with low cobble content. Cobbles are subrounded smooth limestone.			
2.50-2.50							(2.70)				
4.00	87	17	7		9,12/13,20,17 SPT(C) 50/220						
4.00-4.37											
5.20	97	90	90			25.68	5.20	Strong to very strong thinly bedded to thickly bedded dark grey/black fine grained argillaceous fossiliferous LIMESTONE. Fresh to slightly weathered with rare calcite veins.			
5.50											
7.00	97	97	97	5			(4.80)				
8.50	97	97	97					(5.20m to 10.00m BGL) 2 fracture sets. F1: 0 to 25 degrees, close to medium spaced, planar and rough with clay infill. F2: 60 to 80 degrees, widely spaced, planar and rough with clay infill			
10.00						25.68	10.00				

Remarks Bentonite seal installed from 10.00m to 9.00m BGL. 50mm slotted standpipe with pea gravel surround installed from 9.00m to 7.00m BGL. 50mm plain standpipe with a bentonite seal installed from 7.00m to GL with a raised cover. Borehole complete at 10.00m BGL									Scale (approx) 1:50	Logged By SB
									Figure No. 12499-01-23.PBH-21	

Shancloon Wind Farm – Rotary Core Photographs

PBH-01



PBH-01



Shancloon Wind Farm – Rotary Core Photographs

PBH-01



PBH-01



Shancloon Wind Farm – Rotary Core Photographs

PBH-01



PBH-02



Shancloon Wind Farm – Rotary Core Photographs

PBH-02



PBH-02



Shancloon Wind Farm – Rotary Core Photographs

PBH-03



PBH-03



Shanclon Wind Farm – Rotary Core Photographs

PBH-03



PBH-03



Shancloon Wind Farm – Rotary Core Photographs

PBH-03A



PBH-03A



Shancloon Wind Farm – Rotary Core Photographs

PBH-03A



PBH-03A



Shancloon Wind Farm – Rotary Core Photographs

PBH-03A



PBH-04



Shancloon Wind Farm – Rotary Core Photographs

PBH-04



PBH-04

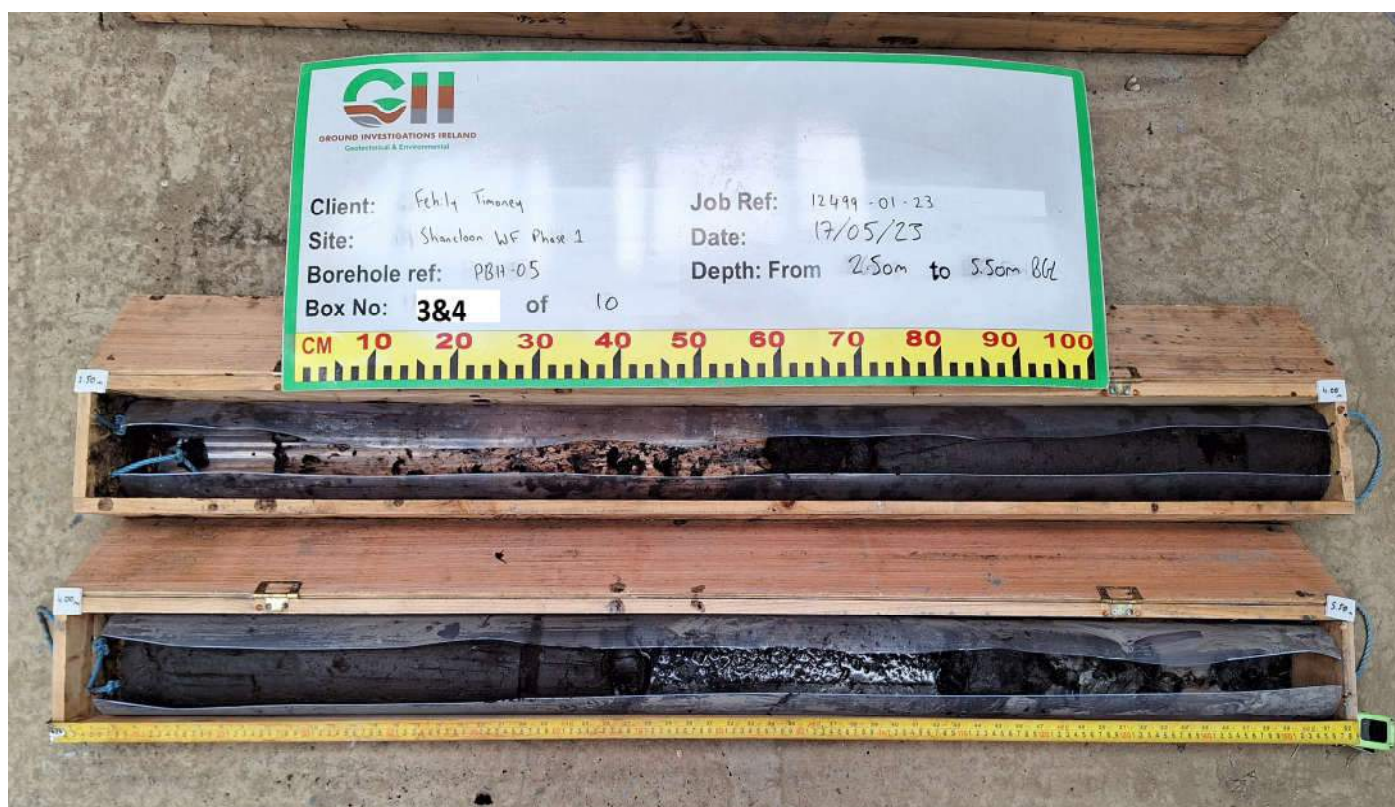


Shancloon Wind Farm – Rotary Core Photographs

PBH-05



PBH-05



Shancloon Wind Farm – Rotary Core Photographs

PBH-05



PBH-05



Shancloon Wind Farm – Rotary Core Photographs

PBH-05



PBH-06



Shancloon Wind Farm – Rotary Core Photographs

PBH-06



PBH-06



Shancloon Wind Farm – Rotary Core Photographs

PBH-06



PBH-06



Shancloon Wind Farm – Rotary Core Photographs

PBH07



PBH-07



Shancloon Wind Farm – Rotary Core Photographs

PBH-07



PBH-08



Shancloon Wind Farm – Rotary Core Photographs

PBH-08



PBH-08



Shancloon Wind Farm – Rotary Core Photographs

PBH-08



PBH-08



Shancloon Wind Farm – Rotary Core Photographs

PBH-09



PBH-09



Shancloon Wind Farm – Rotary Core Photographs

PBH-09



PBH-09



Shancloon Wind Farm – Rotary Core Photographs

PBH-09



PBH-10



Shancloon Wind Farm – Rotary Core Photographs

PBH-10



PBH-10



Shancloon Wind Farm – Rotary Core Photographs

PBH-10



PBH-10



Shancloon Wind Farm – Rotary Core Photographs

PBH-10



PBH-11



Shancloon Wind Farm – Rotary Core Photographs

PBH-11



PBH-11



Shancloon Wind Farm – Rotary Core Photographs

PBH-11



PBH-11



Shancloon Wind Farm – Rotary Core Photographs

PBH-11



PBH-12



Shancloon Wind Farm – Rotary Core Photographs

PBH-12



PBH-12



Shancloon Wind Farm – Rotary Core Photographs

PBH-12



PBH-13



Shancloon Wind Farm – Rotary Core Photographs

PBH-13



PBH-13



Shanclon Wind Farm – Rotary Core Photographs

PBH-13



PBH-13



Shancloon Wind Farm – Rotary Core Photographs

PBH-14



PBH-14



Shancloon Wind Farm – Rotary Core Photographs

PBH-14



PBH-15



Shancloon Wind Farm – Rotary Core Photographs

PBH-15



PBH-15



Shancloon Wind Farm – Rotary Core Photographs

PBH-15



PBH-16



Shancloon Wind Farm – Rotary Core Photographs

PBH-16



PBH-16

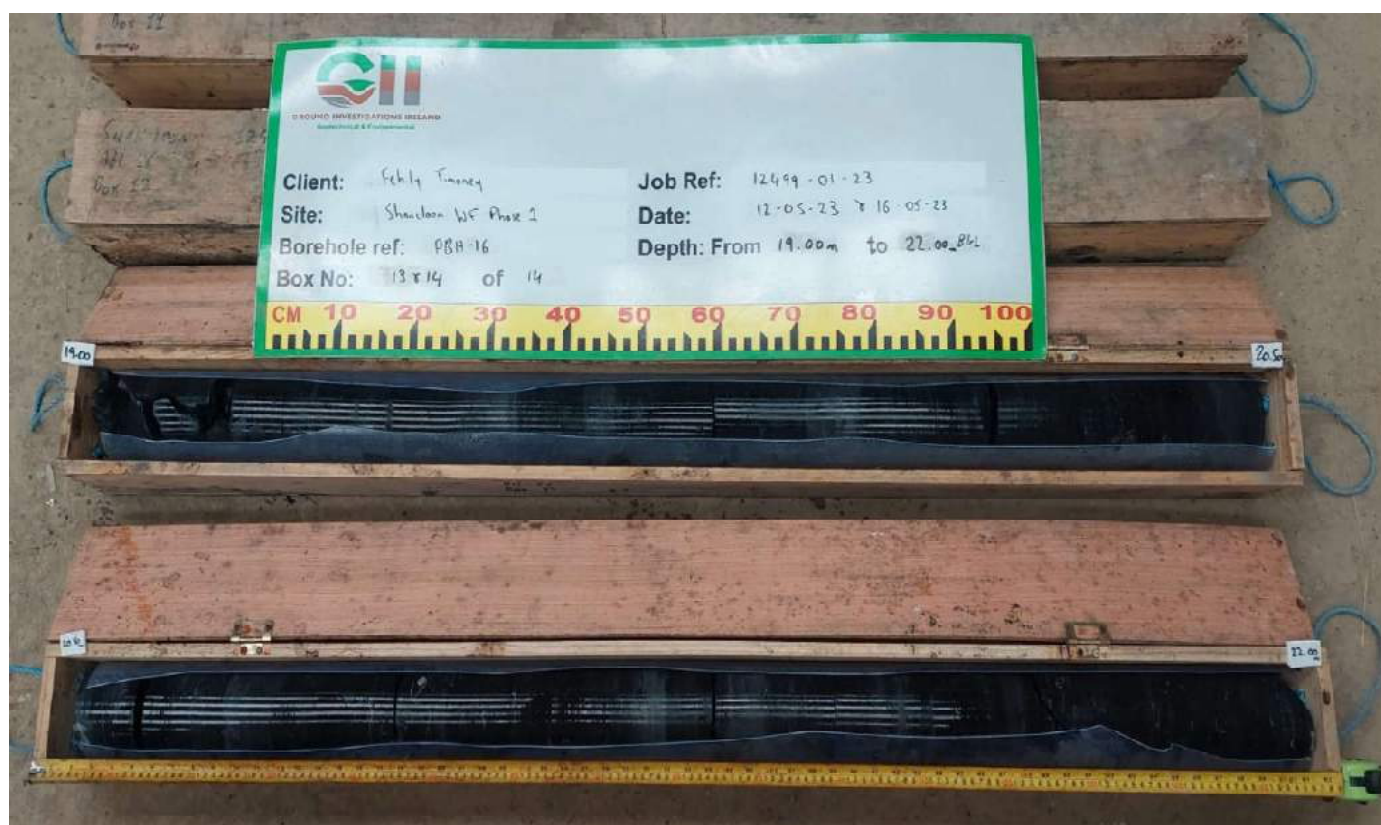


Shancloon Wind Farm – Rotary Core Photographs

PBH-16



PBH-16



Shancloon Wind Farm – Rotary Core Photographs

PBH-17



PBH-17



Shancloon Wind Farm – Rotary Core Photographs

PBH-17



PBH-18



Shancloon Wind Farm – Rotary Core Photographs

PBH-18



PBH-18



Shancloon Wind Farm – Rotary Core Photographs

PBH-18



PBH-18



Shancloon Wind Farm – Rotary Core Photographs

PBH-18

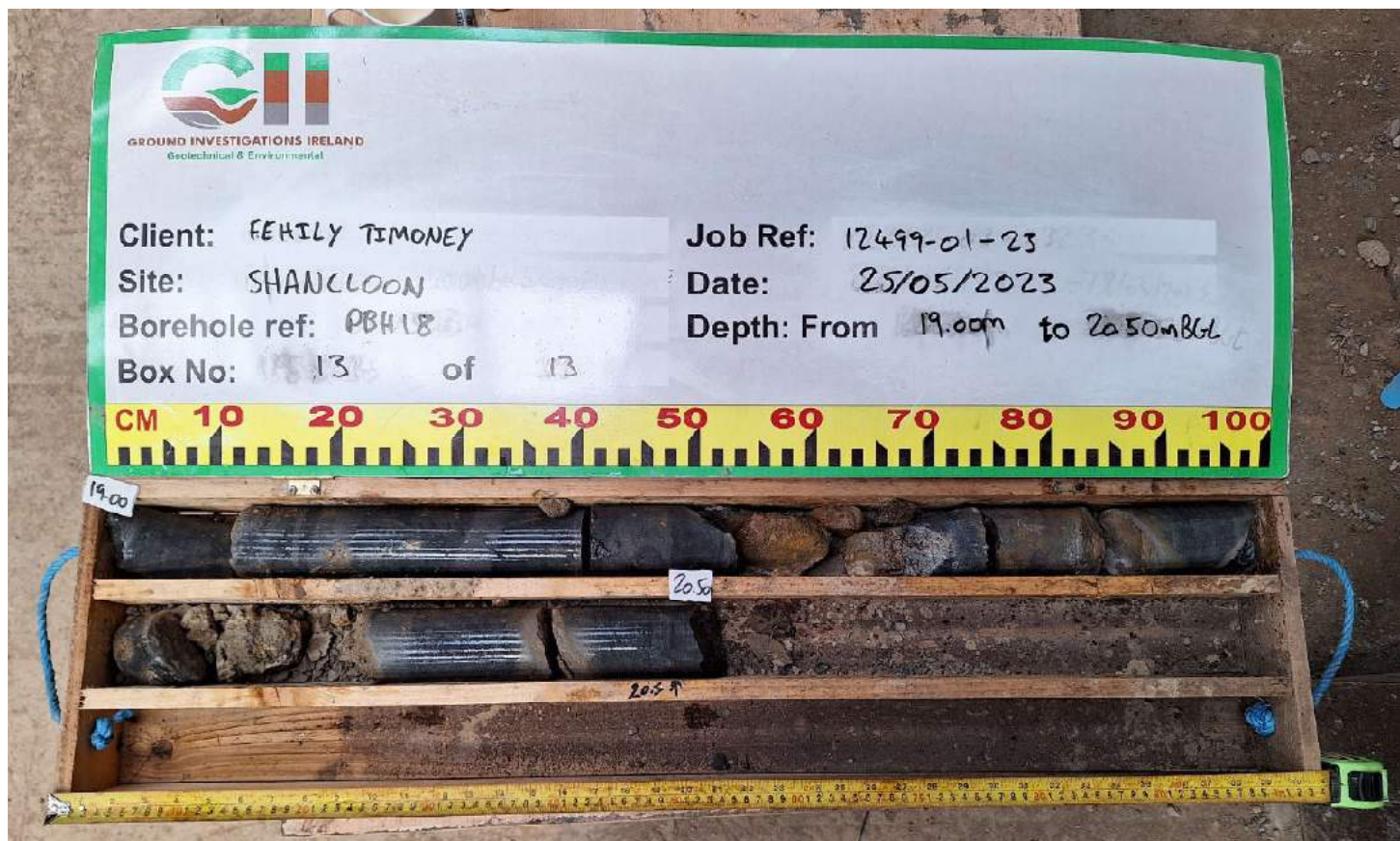


PBH-18



Shancloon Wind Farm – Rotary Core Photographs

PBH-18



PBH-19



Shancloon Wind Farm – Rotary Core Photographs

PBH-19



PBH-19



Shancloon Wind Farm – Rotary Core Photographs

PBH-19



PBH-20

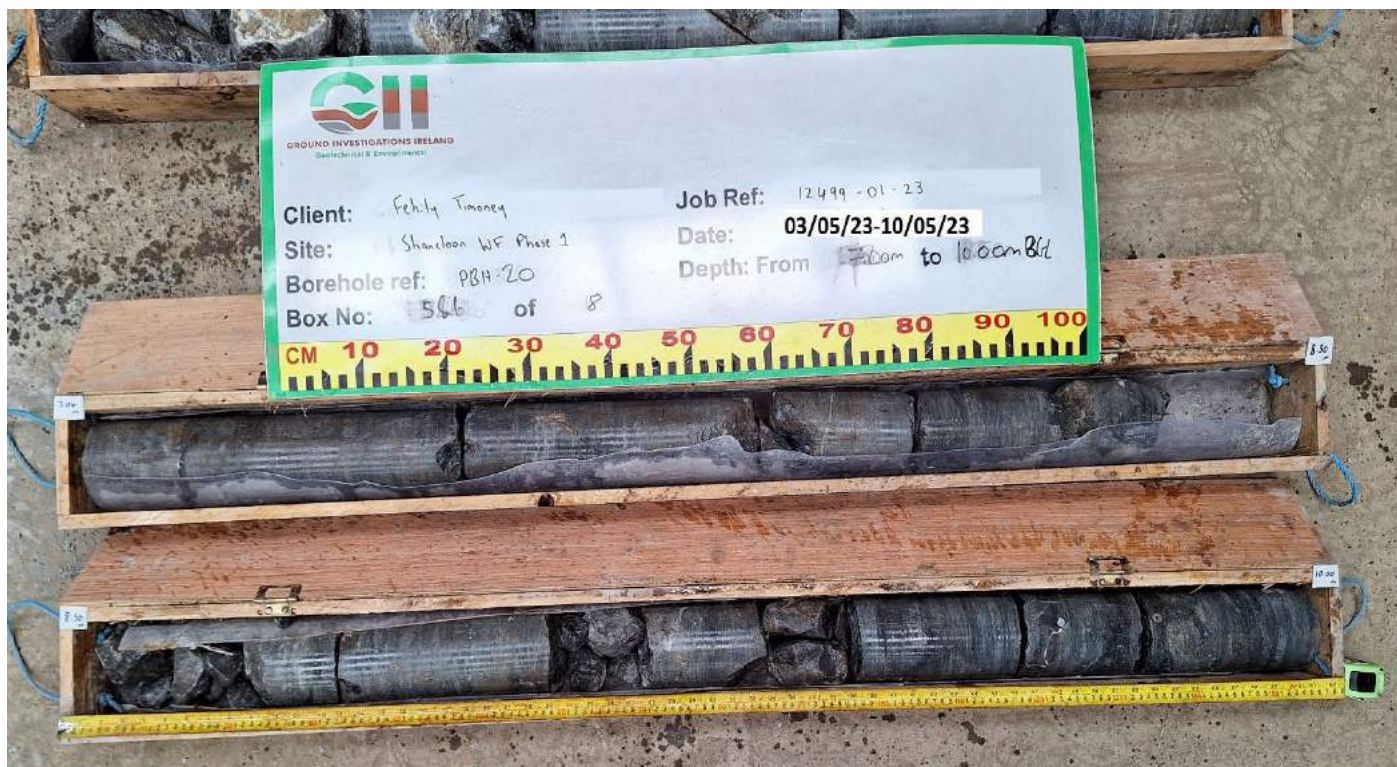


Shancloon Wind Farm – Rotary Core Photographs

PBH-20

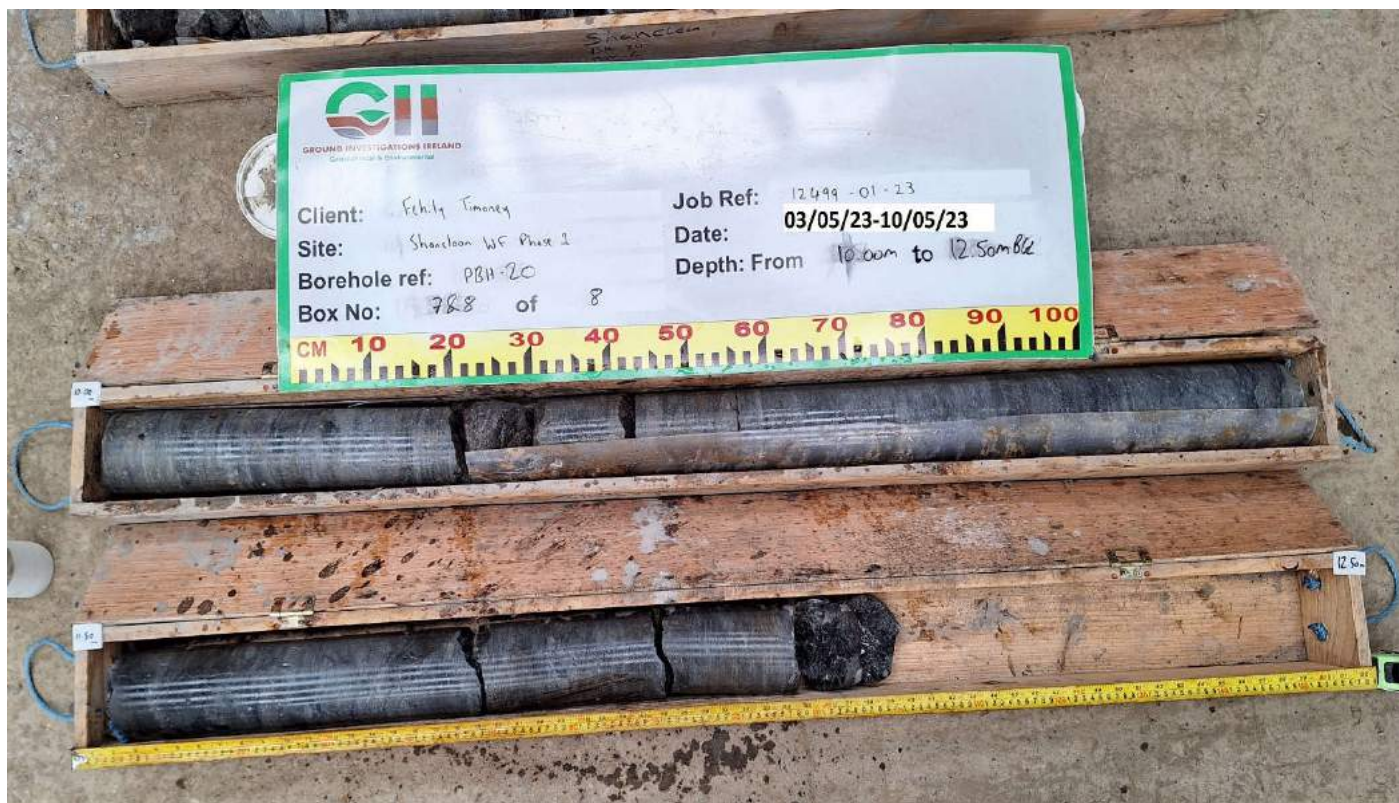


PBH-20



Shancloon Wind Farm – Rotary Core Photographs

PBH-20



PBH-21

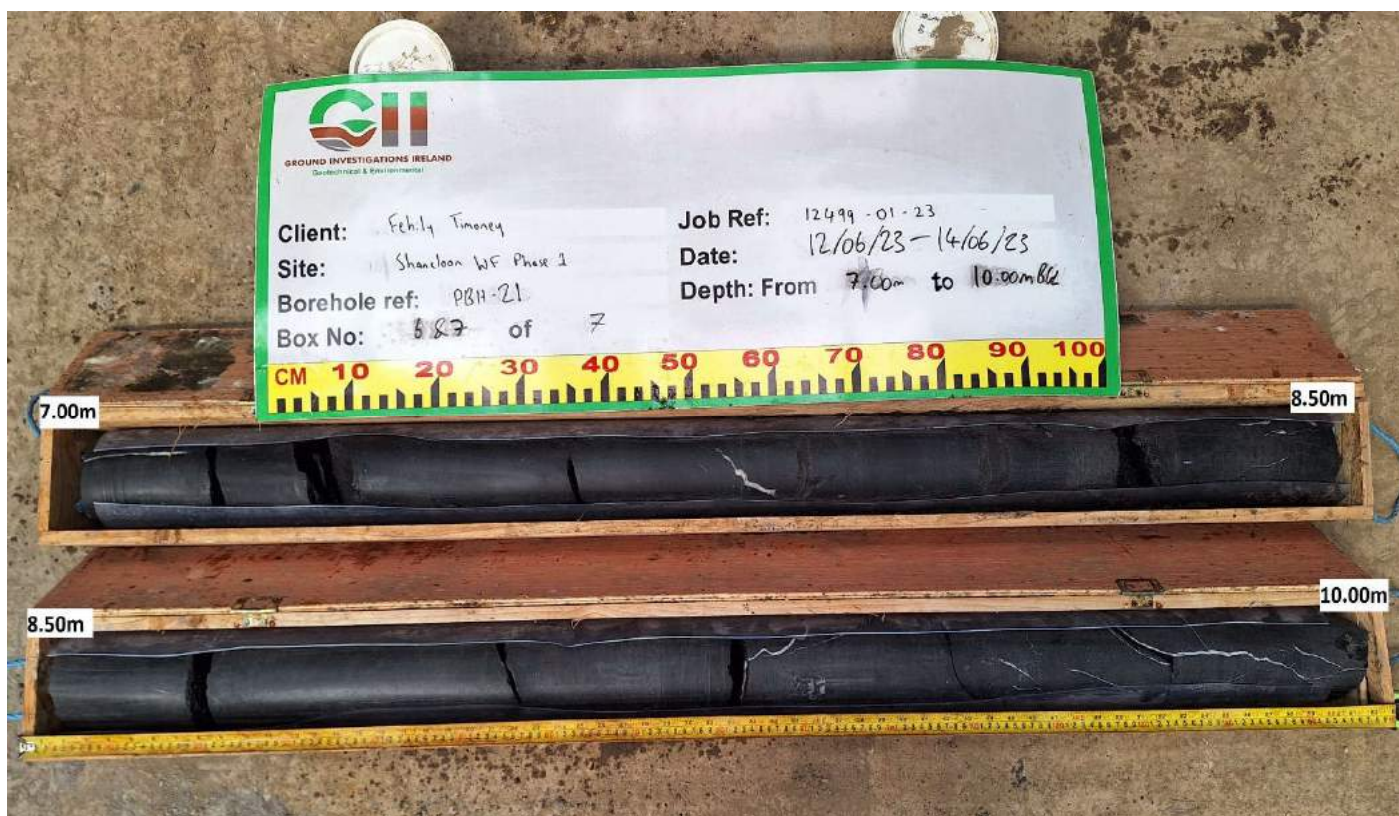


Shancloon Wind Farm – Rotary Core Photographs

PBH-21



PBH-21



APPENDIX 4 – Groundwater Monitoring



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GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

GROUNDWATER MONITORING

Shancloon Wind Farm

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
PBH-01	18/04/2023	16.45	1.12	
PBH-02	18/04/2023	16.35	1.81	
PBH-03	18/04/2023	17.25	8.90	
PBH-04	18/04/2023	17.10	4.63	
PBH-06	18/04/2023	14.55	3.25	
PBH-07	18/04/2023	14.20	0.33	
PBH-09	18/04/2023	15.40	3.34	
PBH-12	18/04/2023	15.50	0.90	
PBH-13	18/04/2023	15.10	2.29	
PBH-15	18/04/2023	16.10	1.58	
PBH-17	18/04/2023	14.40	0.39	



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Web: www.gii.ie

GROUNDWATER MONITORING

Shancloon Wind Farm

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
PBH-01	11/05/2023	11.55	1.30	
PBH-02	11/05/2023	12.05	2.08	
PBH-03	11/05/2023	11.30	9.43	
PBH-04	11/05/2023	11.15	5.28	
PBH-06	11/05/2023	13.40	3.38	
PBH-07	11/05/2023	13.30	0.33	
PBH-09	11/05/2023	12.40	3.83	
PBH-12	11/05/2023	12.45	1.46	
PBH-13	11/05/2023	12.25	2.70	
PBH-15	12/05/2023	9.15	1.69	
PBH-17	11/05/2023	13.15	0.50	



GROUND INVESTIGATIONS IRELAND
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GROUNDWATER MONITORING

Shancloon Wind Farm

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
PBH-01	11/07/2023	13.00	1.57	
PBH-02	11/07/2023	13.10	2.48	
PBH-03	11/07/2023	13.25	9.84	
PBH-04	11/07/2023	12.35	5.72	
PBH-05	11/07/2023	12.10	5.28	
PBH-06	11/07/2023	17.15	4.19	
PBH-07	11/07/2023	17.05	0.57	
PBH-09	11/07/2023	16.30	5.18	
PBH-12	11/07/2023	16.35	2.61	
PBH-13	11/07/2023	16.20	4.03	
PBH-14	11/07/2023	15.50	0.64	
PBH-15	11/07/2023	13.50	1.69	
PBH-16	11/07/2023	14.15	0.45	
PBH-17	11/07/2023	16.55	0.79	
PBH-18	11/07/2023	10.55	1.35	
PBH-19	11/07/2023	11.20	1.23	
PBH-20	11/07/2023	14.55	0.73	
PBH-21	11/07/2023	15.15	1.09	

APPENDIX 5 – Laboratory Testing



Ground Investigations Ireland
Catherinstown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland
D22 K5P8



4225



Attention : James Cashen
Date : 27th September, 2023
Your reference : 12449-01-23
Our reference : Test Report 23/15402 Batch 1
Location : Shancloon Wind Farm
Date samples received : 18th September, 2023
Status : Final Report
Issue : 1

Thirty nine samples were received for analysis on 18th September, 2023 of which thirty nine were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 42.644 kg of CO2

Scope 1&2&3 emissions - 100.778 kg of CO2

Authorised By:



Phil Sommerton BSc

Senior Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12449-01-23
Location: Shancloon Wind Farm
Contact: James Cashen
EMT Job No: 23/15402

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

[illegible]

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12449-01-23
Location: Shancloon Wind Farm
Contact: James Cashen
EMT Job No: 23/15402

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

[illegible]

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12449-01-23
Location: Shancloon Wind Farm
Contact: James Cashen
EMT Job No: 23/15402

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

[illegible]

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12449-01-23
Location: Shancloon Wind Farm
Contact: James Cashen
EMT Job No: 23/15402

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	31	32	33	34	35	36	37	38	39		Please see attached notes for all abbreviations and acronyms		
Sample ID	PBH-15	PBH-16	PBH-18	PBH-18	PBH-19	PBH-19	PBH-20	PBH-21	PBH-11				
Depth	8.20	5.90	4.20	7.50	1.50	4.60	1.00-2.50	1.10	17.35				
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T				
Sample Date	13/09/2023	13/09/2023	13/09/2023	13/09/2023	13/09/2023	13/09/2023	13/09/2023	13/09/2023	11/08/2023				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1				
Date of Receipt	18/09/2023	18/09/2023	18/09/2023	18/09/2023	18/09/2023	18/09/2023	18/09/2023	18/09/2023	18/09/2023		LOD/LOR	Units	Method No.
Sulphur as S	0.04	0.07	-	-	0.02	0.08	0.02	-	0.12		<0.01	%	TM30/PM15
Total Sulphate as SO4 [#]	240	289	-	-	199	371	144	-	504		<50	mg/kg	TM50/PM29
Sulphate as SO4 (2:1 Ext) [#]	0.0409	0.0283	0.0326	0.0117	0.0038	0.0606	0.0152	0.0828	0.0408		<0.0015	g/l	TM38/PM20
pH [#]	8.84	9.34	9.12	8.97	9.16	8.83	8.48	8.41	8.78		<0.01	pH units	TM73/PM11

Element Materials Technology Notification of Deviating Samples

Client Name: Ground Investigations Ireland **Matrix : Solid**

Reference: 12449-01-23

Location: Shancloon Wind Farm

Contact: James Cashen

Notification of Deviating Samples

Matrix : Solid

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 23/15402

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 23/15402

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEPA 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.	Yes		AD	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No



LABORATORY REPORT



Contract Number: PSL23/7322

Report Date: 14 September 2023
Client's Reference: 12499-01-23
Client Name: Ground Investigations Ireland Ltd
Catherinestown House
Hazelhatch Road
Newcastle
Co Dublin
D22 YD52

For the attention of: James Cashen/Barry Sexton

Project Name: Shancloon Wind Farm Phase 1

Date Received: 31/8/2023
Date Commenced: 31/8/2023
Date Completed: 14/9/2023

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
PTP-01		B	3.00		Dark brown clayey very sandy GRAVEL.
PTP-02		B	1.50		Dark brown clayey very sandy GRAVEL.
PTP-02		B	3.50		Brown slightly sandy gravelly CLAY.
PTP-03		D	1.50		Brown slightly sandy gravelly CLAY.
PTP-03		B	2.50		Brown clayey very sandy GRAVEL.
PTP-03		D	4.50		Brown slightly sandy gravelly CLAY.
PTP-04		D	0.50		Brown slightly sandy gravelly CLAY.
PTP-04		D	2.50		Brown slightly sandy gravelly CLAY.
PTP-06		B	1.00		Brown clayey very sandy GRAVEL.
PTP-06		D	1.00		Brown clayey very sandy GRAVEL.
PTP-07		B	0.50		Brown clayey very sandy GRAVEL.
PTP-07		D	0.50		Brown clayey very sandy GRAVEL.
PTP-07		D	2.50		Brown slightly sandy gravelly CLAY.
PTP-08		D	2.50		Brown slightly sandy gravelly CLAY.
PTP-09		D	1.50		Brown slightly sandy gravelly CLAY.
PTP-10		D	1.50		Brown slightly sandy CLAY with some organic material.
PTP-10		B	3.50		Brown clayey very sandy GRAVEL.
PTP-11		B	3.00		Grey slightly sandy CLAY with some organic material.
PTP-12		B	2.00		Brown silty very sandy GRAVEL with cobbles.



Shancloon Wind Farm Phase 1

Contract No:

PSL23/7322

Client Ref:

12499-01-23

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

Shancloon Wind Farm Phase 1

Contract No:

PSL23/7322

Client Ref:

12499-01-23

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
PTP-02		B	3.50		9.4							
PTP-03		D	1.50		5.4							
PTP-03		D	4.50		5.4							
PTP-04		D	0.50		36							
PTP-04		D	2.50		6.9							
PTP-06		D	1.00		11				NP			
PTP-07		D	0.50		8.8				NP			
PTP-07		D	2.50		11			25	14	11	65	Low Plasticity CL
PTP-08		D	2.50		6.1			23	13	10	61	Low Plasticity CL
PTP-09		D	1.50		9.2			36	19	17	90	Intermediate Plasticity CI
PTP-10		D	1.50		86							
PTP-10		B	3.50		13				NP			
PTP-11		B	3.00		56			59	27	32	100	High Plasticity CH
PTP-12		D	2.00		8.8							

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



Shancloon Wind Farm Phase 1

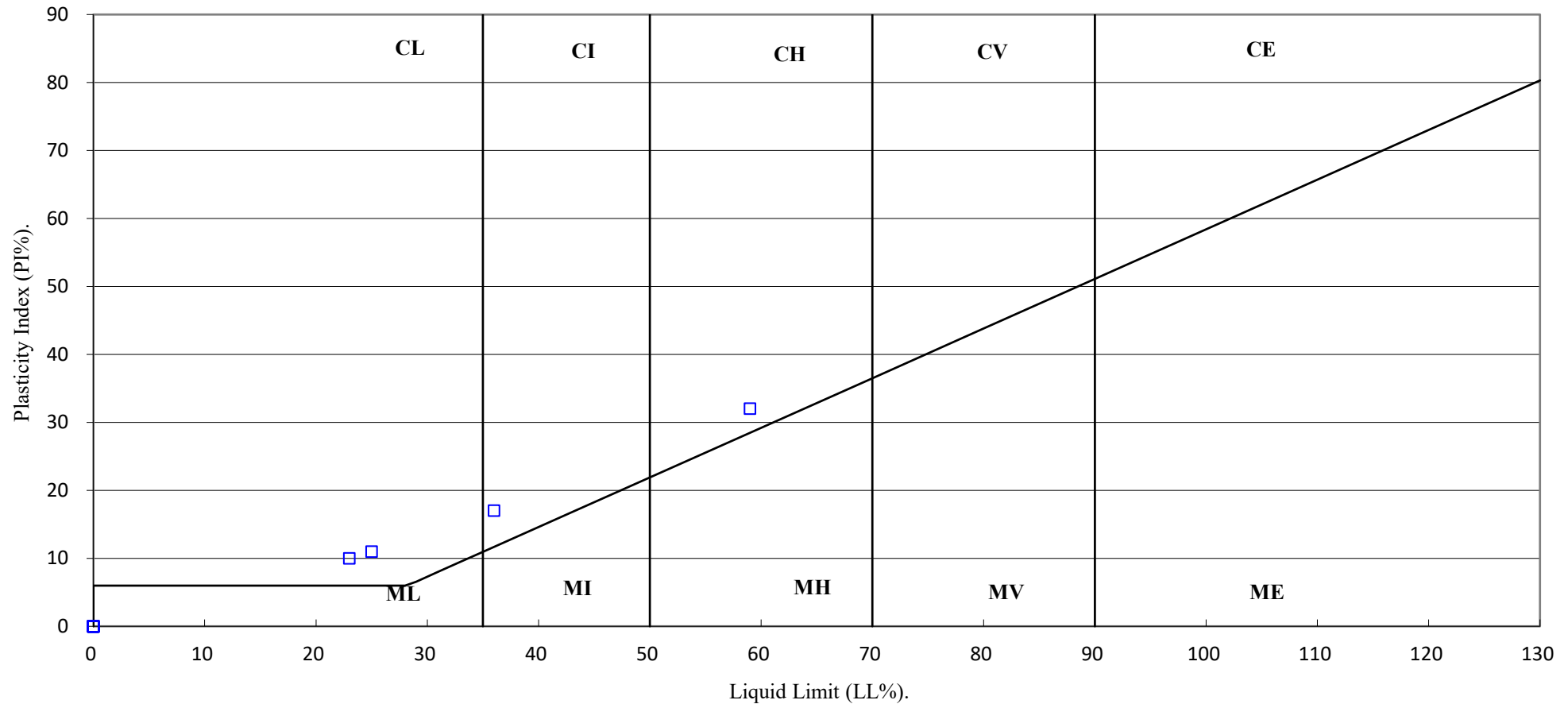
Contract No:

PSL23/7322

Client Ref:

12499-01-23

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



Shancloon Wind Farm Phase 1

Contract No:

PSL23/7322

Client Ref:

12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

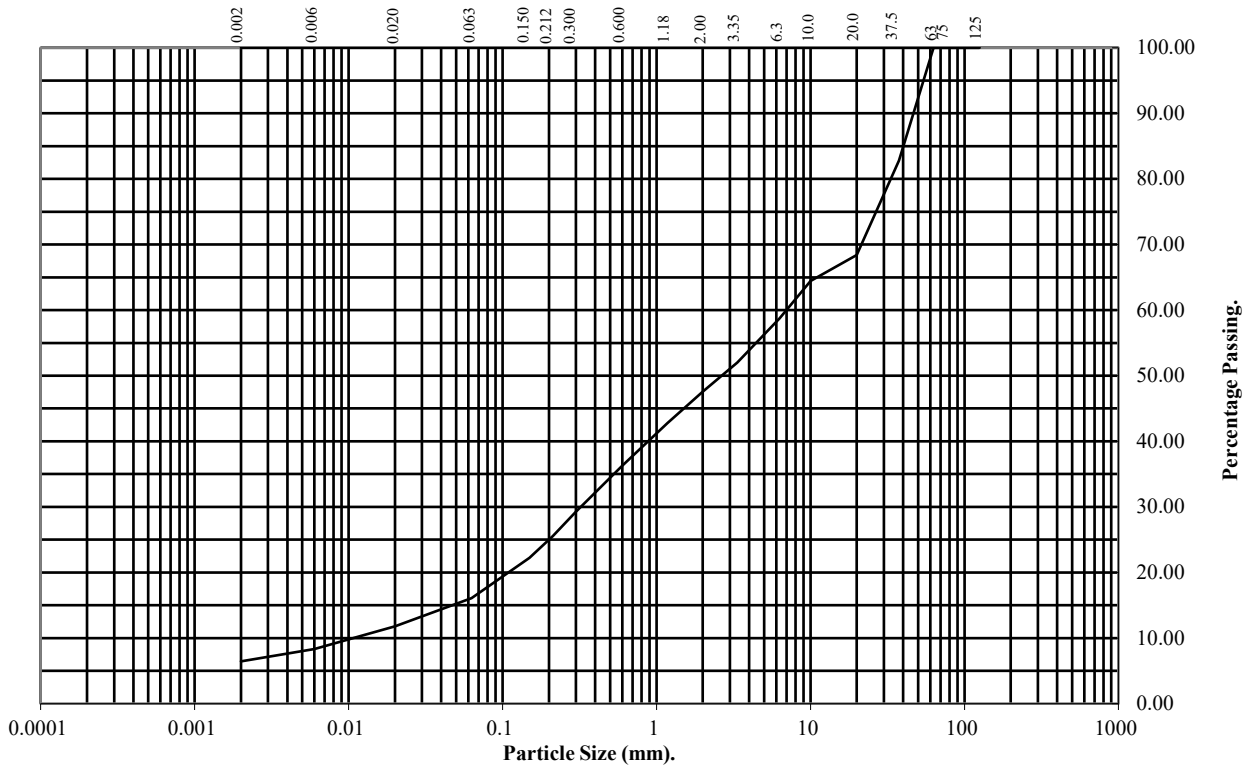
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: PTP-01 Top Depth (m): 3.00

Sample Number: Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	83
20	68
10	64
6.3	59
3.35	52
2	48
1.18	43
0.6	36
0.3	29
0.212	26
0.15	22
0.063	16

Particle Diameter	Percentage Passing
0.02	12
0.006	8
0.002	6

Soil Fraction	Total Percentage
Cobbles	0
Gravel	52
Sand	32
Silt	10
Clay	6

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7322
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:

PTP-02

Top Depth (m):

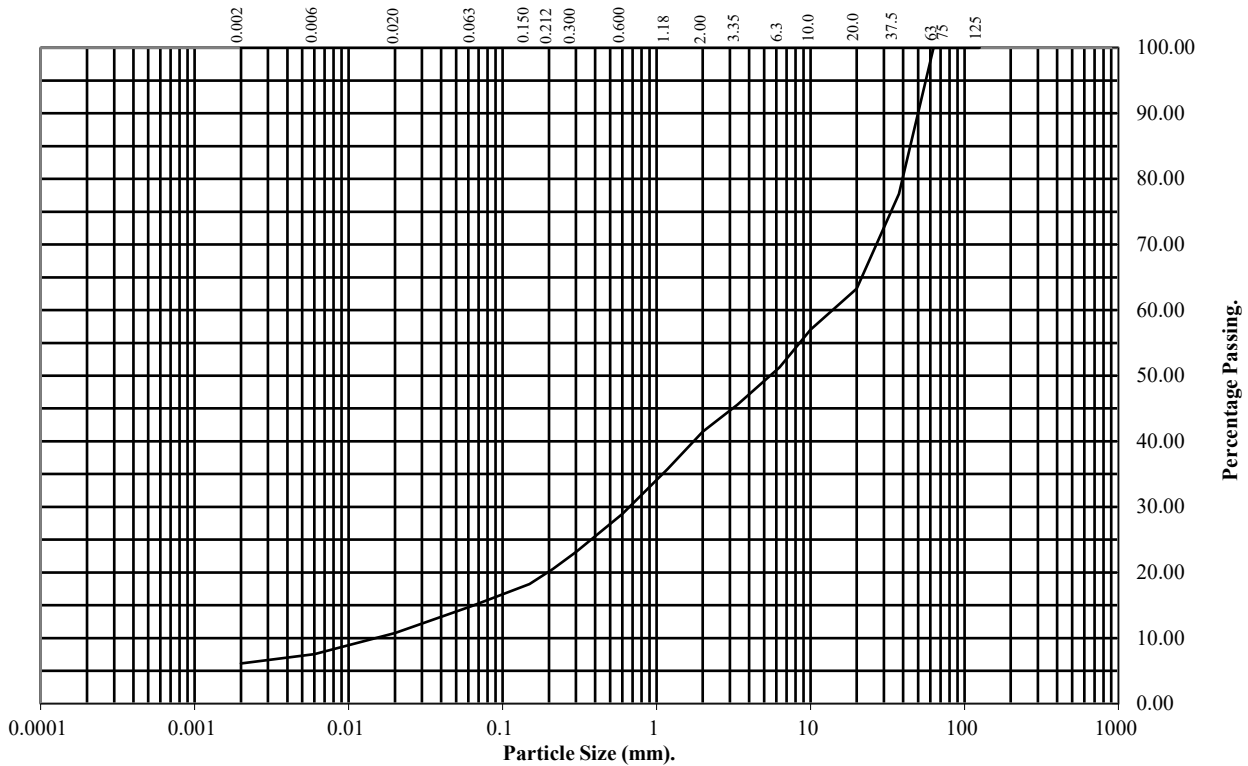
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Sample Number:

Base Depth(m):

Sample Type:

B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	78
20	63
10	57
6.3	51
3.35	46
2	41
1.18	36
0.6	29
0.3	23
0.212	21
0.15	18
0.063	15

Particle Diameter	Percentage Passing
0.02	11
0.006	8
0.002	6

Soil Fraction	Total Percentage
Cobbles	0
Gravel	59
Sand	26
Silt	9
Clay	6

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7322
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:

PTP-03

Top Depth (m):

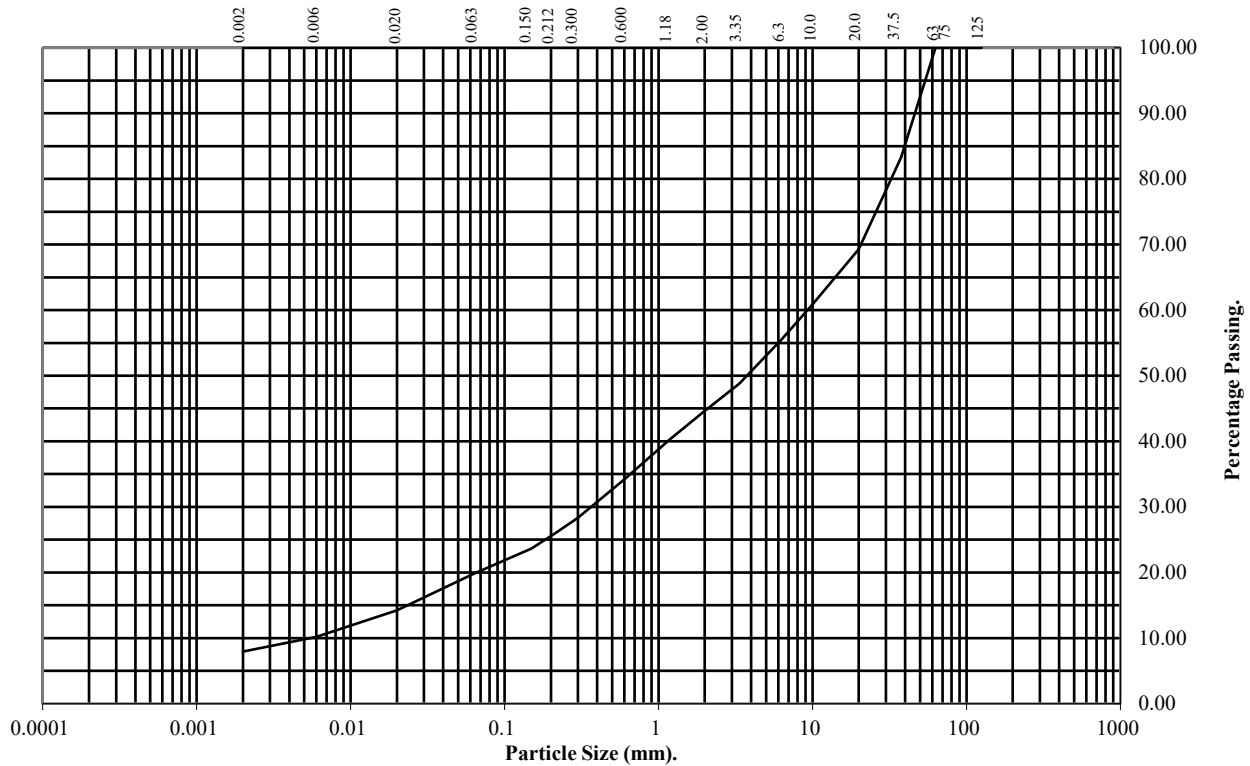
2.50

Sample Number:

Base Depth(m):

Sample Type:

B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	83
20	69
10	61
6.3	56
3.35	49
2	45
1.18	40
0.6	34
0.3	28
0.212	26
0.15	24
0.063	20

Particle Diameter	Percentage Passing
0.02	14
0.006	10
0.002	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	55
Sand	25
Silt	12
Clay	8

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7322
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

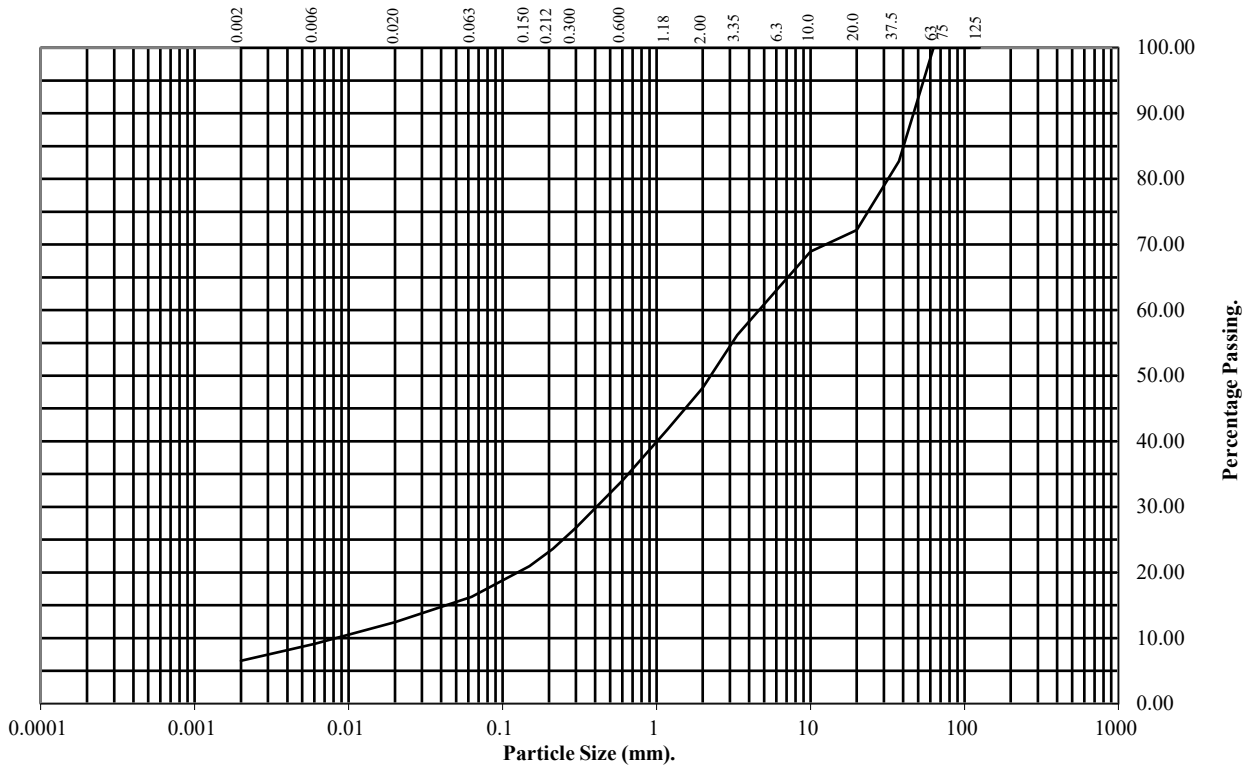
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: PTP-06 Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	83
20	72
10	69
6.3	64
3.35	56
2	48
1.18	42
0.6	34
0.3	27
0.212	24
0.15	21
0.063	16

Particle Diameter	Percentage Passing
0.02	12
0.006	9
0.002	7

Soil Fraction	Total Percentage
Cobbles	0
Gravel	52
Sand	32
Silt	9
Clay	7

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7322
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

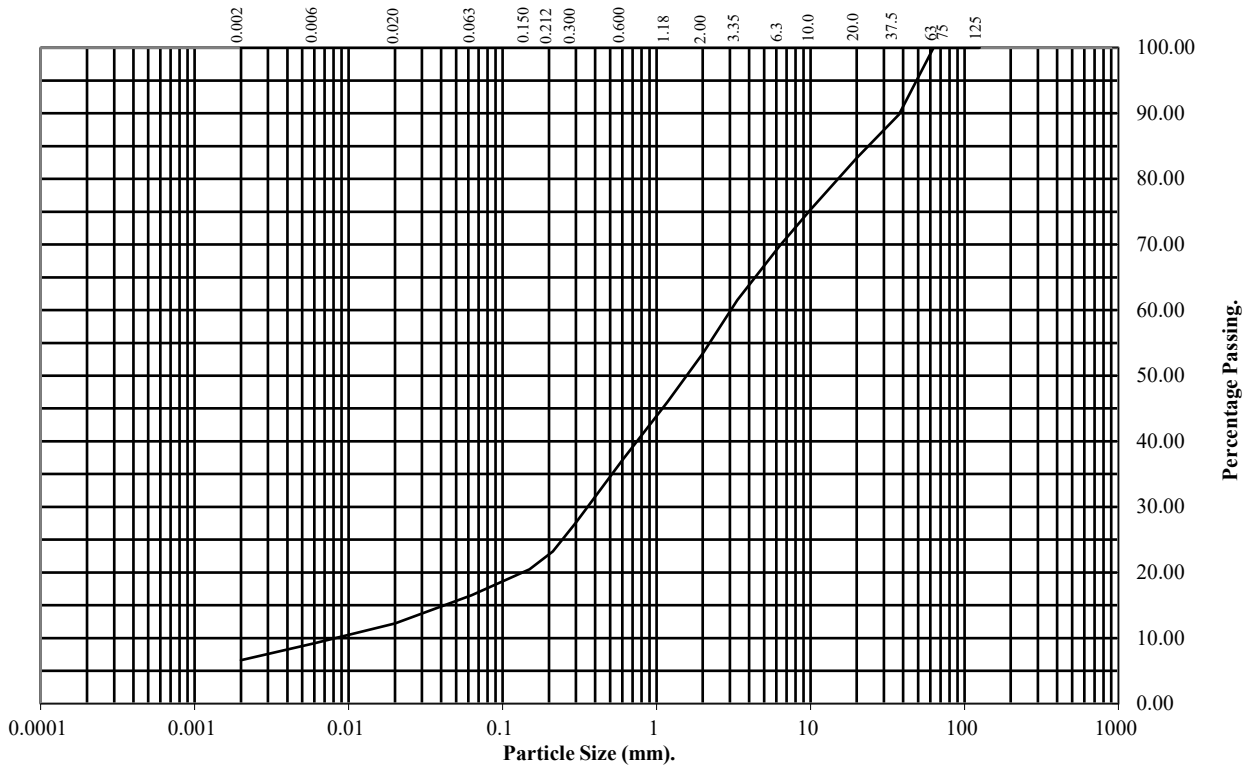
Hole Number: PTP-07

Top Depth (m): 0.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	90
20	83
10	75
6.3	70
3.35	62
2	53
1.18	46
0.6	37
0.3	28
0.212	23
0.15	20
0.063	17

Particle Diameter	Percentage Passing
0.02	12
0.006	9
0.002	7

Soil Fraction	Total Percentage
Cobbles	0
Gravel	47
Sand	36
Silt	10
Clay	7

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7322
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

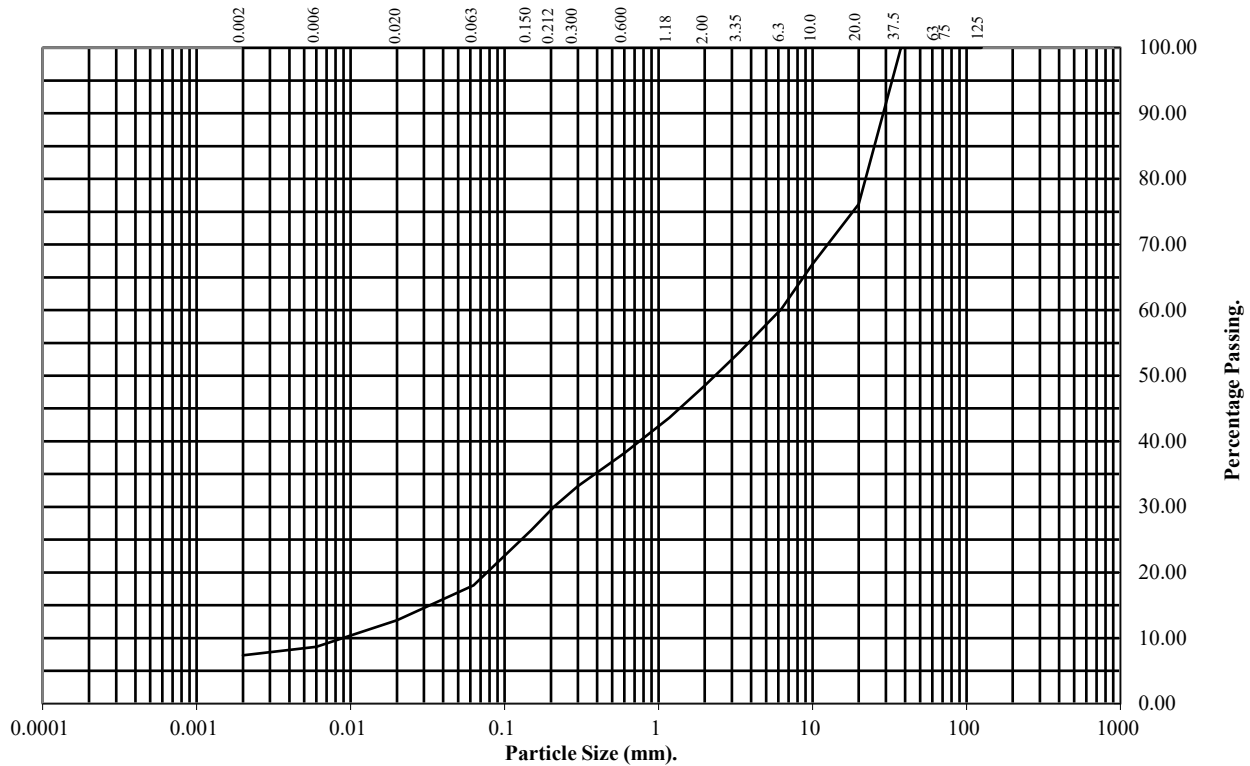
Hole Number: PTP-10

Top Depth (m): 3.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	76
10	67
6.3	60
3.35	54
2	48
1.18	44
0.6	38
0.3	33
0.212	30
0.15	26
0.063	18

Particle Diameter	Percentage Passing
0.02	13
0.006	9
0.002	7

Soil Fraction	Total Percentage
Cobbles	0
Gravel	52
Sand	30
Silt	11
Clay	7

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7322
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:

PTP-12

Top Depth (m):

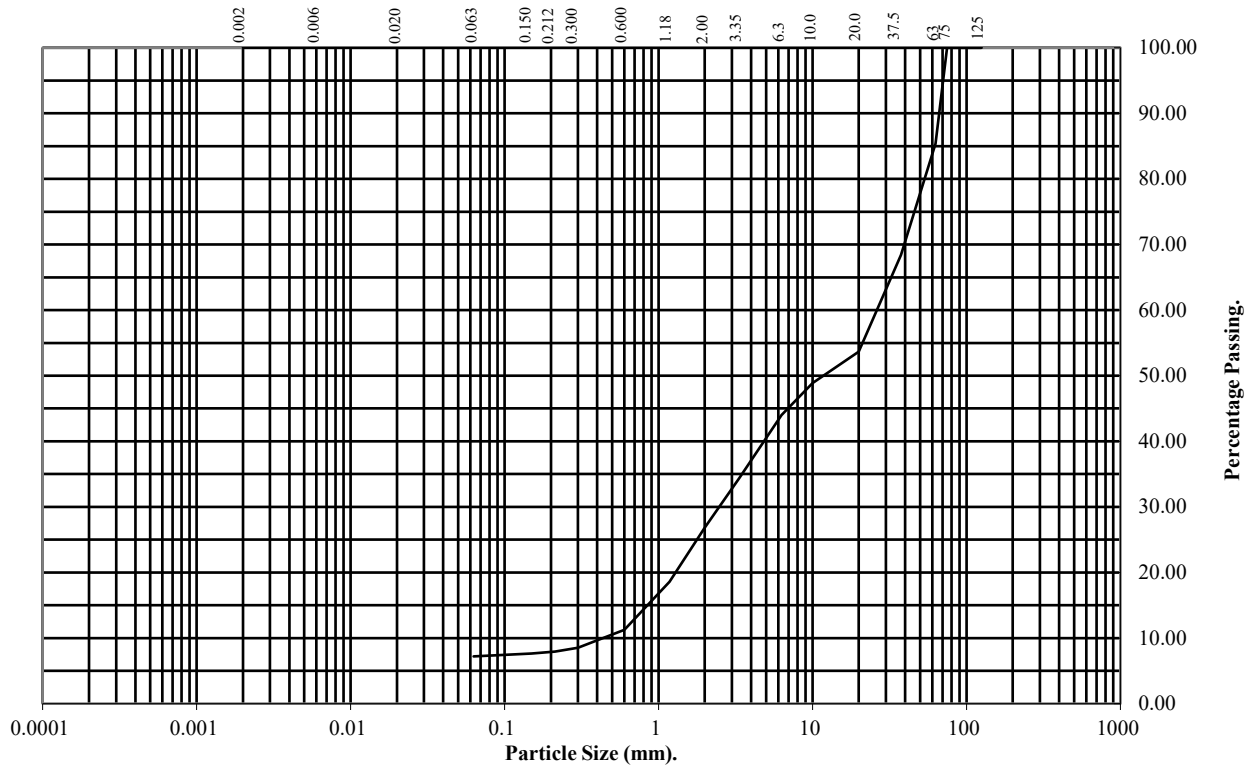
2.00

Sample Number:

Base Depth(m):

Sample Type:

B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	85
37.5	68
20	54
10	49
6.3	44
3.35	34
2	27
1.18	19
0.6	11
0.3	9
0.212	8
0.15	8
0.063	7

Soil Fraction	Total Percentage
Cobbles	15
Gravel	58
Sand	20
Silt/Clay	7

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:

PSL23/7322

Client Ref:

12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:

PTP-18

Top Depth (m):

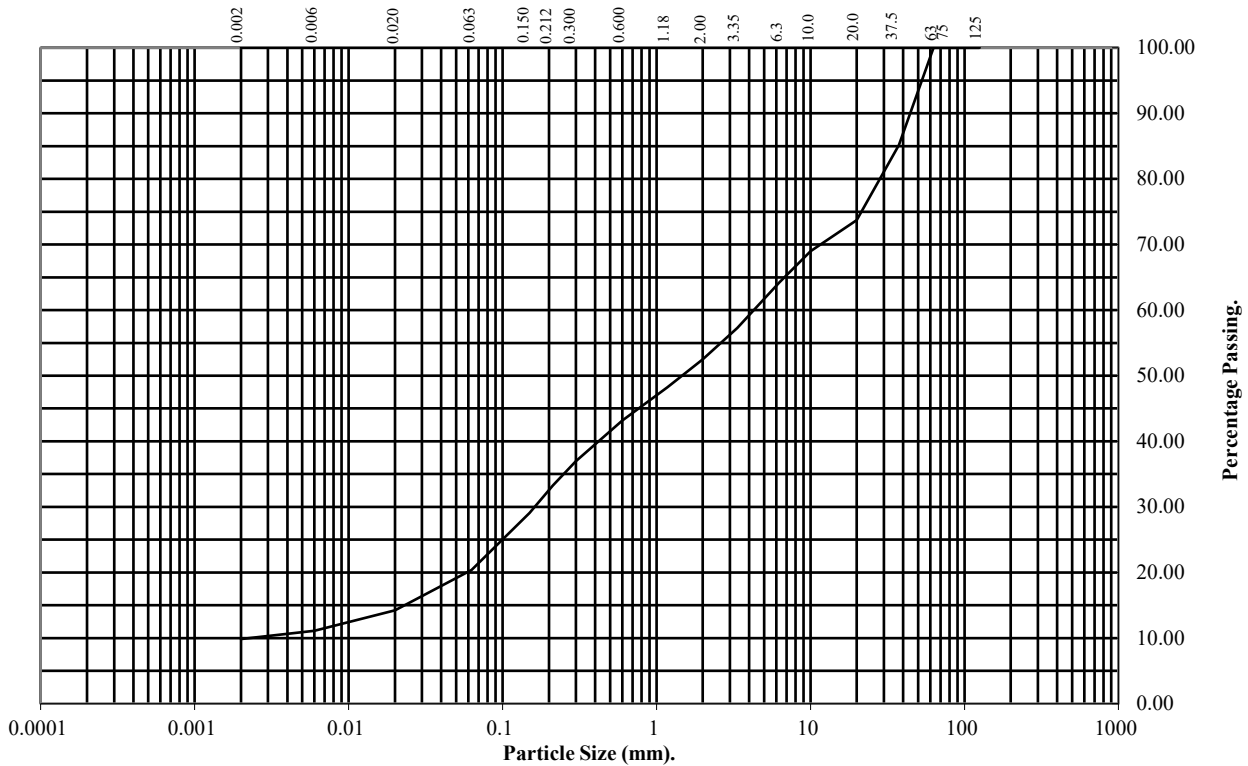
1.50

Sample Number:

Base Depth(m):

Sample Type:

B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	85
20	74
10	69
6.3	64
3.35	57
2	53
1.18	48
0.6	43
0.3	37
0.212	33
0.15	29
0.063	20

Particle Diameter	Percentage Passing
0.02	14
0.006	11
0.002	10

Soil Fraction	Total Percentage
Cobbles	0
Gravel	47
Sand	33
Silt	10
Clay	10

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7322
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:

PTP-22

Top Depth (m):

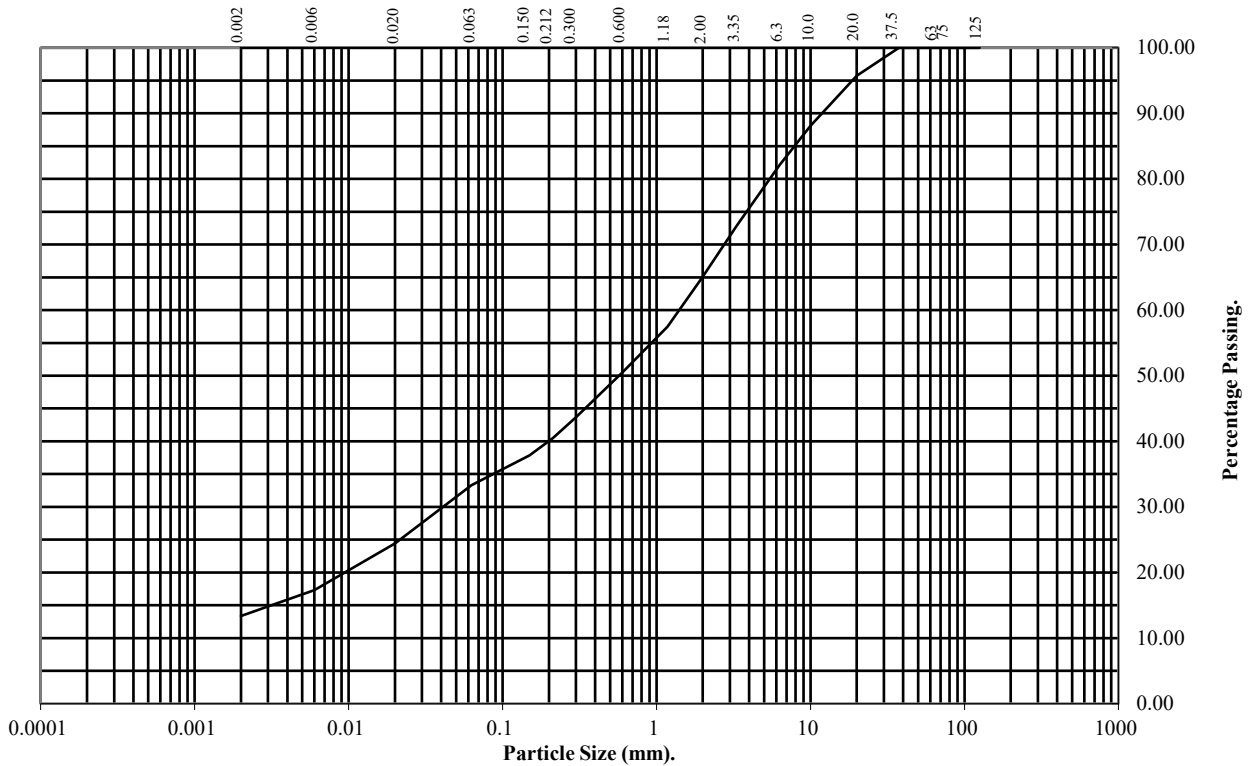
3.00

Sample Number:

Base Depth(m):

Sample Type:

B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	88
6.3	82
3.35	73
2	65
1.18	57
0.6	51
0.3	44
0.212	40
0.15	38
0.063	33

Particle Diameter	Percentage Passing
0.02	24
0.006	17
0.002	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	35
Sand	32
Silt	20
Clay	13

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:

PSL23/7322

Client Ref:

12499-01-23



LABORATORY REPORT



Contract Number: PSL23/7819

Report Date: 03 October 2023
Client's Reference: 12499-01-23
Client Name: Ground Investigations Ireland Ltd

Catherinestown House
Hazelhatch Road
Newcastle
Co Dublin
D22 YD52

For the attention of: James Cashen/Barry Sexton

Project Name: Shancloon Wind Farm Phase 1

Date Received: 14/9/2023
Date Commenced: 14/9/2023
Date Completed: 02/10/2023

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
PBH-01		B	8.00	8.40	Grey GRAVEL of cobbles.
PBH-02		B	6.60	6.90	Grey MUDSTONE.
PBH-03		B	2.75	3.05	Brown sandy gravelly CLAY.
PBH-03		B	9.00	9.40	Brown sandy GRAVEL.
PBH-03A		B	1.70	1.90	Brown slightly sandy very gravelly CLAY with cobbles.
PBH-03A		B	3.50	3.80	Brown sandy gravelly CLAY.
PBH-03A		B	7.70	8.00	Brown sandy gravelly CLAY.
PBH-04		B	4.50	4.90	Dark grey GRAVEL with cobbles.
PBH-05		B	7.00	7.30	Dark grey GRAVEL with cobbles.
PBH-05		B	5.60	5.90	Brown mottled grey sandy CLAY.
PBH-06		B	3.60	3.80	Brown sandy slightly gravelly CLAY.
PBH-06		B	6.50	6.70	Brown mottled grey slightly sandy gravelly CLAY.
PBH-06		B	10.00	10.20	Brown mottled grey slightly sandy gravelly CLAY.
PBH-08		B	3.20	3.50	Brown mottled grey slightly sandy gravelly CLAY.
PBH-08		B	6.20	6.50	Brown mottled grey slightly sandy gravelly CLAY.
PBH-08		B	7.45	7.75	Brown mottled grey very silty sandy GRAVEL.
PBH-09		B	6.50	6.80	Brown mottled grey slightly sandy slightly gravelly CLAY.
PBH-09		B	9.20	9.50	Brown mottled grey very silty sandy GRAVEL.
PBH-11		B	14.95	15.20	Brown mottled grey sandy slightly gravelly CLAY.



Shancloon Wind Farm Phase 1

Contract No:

PSL23/7819

Client Ref:

12499-01-23

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
PBH-13		B	7.00	7.30	Brown mottled grey very clayey very sandy GRAVEL with cobbles.
PBH-13		B	8.20	8.50	Brown mottled grey sandy slightly gravelly CLAY.
PBH-14		B	3.25	3.50	Grey slightly silty slightly sandy GRAVEL with some cobbles.
PBH-14		B	5.70	6.10	Grey slightly silty slightly sandy GRAVEL with some cobbles.
PBH-15		B	9.50	9.80	Brown sandy slightly gravelly CLAY.
PBH-16		B	4.00	4.30	Brown clayey PEAT.
PBH-16		B	5.50	5.80	Grey slightly sandy GRAVEL with cobbles.
PBH-18		B	3.70	3.90	Brown sandy slightly gravelly CLAY.
PBH-18		B	5.60	5.90	Brown sandy slightly gravelly CLAY.
PBH-19		B	1.60	1.90	Brown mottled grey GRAVEL of cobbles.
PBH-19		B	4.20	4.50	Brown sandy slightly gravelly CLAY.
PBH-20		B	1.00	2.50	Brown slightly sandy CLAY.
PBH-21		B	2.70	3.10	Brown mottled grey slightly sandy slightly gravelly CLAY.



Shancloon Wind Farm Phase 1

Contract No:

PSL23/7819

Client Ref:

12499-01-23

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
PBH-02		B	6.60	6.90	28				NP			
PBH-03		B	2.75	3.05	8.3			28	16	12	65	Low Plasticity CL
PBH-03		B	9.00	9.40	4.9				NP			
PBH-03A		B	3.50	3.80	6.8			27	14	13	60	Low Plasticity CL
PBH-03A		B	7.70	8.00	5.5			23	13	10	68	Low Plasticity CL
PBH-04		B	4.50	4.90	4.9				NP			
PBH-05		B	5.60	5.90	14			23	14	9	100	Low Plasticity CL
PBH-06		B	3.60	3.80	7.6			24	13	11	75	Low Plasticity CL
PBH-06		B	6.50	6.70	5.2							
PBH-06		B	10.00	10.20	6.2			26	14	12	64	Low Plasticity CL
PBH-08		B	3.20	3.50	1.1			25	14	11	72	Low Plasticity CL
PBH-08		B	6.20	6.50	5.2							
PBH-08		B	7.45	7.75	1.7				NP			
PBH-09		B	6.50	6.80	6.6			24	13	11	68	Low Plasticity CL
PBH-09		B	9.20	9.50	12							
PBH-11		B	14.95	15.20	7.5			29	16	13	70	Low Plasticity CL
PBH-13		B	7.00	7.30	4.1							
PBH-13		B	8.20	8.50	4.9			22	13	9	88	Low Plasticity CL
PBH-14		B	5.70	6.10	1.5				NP			

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



Shancloon Wind Farm Phase 1

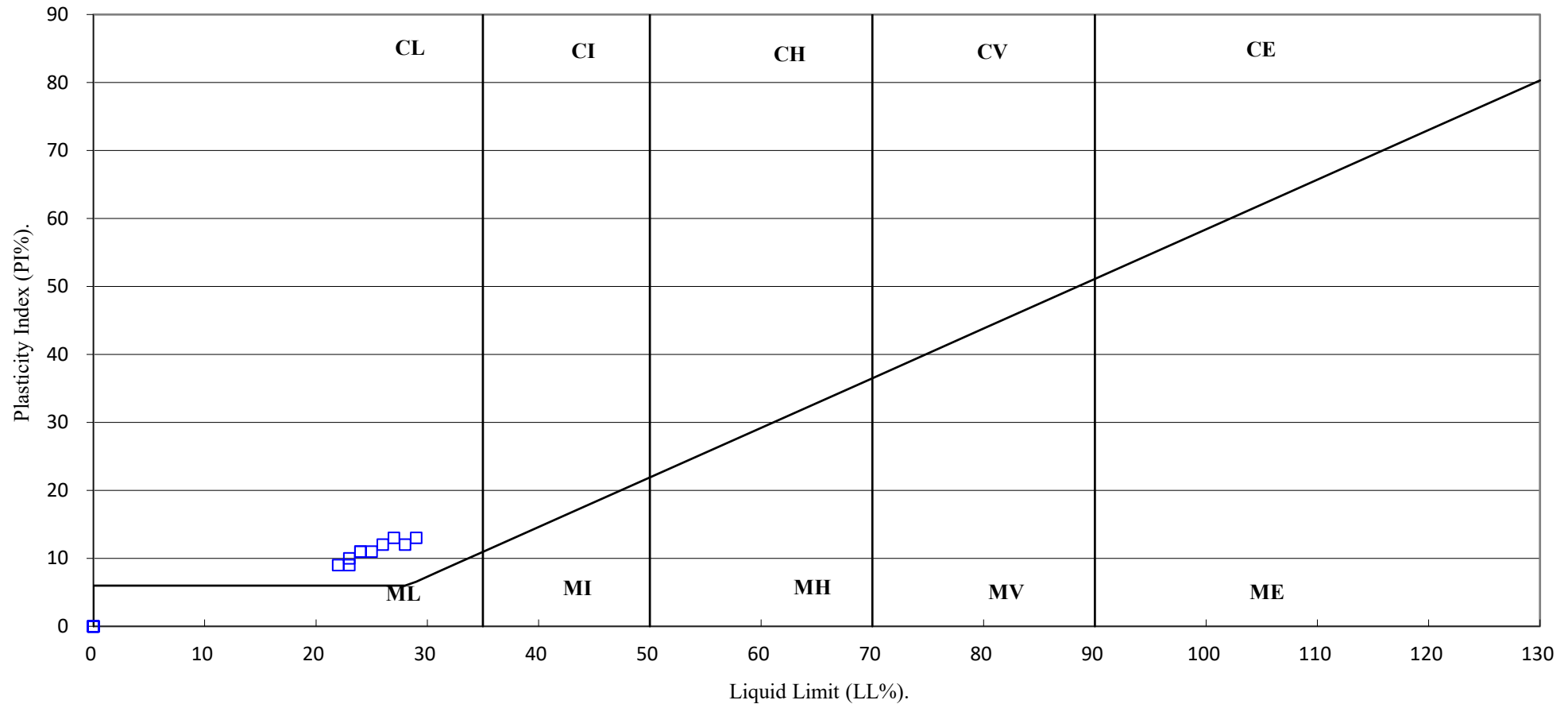
Contract No:

PSL23/7819

Client Ref:

12499-01-23

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



Shancloon Wind Farm Phase 1

Contract No:

PSL23/7819

Client Ref:

12499-01-23

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



Shancloon Wind Farm Phase 1

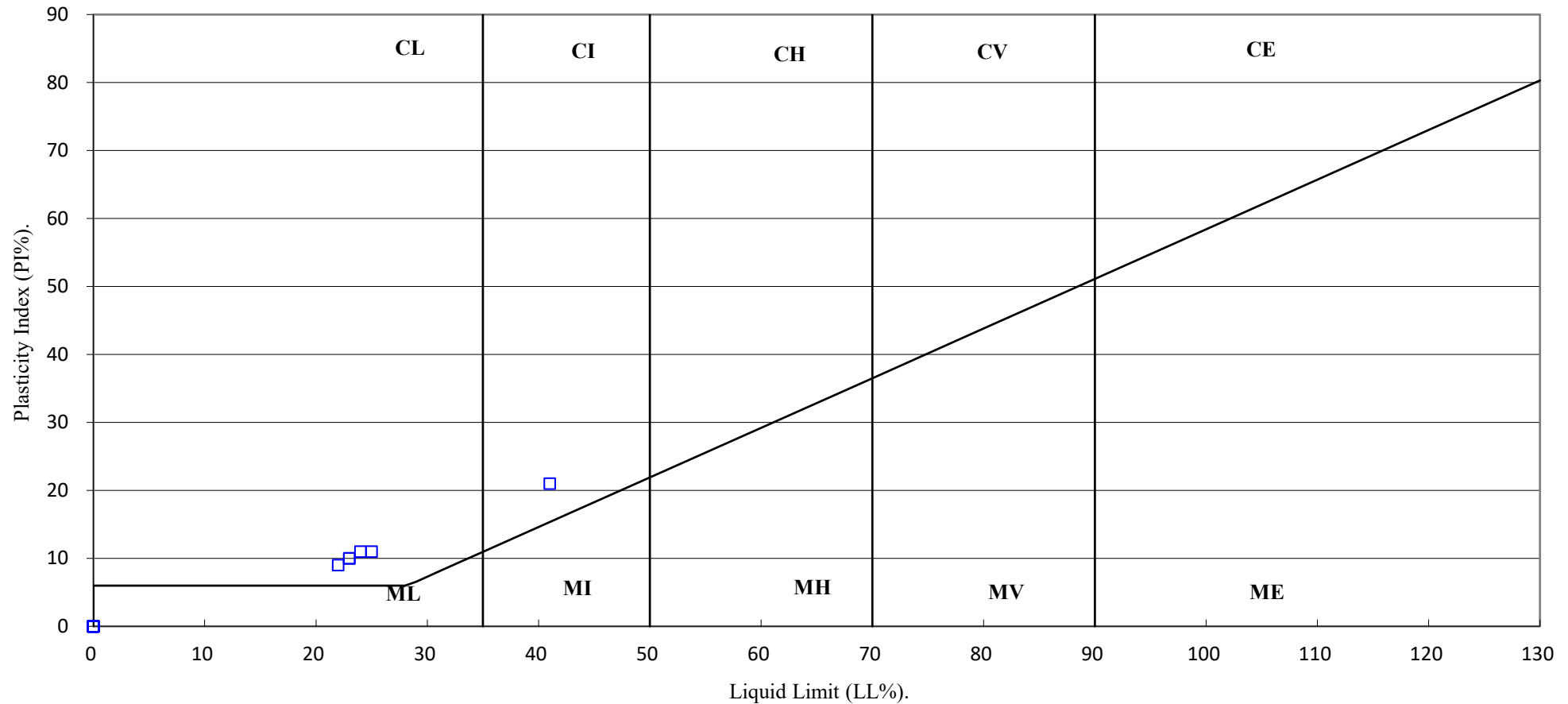
Contract No:

PSL23/7819

Client Ref:

12499-01-23

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



Shancloon Wind Farm Phase 1

Contract No:

PSL23/7819

Client Ref:

12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

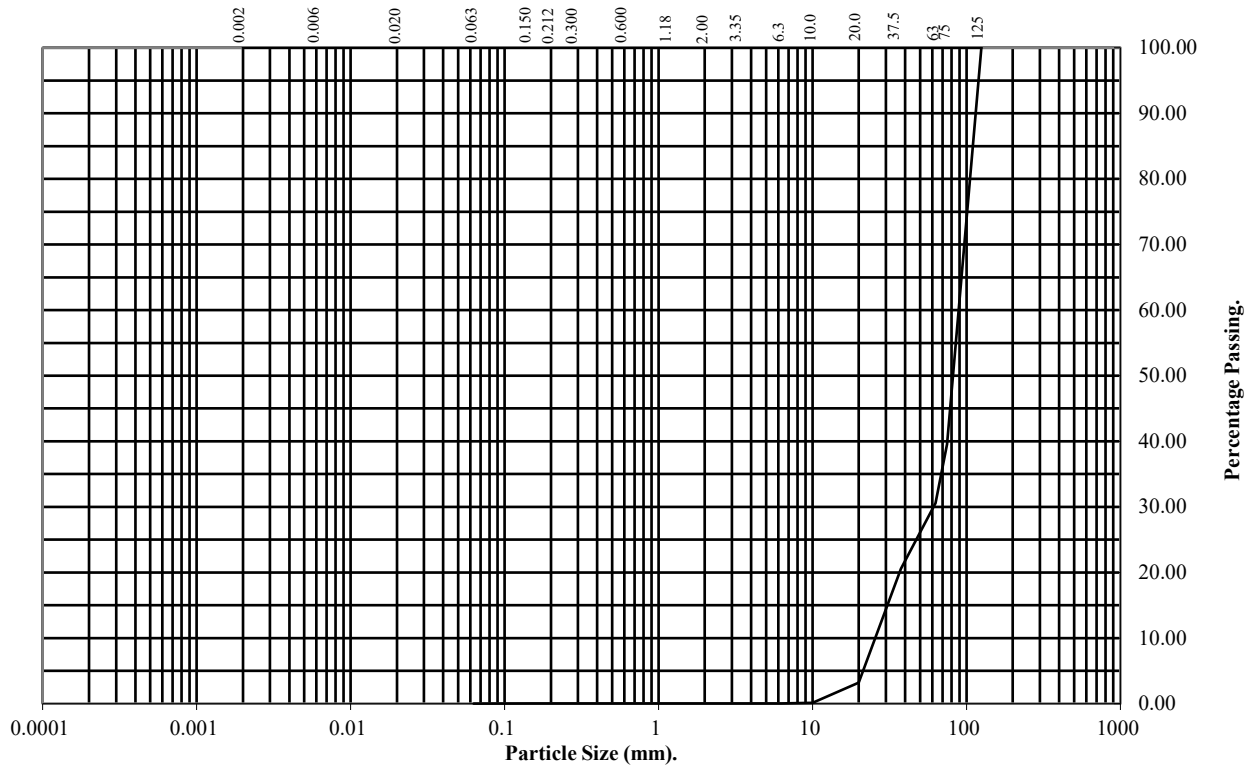
Hole Number: PBH-01

Top Depth (m): 8.00

Sample Number:

Base Depth(m): 8.40

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	40
63	31
37.5	21
20	3
10	0
6.3	0
3.35	0
2	0
1.18	0
0.6	0
0.3	0
0.212	0
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	69
Gravel	31
Sand	0
Silt/Clay	0

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

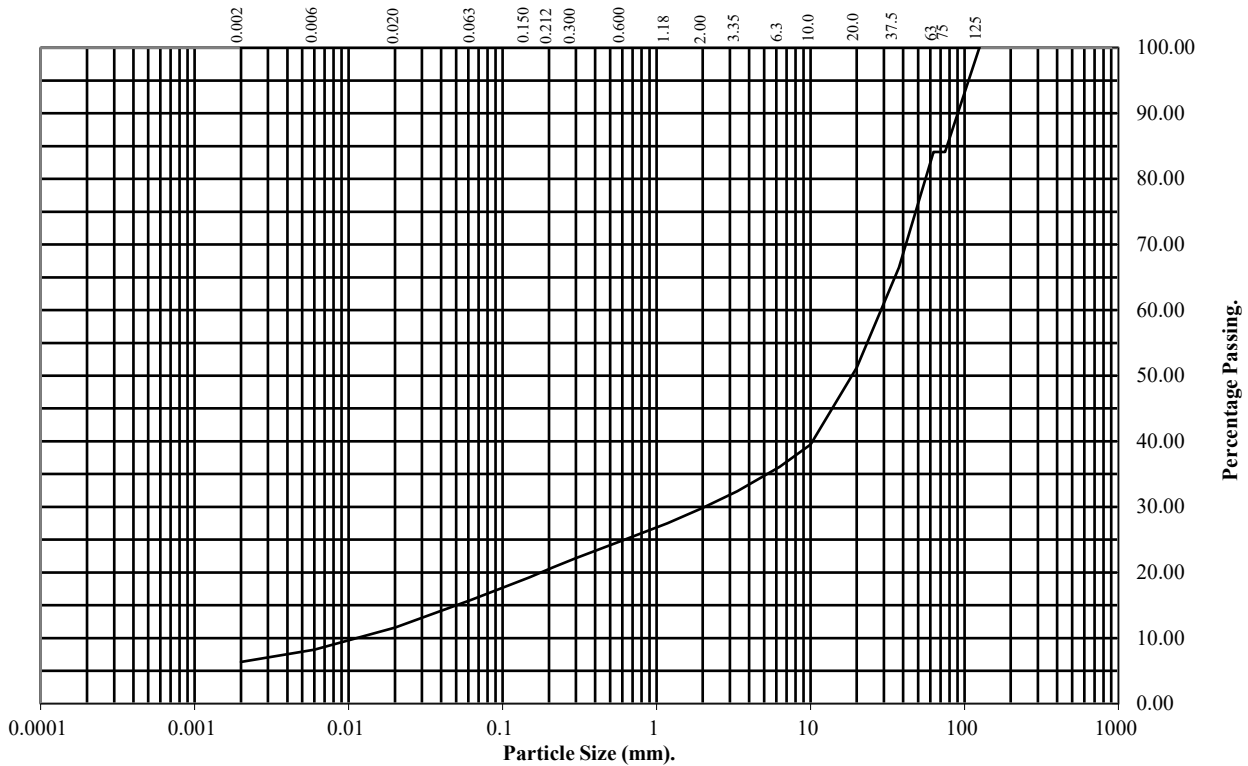
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: PBH-03A Top Depth (m): 1.70

Sample Number: Base Depth(m): 1.90

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	84
63	84
37.5	67
20	51
10	39
6.3	36
3.35	32
2	30
1.18	28
0.6	25
0.3	22
0.212	21
0.15	19
0.063	16

Particle Diameter	Percentage Passing
0.02	12
0.006	8
0.002	6

Soil Fraction	Total Percentage
Cobbles	16
Gravel	54
Sand	14
Silt	10
Clay	6

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

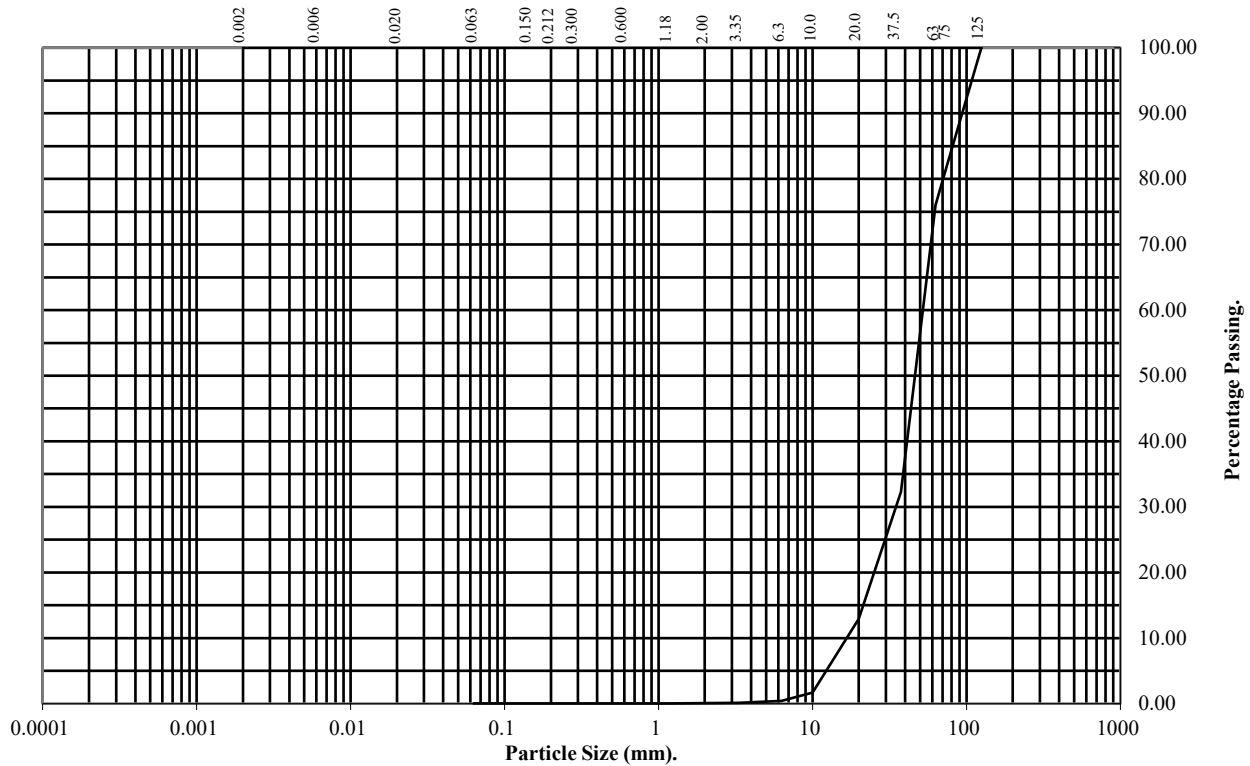
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: PBH-05 Top Depth (m): 7.00

Sample Number: Base Depth(m): 7.30

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	82
63	76
37.5	32
20	13
10	2
6.3	0
3.35	0
2	0
1.18	0
0.6	0
0.3	0
0.212	0
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	24
Gravel	76
Sand	0
Silt/Clay	0

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

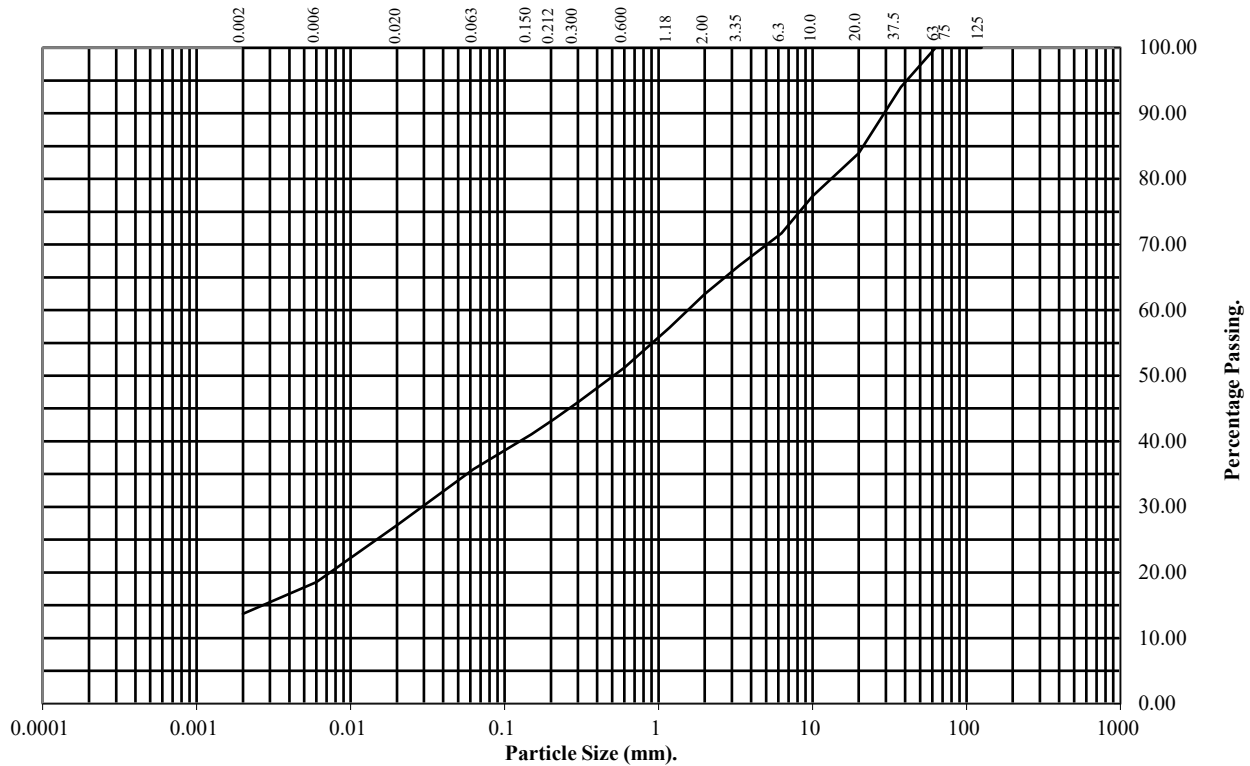
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: PBH-06 Top Depth (m): 6.50

Sample Number: Base Depth(m): 6.70

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	94
20	84
10	77
6.3	72
3.35	67
2	62
1.18	57
0.6	51
0.3	46
0.212	43
0.15	41
0.063	36

Particle Diameter	Percentage Passing
0.02	27
0.006	19
0.002	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	38
Sand	26
Silt	22
Clay	14

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

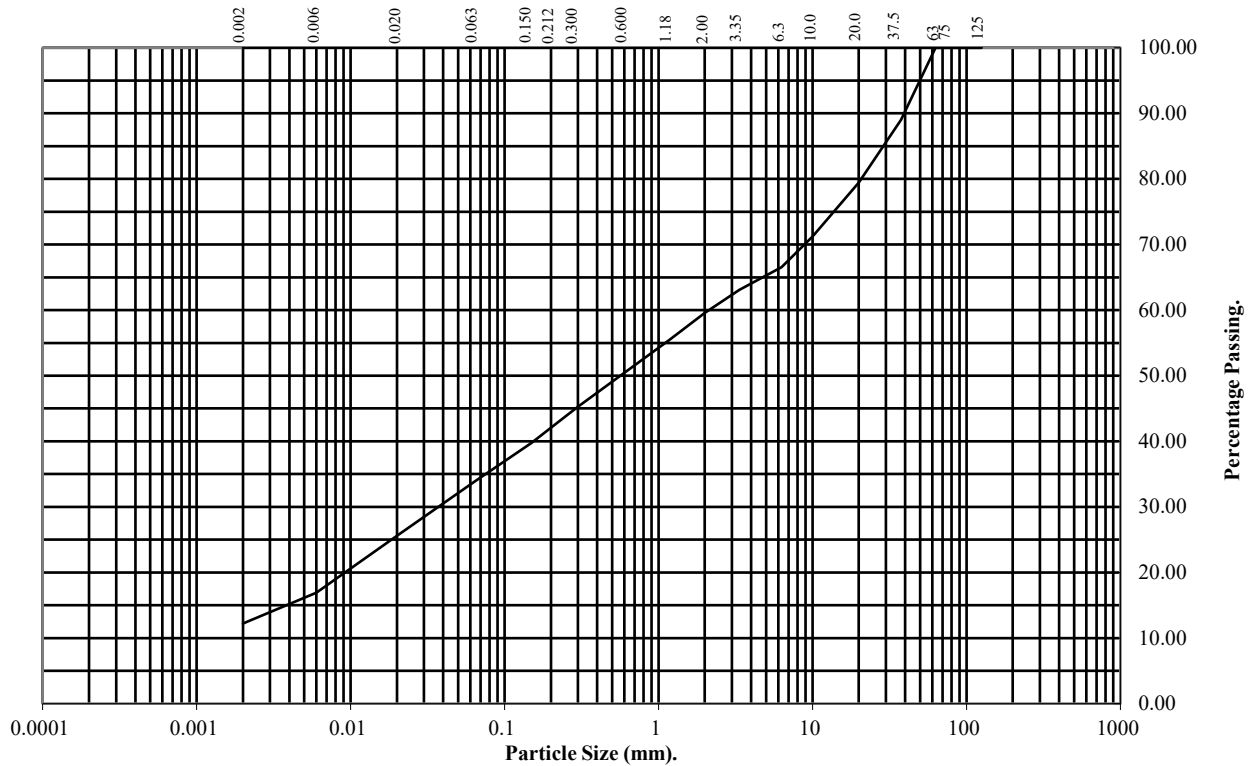
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: PBH-08 Top Depth (m): 6.20

Sample Number: Base Depth(m): 6.50

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	89
20	79
10	71
6.3	67
3.35	63
2	60
1.18	55
0.6	50
0.3	45
0.212	43
0.15	40
0.063	34

Particle Diameter	Percentage Passing
0.02	26
0.006	17
0.002	12

Soil Fraction	Total Percentage
Cobbles	0
Gravel	40
Sand	26
Silt	22
Clay	12

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

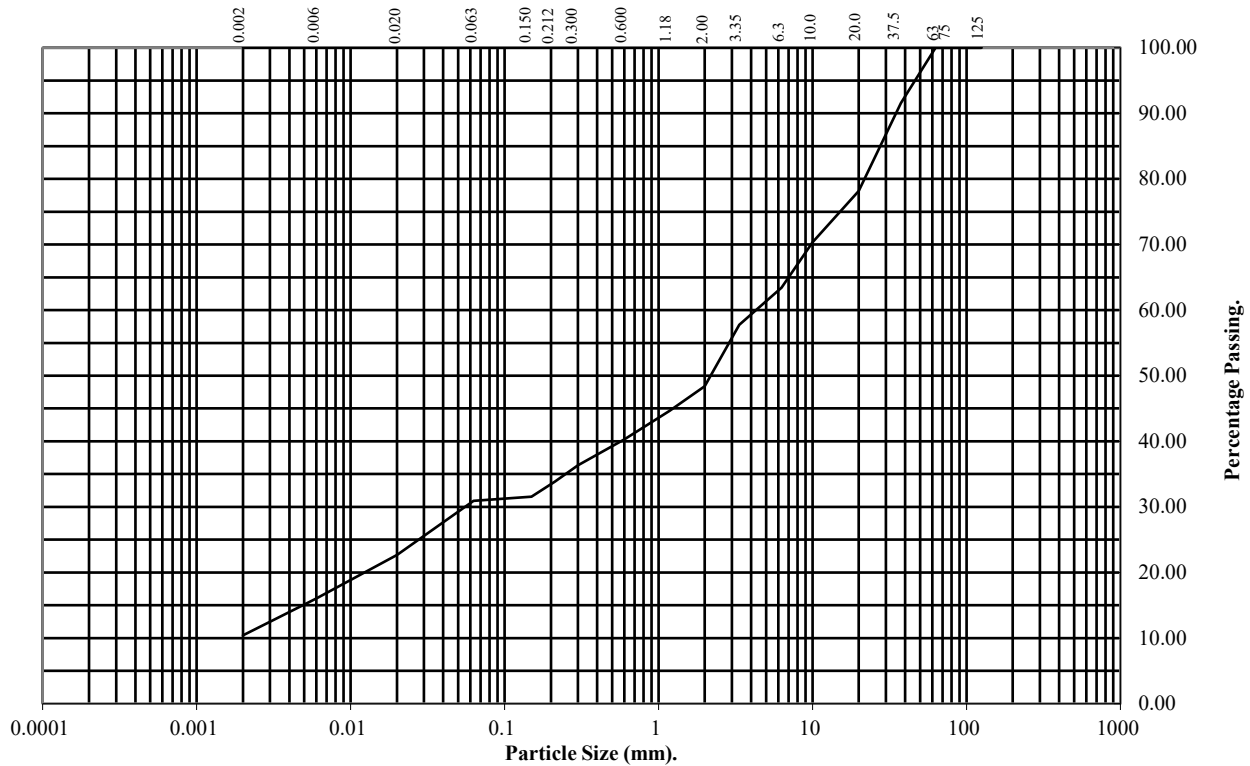
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: PBH-09 Top Depth (m): 9.20

Sample Number: Base Depth(m): 9.50

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	92
20	78
10	70
6.3	63
3.35	58
2	48
1.18	45
0.6	40
0.3	36
0.212	34
0.15	32
0.063	31

Particle Diameter	Percentage Passing
0.02	23
0.006	16
0.002	10

Soil Fraction	Total Percentage
Cobbles	0
Gravel	52
Sand	17
Silt	21
Clay	10

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

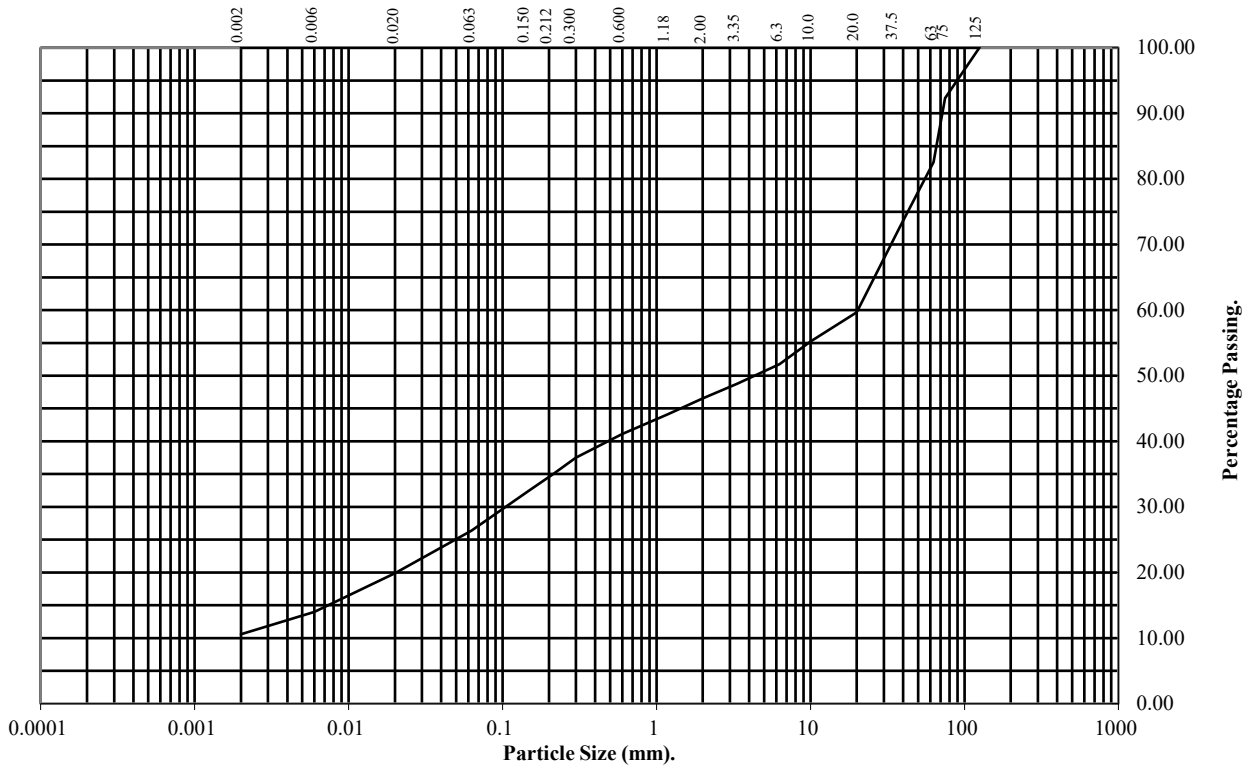
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: PBH-13 Top Depth (m): 7.00

Sample Number: Base Depth(m): 7.30

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	92
63	83
37.5	72
20	60
10	55
6.3	52
3.35	49
2	47
1.18	44
0.6	41
0.3	37
0.212	35
0.15	33
0.063	26

Particle Diameter	Percentage Passing
0.02	20
0.006	14
0.002	11

Soil Fraction	Total Percentage
Cobbles	17
Gravel	36
Sand	21
Silt	15
Clay	11

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

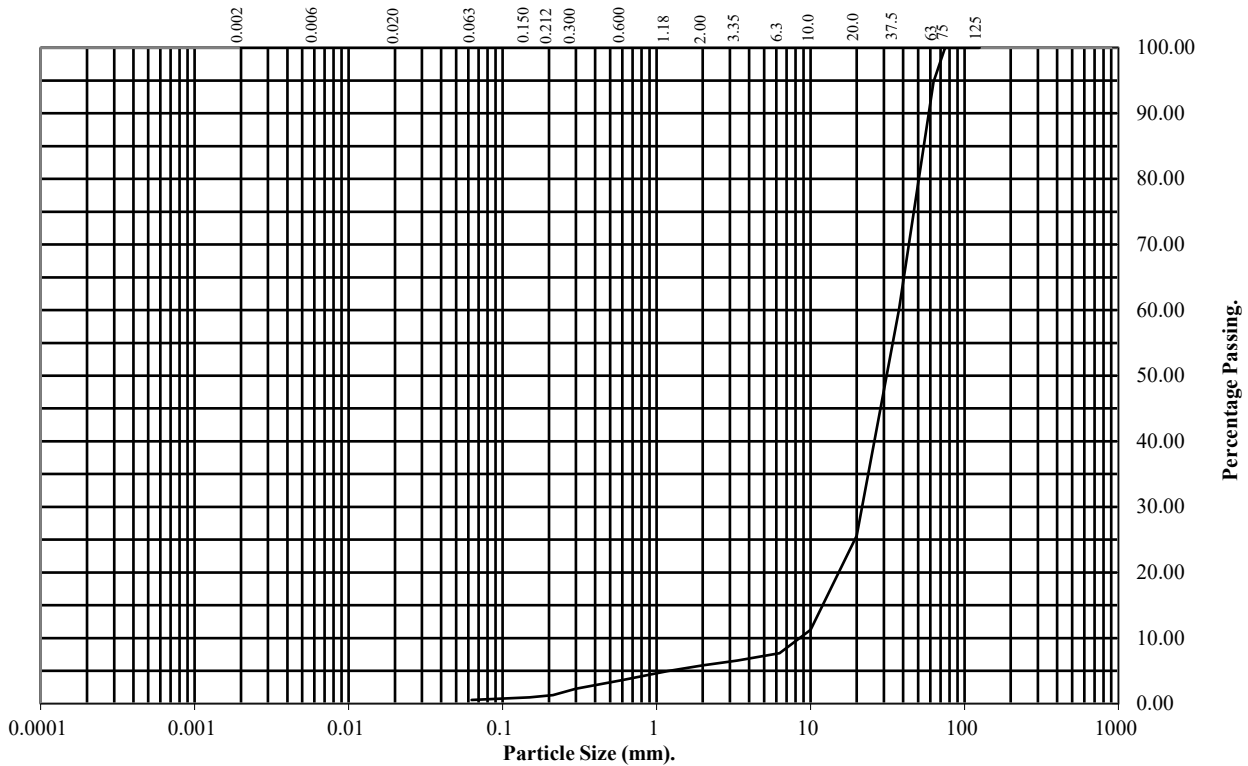
Hole Number: PBH-14

Top Depth (m): 3.25

Sample Number:

Base Depth(m): 3.50

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	95
37.5	60
20	26
10	11
6.3	8
3.35	7
2	6
1.18	5
0.6	4
0.3	2
0.212	1
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	5
Gravel	89
Sand	5
Silt/Clay	1

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

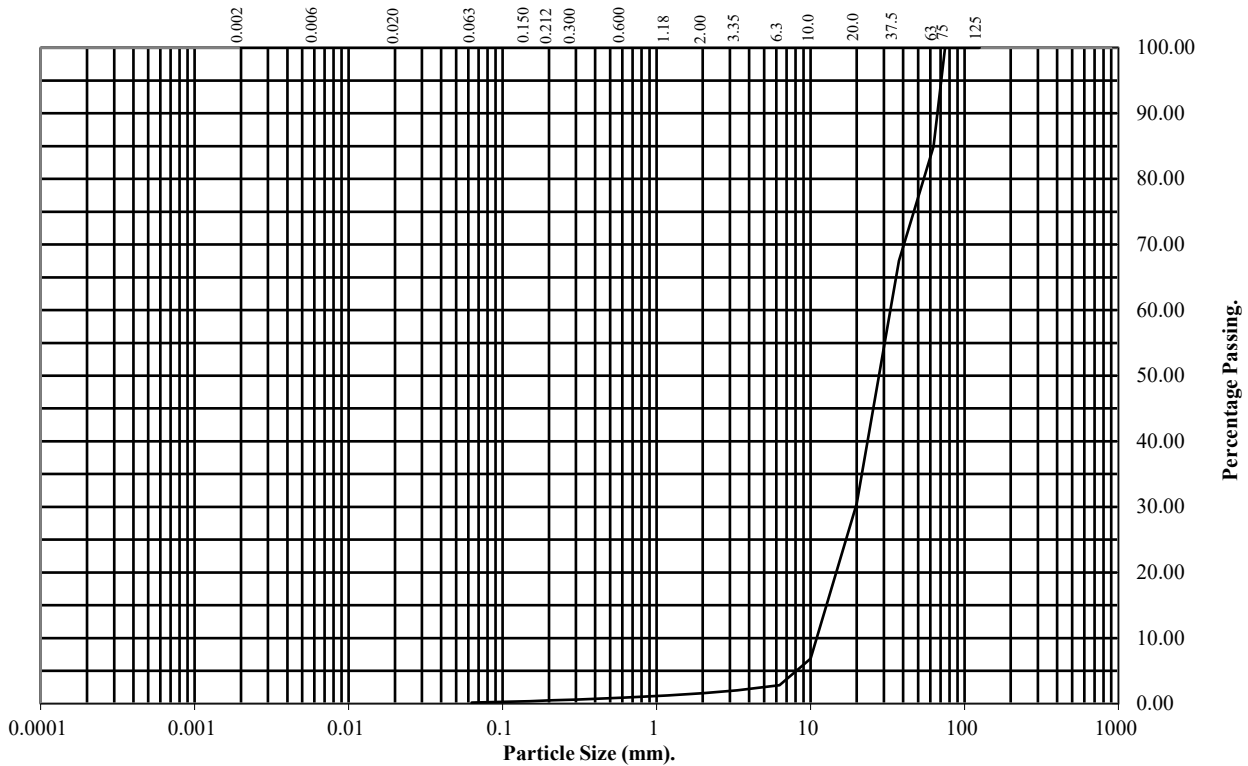
Hole Number: PBH-16

Top Depth (m): 5.50

Sample Number:

Base Depth(m): 5.80

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	85
37.5	68
20	30
10	7
6.3	3
3.35	2
2	2
1.18	1
0.6	1
0.3	1
0.212	0
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	15
Gravel	83
Sand	2
Silt/Clay	0

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

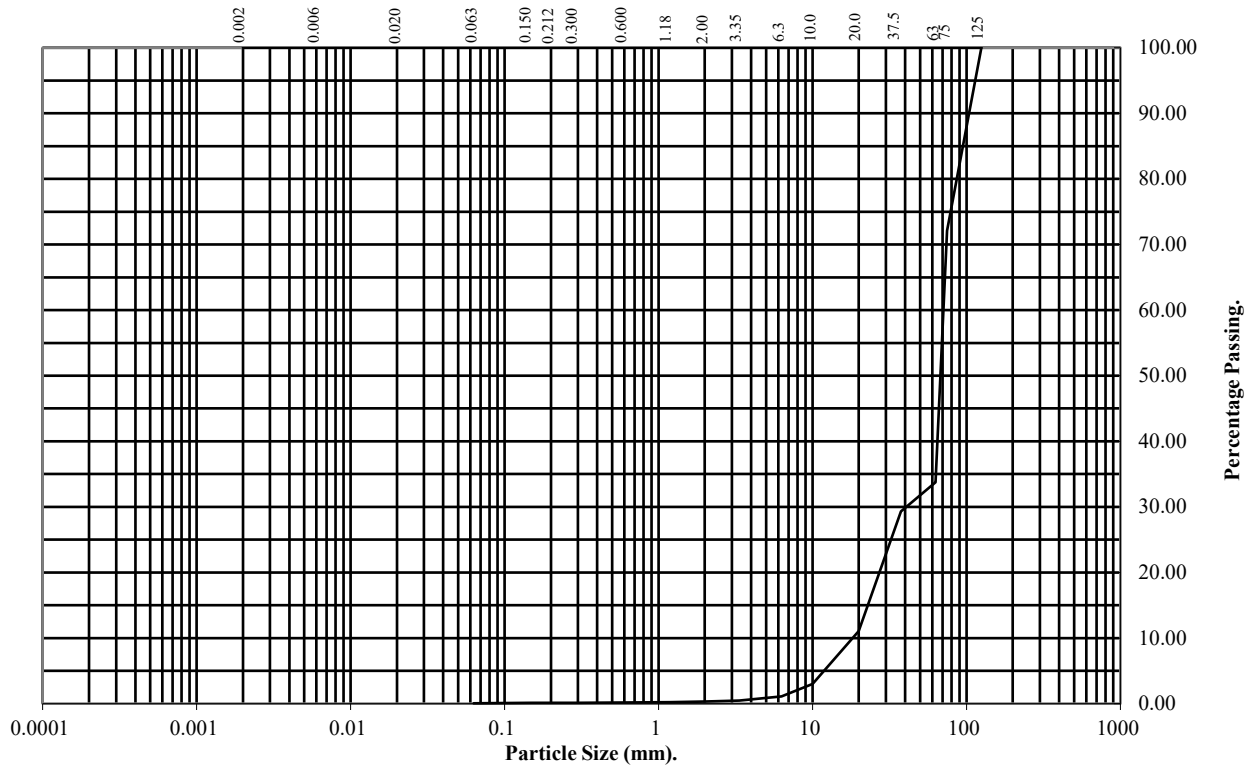
Hole Number: PBH-19

Top Depth (m): 1.60

Sample Number:

Base Depth(m): 1.90

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	72
63	34
37.5	29
20	11
10	3
6.3	1
3.35	0
2	0
1.18	0
0.6	0
0.3	0
0.212	0
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	66
Gravel	34
Sand	0
Silt/Clay	0

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

PARTICLE SIZE DISTRIBUTION TEST

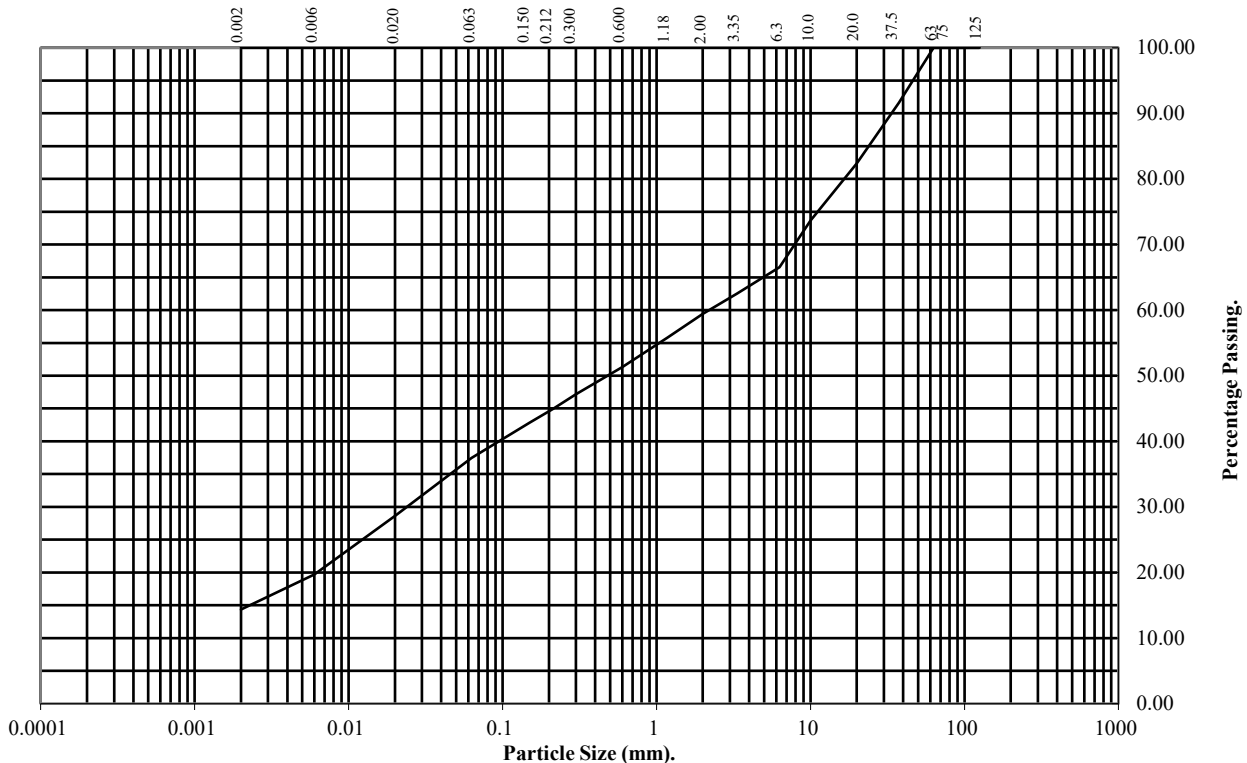
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: PBH-21 Top Depth (m): 2.70

Sample Number: Base Depth(m): 3.10

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	92
20	82
10	74
6.3	67
3.35	63
2	59
1.18	56
0.6	51
0.3	47
0.212	45
0.15	43
0.063	37

Particle Diameter	Percentage Passing
0.02	29
0.006	20
0.002	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	41
Sand	22
Silt	23
Clay	14

Remarks:

See Summary of Soil Descriptions



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

UNIAXIAL COMPRESSIVE STRENGTH

ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006

Borehole Number: PBH-01 **Top Depth (m):** 16.20
Sample Number: - **Base Depth (m):** 16.60
Sample Type: R **Sample Date:** -
Storage Condition: Sealed in Core Box **Date of Receipt:** 13/09/2023
Sample Description: -

Specimen Details/Conditions	
Diameter - mm:	100.02
Height - mm:	210.14
Water Content - %:	0.12
Sample Mass - g:	4547.1
Bulk Density - Mg/m ³ :	2.75
Dry Density - Mg/m ³ :	2.75
Height Ratio: * Sample does not comply with H:D ratio	2.1
Degree of Saturation - %:	98
Assumed Specific Gravity for Degree of Saturation:	2.76

Test Result	
Load Frame/Machine:	CM1/Controls
Date of test:	27/09/2023
Test Duration - mins:	02:18
Orientation:	Unknown
Stress Rate - MPa/s:	0.50
Strain at Failure - kN:	542.20
Unconfined Compressive Strength - Mpa:	69
Mode of Failure:	Vertical Shear

Remarks: -



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

UNIAXIAL COMPRESSIVE STRENGTH

ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006

Borehole Number: PBH-05 **Top Depth (m):** 11.50
Sample Number: - **Base Depth (m):** 11.95
Sample Type: R **Sample Date:** -
Storage Condition: Sealed in Core Box **Date of Receipt:** 13/09/2023
Sample Description: -

Specimen Details/Conditions	
Diameter - mm:	100.06
Height - mm:	210.11
Water Content - %:	0.64
Sample Mass - g:	4550.2
Bulk Density - Mg/m ³ :	2.75
Dry Density - Mg/m ³ :	2.74
Height Ratio: * Sample does not comply with H:D ratio	2.1
Degree of Saturation - %:	91
Assumed Specific Gravity for Degree of Saturation:	2.79

Test Result	
Load Frame/Machine:	CM1/Controls
Date of test:	27/09/2023
Test Duration - mins:	02:11
Orientation:	Unknown
Stress Rate - MPa/s:	0.50
Strain at Failure - kN:	520.10
Unconfined Compressive Strength - Mpa:	66.1
Mode of Failure:	Vertical Shear

Remarks: -



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

UNIAXIAL COMPRESSIVE STRENGTH

ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006

Borehole Number: PBH-06 **Top Depth (m):** 15.00
Sample Number: - **Base Depth (m):** 15.30
Sample Type: R **Sample Date:** -
Storage Condition: Sealed in Core Box **Date of Receipt:** 13/09/2023
Sample Description: -

Specimen Details/Conditions	
Diameter - mm:	100.09
Height - mm:	210.13
Water Content - %:	0.72
Sample Mass - g:	4539.8
Bulk Density - Mg/m ³ :	2.75
Dry Density - Mg/m ³ :	2.73
Height Ratio: * Sample does not comply with H:D ratio	2.1
Degree of Saturation - %:	86
Assumed Specific Gravity for Degree of Saturation:	2.79

Test Result	
Load Frame/Machine:	CM1/Controls
Date of test:	27/09/2023
Test Duration - mins:	01:47
Orientation:	Unknown
Stress Rate - MPa/s:	0.54
Strain at Failure - kN:	457.20
Unconfined Compressive Strength - Mpa:	58.1
Mode of Failure:	Vertical Shear

Remarks: -



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

UNIAXIAL COMPRESSIVE STRENGTH

ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006

Borehole Number: PBH-07 **Top Depth (m):** 8.90
Sample Number: - **Base Depth (m):** 9.30
Sample Type: R **Sample Date:** -
Storage Condition: Sealed in Core Box **Date of Receipt:** 13/09/2023
Sample Description: -

Specimen Details/Conditions	
Diameter - mm:	100.04
Height - mm:	211.07
Water Content - %:	0.57
Sample Mass - g:	4547.8
Bulk Density - Mg/m ³ :	2.74
Dry Density - Mg/m ³ :	2.73
Height Ratio: * Sample does not comply with H:D ratio	2.1
Degree of Saturation - %:	97
Assumed Specific Gravity for Degree of Saturation:	2.77

Test Result	
Load Frame/Machine:	CM1/Controls
Date of test:	27/09/2023
Test Duration - mins:	02:12
Orientation:	Unknown
Stress Rate - MPa/s:	0.52
Strain at Failure - kN:	538.70
Unconfined Compressive Strength - Mpa:	68.5
Mode of Failure:	Vertical Shear

Remarks: -



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

UNIAXIAL COMPRESSIVE STRENGTH

ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006

Borehole Number: PBH-10 **Top Depth (m):** 17.60
Sample Number: - **Base Depth (m):** 17.65
Sample Type: R **Sample Date:** -
Storage Condition: Sealed in Core Box **Date of Receipt:** 13/09/2023
Sample Description: -

Specimen Details/Conditions	
Diameter - mm:	100.13
Height - mm:	210.17
Water Content - %:	0.55
Sample Mass - g:	4560.2
Bulk Density - Mg/m ³ :	2.76
Dry Density - Mg/m ³ :	2.74
Height Ratio: * Sample does not comply with H:D ratio	2.1
Degree of Saturation - %:	85
Assumed Specific Gravity for Degree of Saturation:	2.79

Test Result	
Load Frame/Machine:	CM1/Controls
Date of test:	27/09/2023
Test Duration - mins:	02:02
Orientation:	Unknown
Stress Rate - MPa/s:	0.57
Strain at Failure - kN:	551.80
Unconfined Compressive Strength - Mpa:	70.1
Mode of Failure:	Vertical Shear

Remarks: -



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

UNIAXIAL COMPRESSIVE STRENGTH

ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006

Borehole Number: PBH-14 **Top Depth (m):** 9.80
Sample Number: - **Base Depth (m):** 10.00
Sample Type: R **Sample Date:** -
Storage Condition: Sealed in Core Box **Date of Receipt:** 13/09/2023
Sample Description: -

Specimen Details/Conditions	
Diameter - mm:	100.01
Height - mm:	210.13
Water Content - %:	0.60
Sample Mass - g:	4559.2
Bulk Density - Mg/m ³ :	2.76
Dry Density - Mg/m ³ :	2.75
Height Ratio: * Sample does not comply with H:D ratio	2.1
Degree of Saturation - %:	85
Assumed Specific Gravity for Degree of Saturation:	2.80

Test Result	
Load Frame/Machine:	CM1/Controls
Date of test:	27/09/2023
Test Duration - mins:	02:17
Orientation:	Unknown
Stress Rate - MPa/s:	0.51
Strain at Failure - kN:	551.80
Unconfined Compressive Strength - Mpa:	70.2
Mode of Failure:	Vertical Shear

Remarks: -



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

UNIAXIAL COMPRESSIVE STRENGTH

ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006

Borehole Number: PBH-17 **Top Depth (m):** 15.30
Sample Number: - **Base Depth (m):** 15.50
Sample Type: R **Sample Date:** -
Storage Condition: Sealed in Core Box **Date of Receipt:** 13/09/2023
Sample Description: -

Specimen Details/Conditions	
Diameter - mm:	100.00
Height - mm:	210.21
Water Content - %:	0.57
Sample Mass - g:	4559.2
Bulk Density - Mg/m ³ :	2.76
Dry Density - Mg/m ³ :	2.75
Height Ratio: * Sample does not comply with H:D ratio	2.1
Degree of Saturation - %:	99
Assumed Specific Gravity for Degree of Saturation:	2.79

Test Result	
Load Frame/Machine:	CM1/Controls
Date of test:	27/09/2023
Test Duration - mins:	02:34
Orientation:	Unknown
Stress Rate - MPa/s:	0.50
Strain at Failure - kN:	601.20
Unconfined Compressive Strength - Mpa:	76.5
Mode of Failure:	Vertical Shear

Remarks: -



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

UNIAXIAL COMPRESSIVE STRENGTH

ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006

Borehole Number: PBH-21 **Top Depth (m):** 5.80
Sample Number: - **Base Depth (m):** 6.25
Sample Type: R **Sample Date:** -
Storage Condition: Sealed in Core Box **Date of Receipt:** 13/09/2023
Sample Description: -

Specimen Details/Conditions	
Diameter - mm:	100.04
Height - mm:	214.86
Water Content - %:	0.13
Sample Mass - g:	4667.8
Bulk Density - Mg/m ³ :	2.76
Dry Density - Mg/m ³ :	2.76
Height Ratio: * Sample does not comply with H:D ratio	2.1
Degree of Saturation - %:	51
Assumed Specific Gravity for Degree of Saturation:	2.78

Test Result	
Load Frame/Machine:	CM1/Controls
Date of test:	27/09/2023
Test Duration - mins:	02:18
Orientation:	Unknown
Stress Rate - MPa/s:	0.52
Strain at Failure - kN:	562.80
Unconfined Compressive Strength - Mpa:	71.6
Mode of Failure:	Vertical Shear

Remarks: -



Shancloon Wind Farm Phase 1

Contract No:
PSL23/7819
Client Ref:
12499-01-23

SUMMARY OF POINT LOAD TEST RESULTS



ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation Par / Perp	Dimensions (mm)		Area (mm ²)	D _c ²	D _c (mm)	Failure Load (P)		I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
					W	D				(Mpa)	(kN)					
PBH-01	15.50		A	Perp	100	44	4400	5602.25	74.85	-	24.54	4.38	1.199	5.25	Valid	
PBH-01	16.00		A	Perp	100	56	5600	7130.14	84.44	-	14.76	2.07	1.266	2.62	Valid	
PBH-01	17.30		A	Perp	100	61	6100	7766.76	88.13	-	20.19	2.60	1.291	3.35	Valid	
PBH-03	11.55		A	Perp	100	62	6200	7894.09	88.85	-	20.10	2.55	1.295	3.30	Valid	
PBH-03	13.80		A	Perp	100	56	5600	7130.14	84.44	-	18.11	2.54	1.266	3.22	Valid	
PBH-03	14.20		A	Perp	100	65	6500	8276.06	90.97	-	19.91	2.41	1.309	3.15	Valid	
PBH-03	12.20		A	Perp	100	56	5600	7130.14	84.44	-	36.28	5.09	1.266	6.44	Valid	
PBH-04	6.70		A	Perp	100	57	5700	7257.47	85.19	-	18.86	2.60	1.271	3.30	Valid	
PBH-04	8.00		A	Perp	100	61	6100	7766.76	88.13	-	17.14	2.21	1.291	2.85	Valid	
PBH-04	10.00		A	Perp	100	55	5500	7002.82	83.68	-	24.06	3.44	1.261	4.33	Valid	
PBH-05	13.05		A	Perp	100	38	3800	4838.31	69.56	-	16.41	3.39	1.160	3.93	Valid	
PBH-05	11.50		A	Perp	100	48	4800	6111.55	78.18	-	20.17	3.30	1.223	4.04	Valid	
PBH-06	15.30		A	Perp	100	57	5700	7257.47	85.19	-	18.86	2.60	1.271	3.30	Valid	
PBH-06	16.85		A	Perp	100	59	5900	7512.11	86.67	-	21.26	2.83	1.281	3.63	Valid	
PBH-06	18.35		A	Perp	100	62	6200	7894.09	88.85	-	17.42	2.21	1.295	2.86	Valid	
PBH-07	11.00		A	Perp	100	49	4900	6238.87	78.99	-	11.29	1.81	1.228	2.22	Valid	
PBH-07	10.10		A	Perp	100	58	5800	7384.79	85.93	-	19.19	2.60	1.276	3.32	Valid	
PBH-07	8.90		A	Perp	100	62	6200	7894.09	88.85	-	18.90	2.39	1.295	3.10	Valid	
PBH-10	17.90		A	Perp	100	49	4900	6238.87	78.99	-	19.81	3.18	1.228	3.90	Valid	
PBH-10	18.50		A	Perp	100	57	5700	7257.47	85.19	-	21.26	2.93	1.271	3.72	Valid	
PBH-13	14.70		A	Perp	100	55	5500	7002.82	83.68	-	19.27	2.75	1.261	3.47	Valid	
PBH-13	15.05		A	Perp	100	60	6000	7639.44	87.40	-	20.11	2.63	1.286	3.38	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular

		<p>Shancloon Wind Farm Phase 1</p>	Contract No:
			PSL23/7819
			Client Ref:
			12499-01-23

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D _c ²	D _c (mm)	Failure Load		I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
				Par / Perp	L	D			(Mpa)	(kN)					
PBH-01	15.50		D	Par	-	100	10000	100.00	-	32.17	3.217	1.366	4.39	Valid	
PBH-01	16.00		D	Par	-	100	10000	100.00	-	33.41	3.341	1.366	4.56	Valid	
PBH-01	17.30		D	Par	-	100	10000	100.00	-	34.77	3.477	1.366	4.75	Valid	
PBH-03	11.55		D	Par	-	100	10000	100.00	-	30.14	3.014	1.366	4.12	Valid	
PBH-03	13.80		D	Par	-	100	10000	100.00	-	29.18	2.918	1.366	3.99	Valid	
PBH-03	14.20		D	Par	-	100	10000	100.00	-	37.42	3.742	1.366	5.11	Valid	
PBH-03	12.20		D	Par	-	100	10000	100.00	-	38.55	3.855	1.366	5.27	Valid	
PBH-04	6.70		D	Par	-	100	10000	100.00	-	33.27	3.327	1.366	4.54	Valid	
PBH-04	8.00		D	Par	-	100	10000	100.00	-	32.11	3.211	1.366	4.39	Valid	
PBH-04	10.00		D	Par	-	100	10000	100.00	-	36.61	3.661	1.366	5.00	Valid	
PBH-05	13.05		D	Par	-	100	10000	100.00	-	16.41	1.641	1.366	2.24	Valid	
PBH-05	11.50		D	Par	-	100	10000	100.00	-	20.17	2.017	1.366	2.76	Valid	
PBH-06	15.30		D	Par	-	100	10000	100.00	-	18.86	1.886	1.366	2.58	Valid	
PBH-06	16.85		D	Par	-	100	10000	100.00	-	21.26	2.126	1.366	2.90	Valid	
PBH-06	18.35		D	Par	-	100	10000	100.00	-	17.42	1.742	1.366	2.38	Valid	
PBH-07	11.00		D	Par	-	100	10000	100.00	-	11.29	1.129	1.366	1.54	Valid	
PBH-07	10.10		D	Par	-	100	10000	100.00	-	19.19	1.919	1.366	2.62	Valid	
PBH-07	8.90		D	Par	-	100	10000	100.00	-	18.90	1.890	1.366	2.58	Valid	
PBH-10	17.90		D	Par	-	100	10000	100.00	-	19.81	1.981	1.366	2.71	Valid	
PBH-10	18.50		D	Par	-	100	10000	100.00	-	21.26	2.126	1.366	2.90	Valid	
PBH-13	14.70		D	Par	-	100	10000	100.00	-	19.27	1.927	1.366	2.63	Valid	
PBH-13	15.05		D	Par	-	100	10000	100.00	-	20.11	2.011	1.366	2.75	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random



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SUMMARY OF POINT LOAD TEST RESULTS



ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation Par / Perp	Dimensions (mm)		Area (mm ²)	D _c ²	D _c (mm)	Failure Load (P)		I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
					W	D				(Mpa)	(kN)					
PBH-13	16.40		A	Perp	100	39	3900	4965.63	70.47	-	22.27	4.48	1.167	5.23	Valid	
PBH-13	18.10		A	Perp	100	57	5700	7257.47	85.19	-	24.71	3.40	1.271	4.33	Valid	
PBH-14	9.60		A	Perp	100	43	4300	5474.93	73.99	-	17.18	3.14	1.193	3.74	Valid	
PBH-14	10.40		A	Perp	100	59	5900	7512.11	86.67	-	18.92	2.52	1.281	3.23	Valid	
PBH-14	11.90		A	Perp	100	62	6200	7894.09	88.85	-	17.44	2.21	1.295	2.86	Valid	
PBH-15	15.00		A	Perp	100	56	5600	7130.14	84.44	-	3.95	0.55	1.266	0.70	Valid	
PBH-16	13.25		A	Perp	100	43	4300	5474.93	73.99	-	20.11	3.67	1.193	4.38	Valid	
PBH-16	12.40		A	Perp	100	45	4500	5729.58	75.69	-	18.86	3.29	1.205	3.97	Valid	
PBH-16	16.60		A	Perp	100	53	5300	6748.17	82.15	-	14.28	2.12	1.250	2.65	Valid	
PBH-17	14.00		A	Perp	100	62	6200	7894.09	88.85	-	17.16	2.17	1.295	2.82	Valid	
PBH-17	15.50		A	Perp	100	44	4400	5602.25	74.85	-	7.40	1.32	1.199	1.58	Valid	
PBH-21	8.70		A	Perp	100	60	6000	7639.44	87.40	-	19.26	2.52	1.286	3.24	Valid	
PBH-21	7.80		A	Perp	100	52	5200	6620.85	81.37	-	20.55	3.10	1.245	3.86	Valid	
PBH-21	5.80		A	Perp	100	61	6100	7766.76	88.13	-	19.80	2.55	1.291	3.29	Valid	

***Note** All testing carried out on samples at as received water content

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A = Axial, D = Diametral, I = Irregular

		Shancloon Wind Farm Phase 1	Contract No:
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			Client Ref:
			12499-01-23

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D_c^2	D_c (mm)	Failure Load		I_s (MPa)	Corr Fac F	I_{s50} (MPa)	Failure Type	Remarks
				Par / Perp	L	D			(Mpa)	(kN)					
PBH-13	16.40		D	Par	-	100	10000	100.00	-	29.24	2.924	1.366	3.99	Valid	
PBH-13	18.10		D	Par	-	100	10000	100.00	-	24.71	2.471	1.366	3.38	Valid	
PBH-14	9.60		D	Par	-	100	10000	100.00	-	37.48	3.748	1.366	5.12	Valid	
PBH-14	10.40		D	Par	-	100	10000	100.00	-	38.16	3.816	1.366	5.21	Valid	
PBH-14	11.90		D	Par	-	100	10000	100.00	-	38.17	3.817	1.366	5.21	Valid	
PBH-15	15.00		D	Par	-	100	10000	100.00	-	0.87	0.087	1.366	0.12	Valid	
PBH-16	13.25		D	Par	-	100	10000	100.00	-	35.71	3.571	1.366	4.88	Valid	
PBH-16	12.40		D	Par	-	100	10000	100.00	-	36.10	3.610	1.366	4.93	Valid	
PBH-16	16.60		D	Par	-	100	10000	100.00	-	29.98	2.998	1.366	4.10	Valid	
PBH-17	14.00		D	Par	-	100	10000	100.00	-	38.14	3.814	1.366	5.21	Valid	
PBH-17	15.50		D	Par	-	100	10000	100.00	-	2.74	0.274	1.366	0.37	Valid	
PBH-21	8.70		D	Par	-	100	10000	100.00	-	37.14	3.714	1.366	5.07	Valid	
PBH-21	7.80		D	Par	-	100	10000	100.00	-	36.62	3.662	1.366	5.00	Valid	
PBH-21	5.80		D	Par	-	100	10000	100.00	-	34.92	3.492	1.366	4.77	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random



Shancloon Wind Farm Phase 1

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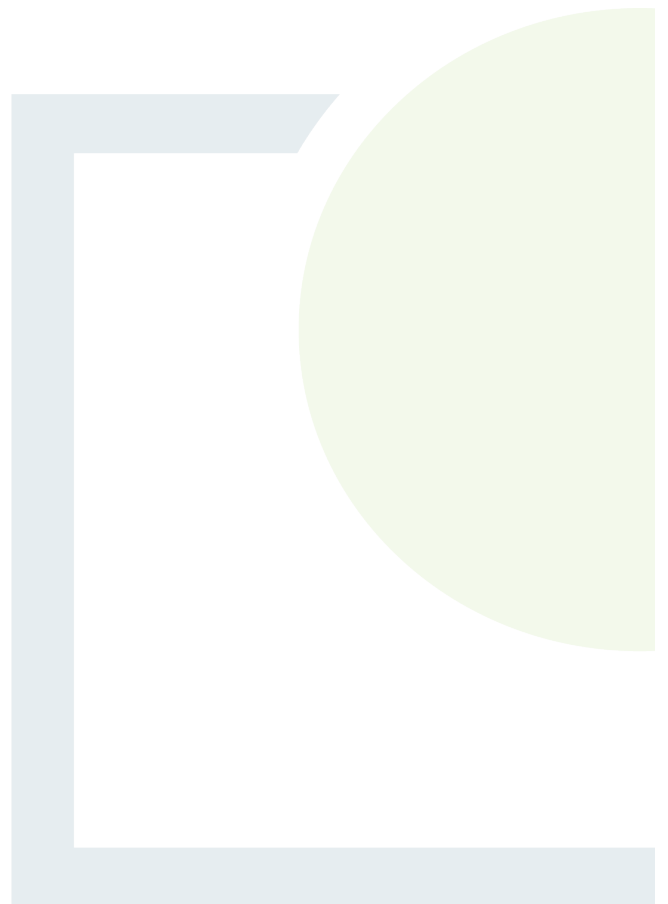
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DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX C

Geophysical Survey
Report



**REPORT
ON THE
GEOPHYSICAL INVESTIGATION
AT
SHANCLOON WIND FARM
COUNTY GALWAY
FOR
FEHILY TIMONEY AND COMPANY**



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28TH NOVEMBER 2023

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PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOPHYSICS LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGP22044		
AUTHOR	CHECKED	REPORT STATUS	DATE
TONY LOMBARD M.SC (GEOPHYSICS)	EURGEOL DR. YVONNE O'CONNELL P.GEO., PH.D. (GEOPHYSICS)	V.01	28 TH JUNE 2022
TONY LOMBARD M.SC (GEOPHYSICS)	EURGEOL DR. YVONNE O'CONNELL P.GEO., PH.D. (GEOPHYSICS)	V.02	28 TH NOVEMBER 2023

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1. EXECUTIVE SUMMARY

APEX Geophysics Limited was requested by Fehily Timoney and Company to carry out a geophysical investigation at the site of the proposed Shancloon Wind Farm, approximately 8.5 km northwest of Tuam, Co. Galway. The purpose of the survey was to provide information on the sub-soil conditions at thirteen proposed turbine bases (T01-T13).

The objectives of the investigation were to assess the depth to bedrock, identify the type of bedrock, identify any potential karst features faults/fissure zones within the bedrock and to propose borehole locations.

The soils mapped by the Geological Survey of Ireland (GSI) at the proposed bases comprise of cut over raised peat and /or till derived from limestones. The GSI bedrock map for the area indicates dark cherty limestone and thin shale of the Ardnasillagh Formation under 12 of the bases with pure limestone of the Cong Limestone Formation underlying base T10. The GSI karst database does not show karst features in the survey area.

The survey was carried out between the 26th of May and 1st of June 2022 and involved the collection of 26 Electrical Resistivity Tomography profiles. In addition, soft ground probing was carried out along each ERT profile to determine the thickness of soft peat (to a maximum probe depth of 5 m bgl).

The results of the investigation at each base are discussed in Section and shown on the maps and sections in **Appendix B**.

Direct investigation logs were provided for inclusion in this final report. Locations have been recommended to confirm nature of the soils and depth to and nature of the bedrock at Turbine T11. Auguring should be undertaken where additional base of peat information is required.

Seismic refraction and MASW profiling should be considered at each base to assist with determining soil stiffness and shear strength, the depth to bedrock and the degree of weathering of the bedrock.

The geophysical report should be reviewed following completion of any further direct investigation and any further geophysical data acquisition.

Where bedrock excavation is proposed, a detailed assessment of excavatability should be carried out combining the results of the geophysical survey, rotary core drilling, strength testing, and trial excavation pits down to formation level using a high-powered excavator of similar rating to that to be used during construction.

2. INTRODUCTION

APEX Geophysics Limited was requested by Fehily Timoney and Company to carry out a geophysical investigation at the site of the proposed Shancloon Wind Farm, Co. Galway. The purpose of the survey was to provide information on the sub-soil conditions at thirteen proposed turbine bases (T01-T13).

2.1 Survey Objectives

The objectives of the investigation were to:

- assess the depth to bedrock;
- identify the type of bedrock;
- identify any potential karst features faults/fissure zones within the bedrock;
- propose borehole locations.

2.2 Site Background

The site is located approximately 8.5 km northwest of Tuam, Co. Galway. Of the 13 proposed wind turbines (T01 – T13), five are situated in open agricultural land (T03, T04, T06, T08 & T09), one is in a forested area (T10) and seven are in areas of open bog areas (T01, T02, T05, T07, T11, T12 & T13), (Fig. 2.1). The topography across the site ranges from c. 26.3 to 39.4 m OD.

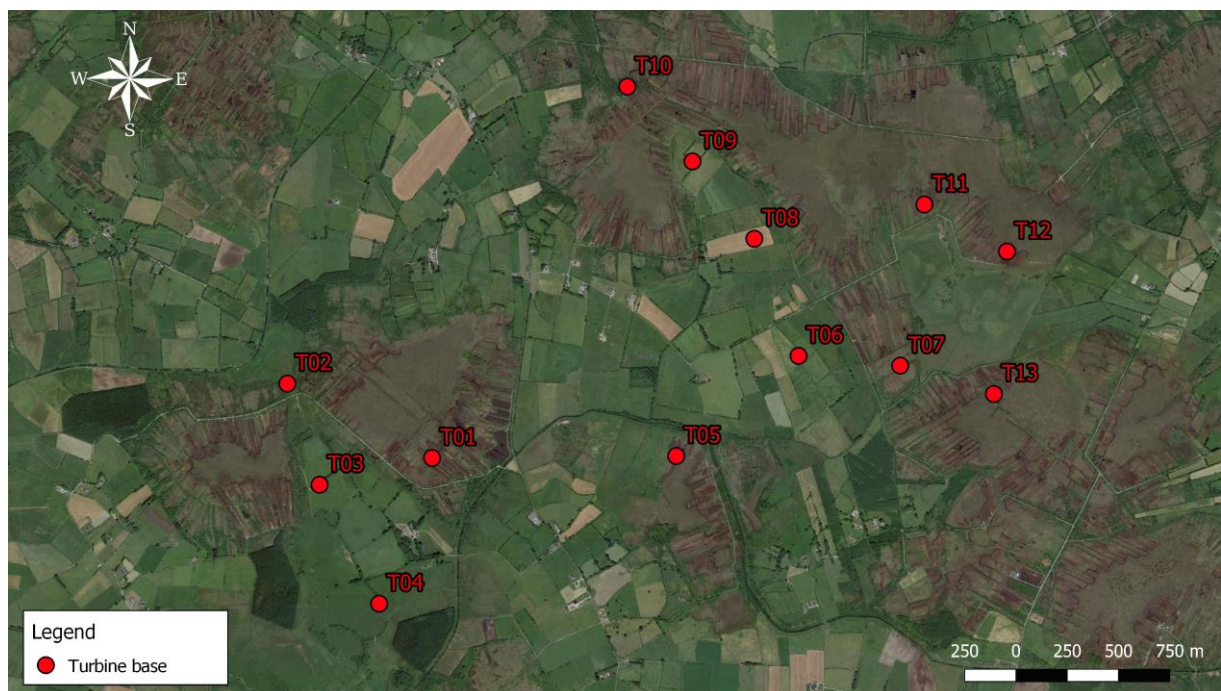


Fig 2.1: Site location with turbine bases highlighted in red.

2.2.1 Soils

The Geological Survey of Ireland (GSI) Quaternary soils map for the area (GSIa, 2019) indicates that the soils at the proposed turbine bases T01, T02, T05, T07, T10, T11, T12 & T13 comprise of cut over raised peat and at turbine bases T03, T04, T06, T08 and T09 comprise of till derived from limestones (Fig. 2.2).

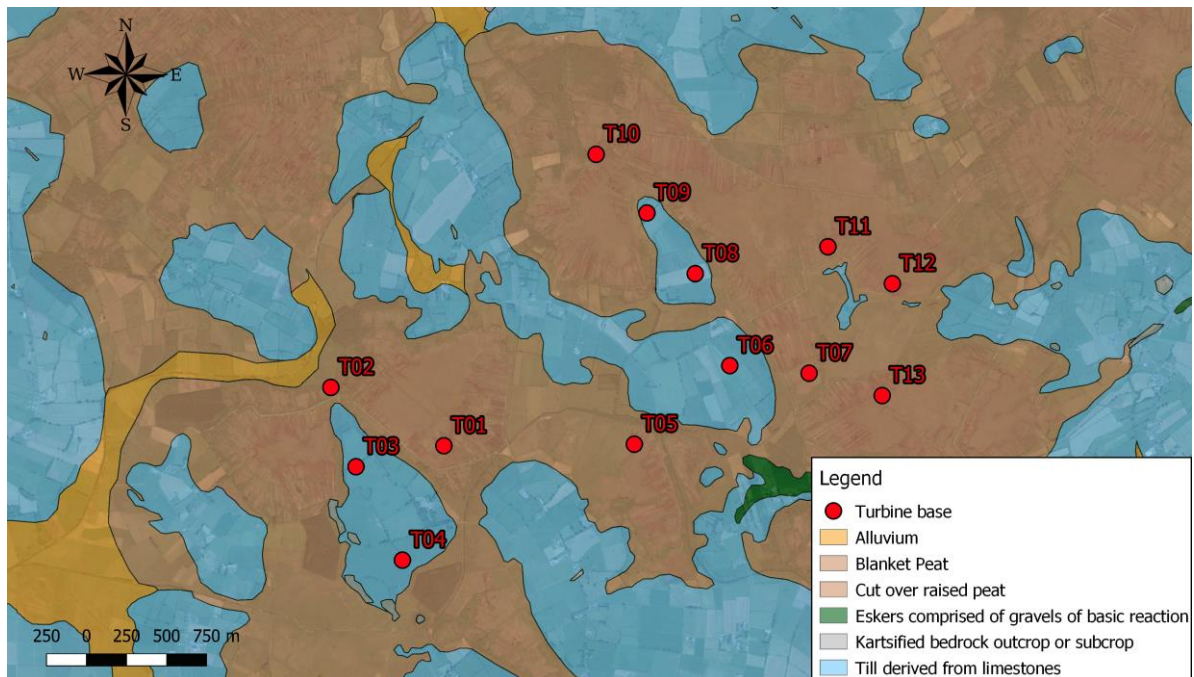


Fig 2.2: The Quaternary sediments map.

2.2.2 Geology

The GSI 1:100k Bedrock Geology map for the area (GSI, 2018) indicates that the survey area is underlain by dark cherty limestone, thin shale of the Ardnasillagh Formation (Fig. 2.3) and pure limestone of the Cong Limestone Formation (T10 only). There is a NE-SW oriented fault mapped across the northwest part of the site. While the GSI karst database does not show karst features in the survey area. A turlough is mapped c. 2 km to the south of the site in the Ardnasillagh Formation.

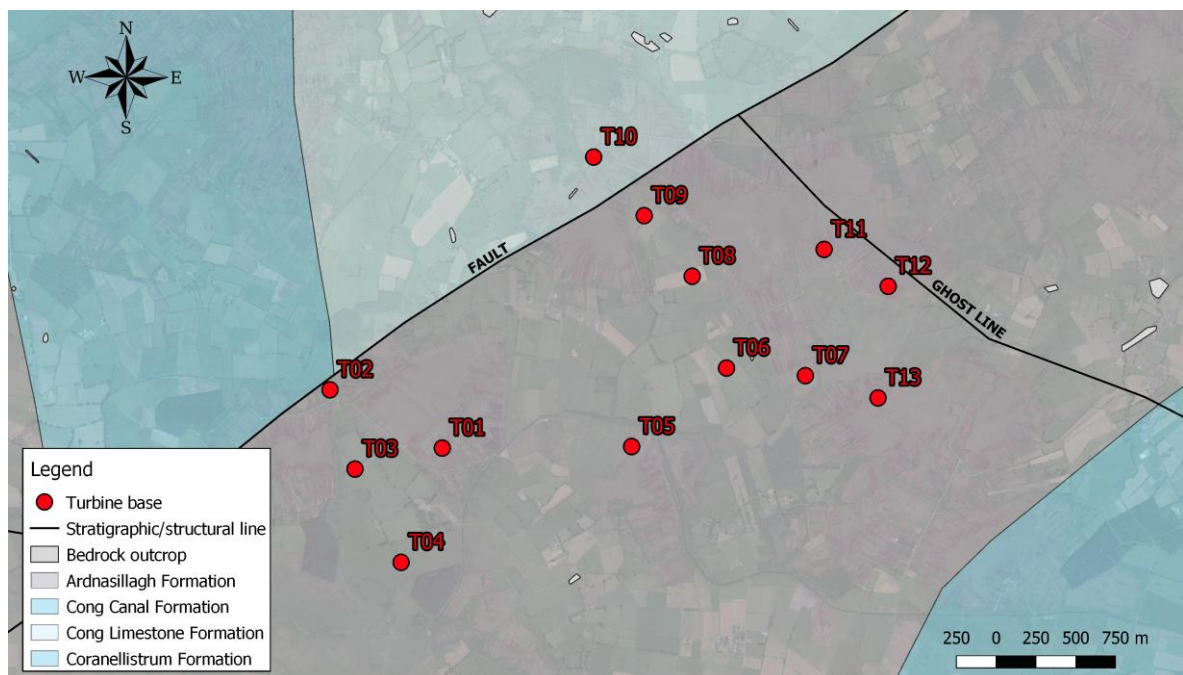


Fig 2.3: Bedrock geology with turbine bases highlighted in red.

2.2.3 Groundwater

The groundwater vulnerability rating for the site (GSIb, 2019) is classified as 'low' at turbine bases T07, T10, T11, T12 & T13, 'moderate' at turbine bases T01, T06, T08, & T09 and 'high' at turbine bases T02, T03, T04 & T05 (Fig. 2.4). The limestone bedrock is classified as a 'Regionally Important Aquifer – karstified (conduit)'.

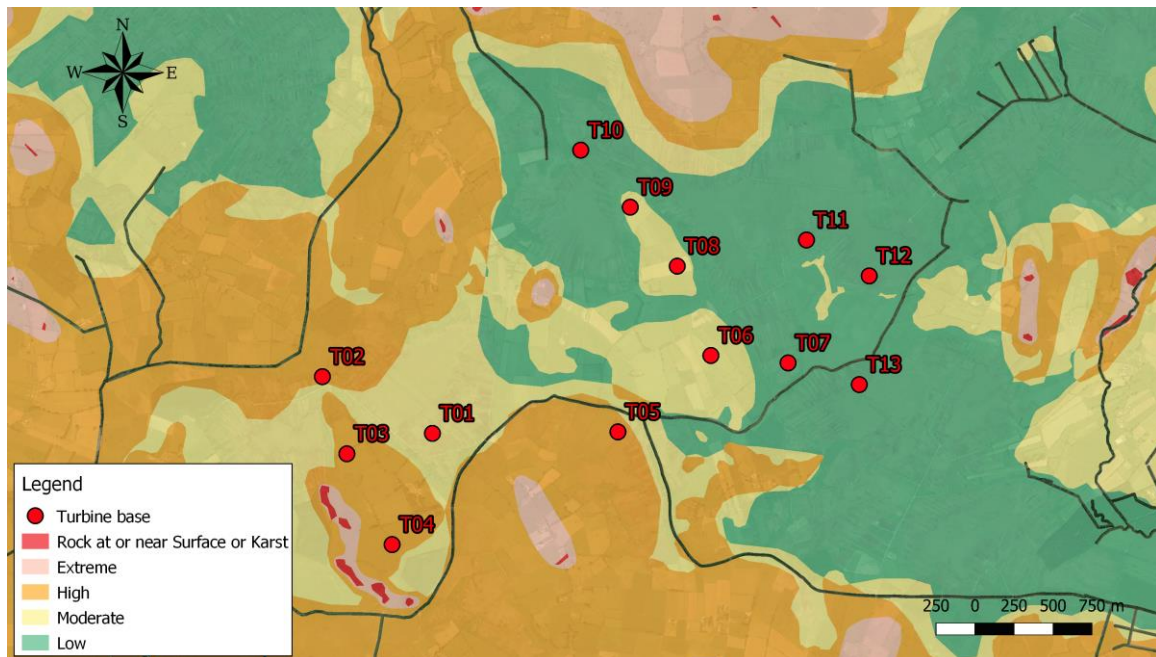


Fig 2.4: Groundwater vulnerability with turbine bases highlighted in red.

2.2.4 Historical Data

The historical 6 inch geological mapping sheet for the area (Fig. 2.5) indicates bog at turbines T01, T02, T05, T07, T11, T12 & T13 and flat drift at the turbines T03, T04, T06, T08 and T09.

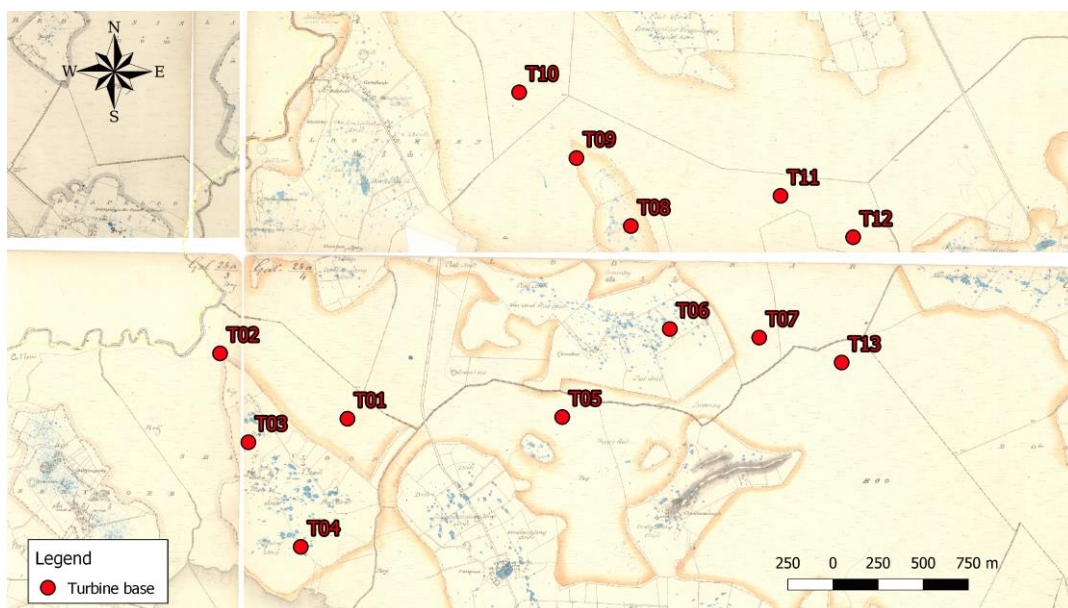


Fig 2.5: The historical 6inch map with turbine bases shown in red.

2.2.5 Direct Investigation Data

Information for twenty three trial pits (PTP-01 – PTP-23) and twenty one rotary cores (PBH-01 to PBH-21) was provided for inclusion in this final report.

The trial pits were excavated to depths ranging from 2.3 to 4.5 m below ground level (bgl) where they terminated. Side wall collapse and possible boulders/bedrock were noted as the reasons for termination on a number of the logs.

The soils generally comprised of a thin peaty topsoil layer and some made ground 0.2 to 1.2 m thick as well as very soft peat (to 3.1 m) and very soft silt/clay over a sequence of predominantly soft-firm sandy gravelly silty clay becoming stiff to very stiff with depth. Occasional thin clayey gravelly sand and silty clayey sandy gravel layers are also present as is very loose and dense to very dense cobbles and boulders with clayey gravel (possible highly weathered rock) and a possible weathered bedrock/karst zone from 8.5 to 14.8 m bgl in PBH-18.

Rock was encountered at depths of 5.2 to 17.0 m bgl. To termination depths of 10.7 to 23.0 m bgl encountered rock was described as medium strong to very strong, moderately weathered to slightly weathered to fresh argillaceous limestone. Fractures with clay smearing and infill were encountered in the rock as were possible fault breccia from 16.6 to 17.0 m bgl (PBH-13), a possible limestone raft and glaciotectionised limestone recovered as clay from 14.4 to 16.2 m bgl (PBH-16) and some non-intact zones 1.6 to 2.8 m thick.

The direct investigation locations are shown on the drawing in Appendix B.

2.3 Survey Rationale

The client specified geophysical investigation methodology consisted of 2D Electrical Resistivity Tomography (ERT) at locations specified by the client. ERT images the resistivity of materials in the subsurface along a profile to produce a 2D cross-section showing the variation in resistivity to depths dependent on the length of the profile. Each cross-section is interpreted to determine the subsurface material types based on the typical resistivities returned for Irish ground materials e.g. sand/gravel will have a high resistivity while silt/clay will have a low resistivity.

In addition, soft ground probing was carried out along each ERT profile to determine the thickness of soft material (to a maximum probe depth of 5 m bgl).

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by variations in the ground properties. Further information on the detailed methodology of the geophysical method employed in this investigation is given in **APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY.**

3. RESULTS

The survey was carried out between the 26th of May and 1st of June 2022 and involved the collection of 26 ERT profiles. The geophysical survey locations are indicated on Drawing AGP22044_01 (Appendix B).

3.1 Electrical Resistivity Tomography (ERT)

Two orthogonal ERT profiles (R1 & R2) were recorded at each turbine base (T01 – T13). The resistivity values have been interpreted in conjunction with the direct investigation data on the following basis:

Resistivity (Ohm-m)	Interpretation
32-100	PEAT
15-100	SILT/CLAY/MARL
100-250	Sandy gravelly SILT/CLAY/DRY PEAT
250-750	Clayey Silty SAND/GRAVEL
100-300	MUDSTONE SHALE or possible weathered/karstified LIMESTONE
>250	LIMESTONE

The top of bedrock has been interpreted for each pair of profiles at each turbine base. The resistivity values do not provide information on the degree of weathering of the bedrock and the addition of seismic refraction profiling would provide more information with respect to this. By combining a number of geophysical techniques it is possible to provide a higher quality interpretation and reduce any ambiguities which may otherwise exist.

4. DISCUSSION

The results at each turbine base are shown on Drawings AGP22044_T01 to AGP22044_T13.

4.1 Turbine Base T01

The results at turbine base T01 are shown on Drawing AGP22044_T01 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting of 1.5 – 6.0 m soft peat (soft ground probes terminated at 5 m bgl without refusing).
- **layer 2** consisting of 4.1 to 6.4 m thick (average of 5.1 m) silt/clay/marl.
- **layer 3** consisting of 1.1 to 3.6 m thick (average 1.6 m) sandy gravelly silt/clay with some cobbles and boulders.
- **layer 4** limestone bedrock at depths from 7.7 to 12.6 m bgl (average 9.6 m bgl and 10.8 at turbine centre). The upper part of the limestone may be returned as cobbles and boulders, encountered in PBH-01 where cobbles and boulders (possible weathered rock) were encountered at a depth of 12.1 m bgl.

4.2 Turbine Base T02

The results at turbine base T02 are shown on Drawing AGP22044_T02 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1**, an intermittent layer of silt/clay up to 4.4 m thick.
- **layer 2** 2.6 to 10.5 m (average 5.7 m) sandy gravelly silt/clay.
- A lense of clayey silty sand/gravel 0.7 to 2.6 m thick on R2 within the sandy gravelly silt/clay layer approximately 20 m south of the turbine centre.
- **layer 3** limestone bedrock at depths from 3.2 to 11.0 m bgl (average 6.8 m bgl and 5.7 m bgl at turbine centre).

4.3 Turbine Base T03

The results at turbine base T03 are shown on Drawing AGP22044_T03 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting of 1.6 to 8.6 m thick (average 5.6 m) clayey silty sand/gravel.
- **layer 2** consisting of 0.7 m to 8.0 m thick (average 2.7 m) sandy gravelly silt/clay .
- **layer 3** limestone bedrock at depths from 7.0 to 12.5 m bgl (average 9.7 m bgl and 9.4 m bgl at turbine centre).

4.4 Turbine Base T04

The results at turbine base T04 are shown on Drawing AGP22044_T04 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** 0.7 to 8.2 m (average 4.1 m) of primarily sandy gravelly clay with some clayey silty sand/gravel located approx. 10 to 60 m north of the turbine centre.
- **layer 2** limestone bedrock at depths from 0.7 m bgl approx. 35 m south of the turbine centre to 8.2 m bgl approx. 40 m north of the turbine centre (average 4.3 m bgl and 4.5 m bgl at turbine centre).The trial pit

and borehole data (PTP-04 & PBH-04) indicate the upper part of the limestone may be weathered to boulders and sandy gravelly silty clay.

4.5 Turbine Base T05

The results at turbine base T05 are shown on Drawing AGP22044_T05 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting of 2.0 to 5.6 m (average 2.8 m) of soft peat.
- **layer 2** consisting of 1.5 to 4.7 m thick (average 3.7 m) of silt/clay/marl that 'pinches out' approx. 10 m northwest of the turbine base.
- **layer 3** consisting of 1.8 to 5.2 m (average 3.2 m) sandy gravelly silt/clay.
- **layer 4** limestone bedrock at depths from 4.8 m bgl approx. 25 m NW of the turbine centre to 11.8 m bgl approx. 20 m southeast of the turbine centre (average 7.8 m bgl and 7.5 m bgl at turbine centre).

4.6 Turbine Base T06

The results at turbine base T06 are shown on Drawing AGP22044_T06 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting primarily of sandy gravelly silt/clay which is 7.9 to 15.8 m thick (average 12.7 m) with 'pockets' of clayey silty sand/gravel also present at the turbine centre and approx. 30 m west and 20 – 30 m east of the turbine centre.
- **layer 2** limestone bedrock at depths from 7.8 to 15.7 m bgl (12.7 m bgl at turbine centre).

4.7 Turbine Base T07

The results at turbine base T07 are shown on Drawing AGP22044_T07 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting of 3.4 to 4.8 m peat.
- **layer 2** consisting of 0.7 to 5.1 m (average 3.3 m) silt/clay.
- **layer 3** consisting of 1.1 to 3.1 m (average 1.7 m) sandy gravelly silt/clay.
- **layer 4** limestone bedrock at depths from 6.1 m bgl approx. 10 m southeast of the turbine centre to 11.3 m bgl approx. 40 m northeast of the turbine centre (average 9.2 and 8.7 m bgl at the turbine centre).

4.8 Turbine Base T08

The results at turbine base T08 are shown on Drawing AGP22044_T08 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting of 0.4 to 5.3 m (average 3 m) clayey silty sand/gravel. This layer 'pinches out' approx. 20 m southwest of the turbine centre.
- **layer 2** consisting of 1.4 to 11.6 m (average 3.6 m) sandy gravelly silt/clay.
- **layer 3** consisting of 0.6 to 7.5 m (average 2.6 m) clayey silty sand/gravel. This may be weathered rock material.

- **layer 4** bedrock which undulates across the turbine base from 5.2 to 16.4 m bgl. While low resistivities in the bedrock have been interpreted as indicating possible mudstone/shale bedrock they may also be indicative of weathered/karstified limestone or clayey silty sand/gravel. The bedrock with resistivities > 300 Ohm-m has been interpreted as limestone. While limestone bedrock was encountered deeper at depths of 16.9 and 15.95 m bgl respectively in PBH-10 and PBH-11 the overlying very stiff clay and cobbles and boulders in conjunction with resistivity values of >300 Ohm-m may indicate weathered rock.

4.9 Turbine Base T09

The results at turbine base T09 are shown on Drawing AGP22044_T09 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting primarily of sandy gravelly silt/clay which is 2.2 to 7.1 m thick with 'pockets' of clayey silty sand/gravel predominantly west/northwest of the turbine centre.
- **Layer 2** consisting of clayey silty sandy gravel, which may be weathered rock, 0.6 to 12.0 m thick (average 5.0 m).
- **layer 3** limestone bedrock which undulates across the base from 4.3 to 15.6 m bgl.

4.10 Turbine Base T10

The results at turbine base T10 are shown on Drawing AGP22044_T10 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting primarily of silt/clay and sandy gravelly silt/clay which is 3.3 to 10.4 m thick (average 3.9 m).
- **layer 2** a layer of clayey silty sand/gravel with cobbles and boulders 0.3 to 9.4 m thick (average 1.6).
- **layer 3** bedrock at depths from 4.1 to 12.2 m bgl (4.9 m bgl at the turbine centre). Low resistivities in the vertical/subvertical bands through the bedrock have been interpreted as indicating possible mudstone/shale bedrock. However, these low resistivities may also be indicative of weathered/karstified limestone. The bedrock with resistivities > 300 Ohm-m has been interpreted as limestone.

4.11 Turbine Base T11

The results at turbine base T11 are shown on Drawing AGP22044_T11 and have been interpreted as indicating the following subsurface layers:

- **layer 1** consisting of 0.6 – 2.2 m soft peat.
- **layer 2** consisting of 0 to 2.4 m silt/clay.
- **layer 3** consisting of 1.0 to 2.8 m sandy gravelly silt/clay.
- **layer 4** bedrock at depths from 2.2 to 5.5 m bgl (3.9 m bgl at the turbine centre). Low bedrock resistivities have been interpreted as indicating possible mudstone/shale bedrock. However, these low resistivities may also be indicative of weathered/karstified limestone or possible sandy gravelly silt/clay. The higher bedrock resistivities (> 300 Ohm-m) have been interpreted as limestone. Boreholes to confirm the nature of this layer are recommended. Depth to bedrock at T11 should be confirmed by borehole drilling.

4.12 Turbine Base T12

The results at turbine base T12 are shown on Drawing AGP22044_T12 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting of 2.3 – 10.2 m soft peat (in places soft ground probes terminated at 5 m bgl without refusing).
- **layer 2** consisting of 0.4 to 4.0 m of silt/clay.
- **layer 3** consisting of 2.2 to 5.8 m sandy gravelly silt/clay.
- **layer 4** limestone bedrock at depths from 6.8 to 14.3 m bgl (10.3 m at turbine centre).

4.13 Turbine Base T13

The results at turbine base T13 are shown on Drawing AGP22044_T13 and have been interpreted in conjunction with the direct investigation data as indicating the following subsurface layers:

- **layer 1** consisting of 2.7 – 6.7 m soft peat (all soft ground probes terminated at 5 m bgl without refusing).
- **layer 2** consisting of 4.5 to 8.6 m of silt/clay/marl.
- **layer 3** consisting of 1.5 to 3.2 m sandy gravelly silt/clay, possible weathered rock towards base.
- **layer 4** limestone bedrock at depths from 9.2 to 17.0 m bgl (12 m at turbine centre).

At the turbine bases where peat is interpreted (T1, T5, T7, T12 & T13) the direct investigation data encountered peat over very soft to soft marl at three of the bases (T1, T5, T13). The soft ground probes generally refused deeper than base of encountered peat. Across the turbine bases there is a generally good correlation between interpreted depth to top of rock and depth to rock encountered in the boreholes.

5. RECOMMENDATIONS

Trial pits and boreholes are recommended to confirm nature of the soils and depth to and nature of the bedrock at the following locations:

No.	Bas	Easting	Northin	Target
PTP T11	T11	534545	755313	Confirm variations in soil type
PBH T10	T10	533094	755921	Investigate Zone of potential bedrock weathering
PBH T11 1	T11	534523	755346	Investigate Zone of potential bedrock weathering
PBH T11 2	T11	534544	755349	Confirm soil type, depth to & nature of bedrock at turbine
PBH T11 3	T11	534544	755376	Confirm soil type, depth to & nature of bedrock

Auguring should be undertaken where the base of peat is not clear.

Seismic refraction and MASW profiling should be considered at each base to assist with determining soil stiffness and shear strength, the depth to bedrock and the degree of weathering/karstification of the bedrock.

The geophysical report should be reviewed following completion of any further direct investigation and any further geophysical data acquisition.

Where bedrock excavation is proposed, a detailed assessment of excavatability should be carried out combining the results of the geophysical survey, rotary core drilling, strength testing, and trial excavation pits down to formation level using a high-powered excavator of similar rating to that to be used during construction.

As karstification of limestone typically involves dissolution of the bedrock and subsequent infill with glacial material, any groundwork or an altered surface drainage pattern in the vicinity of karstified limestone may lead to a reactivation of karst features. The normal mitigation measures applying to construction over karstic limestones, such as sealed drainage, and foundations capable of spanning voids that may come to the surface, should therefore be incorporated into any works.

REFERENCES

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'Engineering Geology', Blackwell Scientific Press.

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'RES2DINV Users Manual', Malaysia.

GSI, 2018;
Bedrock Geology 1:100,000 Shapefile. <http://www.gsi.ie/Mapping.htm>

GSIa, 2019;
Quaternary Subsoils Shapefile. <http://www.gsi.ie/Mapping.htm>

GSIb, 2019;
Groundwater Vulnerability Shapefile. <http://www.gsi.ie/Mapping.htm>

IEEE Std 81-1983 (Guide for measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System).

APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY

Electrical Resistivity Tomography (ERT)

Electrical Resistivity Tomography was carried out to provide information on lateral variations in the overburden material as well as on the underlying overburden and bedrock.

Principles

This surveying technique makes use of the Wenner resistivity array. The 2D-resistivity profiling method records a large number of resistivity readings in order to map lateral and vertical changes in material types. This method involves the use of electrodes connected to a resistivity meter, using computer software to control the process of data collection and storage.

Data Collection

The ERT profiles were recorded using an ABEM Terrameter LS resistivity meter, imaging software, two takeout multicore cables and up to 40 stainless steel electrodes. Saline solution was used at the electrode/ground interface in order to gain a good electrical contact required for the technique to work effectively. The recorded data were processed and viewed immediately after surveying.

Data Processing

The field readings were stored in computer files and inverted using the RES2DINV package (Geotomo Software, 2006) with up to 5 iterations of the measured data carried out for each profile to obtain a 2D-depth model of the resistivities.

The inverted 2D resistivity models and corresponding interpreted geology are displayed on the accompanying drawings. Profiles have been contoured using the same contour intervals and colour codes. Distance is indicated along the horizontal axis of the profiles.

Spatial Relocation

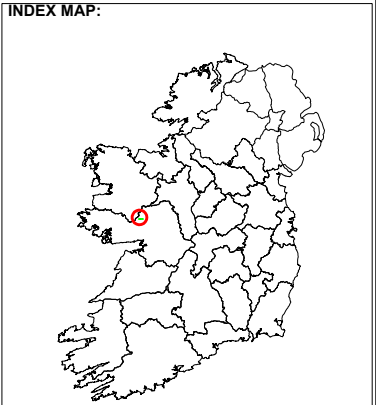
All the geophysical investigation locations were acquired using a Trimble Geo 7X high-accuracy GNSS handheld system using the settings listed below. This system allows collection of GPS data with c.20mm accuracy. On this project Client supplied DTM data was used.

Projection:	Irish Transverse Mercator
Datum:	Ordnance
Coordinate units:	Metres
Altitude units:	Metres
Survey altitude reference:	MSL
Geoid model:	Republic of Ireland

APPENDIX B: DRAWINGS

The information derived from the geophysical investigation is presented in the following drawings:

AGP22044_01	Geophysical Locations	1:12500 @ A4
AGP22044_T01	Fig. 1 Turbine Base T01, Results and Interpretation T1R1 Fig. 2 Turbine Base T01, Results and Interpretation T1R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T02	Fig. 1 Turbine Base T02, Results and Interpretation T2R1 Fig. 2 Turbine Base T02, Results and Interpretation T2R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T03	Fig. 1 Turbine Base T03, Results and Interpretation T3R1 Fig. 2 Turbine Base T03, Results and Interpretation T3R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T04	Fig. 1 Turbine Base T04, Results and Interpretation T4R1 Fig. 2 Turbine Base T04, Results and Interpretation T4R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T05	Fig. 1 Turbine Base T05, Results and Interpretation T5R1 Fig. 2 Turbine Base T05, Results and Interpretation T5R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T06	Fig. 1 Turbine Base T06, Results and Interpretation T6R1 Fig. 2 Turbine Base T06, Results and Interpretation T6R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T07	Fig. 1 Turbine Base T07, Results and Interpretation T7R1 Fig. 2 Turbine Base T07, Results and Interpretation T7R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T08	Fig. 1 Turbine Base T08, Results and Interpretation T8R1 Fig. 2 Turbine Base T08, Results and Interpretation T8R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T09	Fig. 1 Turbine Base T09, Results and Interpretation T9R1 Fig. 2 Turbine Base T09, Results and Interpretation T9R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T10	Fig. 1 Turbine Base T10, Results and Interpretation T10R1 Fig. 2 Turbine Base T10, Results and Interpretation T10R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T11	Fig. 1 Turbine Base T11, Results and Interpretation T11R1 Fig. 2 Turbine Base T11, Results and Interpretation T11R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T12	Fig. 1 Turbine Base T12, Results and Interpretation T12R1 Fig. 2 Turbine Base T12, Results and Interpretation T12R2	1:1250 @ A4 1:1250 @ A4
AGP22044_T13	Fig. 1 Turbine Base T13, Results and Interpretation T13R1 Fig. 2 Turbine Base T13, Results and Interpretation T13R2	1:1250 @ A4 1:1250 @ A4



- LEGEND:
- Proposed turbine
 - 2D resistivity profile
 - Borehole
 - Trial pit

The information displayed here is to be used in conjunction with AGP22044_02 Report on the Geophysical Investigation at Shancloon Wind Farm, Co. Galway for Fehily Timoney and Company Ltd., APEX Geophysics Ltd. 28th November 2023.

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CLIENT: FEHILY TIMONEY AND COMPANY

DRAWING NO: AGP22044_01

SCALE: AS INDICATED @ A4

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FIG.1: TURBINE BASE T01, ERT RESULTS AND INTERPRETATION T1R1

SCALE 1:1250

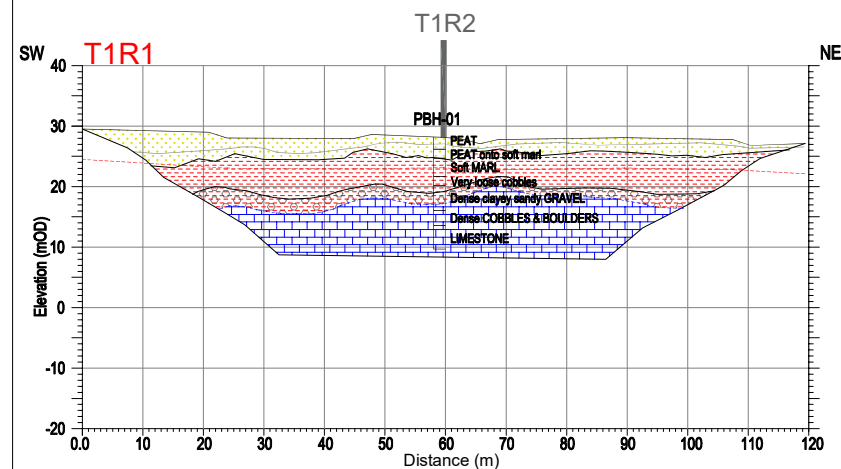
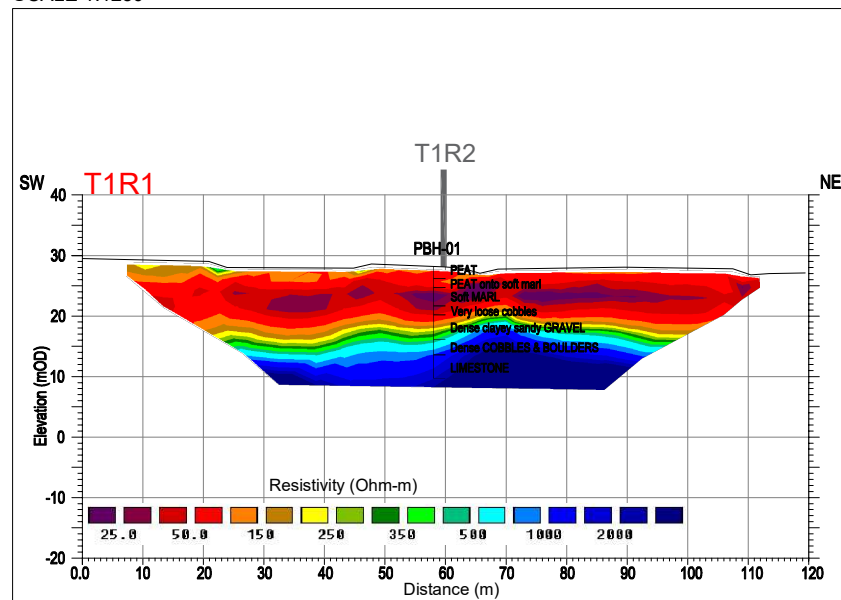
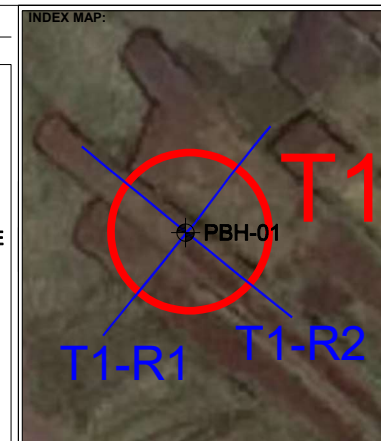
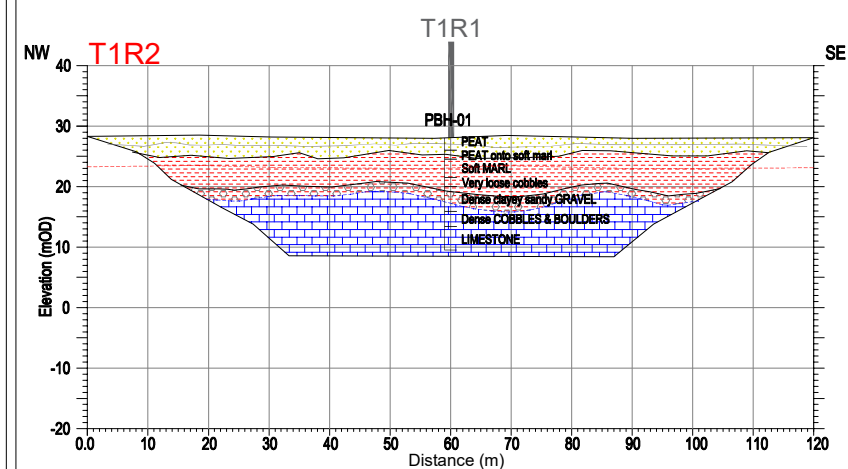
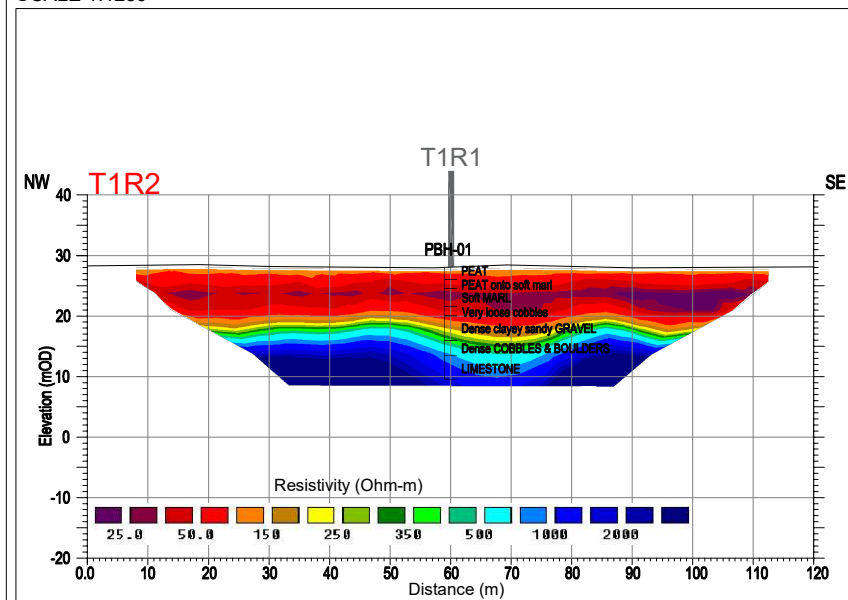


FIG.2: TURBINE BASE T01, ERT RESULTS AND INTERPRETATION T1R2

SCALE 1:1250



- LEGEND:**
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/CLAY
 - Clayey Silty SAND/GRAVEL
 - MUDSTONE/SHALE or possible weathered/karstified LIMESTONE
 - LIMESTONE
 - Possible base of dry PEAT
 - Base of Soft Ground Probes
 - Possible Top of ROCK

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FIG.1: TURBINE BASE T02, ERT RESULTS AND INTERPRETATION T3R1
SCALE 1:1250

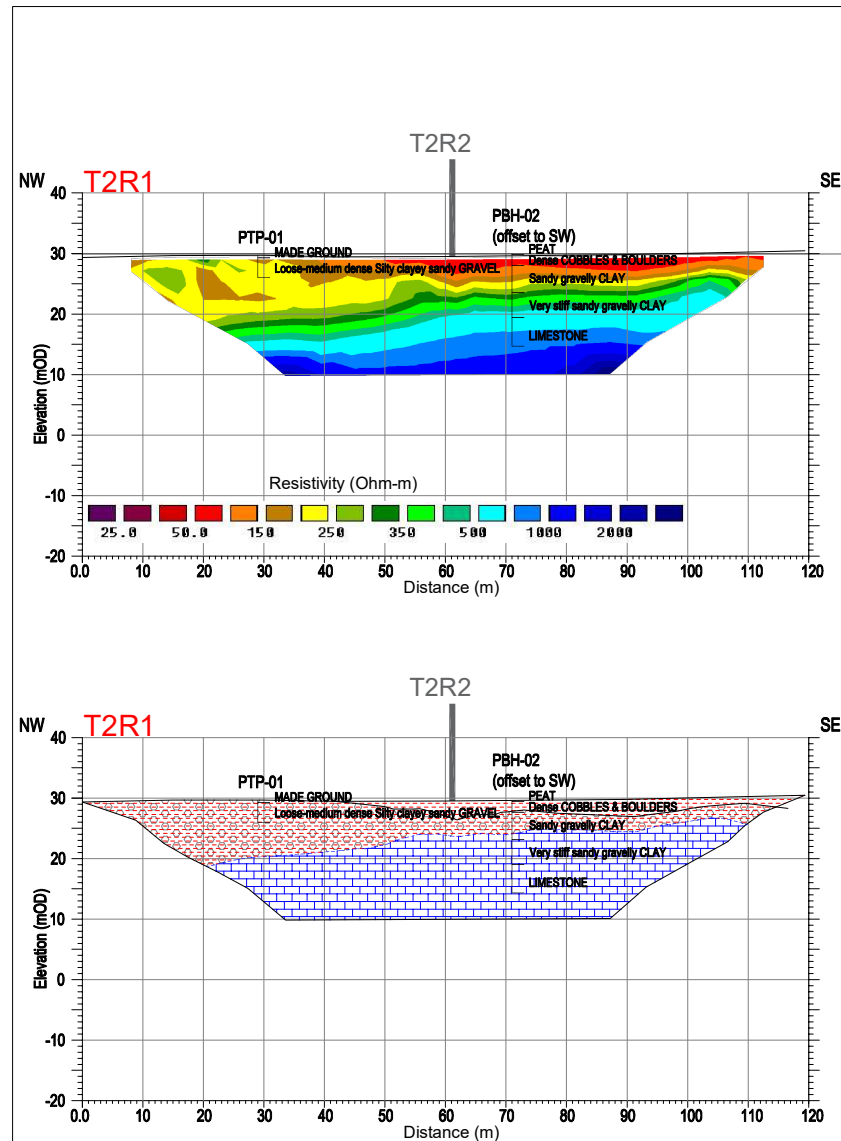
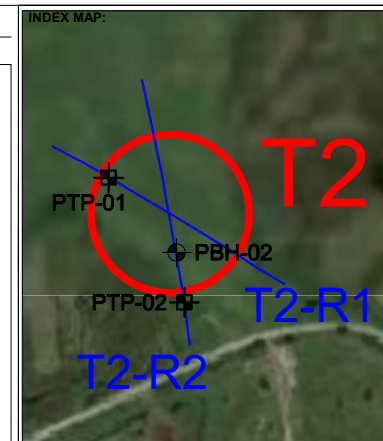
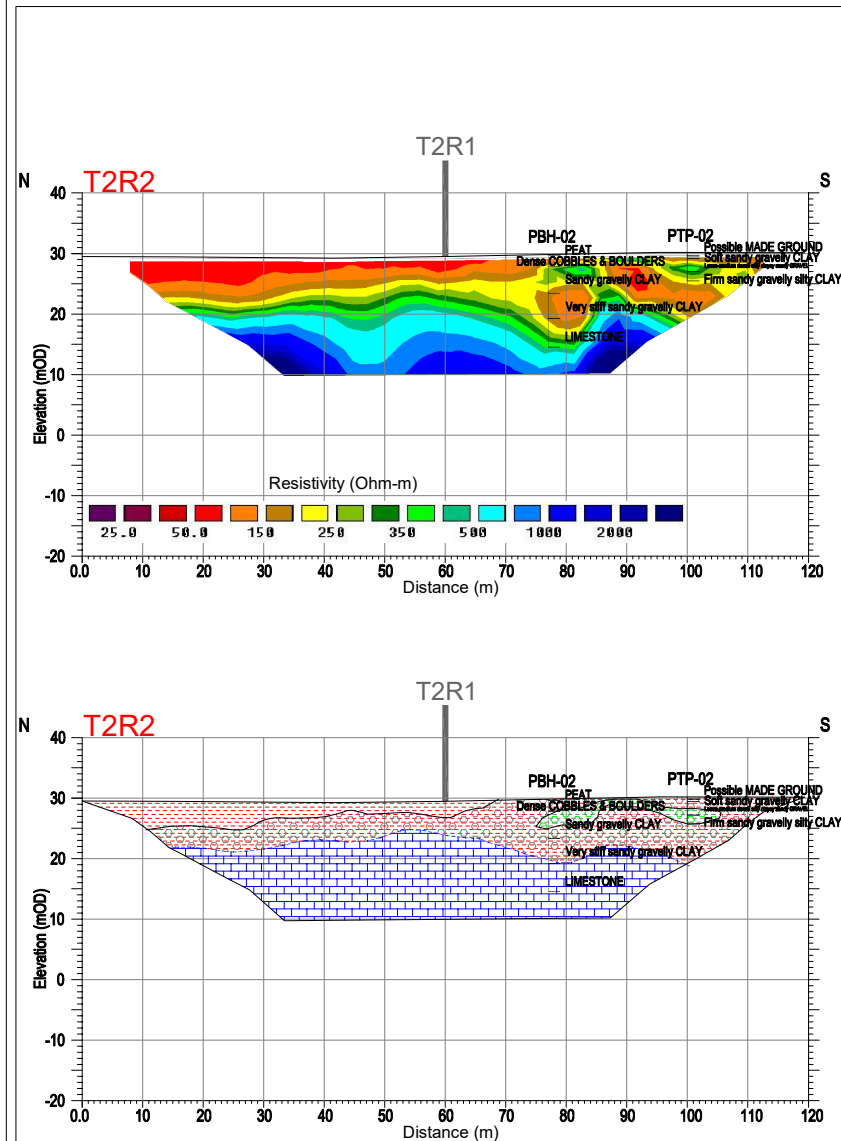


FIG.2: TURBINE BASE T02, ERT RESULTS AND INTERPRETATION T2R2
SCALE 1:1250



- LEGEND:**
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/ CLAY
 - Clayey Silty SAND/GRAVEL
 - MUDSTONE/SHALE or possible weathered/karstified LIMESTONE
 - LIMESTONE
 - Possible base of dry PEAT
 - Base of Soft Ground Probes
 - Possible Top of ROCK

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FIG.1: TURBINE BASE T03, ERT RESULTS AND INTERPRETATION T3R1
SCALE 1:1250

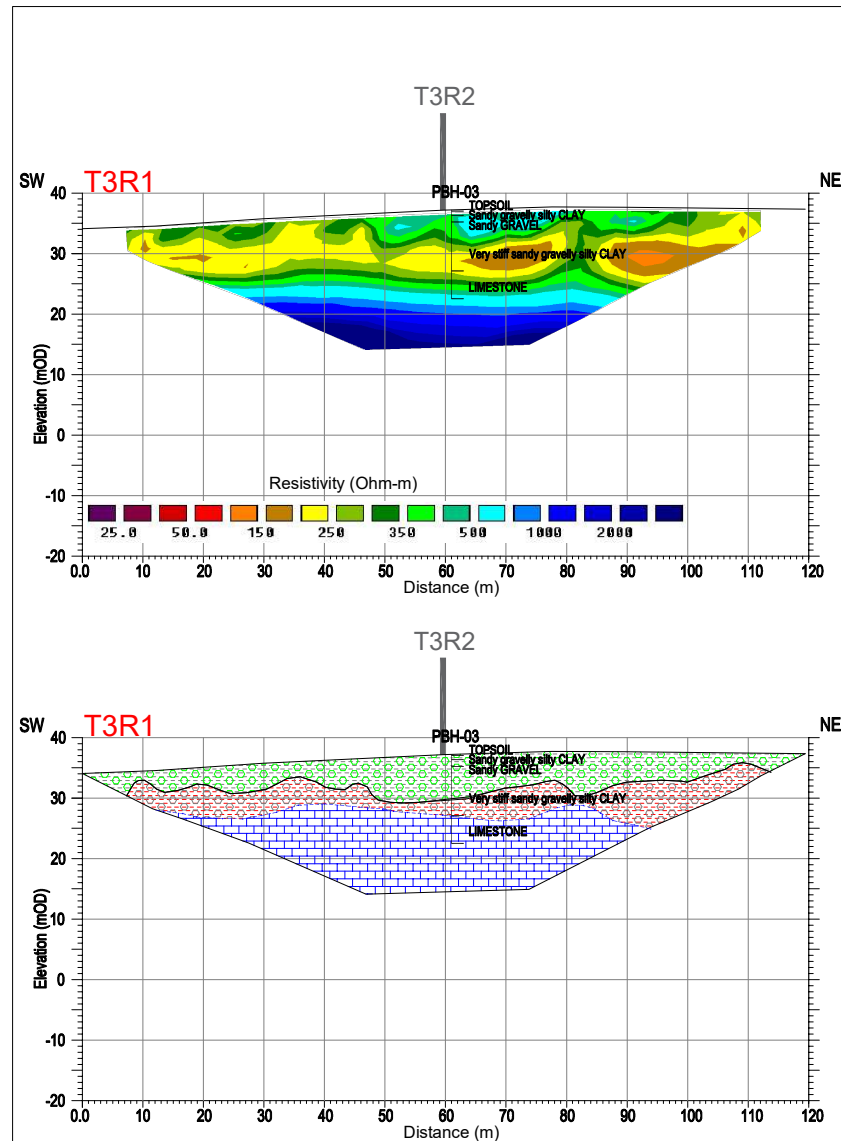
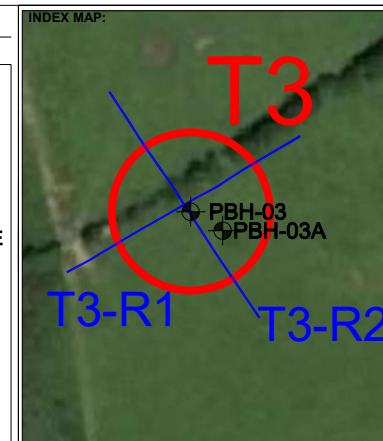
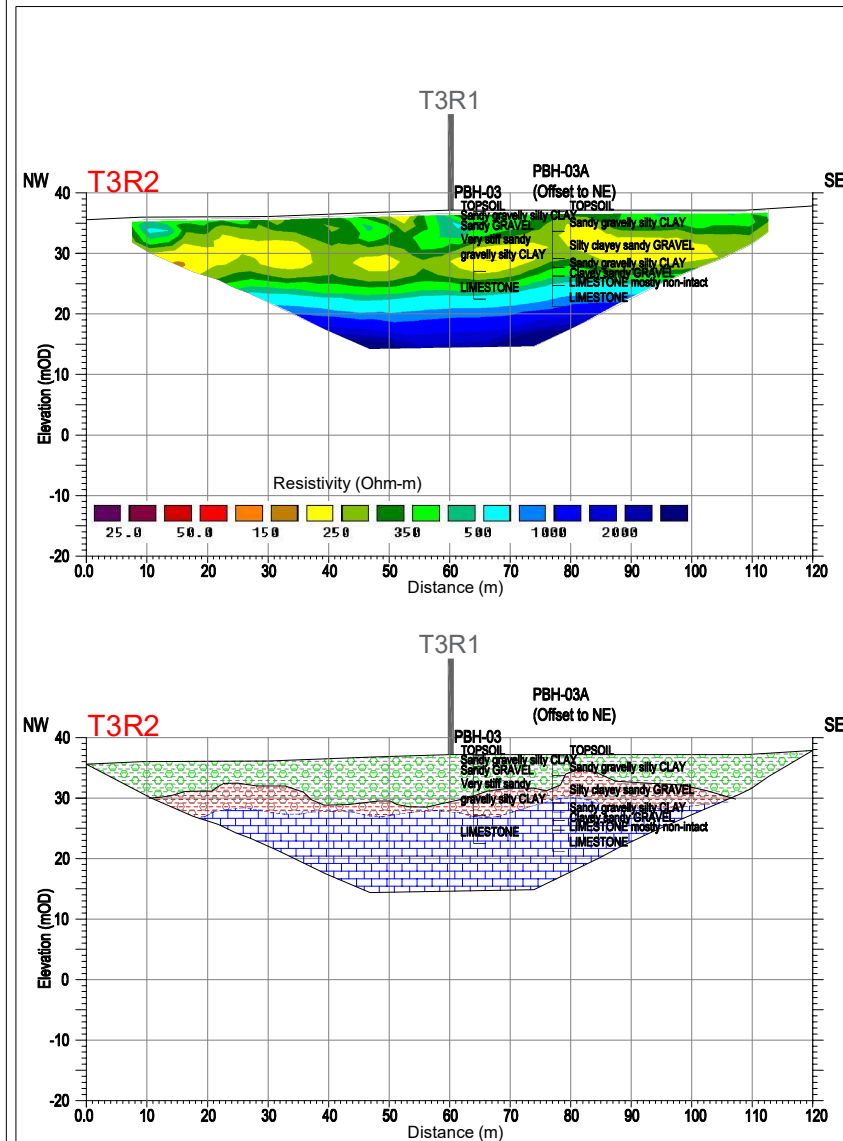


FIG.2: TURBINE BASE T03, ERT RESULTS AND INTERPRETATION T3R2
SCALE 1:1250



- LEGEND:
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/CLAY
 - Clayey Silty SAND/GRAVEL
 - MUDSTONE/SHALE or possible weathered/karstified LIMESTONE
 - LIMESTONE
 - Possible base of dry PEAT
 - Base of Soft Ground Probes
 - Possible Top of ROCK

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FIG.1: TURBINE BASE T04, ERT RESULTS AND INTERPRETATION T4R1
SCALE 1:1250

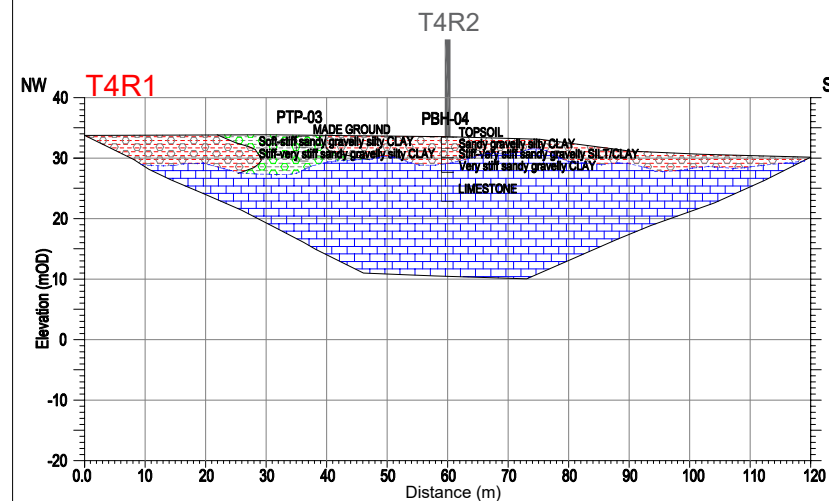
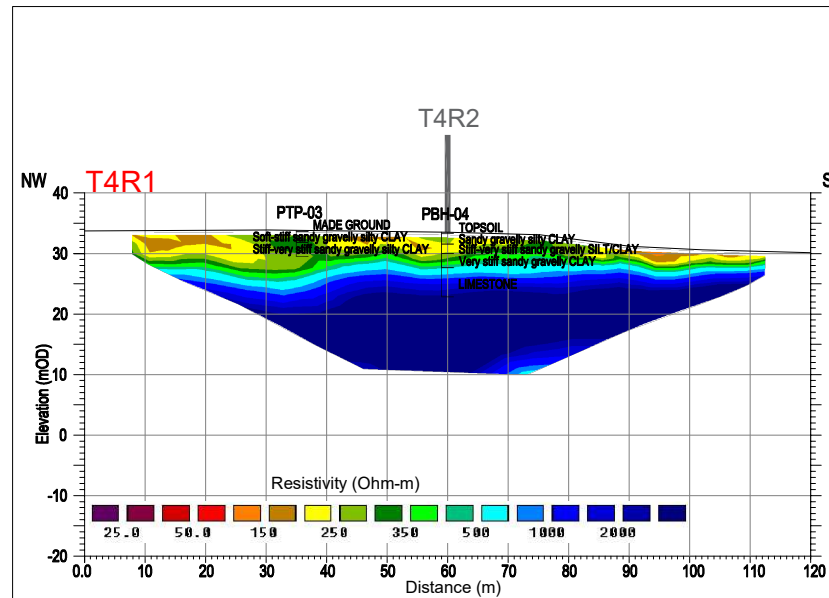
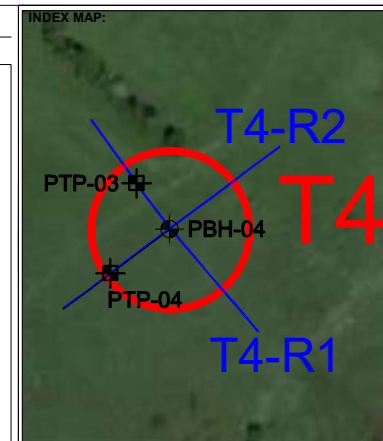
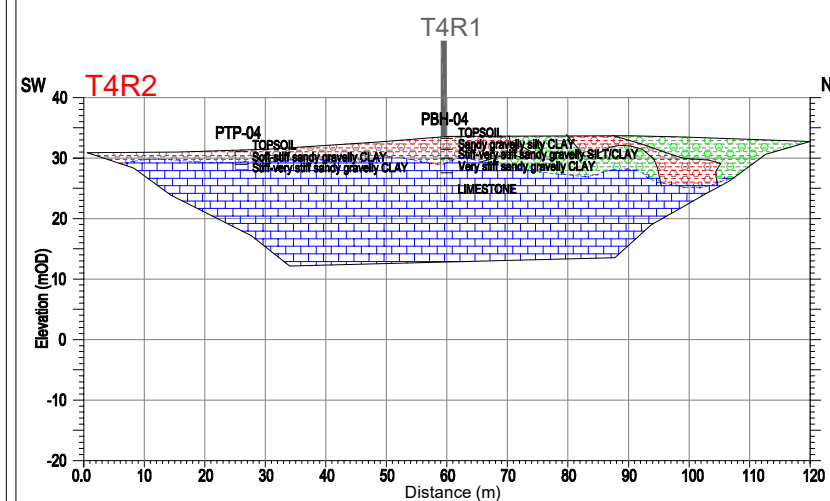
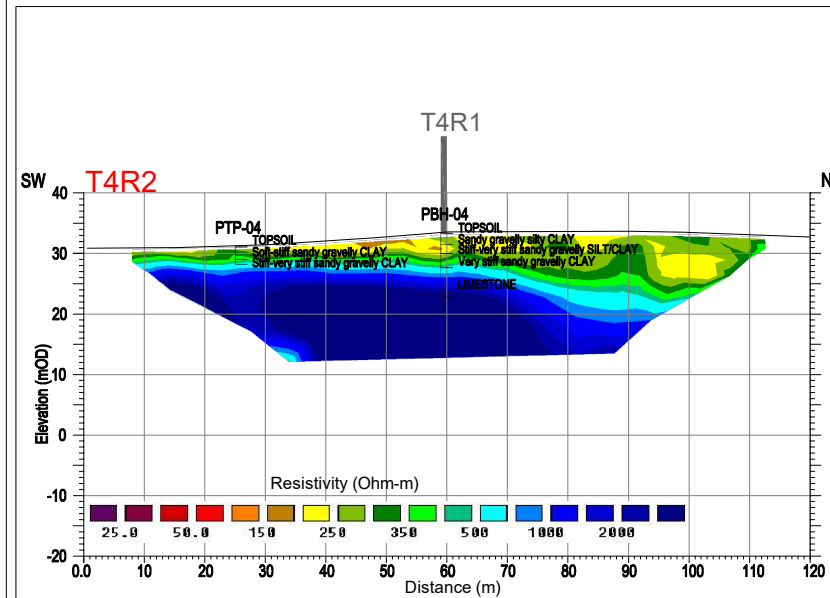


FIG.2: TURBINE BASE T04, ERT RESULTS AND INTERPRETATION T4R2
SCALE 1:1250



- LEGEND:
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/CLAY
 - Clayey Silty SAND/GRAVEL
 - MUDSTONE/SHALE or possible weathered/karstified LIMESTONE
 - LIMESTONE
 - Possible base of dry PEAT
 - Base of Soft Ground Probes
 - Possible Top of ROCK

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FIG.1: TURBINE BASE T05, ERT RESULTS AND INTERPRETATION T5R1

SCALE 1:1250

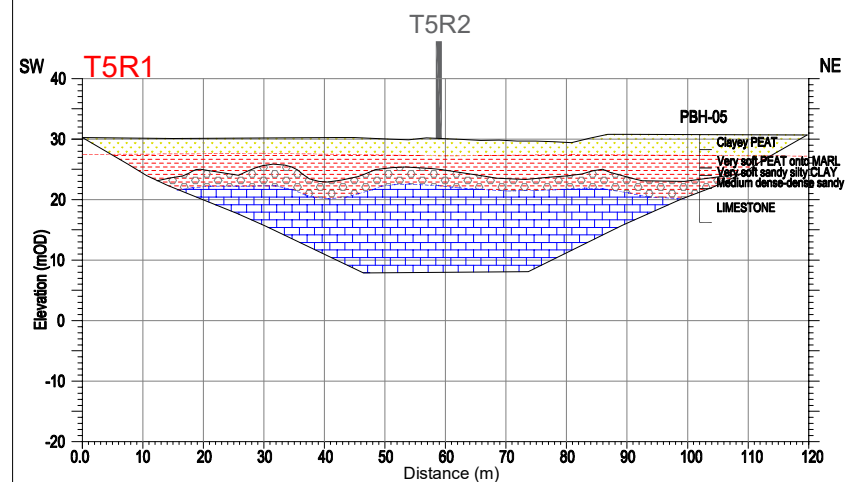
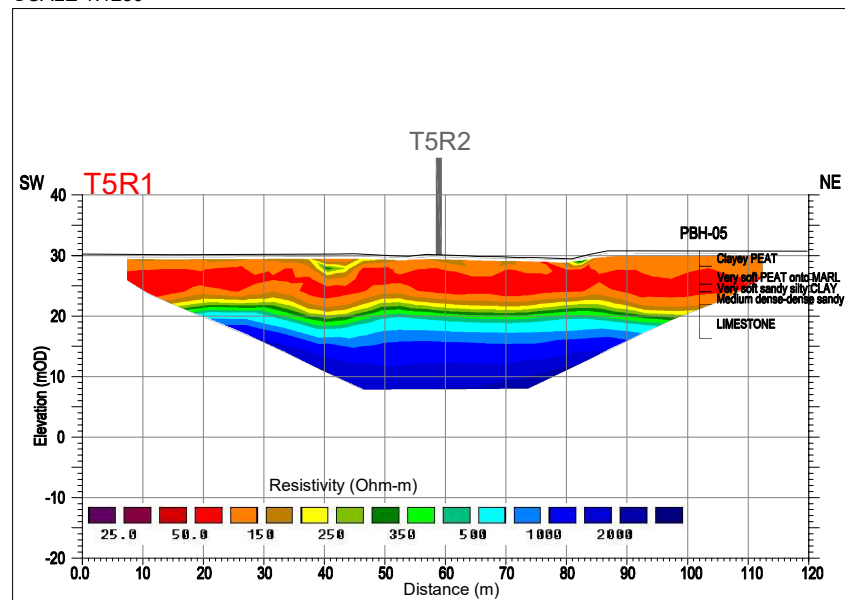
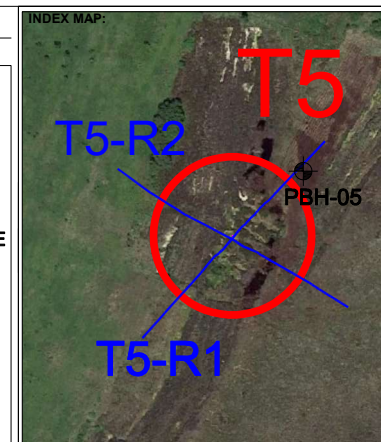
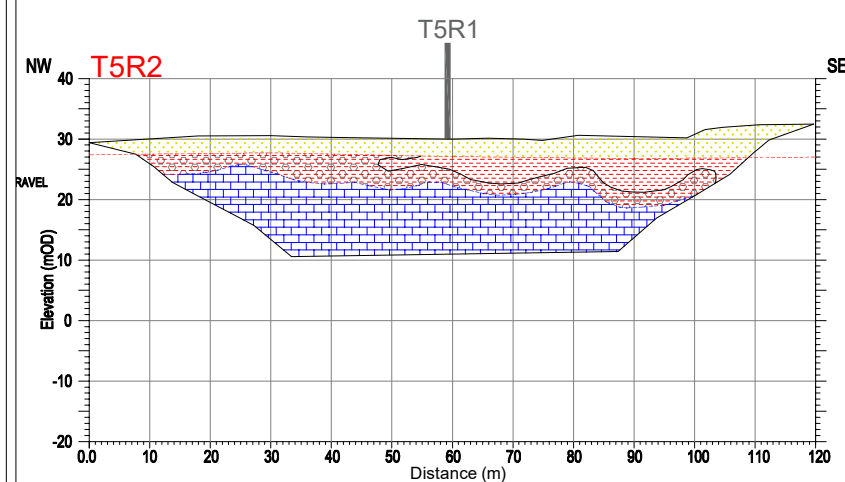
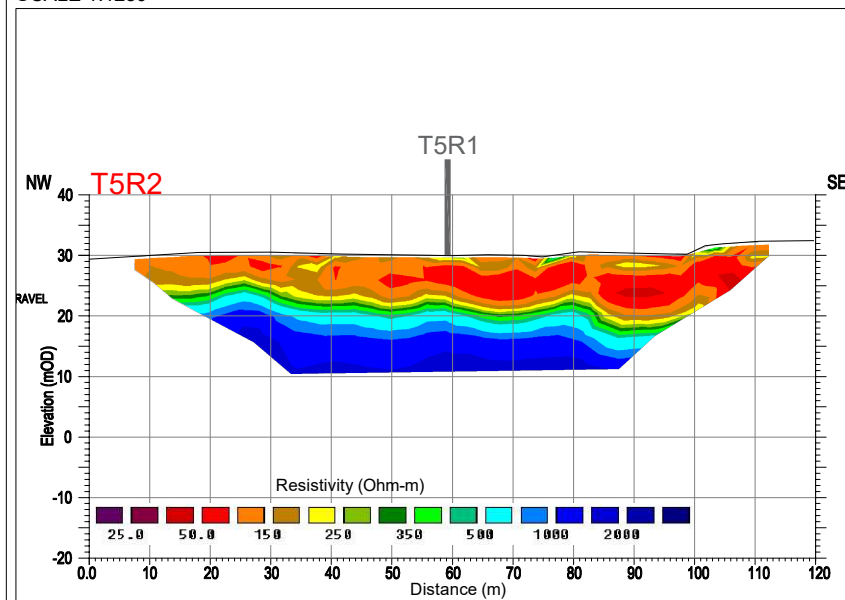


FIG.2: TURBINE BASE T05, ERT RESULTS AND INTERPRETATION T5R2

SCALE 1:1250



- LEGEND:**
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/ CLAY
 - Clayey Silty SAND/GRAVEL
 - MUDSTONE/SHALE or possible weathered/karstified LIMESTONE
 - LIMESTONE
 - Possible base of dry PEAT
 - Base of Soft Ground Probes
 - Possible Top of ROCK

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FIG.1: TURBINE BASE T06, ERT RESULTS AND INTERPRETATION T6R1

SCALE 1:1250

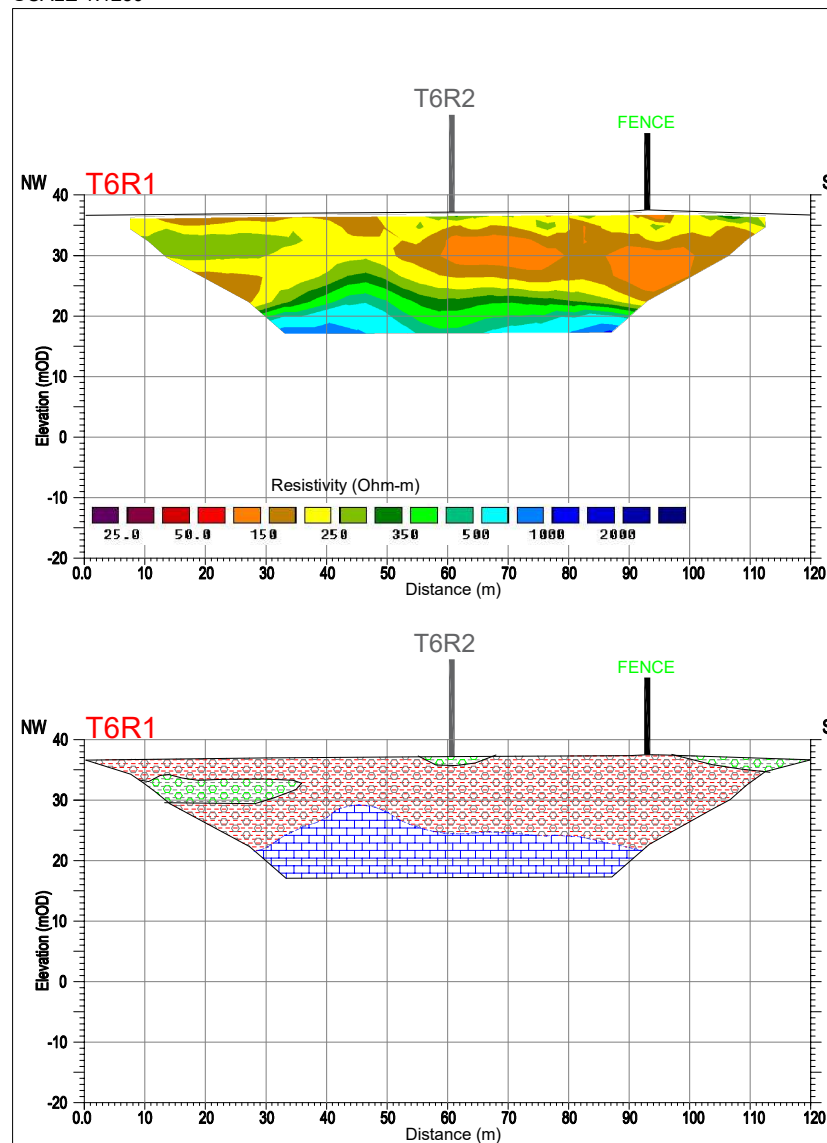
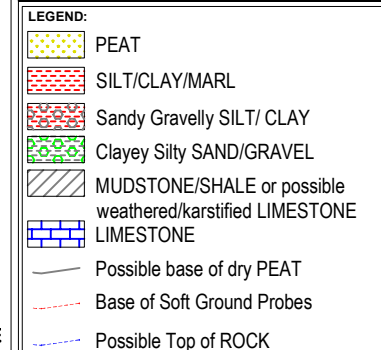
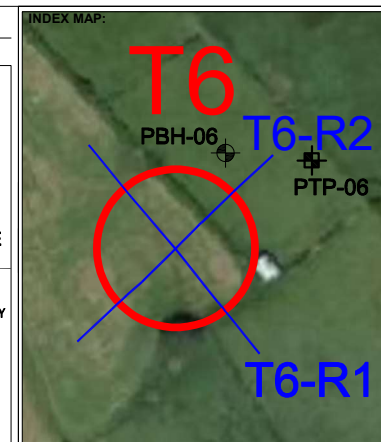
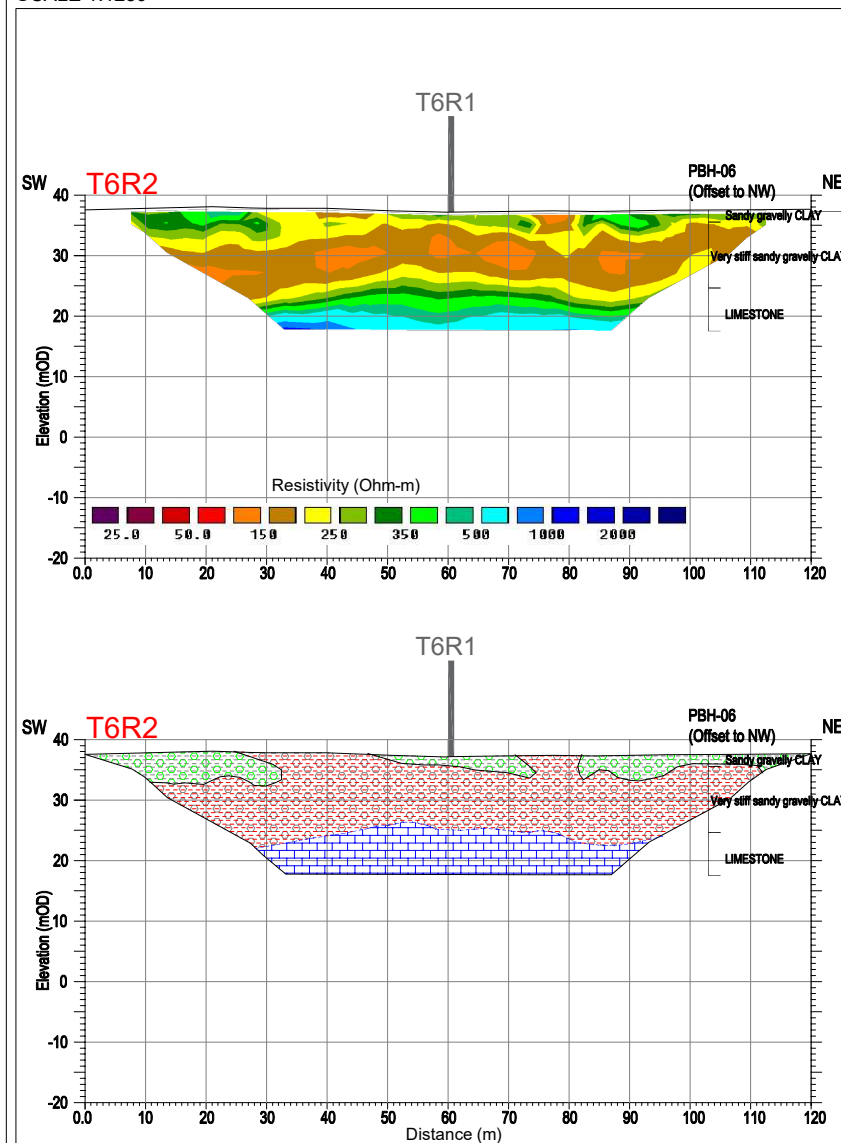


FIG.2: TURBINE BASE T06, ERT RESULTS AND INTERPRETATION T6R2

SCALE 1:1250



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FIG.1: TURBINE BASE T07, ERT RESULTS AND INTERPRETATION T7R1

SCALE 1:1250

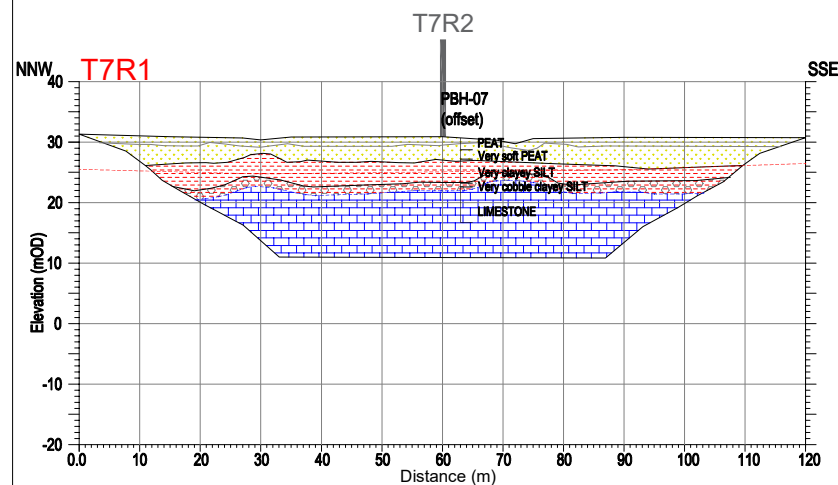
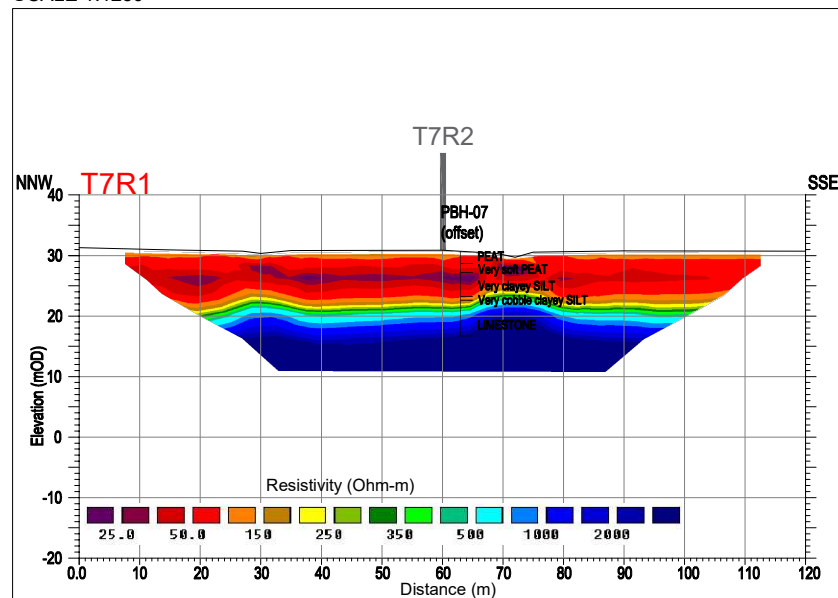
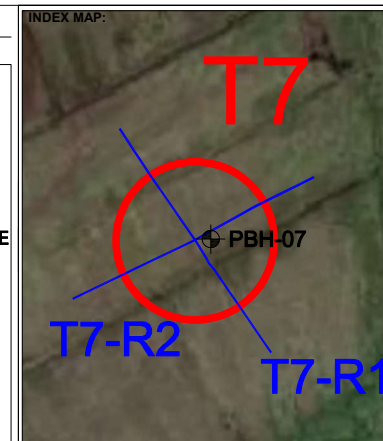
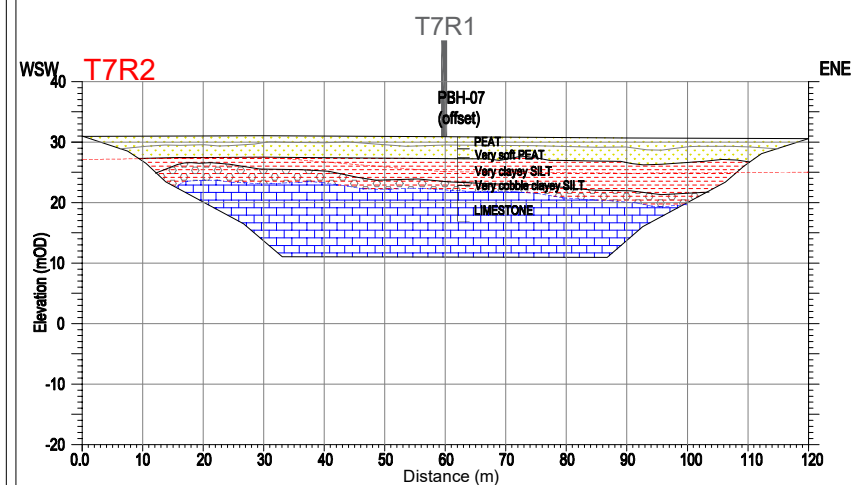
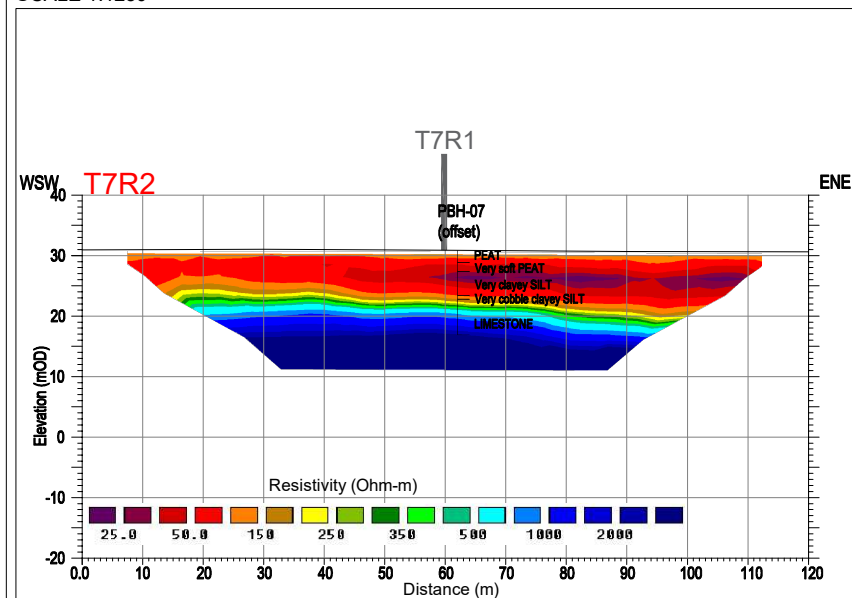


FIG.2: TURBINE BASE T07, ERT RESULTS AND INTERPRETATION T7R2

SCALE 1:1250



- LEGEND:**
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/ CLAY
 - Clayey Silty SAND/GRAVEL
 - MUDSTONE/SHALE or possible weathered/karstified LIMESTONE
 - LIMESTONE
 - Possible base of dry PEAT
 - Base of Soft Ground Probes
 - Possible Top of ROCK

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FIG.1: TURBINE BASE T08, ERT RESULTS AND INTERPRETATION T8R1

SCALE 1:1250

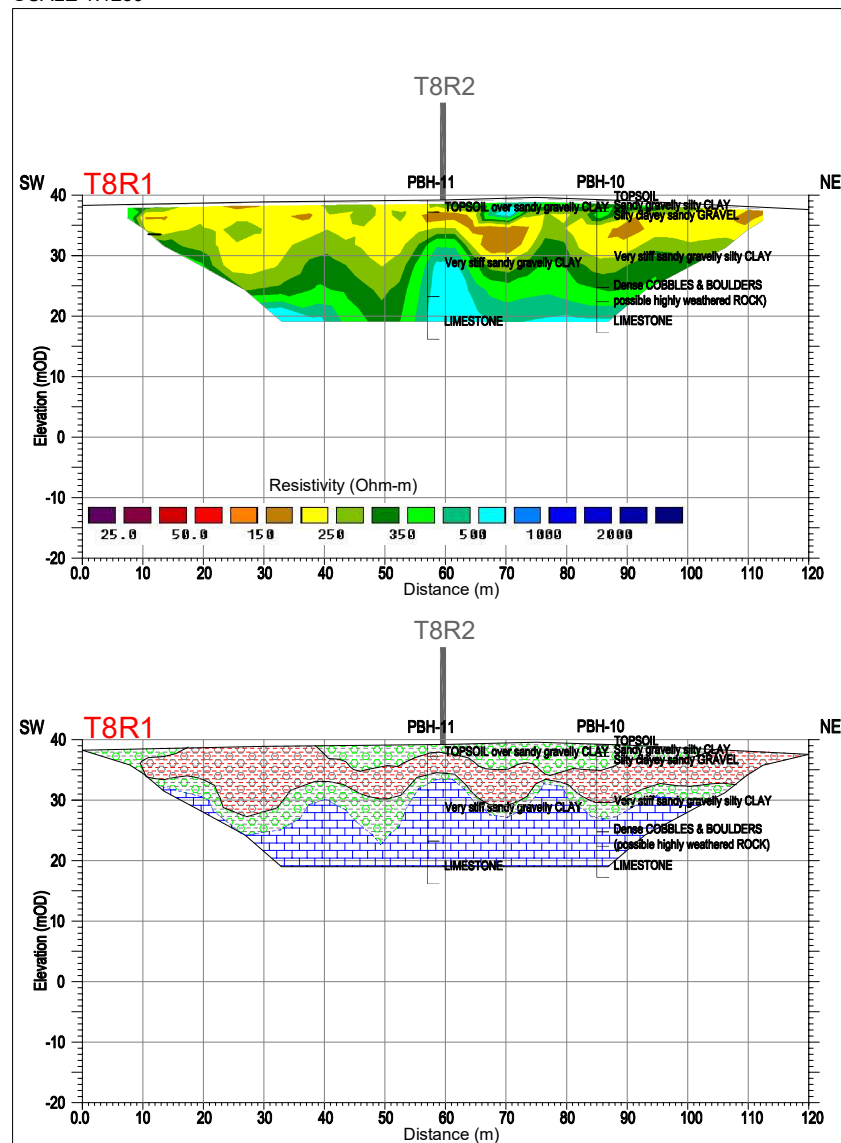
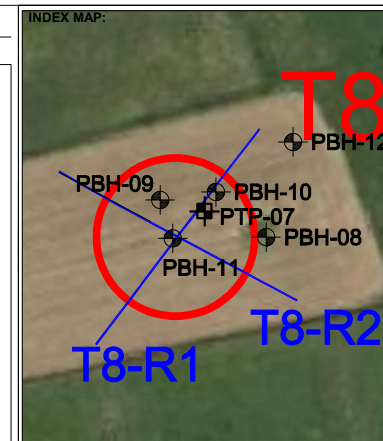
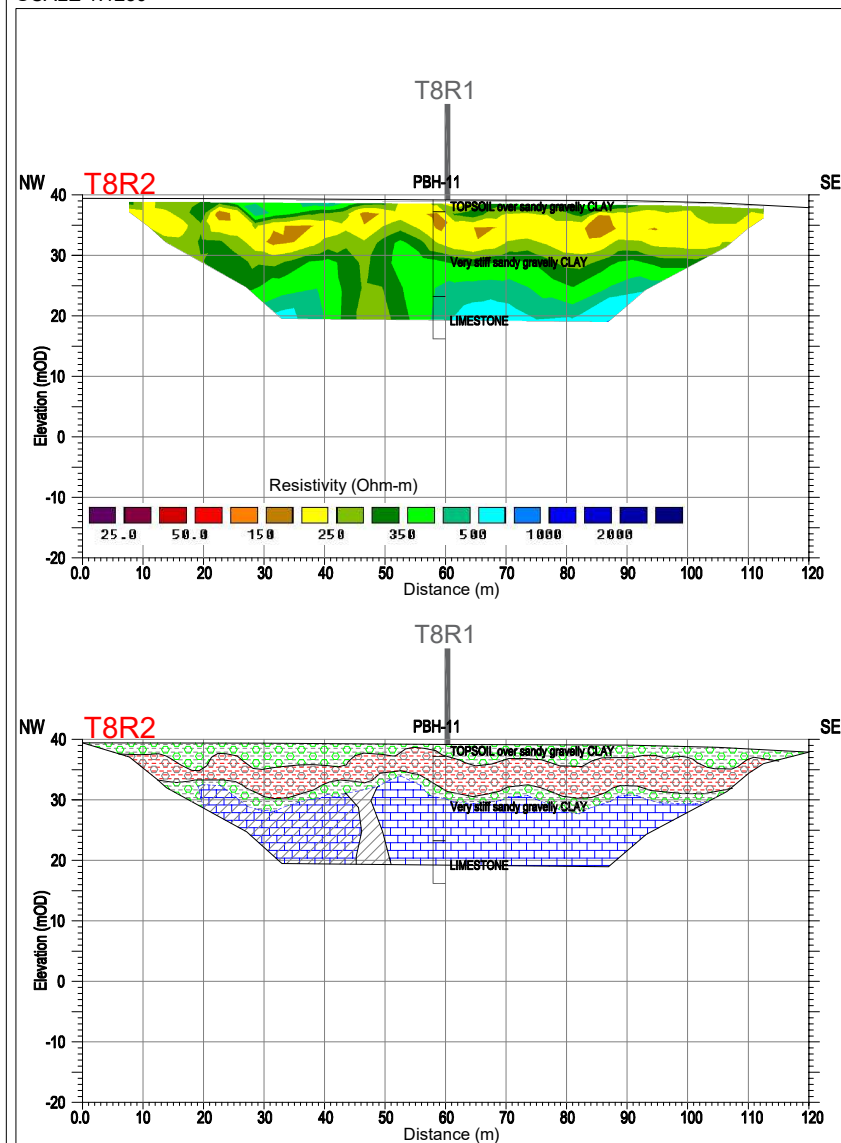


FIG.2: TURBINE BASE T08, ERT RESULTS AND INTERPRETATION T8R2

SCALE 1:1250



- LEGEND:
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/ CLAY
 - Clayey Silty SAND/GRAVEL
 - MUDSTONE/SHALE or possible weathered/karstified LIMESTONE
 - LIMESTONE
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FIG.1: TURBINE BASE T09, ERT RESULTS AND INTERPRETATION T9R1

SCALE 1:1250

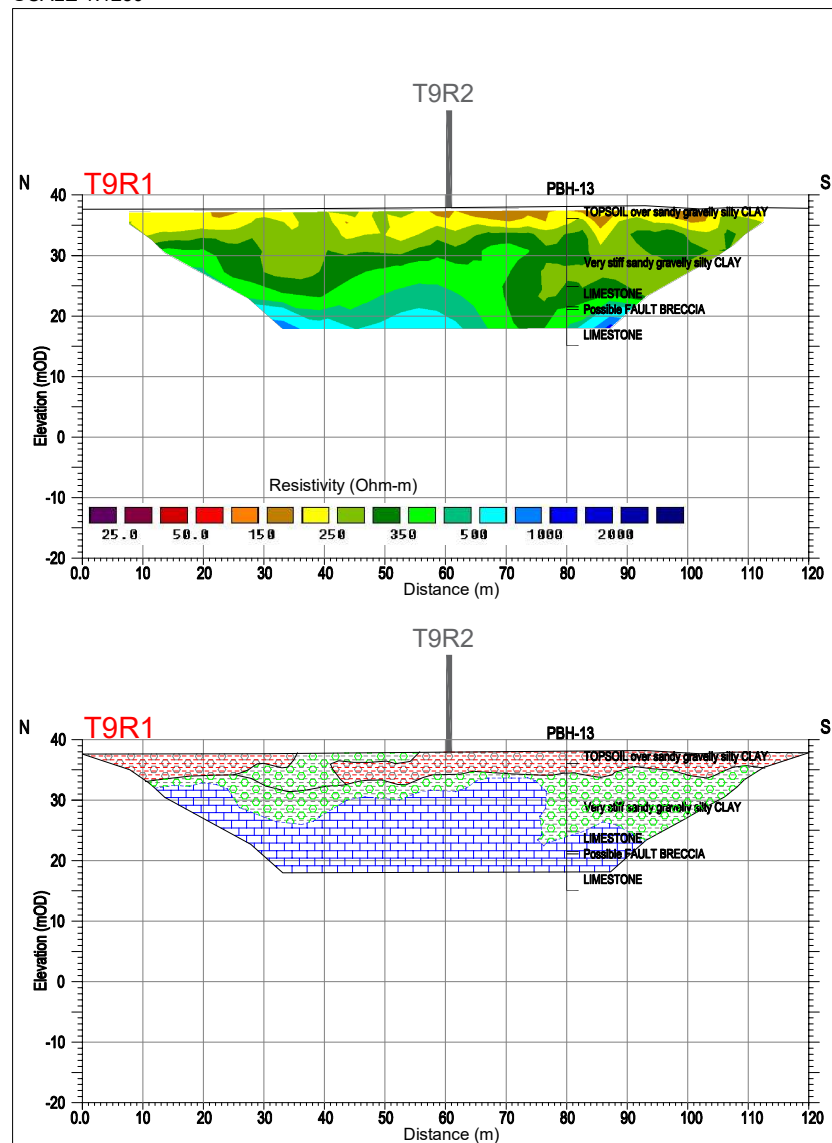
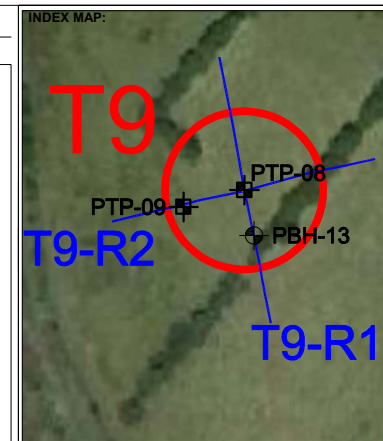
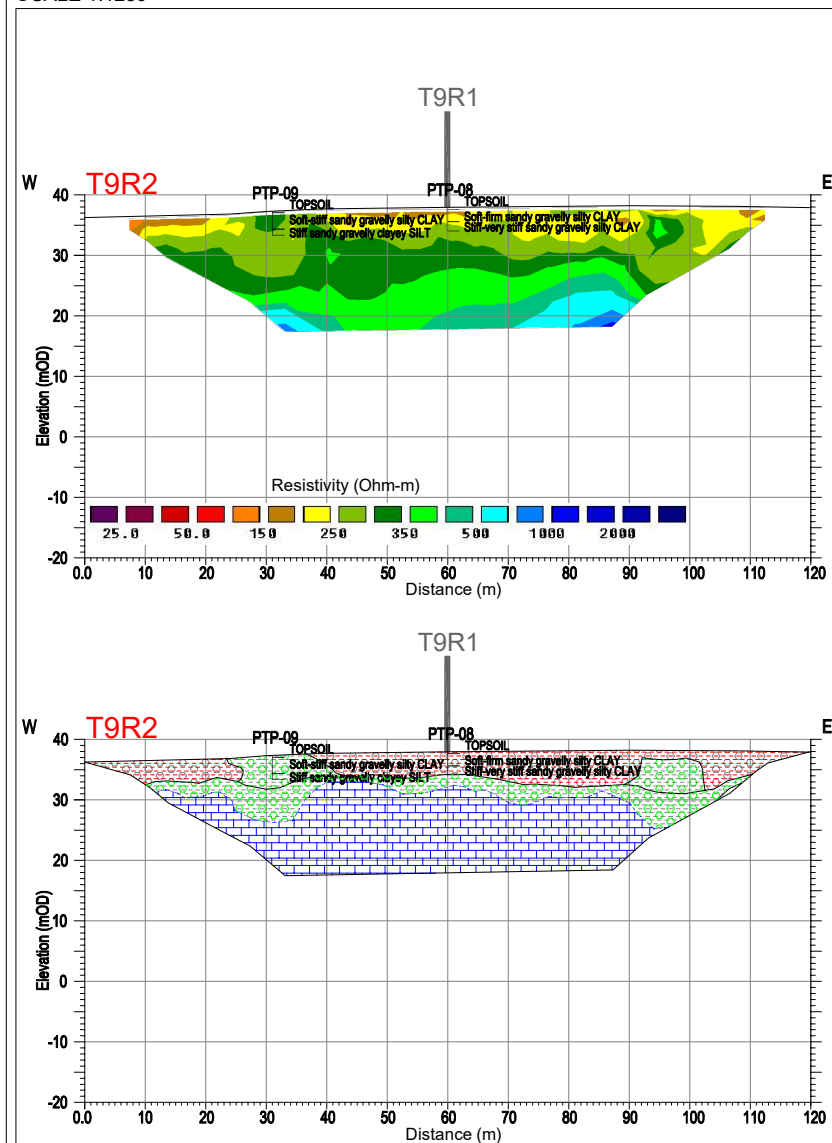


FIG.2: TURBINE BASE T09, ERT RESULTS AND INTERPRETATION T9R2

SCALE 1:1250



- LEGEND:**
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/ CLAY
 - Clayey Silty SAND/GRAVEL
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FIG.1: TURBINE BASE T10, ERT RESULTS AND INTERPRETATION T10R1

SCALE 1:1250

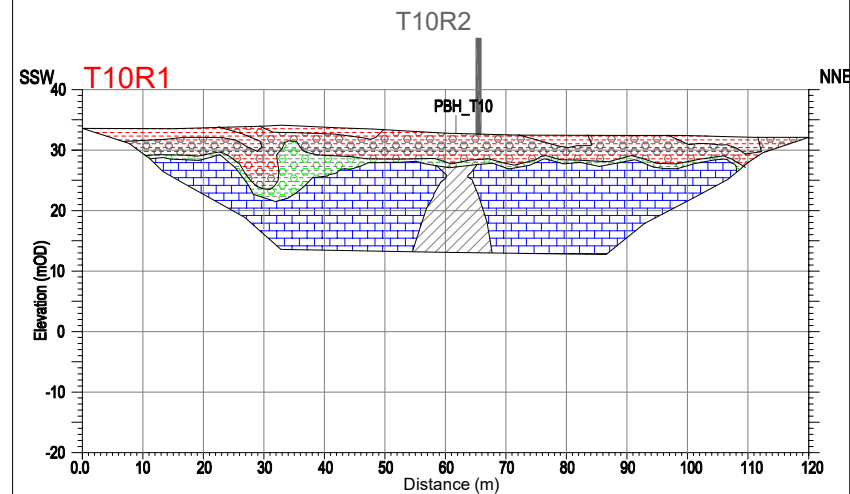
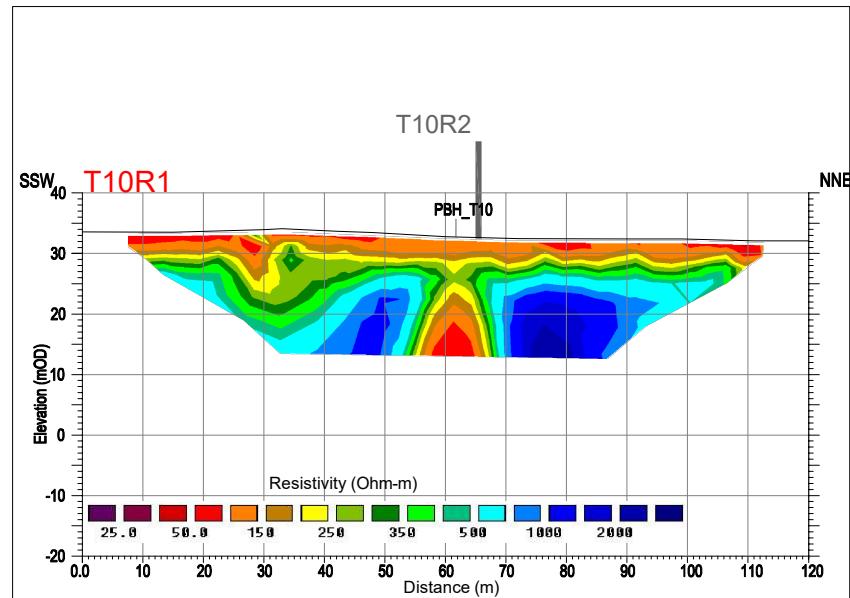
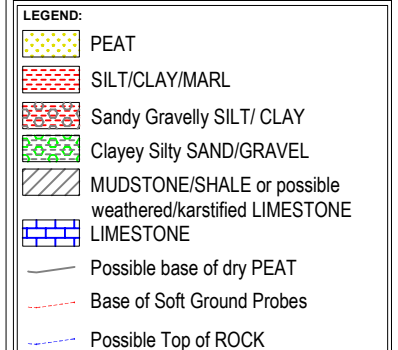
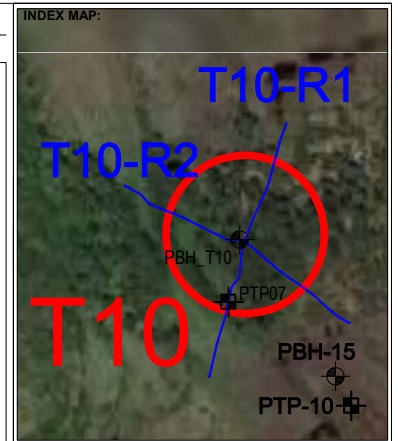
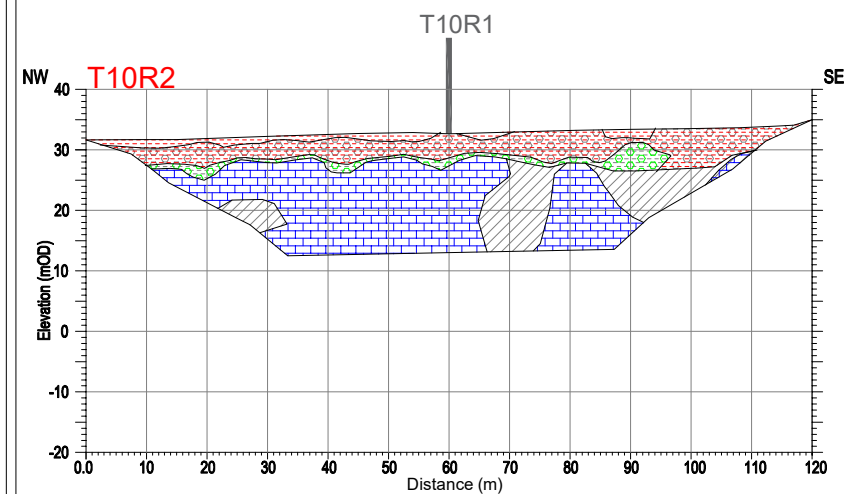
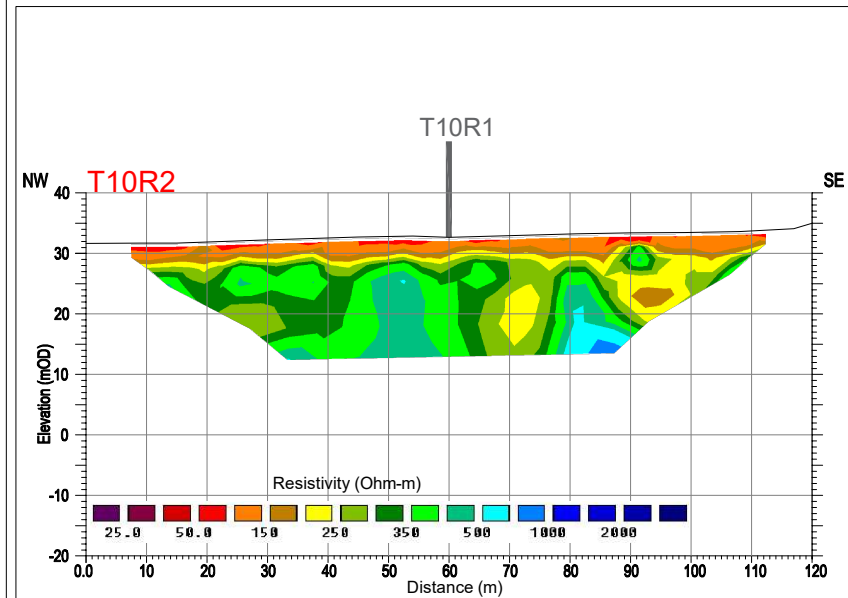


FIG.2: TURBINE BASE T10, ERT RESULTS AND INTERPRETATION T10R2

SCALE 1:1250



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FIG.1: TURBINE BASE T11, ERT RESULTS AND INTERPRETATION T11R1
SCALE 1:1250

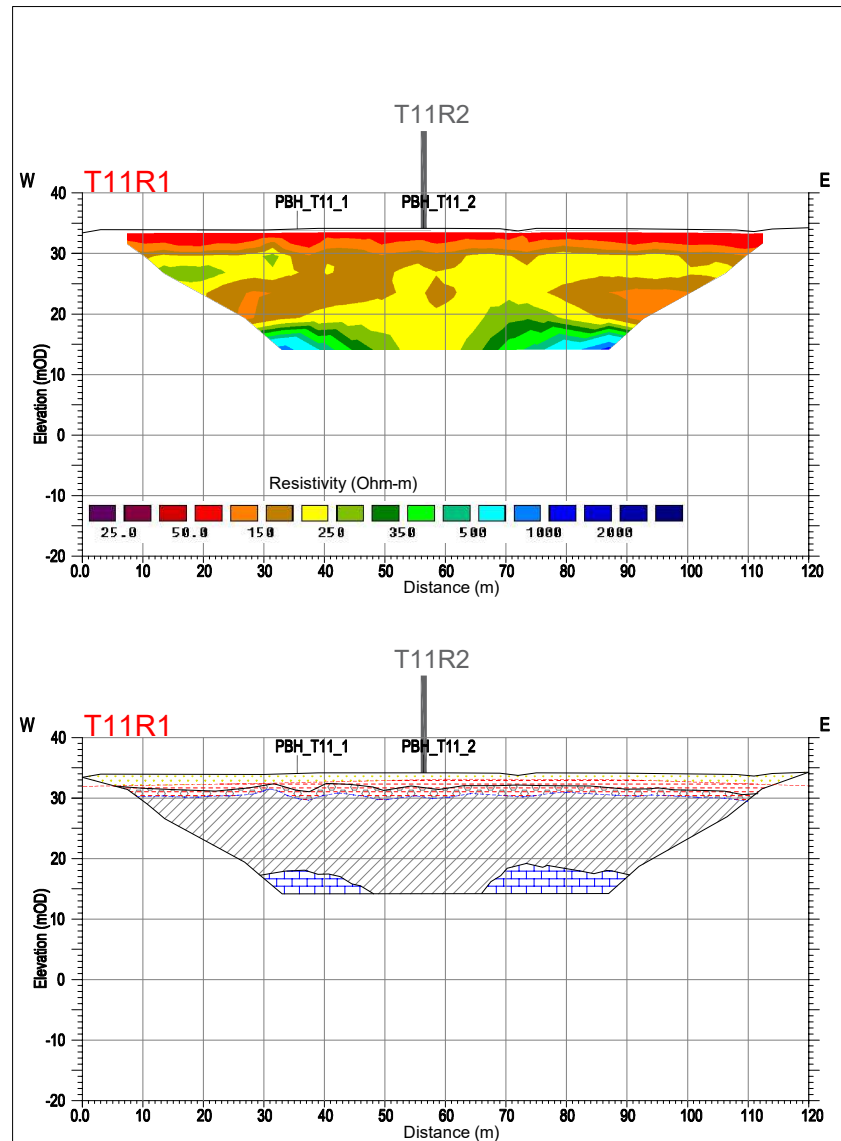
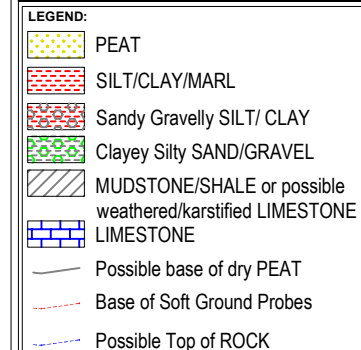
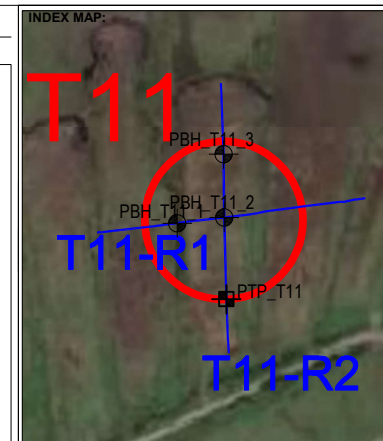
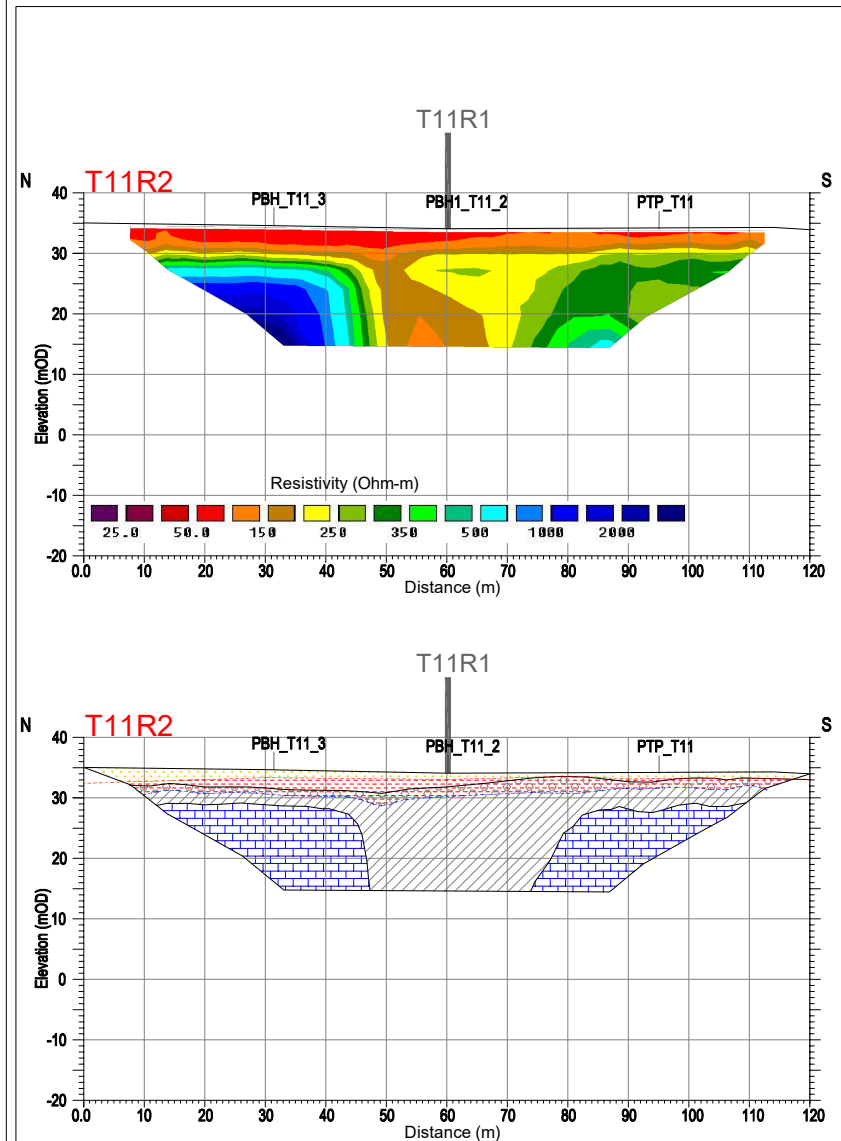


FIG.2: TURBINE BASE T11, ERT RESULTS AND INTERPRETATION T11R2
SCALE 1:1250



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FIG.1: TURBINE BASE T12, ERT RESULTS AND INTERPRETATION T12R1

SCALE 1:1250

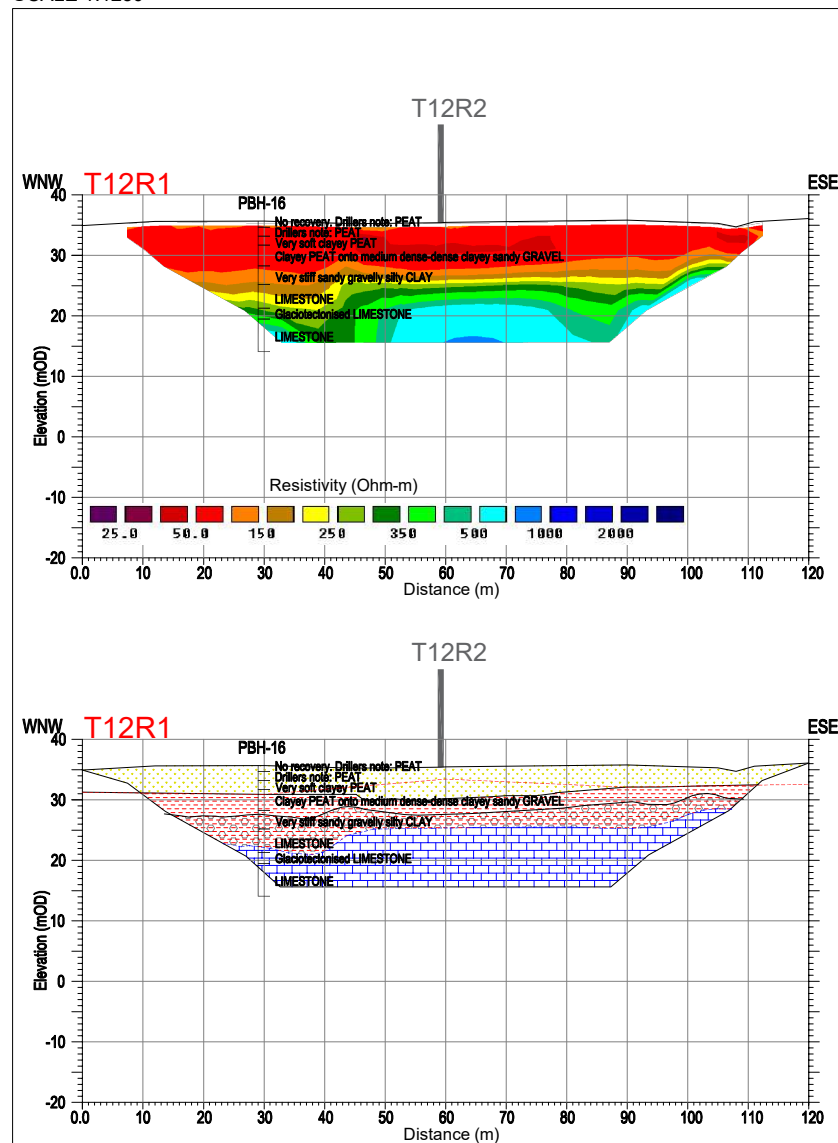
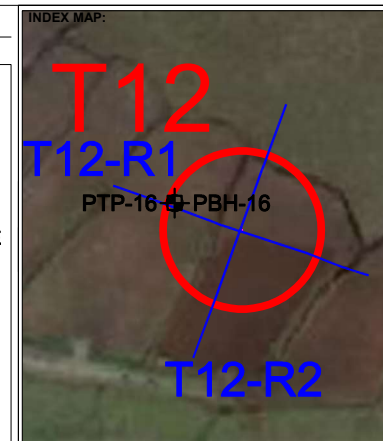
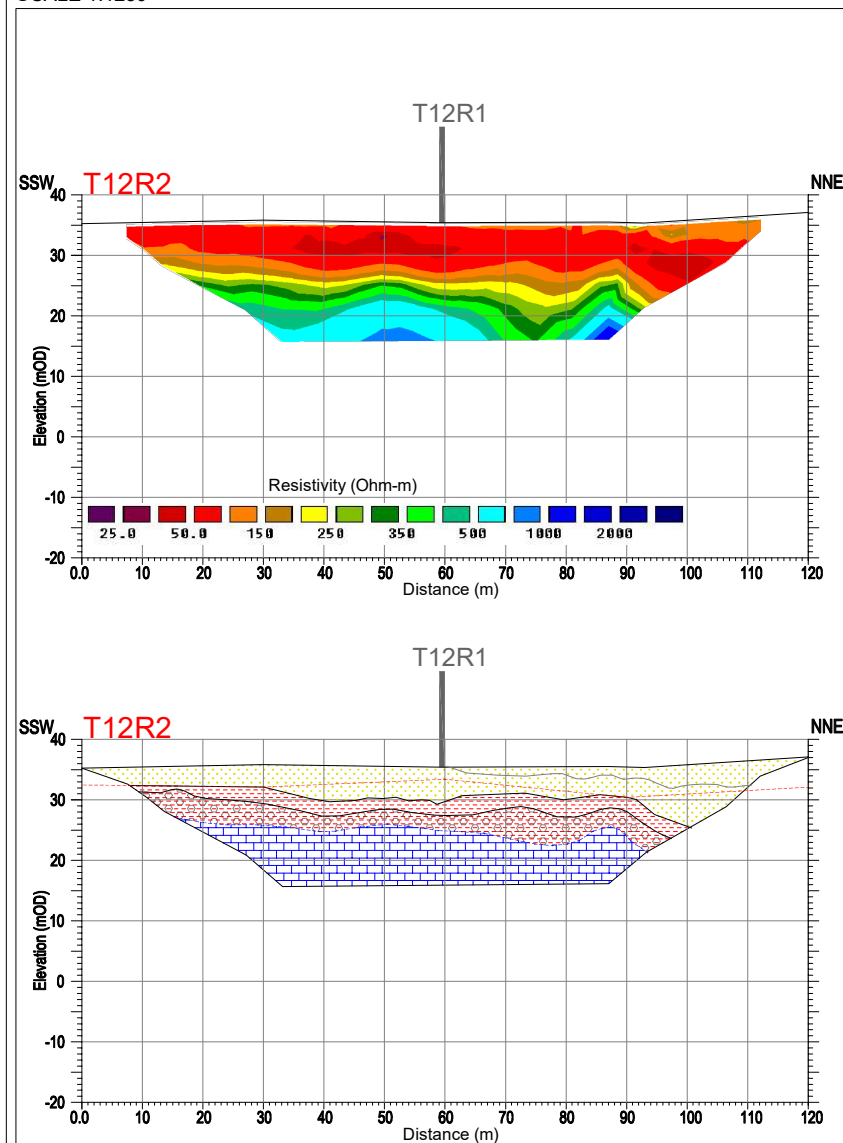


FIG.2: TURBINE BASE T12, ERT RESULTS AND INTERPRETATION T12R2

SCALE 1:1250



- LEGEND:
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/CLAY
 - Clayey SILTY SAND/GRAVEL
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FIG.1: TURBINE BASE T13, ERT RESULTS AND INTERPRETATION T13R1

SCALE 1:1250

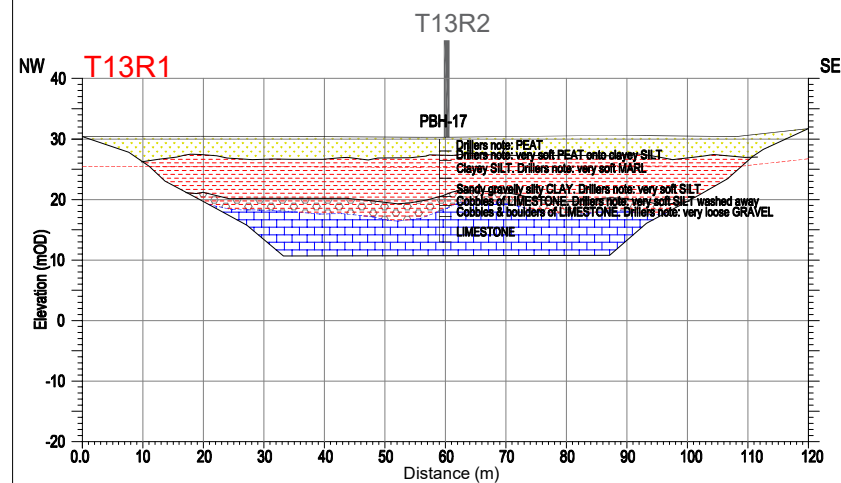
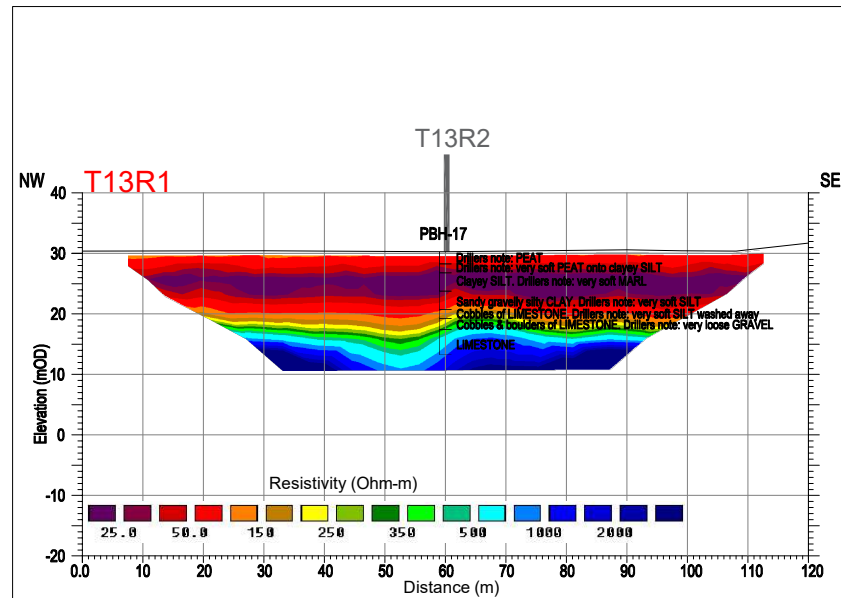
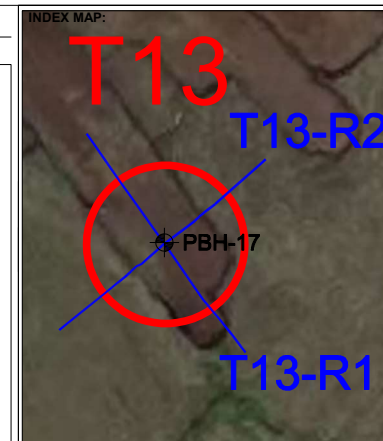
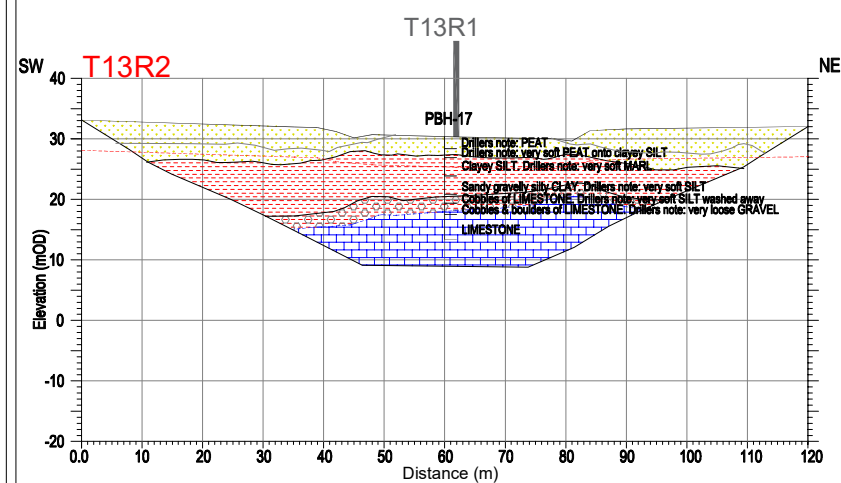
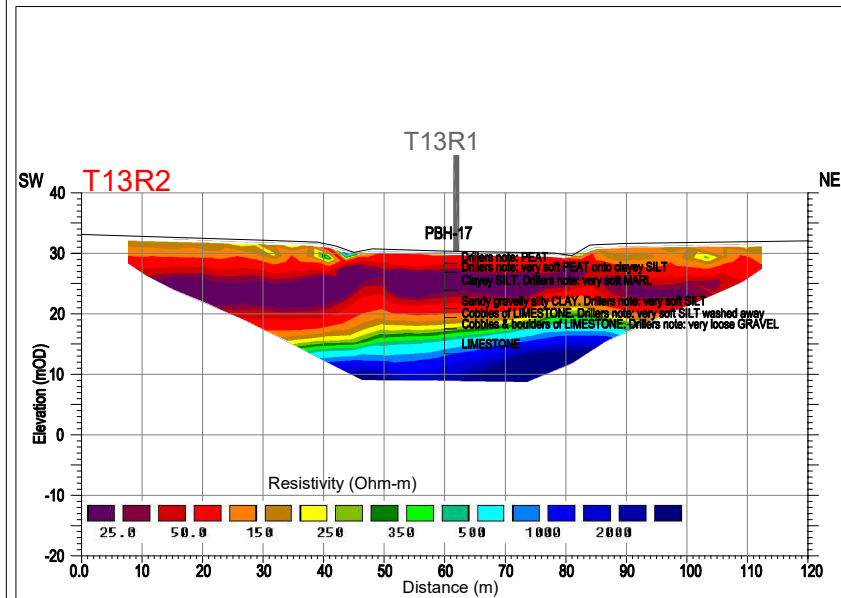


FIG.2: TURBINE BASE T13, ERT RESULTS AND INTERPRETATION T13R2

SCALE 1:1250



- LEGEND:
- PEAT
 - SILT/CLAY/MARL
 - Sandy Gravelly SILT/CLAY
 - Clayey Silty SAND/GRAVEL
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