Clifton Scannell Emerson Associates

Dub11 Substation - Kilcarberry

Flood Risk Assessment

Client: Vantage Data Centers

Date: 6th October 2021

Job Number: 21_115

CONSULTING ENGINEERS

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1. Introduction

Clifton Scannell Emerson Associates were requested to undertake a Flood Risk Assessment (FRA) to support the submission of a planning application by Vantage Data Centers for the proposed Substation development in Kilcarbery, Profile Park, County Dublin. The proposed development is of a brownfield site of approximately 0.6 Hectares. The site lies approximately 700m north of Casement Aerodrome and 12km west of Dublin City Centre, and is accessed from the R134 New Nangor Road.

The proposed development primarily comprises the provision of two no. 110kV underground transmission lines and a 110kV Gas Insulated Switchgear (GIS) substation compound along with associated and ancillary works and is described as follows:

Figure 1: Aerial view of site

The proposed 110kV GIS Substation Compound is to be located on lands to the south of those that are subject of an application for 2 no. data centres under South Dublin County Council Reg. Ref. SD21A/0241 and to the south of Falcon Avenue within Profile Park, and within an overall landholding bound to the north by Falcon Avenue, Profile Park; to the west by Casement Road, Profile Park; and to the east and south by undeveloped lands; and partly by the Digital Reality complex to the south-east within Profile Park, Clondalkin, Dublin 22. The site of the proposed development has an area of c. 3.19 hectares.

The proposed 110kV Gas Insulated Switchgear (GIS) Substation Compound includes the provision of a two storey GIS Substation building (with a gross floor area of 1,477sqm) (known as the Kilcarbery Substation), three transformers with associated ancillary equipment and enclosures, a single storey Client Control Building (with a gross floor area of 51.5sqm), lightning masts, car parking, associated underground services and roads within a 2.6m high fenced compound and all associated construction and ancillary works.

One proposed underground single circuit 110kV transmission line will connect the proposed Kilcarbery 110kV GIS Substation to the existing 110kV Barnakyle Substation to the west. The proposed transmission line covers a distance of approximately 274m within the townlands of Aungierstown and Ballybane, and Kilbride and will pass under the internal road network within Profile Park to where it will connect into the Barnakyle substation.

One proposed underground single circuit 110kV transmission line will connect the proposed Kilcarbery 110kV GIS Substation to the existing 110kV underground Castlebaggot - Barnakyle circuit to the west within the Grange Castle South Business Park. The proposed transmission line covers a distance of approximately 492m within the townlands of Aungierstown and Ballybane, and Kilbride and will pass both under, and to the north of the internal road network within Profile Park and Grange Castle Business Park South where it will connect into the Castlebaggot - Barnakyle circuit at a proposed new joint bay.

The development includes the connections to the two substations (existing and proposed) as well as to the Castlebaggot - Barnakyle circuit, associated underground services, and all associated construction and ancillary works.

1.1 Scope of the Report

This Report is prepared in accordance with the requirements of the Department of the Environment Publication "The Planning system and Flood Risk Management guidelines for Planning Authorities (FRMG) published in November 2009. The scope of this assessment is a review of the flood risks which may affect the proposed development and/or the effect of increased flood risk to adjacent properties resulting from the proposed development.

1.2 Background Information

1.2.1 Catchment-based Flood Risk Assessment and Management

The Catchment-based Flood Risk Assessment and Management (CFRAM) program has been implemented by the Office of Public Works (OPW) as a competent authority in Ireland for the EU floods directive. Over 29 Flood Risk Management Plans (FRMPs) have been prepared in coordination with the implementation of the Water Framework Directive (WFD). The FRMPs involved undertaking detailed engineering assessments and producing flood protection measures. The assessments addressed the potential impact of the proposed measures on waterbodies, hydromorphology and quality status.

1.2.2 OPW Flood Guidelines for Planning Authorities

The purpose of The Planning System and Flood Risk Management Guidelines for Planning Authorities published by the OPW in 2009 (OPW Guidelines) is to introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process.

1.2.3 Objectives of OPW Guidelines

Floods can have a broad range of impacts on people, property, infrastructure and the environment. Flood can cause damage to infrastructure including electricity and other utilities with significant detrimental impacts on local and regional economies. This may cause long-term closures of businesses, leading to economic loss other than the damage caused during the event. The following are the core objectives of the OPW Guidelines:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

1.2.4 Flood Risk Assessment FRA Key Concepts

For carrying out a Site-specific Flood Risk Assessment (SSFRA), the OPW Guidelines recommend using the Source-Path-Receptor concept model to identify where the flood originates from, the

floodwaters path, and the areas in which assets and people might be affected by such flooding (section 2.18 of the OPW Guidelines, 2009). Figure 2 show a schematic representation of S-P-R model.

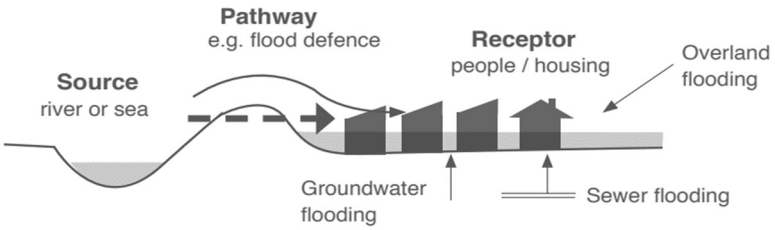

Figure 2: Source-Path-Receptor Model (extracted from OPW Guidelines, 2009)

The other key concept in flood management is the "Flood Risk", which is "the combination of the likelihood of flooding and the potential consequences arising". Consideration of flood risk must be addressed in terms of:

- The likelihood of flooding, expressed as percentage probability or exceedance each year; and;
- The consequences of flooding as the associated hazard e.g. flood depth and velocity.

Flood risk is then expressed with the relationship:

Flood Risk = Likelihood of flooding x Consequences of flooding.

1.2.5 Flood Zones

The Flood Zone is the spatial inundation area that falls within a range of likelihood of flooding. The OPW Guidelines specify three levels of flood zones:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% Annual Exceedance Probability (AEP) for river flooding and 0.5% AEP for coastal flooding);
Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% and 1% AEP for river flooding and between 0.1% and 0.5% AEP for coastal flooding;
Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP for both river and coastal flooding).

Flood Zone C covers all areas of the plan which are not in Zones A or B.

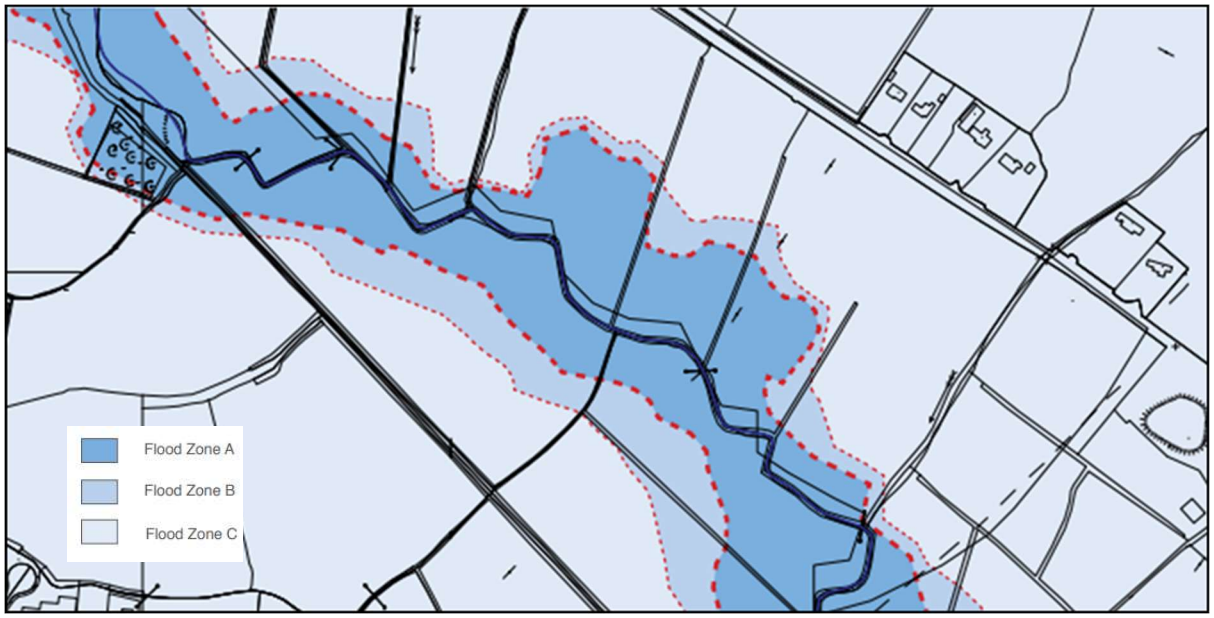

Figure 3: Example of the three flood risk zones (extracted from OPW Guidelines, 2009)

According to the OPW Guidelines, the planning implications for each of the zones mentioned above are:

Zone A - High probability of flooding. Most types of development would be considered inappropriate in this zone.

Zone B - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone.

Zone C - Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to an assessment of flood hazards from sources other than rivers and the coast), but would need to meet the normal range of other planning and sustainable development considerations.

1.2.6 Sequential Approach

The Sequential Approach is an important tool used in the planning process which gives preference to locate a new development in the Low Flood Risk Zone and ensures that it does not have an adverse impact of flooding.

According to the sequential approach, if the development lies within a Flood Zone, it is required to consider measures for mitigating the flood impact to an acceptable level. It is also required to provide justification for proposing a development on a higher risk flood zone (see Figure 4 and 5 below).

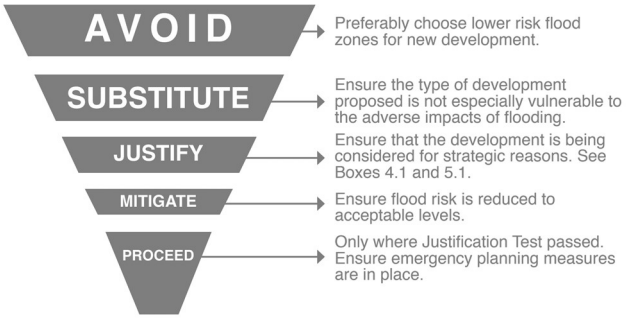

Figure 4: FRA Sequential Approach (extracted from OPW Guidelines, 2009)

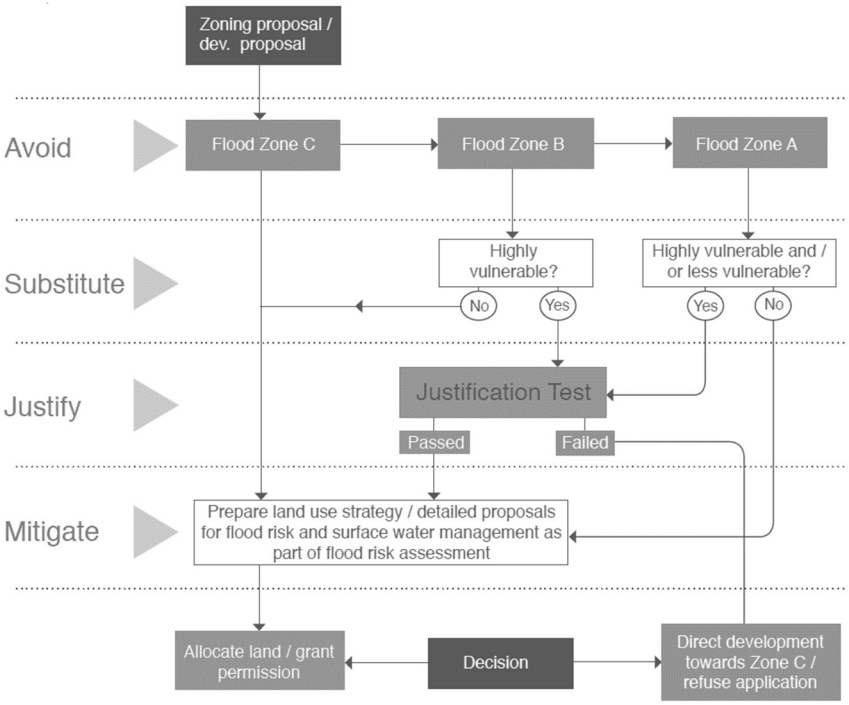

Figure 5: Sequential approach mechanism in the planning process (extracted from OPW Guidelines, 2009)

1.2.7 Development Classification

The OPW Guidelines provided three vulnerability categories based on the type of development which are:

- **Highly vulnerable:** This includes essential infrastructure, such as primary transport and utilities distribution, electricity generating power stations and sub-stations
- **Less vulnerable:** This category includes land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;
- **Water compatible:** Includes water-based flood control and recreational developments and other amenities, open space, outdoor sports and recreation facilities.

The OPW Guidelines, as described in Section 2.2.4 of this report, sets out a sequential approach which makes use of flood risk assessments and classifies the vulnerability of flooding of different types of developments.

Table 3.2 of the OPW Guidelines illustrates those types of developments that would be appropriate to each flood zone (reproduced in Table 1 below) and those that would be required to meet a Justification Test in accordance to Box 5.1 in the guidelines.

Table 1: Matrix of vulnerability versus flood zone (extracted from OPW Guidelines, 2009)

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

1.3 Impact of Climate Change on Flood Risk

The OPW states in the "Climate Change Sectoral Adaptation Plan 2015-2019" that climate change will significantly increase the flood risk by different mechanisms including:

- Sea level rise;
- Increase in Rainfall/Runoff;
- Increase in wind speed and hence extreme storm surge events.

The OPW specified two main Climate Change Scenarios for the Pilot CFRAMS Studies, which are: (1) Mid-Range Future Scenario MRFS and; (2) High-End Future Scenario HEFS. Table 2 below shows the parameters of each scenario.

Table 2: Flood Parameters for the Mid-Range Future and High-End Future Scenarios. Adopted From "Climate Change Sectoral Adaptation Plan 2015-2019"

Parameter	MRFS	HEFS
Rainfall	+20%	+30%
Flood Flows	+20%	+30%
Sea Level Rising	+500 mm	+1000 mm

2. Stage 1 - Flood Risk Identification

2.1 General

In this stage of the FRA, we use the existing information to identify any flooding issues related to the site that may require any further investigation.

2.2 Source of Information

Information source reviewed for flood risk identification are listed in Table 3 below:

Table 3: Information Source Consulted

	Information Source	Remarks
1	Information on watercourse and streams in the study area such as those available from OS Maps, EPA and GeoHive	An extract from EPA map viewer https://gis.epa.ie/EPAMaps/; with active *stream* and *flow direction* layers in Figure 6 shows the presence of a stream to the east of the site, running north toward the Griffeen River.
2	Predictive fluvial, coastal, pluvial and groundwater flood maps available on CFRAMS mapping obtained for the site from https://www.floodinfo.ie/map/floodmaps/	The site lies in Flood Zone C with 3% of the site having a 0.1% probability of flooding.
	SI ground water levels – See Appendix A.	Trial pits were free of water, with the only seepage occurring at 2.30m.

Figure 6: Extract from GeoHive Mapping indicating location of stream adjacent to site

2.3 OPW Flood Hazard Website

The OPW flood mapping website has been consulted. The proposed site location has no record of historical flooding. The nearest flood notes relate to flooding at the Peamount R134 R120 junction which was flooded in November 2000, see Figure 7. This junction lies approximately 1.2km from the proposed site.

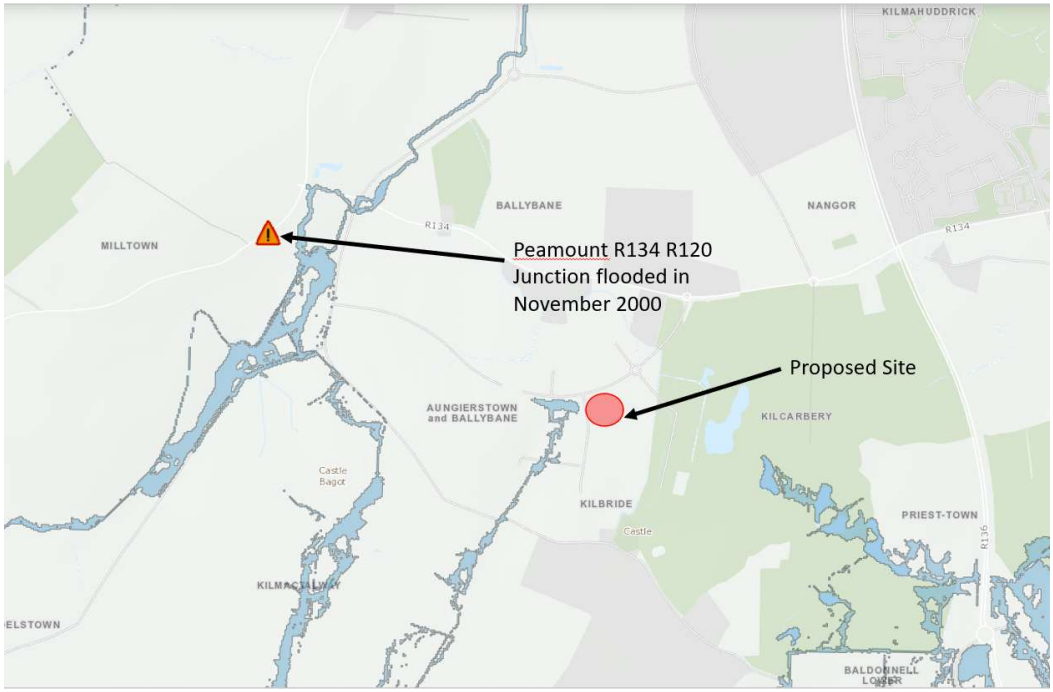

Figure 7: Historical Floods from OPW Website

2.4 PFRA Preliminary Flood Risk Assessment Map

The Catchment Flood Risk Assessment and Management (CFRAM) programme is designed to assess and map the country's river systems to identify areas at risk of significant flooding.

The PFRA Draft Map predicts flooding to the site under the following headings:

- Coastal Flood Extents (low, medium and high probability)
- River Flood Extents (low, medium and high probability)

As can be seen in Figure 8, approximately 3% of the site as a 0.1% probability of flooding. These are small, localised spots not connected to existing watercourses identified in the flood studies mapping and with the topography of the existing site falling form west to east, water is unlikely to actually pond at these locations. The site can therefore be classified as Zone C.

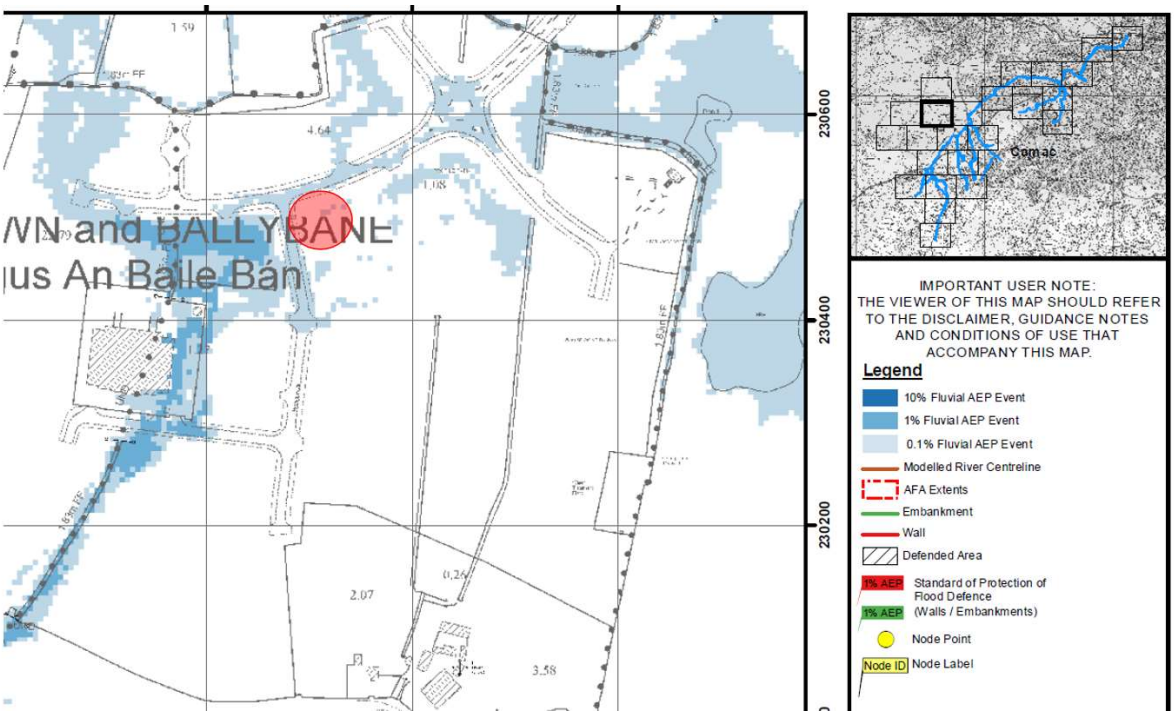

Figure 8: PFRA Maps – River Flood Extents – High-End Future Scenario

2.5 Historic O.S. Maps

Figure 9 shows the historic 6" OS mapping for the site and its immediate surroundings. There is no indication of flood risk at the site.

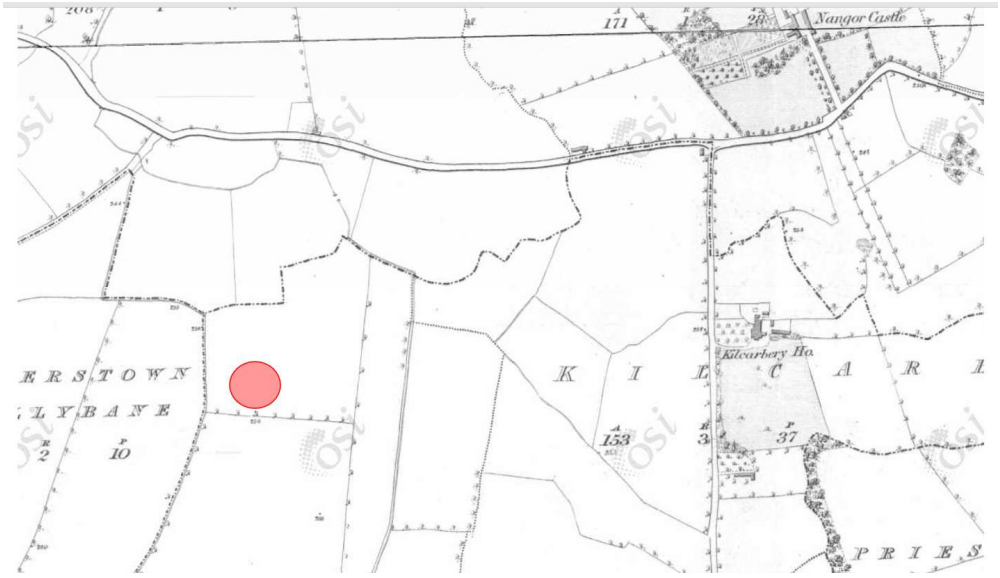

Figure 9: Historic 6" OSI Map

2.6 Pluvial Flooding

Pluvial flooding is usually caused by intense rainfall that may only last a few hours. The resulting water follows natural valley lines, creating flow paths along roads and through and around developments and ponding in low spots, which often coincide with fluvial floodplains in low lying areas. Any areas at risk from fluvial flooding will almost certainly be at risk from pluvial flooding.

Current CFRAM Final Pluvial Flood Maps for the catchment are not available. However, there have been no recorded historical flood events at the site and the site is located in Zone C. Furthermore, the proposed substation facility's surface water drainage system will be designed, constructed and tested in accordance with the Greater Dublin Drainage Strategic Study, Greater Dublin Regional Code of Practice for Drainage Works v6 and the CIRIA SuDS Manual V6, thereby mitigating any risk from pluvial flooding.

3. Stage 2: Initial Flood Risk Assessment

The indicators described in Section 4 suggest that the site is not at risk from Fluvial, Coastal, or Pluvial flooding. Accordingly, it is the conclusion of this flood risk assessment that a detailed assessment of flood risk is not appropriate.

4. Conclusion

We have assessed the available information and inspected the site and its environment. We have also taken into account the proposed building finished floor levels which will be approximately 1.2m higher than the existing ground level to facilitate tie-ins to the exiting road at the proposed entrances. The proposed development is not deemed to have any significant risk of flooding as discussed earlier in this report and is classified as Zone C. The proposed substation development falls under strategic infrastructure, for which the guidelines state that the development is appropriate within Flood Zone C as shown in Table 4 below. The site is therefore suitable for planning.

Table 4: Matrix of vulnerability versus flood zone (extracted from OPW Guidelines, 2009)

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

The assessment of each potential flood source is detailed in the table on the following page.

FLOOD SOURCE	PATHWAY	INFORMATION SOURCE CONSULTED	LIKELYHOOD	REASON
Storm surge from Irish Sea	Back-up of council drainage	Irish Water Drainage Records & OPW and Local Authority Reports	Low	Lowest level of defence 75m O.D. Distance and Level difference from Irish Sea.
Surface water	Surcharging system blockage	Irish Water Drainage Records & OPW and Local Authority Reports	Low	No record of surcharging or blockages on existing systems. Drainage Network maintained by Profile Park Management Company.
Foul sewer	Surcharging system blockage	Irish Water Drainage Records & OPW and Local Authority Reports	Low	No record of surcharging or blockages on existing systems. Drainage Network maintained by Profile Park Management Company.
Ground water source	Surcharging	OS Historic Maps PFRA Maps	Low	From mapping information there is no evidence of ground water flooding.
Overland flow	Run-off from roads	Site survey OS Maps PFRA Maps	Low	The nearest flood notes relate to flooding at the Peamount R134 R120 junction, 1.2km from the proposed site. Existing Drainage Network maintained by Profile Park Management Company. Proposed Finished Floor Levels higher than existing levels.

Appendix A: Site Investigation

IGSL Ltd

Project Appollo (Substation)

Ground Investigation Report

Project No. 23415

August 2021

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FOREWORD
The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards
The ground investigation works for this project (**Project Appollo (Substation)**) have been carried out by IGSL Limited in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (2015) and BS 1377 (Parts 1 to 9) and the following European Norms:

- EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- EN ISO 14688-1:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Principles for a classification
- EN ISO 14689-1:2017 Geotechnical Investigation and Testing – Identification, description & classification of rock

Reporting
No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations. The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

This report has been prepared for Ramboll and the information should not be used without their prior written permission. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Boring Procedures
Unless otherwise stated, 'shell and auger' or cable percussive boring technique has been employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing complies with the recommendations of IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variation is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

In-Situ Testing
Standard penetration tests were conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 and the Energy Ratio (E_r). A calibration certificate is available upon request. The E_r is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the

engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

Soil Sampling
Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2002 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Class 1 thin wall undisturbed tube samples (UT100) were obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2002 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2002) is shown in Table A.

Table A – Details of Sample Quality Requirements

EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S
5.5.6	Particle Size Analysis	N/S
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S
5.5.9	Soil Dispersivity	N/S
5.5.10	Frost Susceptibility	N/S
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S
5.11	Permeability	2

N/S – not stated. Presume a representative sample of appropriate size.

Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Groundwater
The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible, drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Where peat has been encountered, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 and Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

1. INTRODUCTION

IGSL has undertaken a programme of geotechnical site investigation works at a greenfield site located in Profile Park, Dublin 22. The site comprises a net area of approx. 1.6 acres (Figure 1). Profile Park comprises a 100 acre fully enclosed, private business park situated approximately 13 kilometres west of Dublin city centre.

Figure 1 – Site Location Plan (boxed area denotes extent of site investigation area)

Retrieved from Google Earth Pro (Image dated 04/04/2021)

The investigation comprised trial pits, dynamic probes, soakaway testing (to BRE 365) and in situ plate bearing testing. The investigations were executed in accordance with BS 5930, Code of Practice for Site Investigations (2015) and EN 1997-2 Eurocode 7 Part 2 Ground Investigation & Testing and supervised by an IGSL engineering geologist.

Geotechnical, chemical and environmental laboratory testing was scheduled on a range of soil and upper rockhead samples. The geotechnical testing included moisture contents, Atterberg Limits and particle size distribution [PSD]. Soil thermal conductivity was also measured using needle probe methods. Chemical analysis of soil samples to the BRE SD1 Concrete in Aggressive Ground suite was completed. Pyrite analysis to EN1744 was undertaken in order to quantify total sulphur and acid-soluble sulphate contents and to allow estimation of both oxidisable sulphides and equivalent pyrite content in the rock sample. Environmental tests were undertaken on soil samples (WAC *Rilta* suite) to assess suitability for off-site disposal to landfill. This report presents the factual geotechnical data acquired from the 2021 investigation. The exploratory hole locations are plotted on the site plan in Appendix 8.

2. FIELDWORK

2.1 General

The fieldworks were undertaken during June 2021. The works which form this report comprise the following:

- Trial Pits (6 No.)
- Dynamic Probing (22 No.[i])
- Soakaway Testing (to BRE365) (1 No.)
- Plate Bearing Testing (5 No.)
- Surveying of Exploratory Hole Locations

[i] Dynamic Probeholes DP12A and DP12B were undertaken following shallow refusals in both DP12 and DP12A

2.2 Trial Pits

Trial pitting was undertaken at six locations across the site using a JCB backhoe excavator. After first scanning the ground using a cable avoidance tool [CAT] and after consultation with available service drawings, the trial pits were each excavated, logged and sampled under the direction of an IGSL engineering geologist in accordance with BS 5930 (2015). Bulk disturbed samples (typically 30 to 40 kg) were taken as the pits progressed. The bulk samples were placed in heavy-duty polyethylene bags and sealed before being transported to Naas for laboratory testing.

All trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site geotechnical engineer. The trial pit logs and photos are presented in Appendix 1 and include descriptions of the soils encountered, groundwater conditions (where encountered) and stability of the pit sidewalls.

2.3 Dynamic Probing

In-situ "Heavy" dynamic probing (DPH) was performed at twenty-two locations using a compact crawler rig. The tracked Dando Terrier probing unit meets the requirements of BS 1377, Part 9 (1990) and IS EN 1997-2:2007. Due to shallow obstructions, additional probes were undertaken at locations DP12A and DP12B.

The probing rig utilized a 50kg drop weight and 500mm drop height with a 60° cone. In accordance with the standards, the number of blows required to drive the cone each 100mm increment into the sub-soil was recorded. Probing is generally terminated when blow counts, N_{100} values, exceed 25, in order to avoid damage to equipment. The probe records are presented in Appendix 2 and include blow-counts in both numerical and graphical format.

2.4 Soakaway Testing (to BRE 365)

An infiltration test was performed to assess the suitability of the subsoil for dispersion of storm water through a soakaway system. The infiltration test was performed in accordance with BRE Digest 365 'Soakaway Design'. To obtain a measure of the infiltration rate of the subsoil, water was poured into the test pit, with records taken of the fall in water level against time. Following the first soak cycle, the procedure was repeated to ensure saturation of the subsoil. The infiltration rate is the volume of water dispersed per unit of exposed area per unit of time, and is generally expressed as metres / minute or metres / second. Designs are based on the slowest infiltration rate, which is generally calculated from the final soak cycle. The soakaway design logs are presented in Appendix 3.

2.5 Plate Bearing Testing

Plate bearing tests were conducted at five locations each at a depth of 0.30m below ground level [bgl]. The tests were conducted on typically grey brown sandy very gravelly CLAY. Plate testing was undertaken to evaluate the modulus of sub-grade reaction (Ks) and equivalent CBR value. A 450mm diameter plate was used for the tests with kentledge provided by a mechanical excavator. Two load

cycle tests were performed and the load / settlement plots, Ks and equivalent CBR values are presented in Appendix 4.

2.6 Surveying of Exploratory Hole Locations

Following completion of the exploratory works, surveying was carried out using GPS techniques. Co-ordinates (x, y) were measured to Irish Transverse Mercator and ground levels (z) established to Malin Head. The co-ordinates and ground levels are shown on the exploratory hole logs with locations shown on the exploratory hole plan in Appendix 8.

3. LABORATORY TESTING

Geotechnical laboratory testing was performed at IGSL's INAB-accredited laboratory in accordance with the methods set out in BS1377; British Standard Methods of Test for Soils for Civil Engineering Purposes; British Standards Institute:1990. Soils testing included moisture content and Atterberg Limit (Liquid / Plastic Limits) determination along with analysis of particle size distribution [PSD] and soil conductivity. The results from geotechnical testing on selected trial pit soils are presented in Appendix 5.

Chemical testing of soils to BRE SD1 test suite was also completed. The results feature in the Chemtest report in Appendix 6. Soil samples were selected from pits for specialist Waste Acceptance Criteria (WAC) analysis. The results can be used to classify the material with regard to its potential for disposal to landfill. These results are also presented in the Chemtest report in Appendix 6. The results of the testing to EN1744 on the upper rockhead sample from TP02 are presented in the Nicholls Colton report presented in Appendix 7.

BIBLIOGRAPHY

1.0 BS 5930 (1999 + A2:2010) Code of Practice for Site Investigation, British Standards Institution (BSI).

2.0 BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.

3.0 Eurocode 7, Part 2: Ground Investigation & Testing (EN 1997-2:2007)

4.0 Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.

Appendix 1

Trial Pit Logs and Photographs

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP01**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,641.45 E 730,516.65 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	74.47
ENGINEER	Ramboll	**EXCAVATION METHOD**	JCB

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	Firm brown sandy slightly gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to medium, subangular to angular.					AA159736 AA159737	B B	0.40-0.50 0.40-0.50		
			0.60	73.87						
1.0	Firm to stiff greyish brown sandy very gravelly CLAY with a medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159738 AA159739	B B	1.80-1.90 1.80-1.90		
			2.00	72.47						
2.0	Possible LIMESTONE Rockhead End of Trial Pit at 2.00m									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,674.85 E 730,523.58 N
		DATE STARTED	22/06/2021
		DATE COMPLETED	22/06/2021
CLIENT		**GROUND LEVEL (m)**	74.10
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Firm brown sandy very gravelly CLAY with a medium to high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159728 AA159729	B B	0.50-0.60 0.50-0.60		
1.0 Possible Weathered Rockhead comprising muddy limestone recovered as (dense) brown slightly clayey slightly sandy GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular.		1.00	73.10		AA159730 AA159731	B B	1.90-2.00 1.90-2.00		
2.0 Possible LIMESTONE Rockhead End of Trial Pit at 2.10m		2.10	72.00						

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP03**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,702.61 E 730,534.87 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	73.75
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Brown mottled grey slightly silty sandy gravelly CLAY with a low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.					AA159748	B	0.50-0.60		
					AA159749	B	0.50-0.60		
1.0									
Firm to stiff black sandy very gravelly CLAY with a medium to high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.		1.90	71.85						
2.0				1 (Seepage)	AA159750	B	2.30-2.40		
					AA159751	B	2.30-2.40		
Possible LIMESTONE Rockhead End of Trial Pit at 2.50m		2.50	71.25						

Groundwater Conditions
Seepage at 2.30m

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP04**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,705.37 E 730,508.75 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	73.94
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0									
Firm brown sandy gravelly CLAY with a low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to angular.					AA159744 AA159745	B B	0.50-0.60 0.50-0.60		
1.0									
Possible Weathered Rockhead comprising muddy limestone recovered as (dense) brown slightly clayey slightly sandy GRAVEL with a high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.		1.10	72.84		AA159746	B	1.50-1.60		
Possible LIMESTONE Rockhead End of Trial Pit at 1.60m		1.60	72.34		AA159747	B	1.50-1.60		
2.0									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP05**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,680.66 E 730,500.79 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	74.30
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Firm brown sandy gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to medium, subangular to angular.					AA159740 AA159741	B B	0.40-0.50 0.40-0.50		
Stiff brown sandy very gravelly CLAY with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular.		0.60	73.70						
1.0					AA159742 AA159743	B B	1.60-1.70 1.60-1.70		
Possible LIMESTONE Rockhead End of Trial Pit at 1.70m		1.70	72.60						
2.0									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP06**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,643.57 E 730,495.61 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	74.75
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Firm brown sandy very gravelly CLAY with a medium to high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159732 AA159733	B B	0.50-0.60 0.50-0.60		
		0.90	73.85						
1.0 Dark brown sandy very gravelly CLAY with a low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159734 AA159735	B B	1.60-1.70 1.60-1.70		
		1.80	72.95						
Possible LIMESTONE Rockhead End of Trial Pit at 1.80m									
2.0									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

IGSL TP LOG 23415.GPJ IGSL.GDT 24/8/21

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP01 – 1 of 3

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Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP01 – 3 of 3

TP02 – 1 of 3

TP02 – 2 of 3

TP02 – 3 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP03 – 1 of 3

TP03 – 2 of 3

TP03 – 3 of 3

TP04 – 1 of 3

TP04 – 2 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

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Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP05 – 1 of 3

TP05 – 2 of 3

TP05 – 3 of 3

TP06 – 1 of 3

TP06 – 2 of 3

TP06 – 3 of 3

Appendix 2

Dynamic Probing

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP01
SHEET Sheet 1 of 1

CO-ORDINATES 703,634.41 E
730,480.71 N
GROUND LEVEL (mOD) 74.93

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	5
						0.20	6
						0.30	7
						0.40	8
						0.50	13
						0.60	15
						0.70	14
						0.80	15
						0.90	11
1.0						1.00	8
						1.10	5
						1.20	4
						1.30	4
						1.40	11
						1.50	17
						1.60	23
						1.70	19
						1.80	14
						1.90	8
2.0						2.00	12
						2.10	10
						2.20	10
						2.30	25
	End of Probe at 2.40 m			72.53			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP02
SHEET Sheet 1 of 1

CO-ORDINATES 703,658.47 E
730,483.35 N
GROUND LEVEL (mOD) 74.76

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

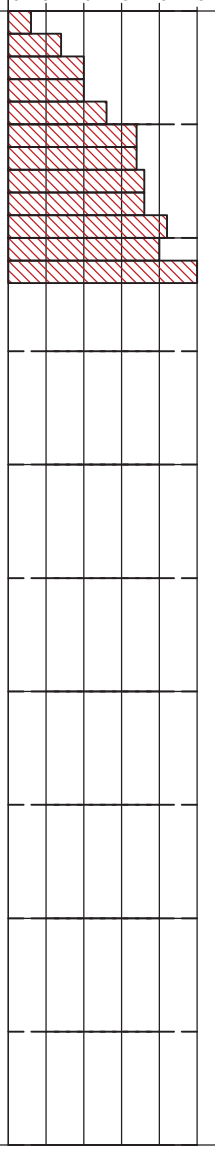
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	7
						0.20	10
						0.30	10
						0.40	13
						0.50	17
						0.60	17
						0.70	18
						0.80	18
						0.90	21
1.0						1.00	20
	End of Probe at 1.20 m			73.56		1.10	25
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP03
SHEET Sheet 1 of 1

CO-ORDINATES 703,678.30 E
730,485.98 N
GROUND LEVEL (mOD) 74.40

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

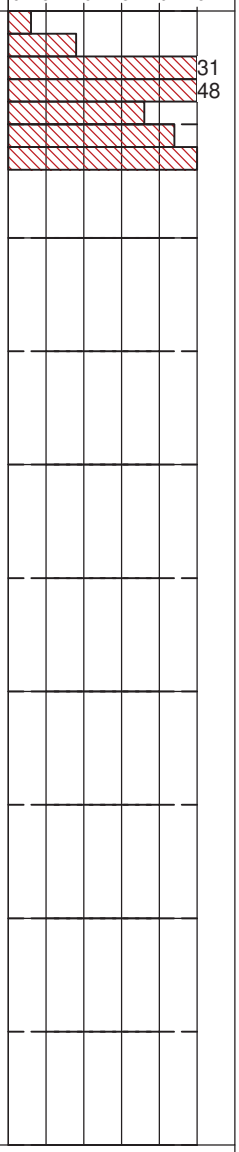
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	9
						0.20	31
						0.30	48
						0.40	18
						0.50	22
						0.60	25
	End of Probe at 0.70 m			73.70			
1.0							
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP04
SHEET Sheet 1 of 1

CO-ORDINATES 703,697.97 E
730,490.03 N

GROUND LEVEL (mOD) 74.13

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

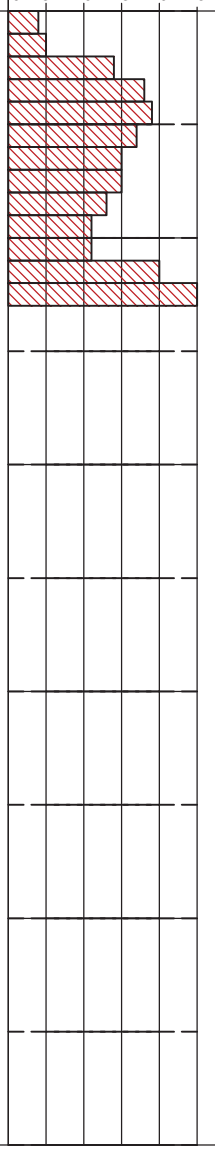
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	5
						0.20	14
						0.30	18
						0.40	19
						0.50	17
						0.60	15
						0.70	15
						0.80	13
						0.90	11
1.0						1.00	11
						1.10	20
						1.20	25
	End of Probe at 1.30 m			72.83			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP05
SHEET Sheet 1 of 1

CO-ORDINATES 703,721.25 E
730,497.34 N

GROUND LEVEL (mOD) 74.00

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	5
						0.10	9
						0.20	9
						0.30	15
						0.40	20
						0.50	17
						0.60	12
						0.70	11
						0.80	9
						0.90	7
1.0						1.00	8
						1.10	7
						1.20	5
						1.30	5
						1.40	4
						1.50	6
						1.60	8
						1.70	10
						1.80	10
						1.90	11
2.0						2.00	25
	End of Probe at 2.10 m			71.90			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP06
SHEET Sheet 1 of 1

CO-ORDINATES 703,718.48 E
730,512.36 N
GROUND LEVEL (mOD) 73.92

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

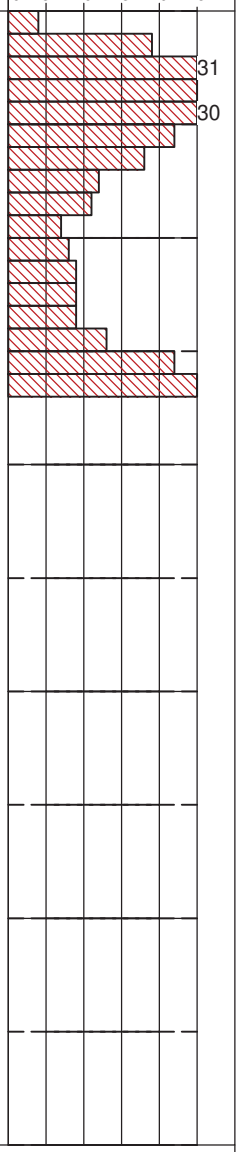
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	19
						0.20	31
						0.30	25
						0.40	30
						0.50	22
						0.60	18
						0.70	12
						0.80	11
						0.90	7
1.0						1.00	8
						1.10	9
						1.20	9
						1.30	9
						1.40	13
						1.50	22
						1.60	25
	End of Probe at 1.70 m			72.22			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP07
SHEET Sheet 1 of 1

CO-ORDINATES 703,697.27 E
730,510.48 N

GROUND LEVEL (mOD) 74.03

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	8
						0.20	6
						0.30	5
						0.40	2
						0.50	4
						0.60	2
						0.70	3
						0.80	4
						0.90	13
1.0						1.00	16
						1.10	8
						1.20	11
						1.30	12
						1.40	14
						1.50	15
						1.60	16
						1.70	16
						1.80	23
						1.90	25
2.0	End of Probe at 2.00 m			72.03			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP08
SHEET Sheet 1 of 1

CO-ORDINATES 703,677.23 E
730,508.92 N
GROUND LEVEL (mOD) 74.28

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

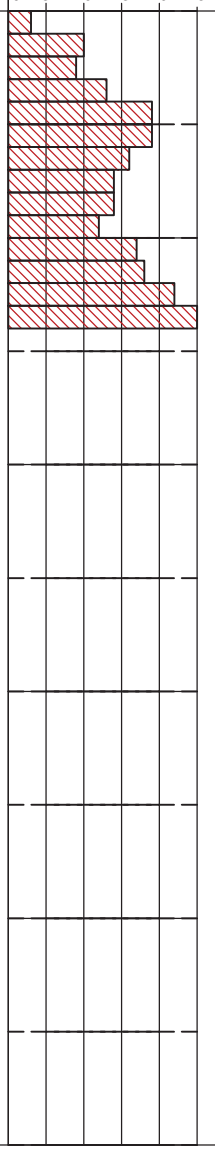
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	10
						0.20	9
						0.30	13
						0.40	19
						0.50	19
						0.60	16
						0.70	14
						0.80	14
						0.90	12
1.0						1.00	17
						1.10	18
						1.20	22
						1.30	25
	End of Probe at 1.40 m			72.88			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP09
SHEET Sheet 1 of 1

CO-ORDINATES 703,659.76 E
730,505.35 N
GROUND LEVEL (mOD) 74.67

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	6
						0.10	11
						0.20	16
						0.30	17
						0.40	13
						0.50	15
						0.60	17
						0.70	16
						0.80	10
						0.90	9
1.0						1.00	10
						1.10	12
						1.20	13
						1.30	25
	End of Probe at 1.40 m			73.27			
2.0							
3.0							
4.0							

Graphic Probe Record
0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP10
SHEET Sheet 1 of 1

CO-ORDINATES 703,633.00 E
730,501.03 N
GROUND LEVEL (mOD) 74.77

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	6
						0.20	11
						0.30	17
						0.40	24
						0.50	23
						0.60	17
						0.70	14
						0.80	15
						0.90	10
1.0						1.00	7
						1.10	5
						1.20	5
						1.30	7
						1.40	7
						1.50	5
						1.60	5
						1.70	6
						1.80	7
						1.90	25
2.0	End of Probe at 2.00 m			72.77			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP11
SHEET Sheet 1 of 1

CO-ORDINATES 703,634.25 E
730,512.03 N
GROUND LEVEL (mOD) 74.47

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

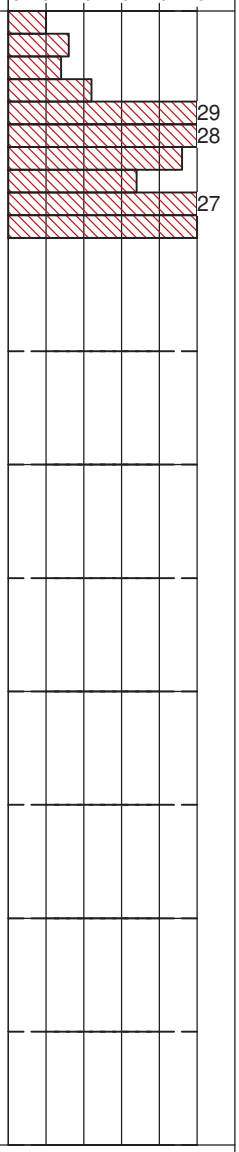
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	5
						0.10	8
						0.20	7
						0.30	11
						0.40	29
						0.50	28
						0.60	23
						0.70	17
						0.80	27
						0.90	25
1.0	End of Probe at 1.00 m			73.47			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP12
SHEET Sheet 1 of 1

CO-ORDINATES 703,660.86 E
730,517.73 N

GROUND LEVEL (mOD) 74.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record (0 5 10 15 20 25)
0.0	.					0.00	9	
						0.10	14	
						0.20	35	35
	End of Probe at 0.30 m			74.24				
1.0								
2.0								
3.0								
4.0								

GROUNDWATER OBSERVATIONS

REMARKS
Obstruction encountered. Moved to DP12A with probe re-attempted.

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP12A
SHEET Sheet 1 of 1

CO-ORDINATES 703,660.86 E
730,517.73 N

GROUND LEVEL (mOD) 74.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record (0 5 10 15 20 25)
0.0	.					0.00	10	
						0.10	31	31
	End of Probe at 0.20 m			74.34				
1.0								
2.0								
3.0								
4.0								

GROUNDWATER OBSERVATIONS

REMARKS
Obstruction encountered. Moved to DP12B with probe re-attempted.

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP12B
SHEET Sheet 1 of 1

CO-ORDINATES 703,660.86 E
730,517.73 N

GROUND LEVEL (mOD) 74.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

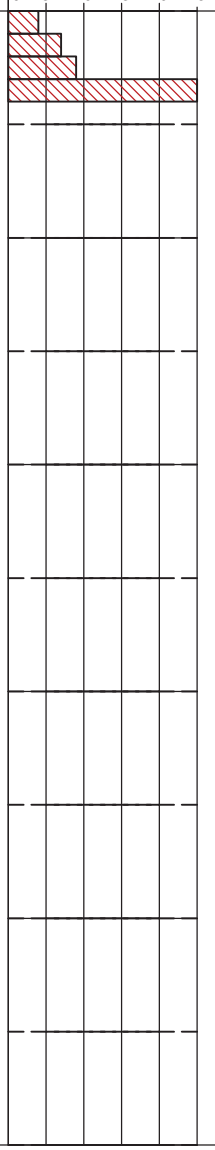
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	7
						0.20	9
						0.30	25
	End of Probe at 0.40 m			74.14			
1.0							
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP13
SHEET Sheet 1 of 1

CO-ORDINATES 703,676.23 E
730,520.95 N
GROUND LEVEL (mOD) 74.09

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	12
						0.20	8
						0.30	7
						0.40	9
						0.50	10
						0.60	12
						0.70	11
						0.80	10
						0.90	8
1.0						1.00	13
						1.10	13
						1.20	10
						1.30	9
						1.40	9
						1.50	7
						1.60	8
						1.70	4
						1.80	4
						1.90	5
2.0						2.00	8
						2.10	12
						2.20	25
	End of Probe at 2.30 m			71.79			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP14
SHEET Sheet 1 of 1

CO-ORDINATES 703,697.07 E
730,526.54 N
GROUND LEVEL (mOD) 73.90

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	2
						0.10	4
						0.20	6
						0.30	6
						0.40	10
						0.50	9
						0.60	8
						0.70	6
						0.80	5
						0.90	6
1.0						1.00	4
						1.10	2
						1.20	2
						1.30	2
						1.40	2
						1.50	3
						1.60	7
						1.70	19
						1.80	24
						1.90	25
2.0	End of Probe at 2.00 m			71.90			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP15
SHEET Sheet 1 of 1

CO-ORDINATES 703,714.22 E
730,530.72 N
GROUND LEVEL (mOD) 73.82

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	5
						0.20	6
						0.30	5
						0.40	3
						0.50	3
						0.60	4
						0.70	3
						0.80	2
						0.90	0
1.0						1.00	1
						1.10	3
						1.20	6
						1.30	20
						1.40	22
						1.50	15
						1.60	14
						1.70	25
	End of Probe at 1.80 m			72.02			
2.0							
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP16
SHEET Sheet 1 of 1

CO-ORDINATES 703,709.00 E
730,551.32 N
GROUND LEVEL (mOD) 73.42

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	7
						0.10	12
						0.20	18
						0.30	12
						0.40	8
						0.50	5
						0.60	3
						0.70	2
						0.80	2
						0.90	6
1.0						1.00	12
						1.10	9
						1.20	25
	End of Probe at 1.30 m			72.12			
2.0							
3.0							
4.0							

Graphic Probe Record
0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP17
SHEET Sheet 1 of 1

CO-ORDINATES 703,696.59 E
730,547.68 N
GROUND LEVEL (mOD) 73.51

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

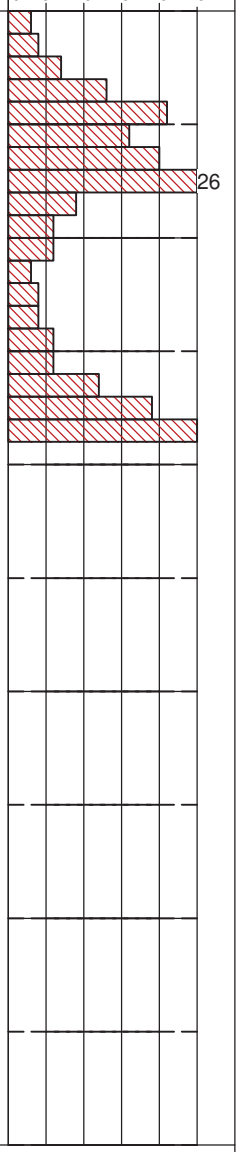
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	4
						0.20	7
						0.30	13
						0.40	21
						0.50	16
						0.60	20
						0.70	26
						0.80	9
						0.90	6
1.0						1.00	6
						1.10	3
						1.20	4
						1.30	4
						1.40	6
						1.50	6
						1.60	12
						1.70	19
						1.80	25
	End of Probe at 1.90 m			71.61			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP18
SHEET Sheet 1 of 1

CO-ORDINATES 703,673.63 E
730,539.03 N
GROUND LEVEL (mOD) 73.92

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	12
						0.20	19
						0.30	24
						0.40	22
						0.50	16
						0.60	16
						0.70	12
						0.80	15
						0.90	8
1.0						1.00	9
						1.10	8
						1.20	9
						1.30	10
						1.40	15
						1.50	18
						1.60	14
						1.70	11
						1.80	25
	End of Probe at 1.90 m			72.02			
2.0							
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP19
SHEET Sheet 1 of 1

CO-ORDINATES 703,661.62 E
730,534.73 N
GROUND LEVEL (mOD) 74.16

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

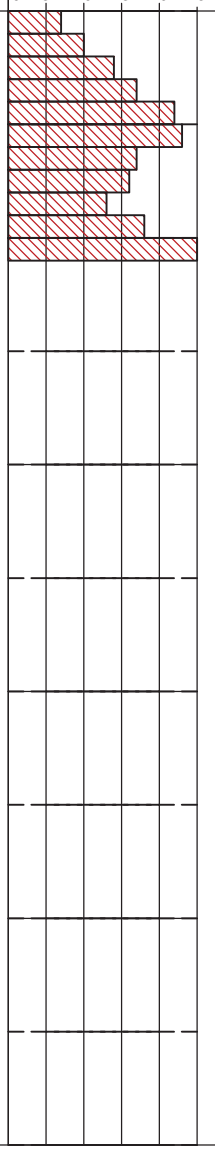
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	7
						0.10	10
						0.20	14
						0.30	17
						0.40	22
						0.50	23
						0.60	17
						0.70	16
						0.80	13
						0.90	18
1.0						1.00	25
	End of Probe at 1.10 m			73.06			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP20
SHEET Sheet 1 of 1

CO-ORDINATES 703,635.43 E
730,523.72 N
GROUND LEVEL (mOD) 74.46

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	7
						0.10	10
						0.20	7
						0.30	6
						0.40	5
						0.50	7
						0.60	6
						0.70	4
						0.80	3
						0.90	5
1.0						1.00	5
						1.10	3
						1.20	3
						1.30	3
						1.40	3
						1.50	5
						1.60	4
						1.70	6
						1.80	19
						1.90	25
2.0	End of Probe at 2.00 m			72.46			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

Appendix 3

Soakaway Test Records

Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Project Appollo	Contract No.	23415
Test No.	SA01 (Cycle 1)	Easting	703665.051
Engineer:	Ramboll	Northing	730509.392
Date:	22/06/2021	Elevation (m OD)	74.466

Summary of ground conditions

from	to	Description	Ground water
0.00	1.00	Firm brown sandy very gravelly CLAY with a medium cobble content	
1.00	2.10	Brown slightly clayey slightly sandy GRAVEL with a medium cobble content	Dry

Notes:

Field Data

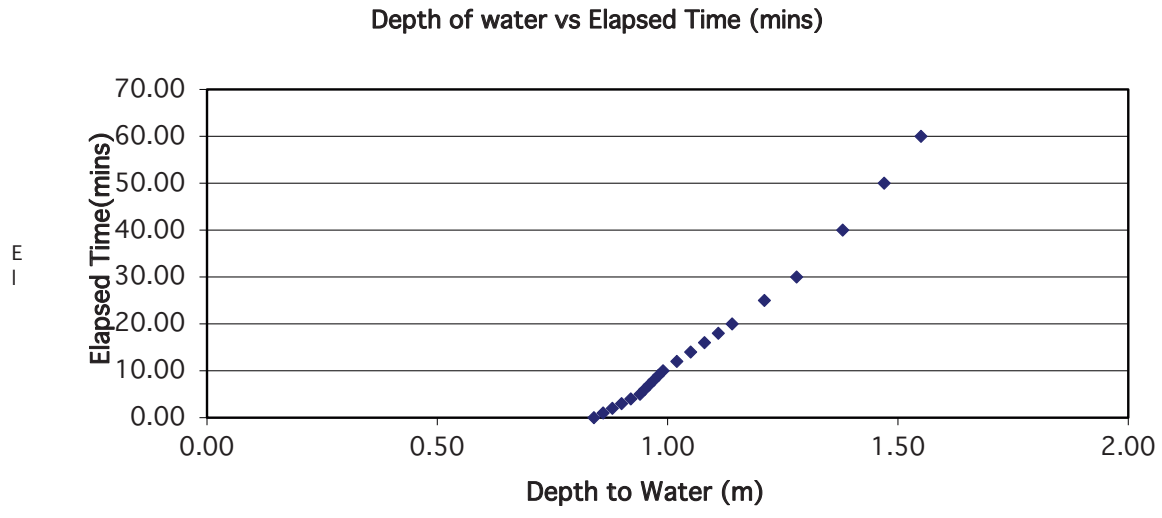
Depth to Water (m)	Elapsed Time (min)
0.84	0.00
0.86	1.00
0.88	2.00
0.90	3.00
0.92	4.00
0.94	5.00
0.95	6.00
0.96	7.00
0.97	8.00
0.98	9.00
0.99	10.00
1.02	12.00
1.05	14.00
1.08	16.00
1.11	18.00
1.14	20.00
1.21	25.00
1.28	30.00
1.38	40.00
1.47	50.00
1.55	60.00

Field Test

Depth of Pit (D)	2.10	m
Width of Pit (B)	0.60	
Length of Pit (L)	1.60	m
Initial depth to Water =	0.84	m
Final depth to water =	1.55	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.96	m2
*Av. side area of permeable stratum over test perio	3.982	m2
Total Exposed area =	4.942	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.0023 m/min or 3.83111E-05 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Project Appollo	Contract No.	23415
Test No.	SA01 (Cycle 2)	Easting	703665.051
Engineer:	Ramboll	Northing	730509.392
Date:	22/06/2021	Elevation (m OD)	74.466

Summary of ground conditions

from	to	Description	Ground water
0.00	1.00	Firm brown sandy very gravelly CLAY with a medium cobble content	Dry
1.00	2.10	Brown slightly clayey slightly sandy GRAVEL with a medium cobble content	

Notes:

Field Data

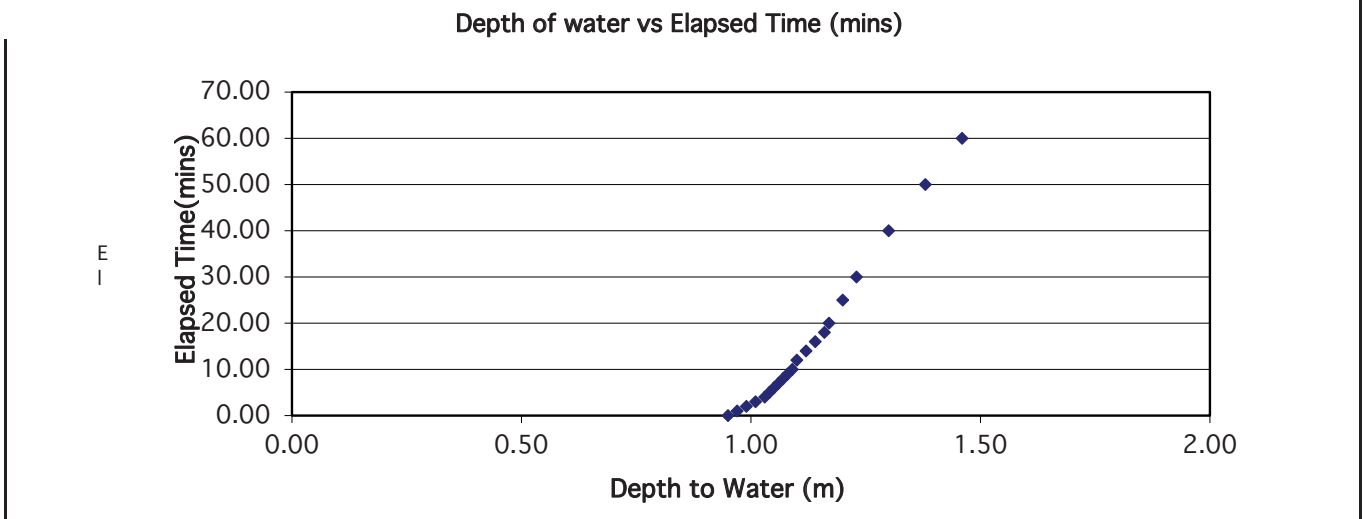
Depth to Water (m)	Elapsed Time (min)
0.95	0.00
0.97	1.00
0.99	2.00
1.01	3.00
1.03	4.00
1.04	5.00
1.05	6.00
1.06	7.00
1.07	8.00
1.08	9.00
1.09	10.00
1.10	12.00
1.12	14.00
1.14	16.00
1.16	18.00
1.17	20.00
1.20	25.00
1.23	30.00
1.30	40.00
1.38	50.00
1.46	60.00

Field Test

Depth of Pit (D)	2.10	m
Width of Pit (B)	0.60	
Length of Pit (L)	1.60	m
Initial depth to Water =	0.95	m
Final depth to water =	1.46	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.96	m2
*Av. side area of permeable stratum over test perio	3.938	m2
Total Exposed area =	4.898	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00167 m/min or 2.77664E-05 m/sec



Appendix 4

Plate Bearing Test Records

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

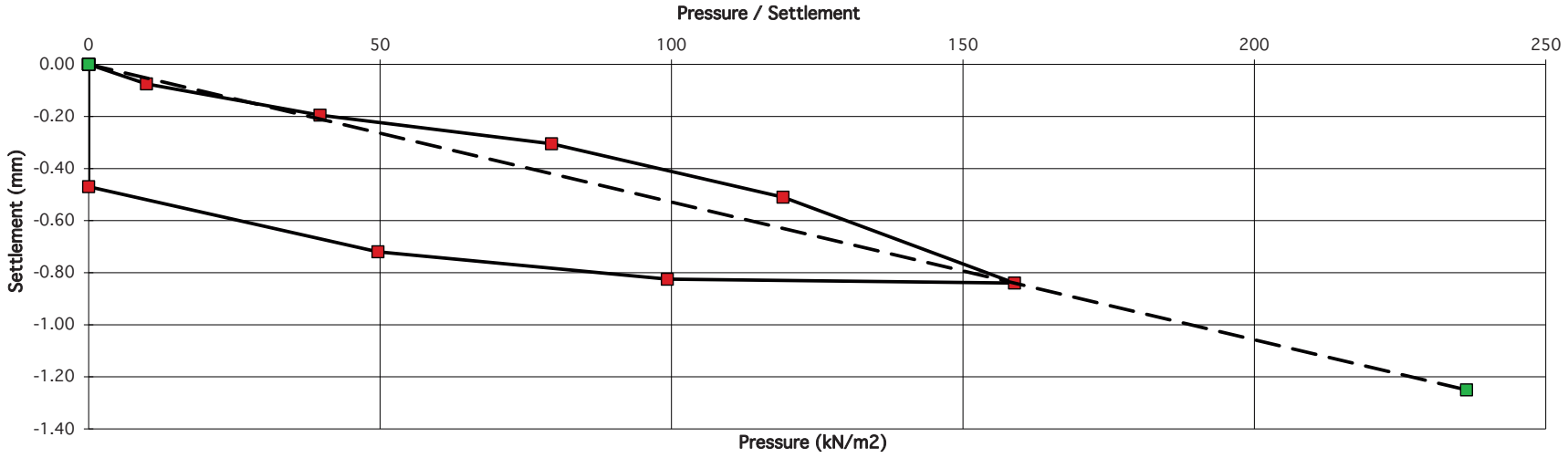
Reference No.	R122967
Contract	Project Appollo (Substation)
Test No.	PT01 - Load
Location	E - 703650.516, N - 730520.551, Elev - 74.399
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 189
Modulus of subgrade reaction = 122 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 39.6 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

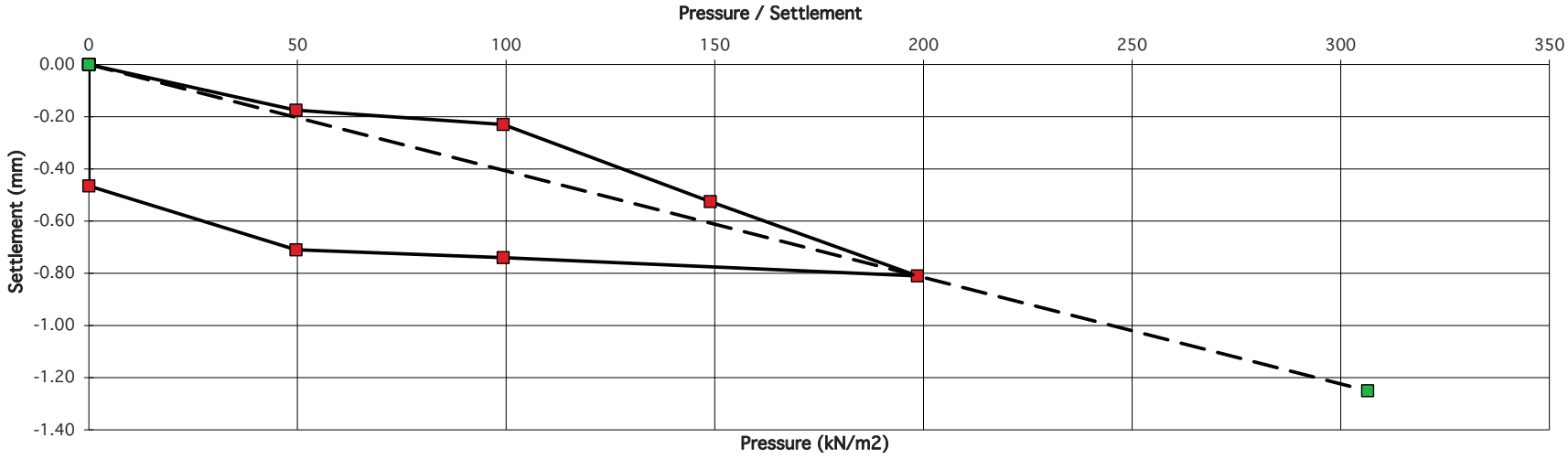
Reference No.	R122967
Contract	Project Appollo (Substation)
Test No.	PT01 - Reload
Location	E - 703650.516, N - 730520.551, Elev - 74.399
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 245
Modulus of subgrade reaction = 158 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 62.0 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

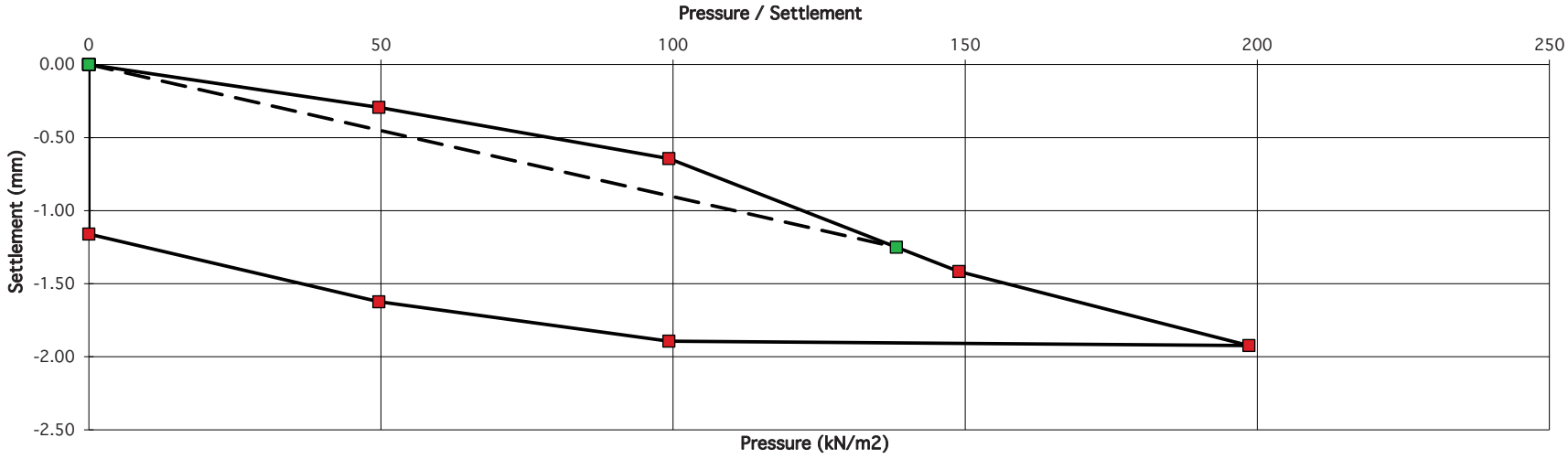
Reference No.	R122968
Contract	Project Appollo (Substation)
Test No.	PT02 - Load
Location	E - 703696.213, N - 730534.222, Elev - 73.759
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No. .....

Depth ..... m bgl



Gradient at 1.25 mm settlement intersection = 111
Modulus of subgrade reaction = 71 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 15.6 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

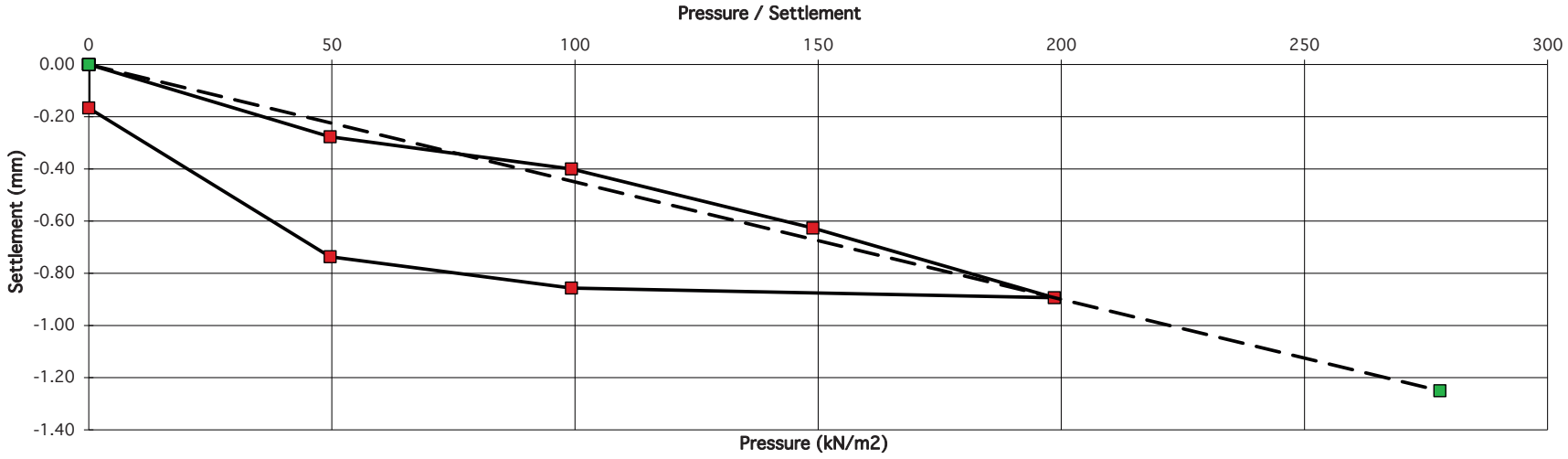
Reference No.	R122968
Contract	Project Appollo (Substation)
Test No.	PT02 - Reload
Location	E - 703696.213, N - 730534.222, Elev - 73.759
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 222
Modulus of subgrade reaction = 143 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 52.4 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

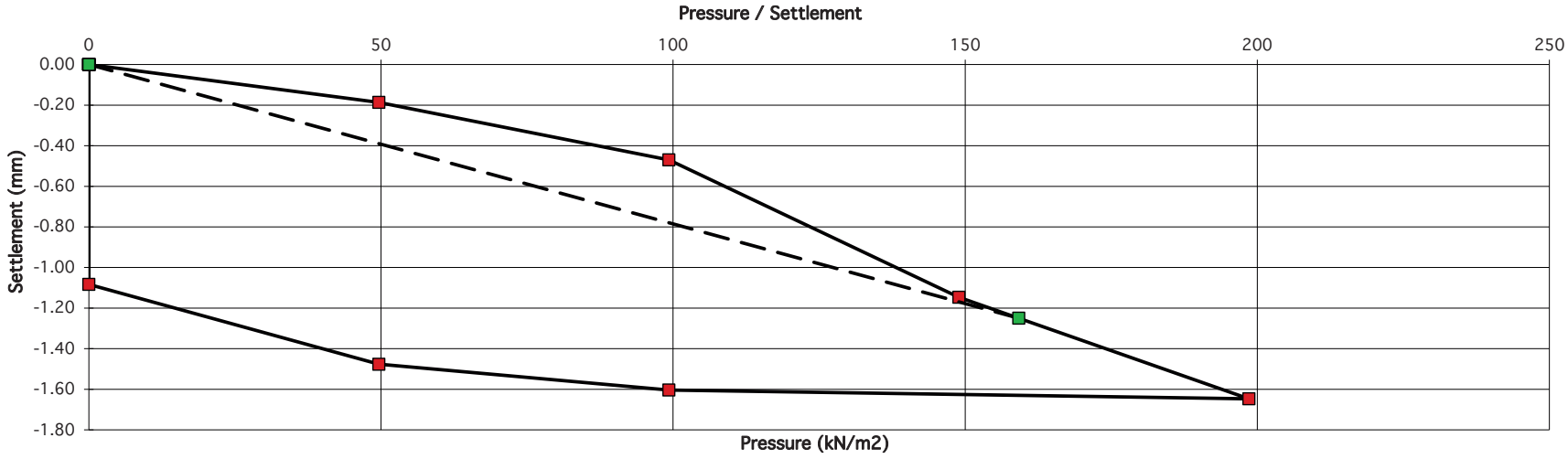
Reference No.	R122969
Contract	Project Appollo (Substation)
Test No.	PT03 - Load
Location	E - 703679.275, N - 730514.143, Elev - 74.203
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No. .....

Depth ..... m bgl



Gradient at 1.25 mm settlement intersection = 127
Modulus of subgrade reaction = 82 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 19.9 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

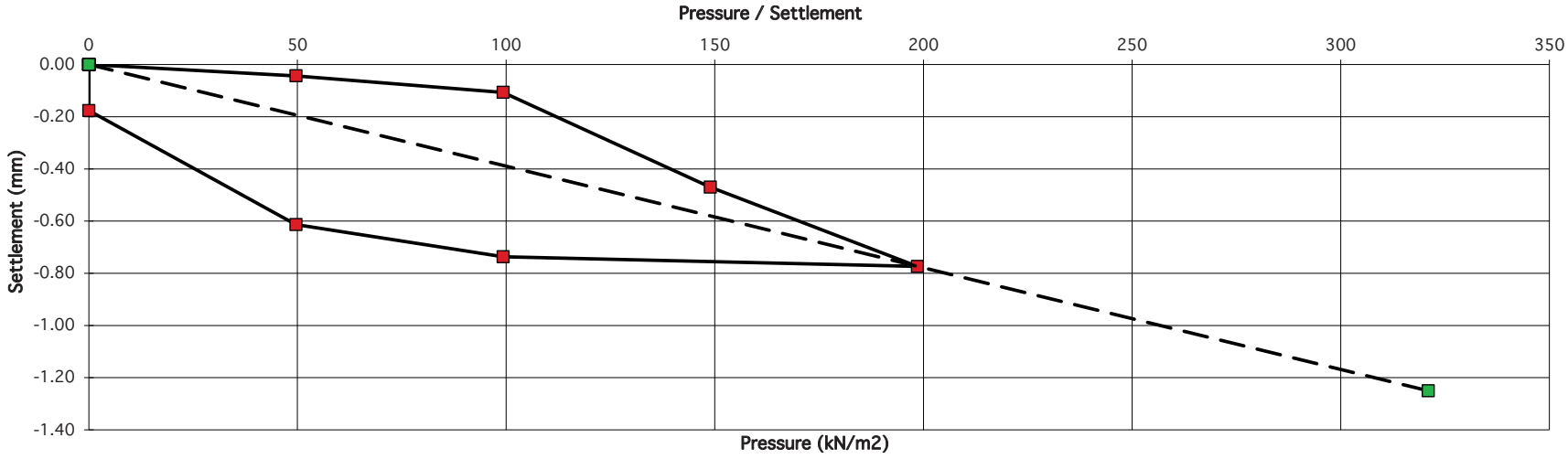
Reference No.	R122969
Contract	Project Appollo (Substation)
Test No.	PT03 - Reload
Location	E - 703679.275, N - 730514.143, Elev - 74.203
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 257
Modulus of subgrade reaction = 165 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 67.2 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

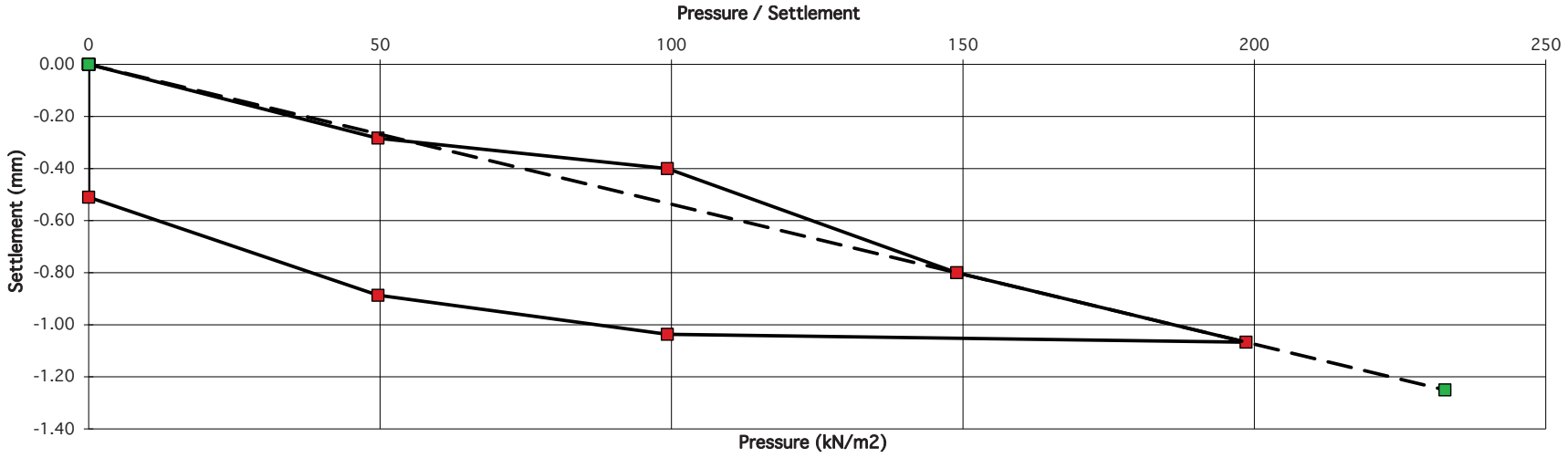
Reference No.	R122970
Contract	Project Appollo (Substation)
Test No.	PT04 - Load
Location	E - 703700.577, N - 730501.087, Elev - 74.05
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Stiff sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 186
Modulus of subgrade reaction = 120 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 38.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

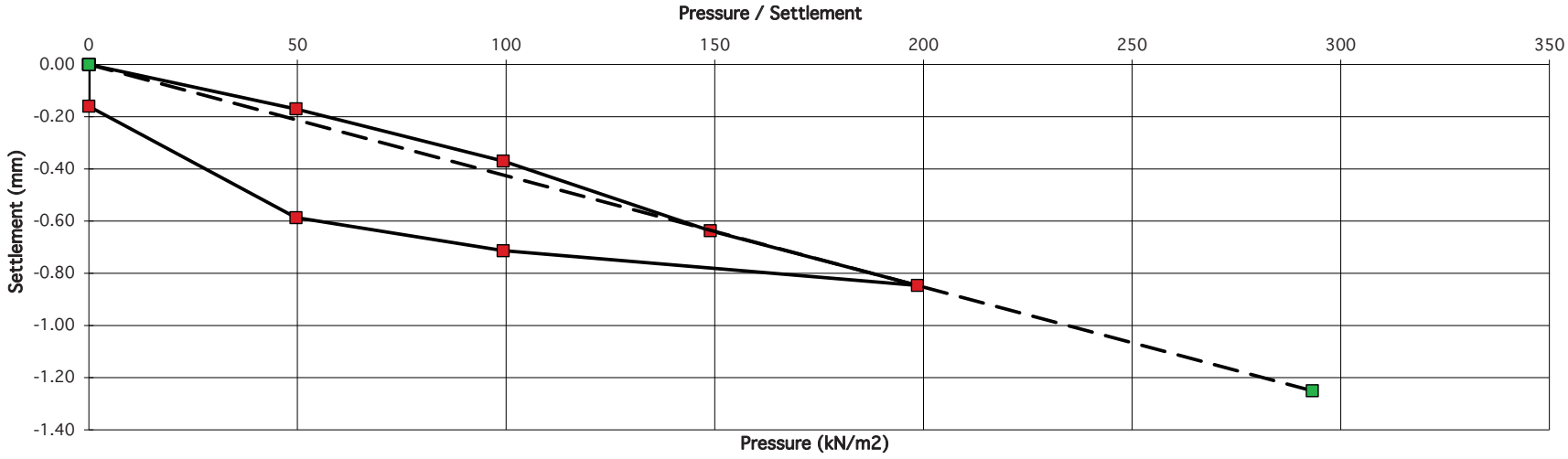
Reference No.	R122970
Contract	Project Appollo (Substation)
Test No.	PT04 - Reload
Location	E - 703700.577, N - 730501.087, Elev - 74.05
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Stiff sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 235
Modulus of subgrade reaction = 151 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 57.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

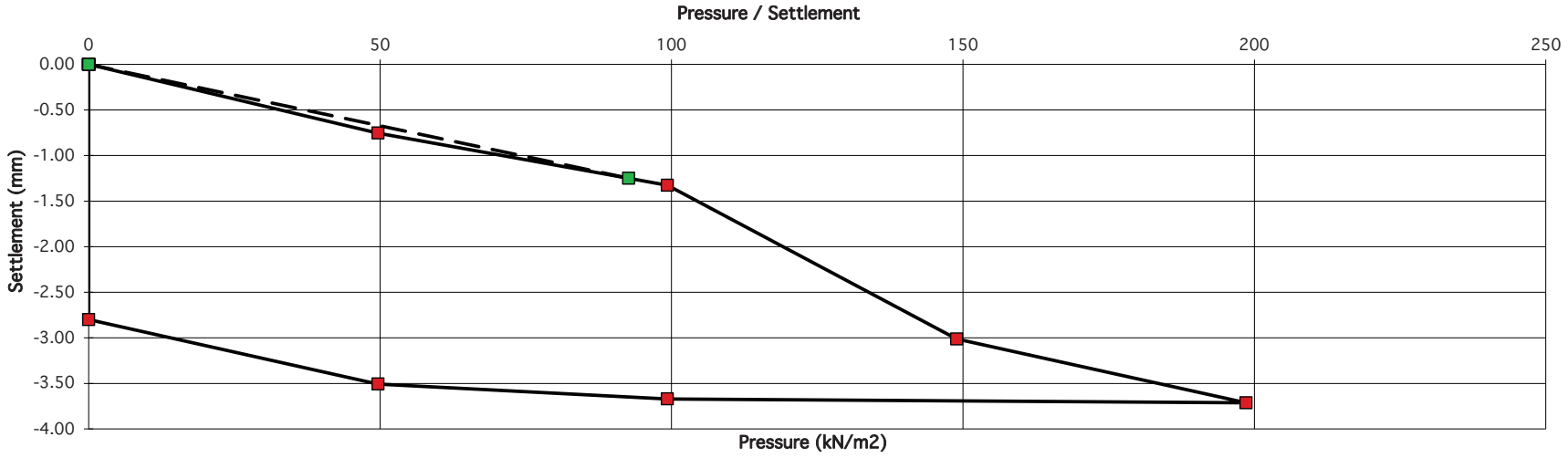
Reference No.	R122971
Contract	Project Appollo (Substation)
Test No.	PT05 - Load
Location	E - 703651.343, N - 730496.431, Elev - 74.793
Depth	300mm
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 74
Modulus of subgrade reaction = 48 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 7.8 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

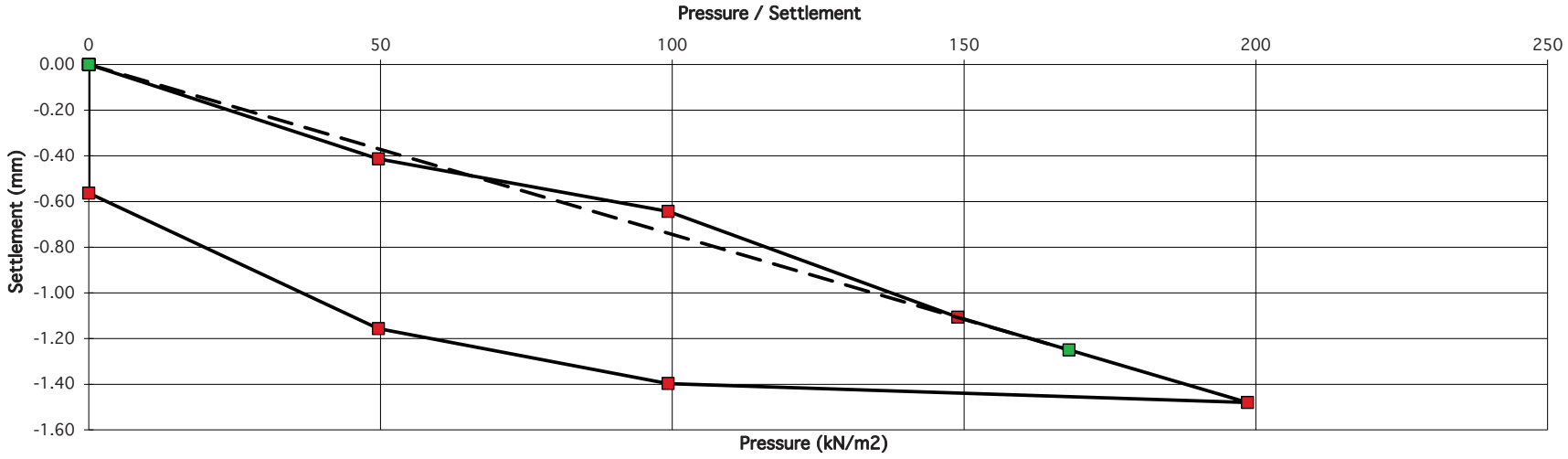
Reference No.	R122971
Contract	Project Appollo (Substation)
Test No.	PT05 - Reload
Location	E - 703651.343, N - 730496.431, Elev - 74.793
Depth	300mm
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 134
Modulus of subgrade reaction = 86 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 21.9 %

Appendix 5

Geotechnical Laboratory Test Results - Soil

IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R124908** Contract No. 23415 Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station Site

Customer Ramboll

Samples Received: 07/07/21 Date Tested: 07/07/21

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
TP01	AA159738	1.8	A21/3390	B	15	39	21	18	57	WS	4.4	C I	Brown slightly sandy, gravelly, CLAY
TP02	AA159729	0.5	A21/3392	B	13	35	20	15	71	WS	4.4	C L	Brown sandy gravelly CLAY
TP03	AA159749	0.5	A21/3393	B	17	35	19	16	74	WS	4.4	C L	Brown sandy gravelly CLAY
TP03	AA159751	2.3	A21/3394	B	20	35	23	12	49	WS	4.4	C L	Grey/brown slightly sandy, gravelly, CLAY
TP04	AA149746	1.5	A21/3395	B	15	35	19	16	58	WS	4.4	C L	Brown sandy gravelly CLAY
TP05	AA159742	1.6	A21/3396	B	12	39	22	17	71	WS	4.4	C I	Brown slightly sandy, gravelly, CLAY
TP06	AA159733	0.5	A21/3397	B	12	40	21	19	46	WS	4.4	C I	Brown sandy gravelly CLAY
TP06	AA159735	1.6	A21/3398	B	9.8	35	21	14	48	WS	4.4	C L	Brown slightly sandy, gravelly, CLAY with many cobbles

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
Opinions and interpretations are outside the scope of accreditation. * denotes Customer supplied information.

IGSL Ltd Materials Laboratory

Persons authorized to approve reports
H Byrne (Laboratory Manager)

Approved by	Date	Page
H Byrne	13/08/21	1 of 1

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	93	
28	82	
20	74	
14	69	
10	65	
6.3	59	
5	57	
3.35	54	
2	52	
1.18	49	SAND
0.6	47	
0.425	46	
0.3	44	
0.15	41	
0.063	38	SILT/CLAY
0.037	33	
0.027	29	
0.017	26	
0.010	23	
0.007	20	
0.005	18	
0.002	14	

Contract No. 23415 Report No. R124909
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP01
Sample No.* AA159738 Lab. Sample No. A21/3390
Sample Type: B
Depth* (m) 1.80 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
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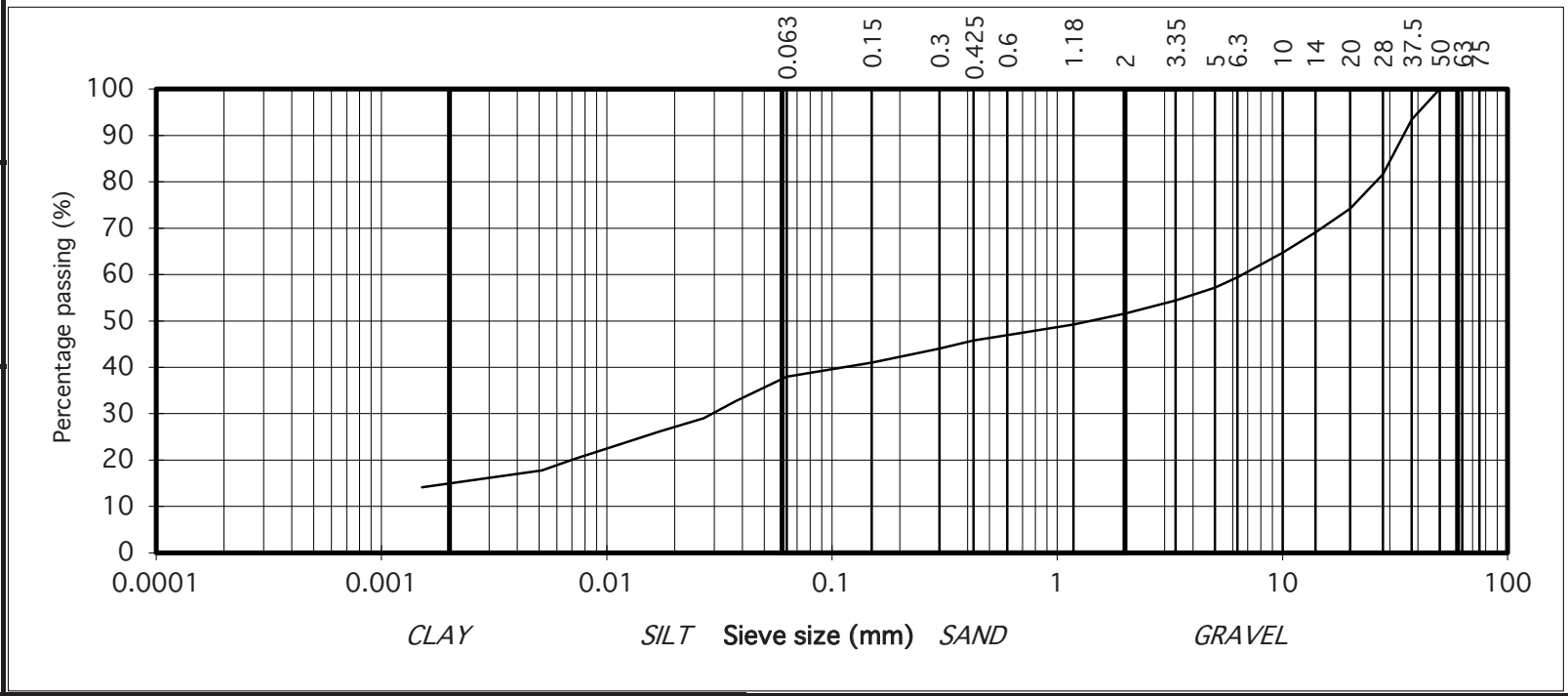

IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	95	
28	88	
20	79	
14	66	
10	63	
6.3	57	
5	55	
3.35	52	
2	50	
1.18	48	SAND
0.6	47	
0.425	47	
0.3	45	
0.15	41	
0.063	39	SILT/CLAY
0.037	34	
0.027	32	
0.017	28	
0.010	23	
0.007	21	
0.005	18	
0.002	15	

Contract No. 23415 Report No. R124910
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP03
Sample No.* AA159750 Lab. Sample No. A21/3394
Sample Type: B
Depth* (m) 2.30 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Grey/brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
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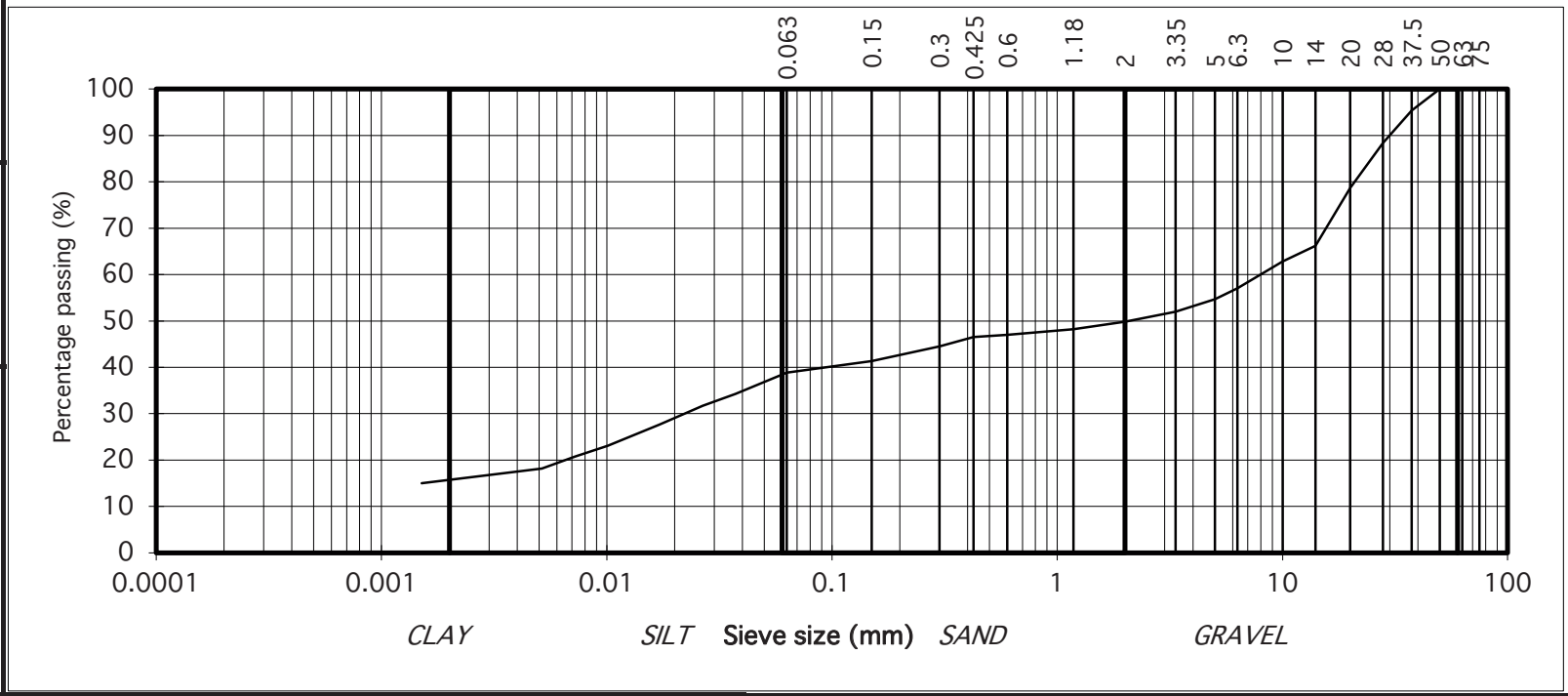

IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	96	
28	87	
20	74	
14	68	
10	64	
6.3	56	
5	52	
3.35	47	
2	42	
1.18	40	SAND
0.6	37	
0.425	36	
0.3	35	
0.15	31	
0.063	28	SILT/CLAY
0.038	24	
0.027	21	
0.018	17	
0.010	15	
0.007	14	
0.005	12	
0.002	10	

Contract No. 23415 Report No. R124911
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP05
Sample No.* AA159742 Lab. Sample No. A21/3396
Sample Type: B
Depth* (m) 1.60 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
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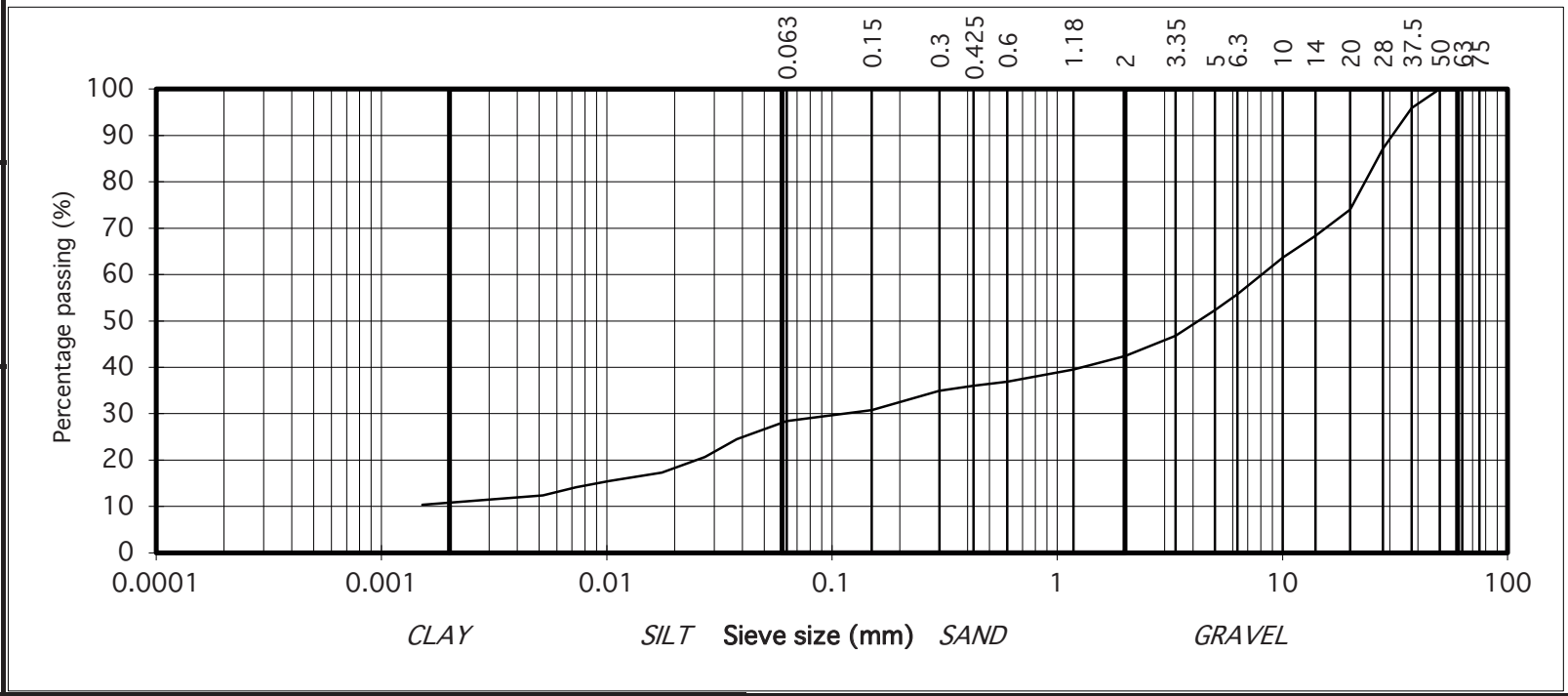

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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	73	
50	68	GRAVEL
37.5	68	
28	63	
20	61	
14	56	
10	52	
6.3	48	
5	46	
3.35	43	
2	41	
1.18	39	SAND
0.6	37	
0.425	37	
0.3	35	
0.15	31	
0.063	28	SILT/CLAY
0.037	25	
0.027	22	
0.017	19	
0.010	17	
0.007	13	
0.005	12	
0.002	10	

Contract No. 23415 Report No. R124912
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP06
Sample No.* AA159735 Lab. Sample No. A21/3398
Sample Type: B
Depth* (m) 1.60 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Brown slightly sandy, gravelly, CLAY with many cobbles

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
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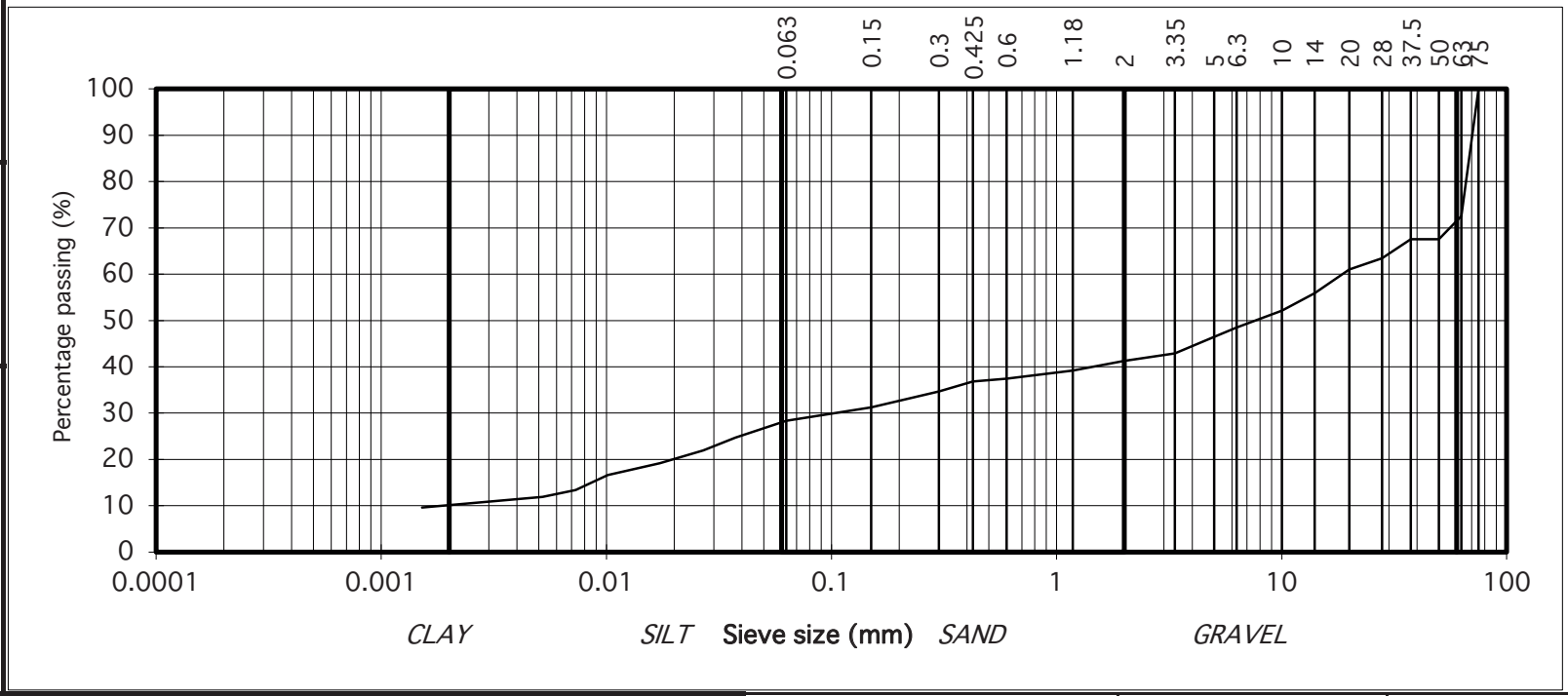

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Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Determination of Thermal Conductivity of Soil by Thermal Needle Probe

Report No. **R123623**

Contract No. 23415

Contract Name: Sub Station Site Grangecastle

Client: Ramboll

Sample No. 159729

Location TP02 0.5m

Soil description Brown sandy gravelly SILT/CLAY

Preparation <8mm material remoulded at as received water content

Date Tested: 08/07/2021

Test No.	Thermal Conductivity K (W/m.k)	Thermal Resistivity R (m K/W)
1	1.1812	0.8466
2	0.9028	1.1077
3	1.0554	0.9475
4	0.9860	1.0142
5	1.1528	0.8674
Average	1.0556	0.9567

Bulk density (Mg/m3)	1.66
Dry density (Mg/m3)	1.44
Water Content (%)	14.9
Porosity	0.46
Particle density (assumed)	2.65

Notes: Water content measured in accordance with ISO 17892-1:2014. Bulk density measured by linear measurement. Porosity calculated (voids ratio/1+voids ratio). Thermal measurements undertake using a TEMPOS and TR-3 probe (manufactured by METER Group).

The result relates to the specimen tested as received
Opinions and interpretations are outside the scope of accreditation.

Persons authorised to approve report
J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Determination of Thermal Conductivity of Soil by Thermal Needle Probe

Report No. **R123624**

Contract No. 23415

Contract Name: Sub Station Site Grangecastle

Client: Ramboll

Sample No. 159751

Location TP03 2.3m

Soil description Brown and dark grey slightly sandy gravelly SILT/CLAY

Preparation <8mm material remoulded at as received water content

Date Tested: 08/07/2021

Test No.	Thermal Conductivity K (W/m.k)	Thermal Resistivity R (m K/W)
1	1.4219	0.7033
2	1.6206	0.6171
3	1.4728	0.6790
4	1.4778	0.6767
5	1.5796	0.6331
Average	1.5145	0.6618

Bulk density (Mg/m3)	1.89
Dry density (Mg/m3)	1.48
Water Content (%)	27.3
Porosity	0.44
Particle density (assumed)	2.65

Notes: Water content measured in accordance with ISO 17892-1:2014. Bulk density measured by linear measurement. Porosity calculated (voids ratio/1+voids ratio). Thermal measurements undertake using a TEMPOS and TR-3 probe (manufactured by METER Group).

The result relates to the specimen tested as received
Opinions and interpretations are outside the scope of accreditation.

Persons authorised to approve report
J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Materials Laboratory	Approved by	Date	Page
		12/07/21	1 of 1

IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Determination of Thermal Conductivity of Soil by Thermal Needle Probe

Report No. **R123625**

Contract No. 23415

Contract Name: Sub Station Site Grangecastle

Client: Ramboll

Sample No. 159734

Location TP06 1.6m

Soil description Brown slightly sandy slightly gravelly SILT/CLAY

Preparation <8mm material remoulded at as received water content

Date Tested: 08/07/2021

Test No.	Thermal Conductivity K (W/m.k)	Thermal Resistivity R (m K/W)
1	1.4874	0.6723
2	1.4295	0.6996
3	1.4828	0.6744
4	1.4611	0.6844
5	1.2452	0.8031
Average	1.4212	0.7068

Bulk density (Mg/m3)	1.94
Dry density (Mg/m3)	1.7
Water Content (%)	14.4
Porosity	0.36
Particle density (assumed)	2.65

Notes: Water content measured in accordance with ISO 17892-1:2014. Bulk density measured by linear measurement. Porosity calculated (voids ratio/1+voids ratio). Thermal measurements undertake using a TEMPOS and TR-3 probe (manufactured by METER Group).

The result relates to the specimen tested as received
Opinions and interpretations are outside the scope of accreditation.

Persons authorised to approve report
J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Materials Laboratory	Approved by	Date	Page
		12/07/21	1 of 1

Appendix 6

Chemical / Environmental Test Records – Soil

2183

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

Final Report

Report No.:	21-23005-1		
Initial Date of Issue:	13-Jul-2021		
Client	IGSL		
Client Address:	M7 Business Park Naas County Kildare Ireland		
Contact(s):	Darren Keogh		
Project	23415 Proposed Sub Station Site Grangecastle Dublin		
Quotation No.:	Q20-21693	**Date Received:**	05-Jul-2021
Order No.:		**Date Instructed:**	05-Jul-2021
No. of Samples:	6		
Turnaround (Wkdays):	7	**Results Due:**	13-Jul-2021
Date Approved:	13-Jul-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL				**Chemtest Job No.:**		21-23005	21-23005	21-23005
Quotation No.: Q20-21693				**Chemtest Sample ID.:**		1234405	1234406	1234408
Order No.:				Client Sample Ref.:		AA159748	AA159746	AA159732
				Sample Location:		TP03	TP04	TP06
				Sample Type:		SOIL	SOIL	SOIL
				Top Depth (m):		0.50	1.50	0.50
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
pH	U	1010	10:1		N/A	8.8	9.0	9.0
Ammonium	U	1220	10:1	mg/l	0.050	0.080	0.056	0.090
Ammonium	N	1220	10:1	mg/kg	0.10	1.1	0.86	1.4
Boron (Dissolved)	U	1455	10:1	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Benzo[j]fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010	< 0.010	< 0.010

Results - Soil

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL				**Chemtest Job No.:**	21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693				**Chemtest Sample ID.:**	1234404	1234405	1234406	1234407	1234408	1234409
Order No.:				Client Sample Ref.:	AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
				Sample Location:	TP01	TP03	TP04	TP05	TP06	TP06
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.40	0.50	1.50	0.50	0.50	1.60
				Asbestos Lab:		COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type	U	2192		N/A		-	-		-	
Asbestos Identification	U	2192		N/A		No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	
Moisture	N	2030	%	0.020	15	13	4.0	11	6.9	9.7
pH (2.5:1)	N	2010		4.0	[A] 8.8			[A] 9.0		[A] 9.2
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		[A] < 0.40	[A] < 0.40		[A] < 0.40	
Magnesium (Water Soluble)	N	2120	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Total Sulphur	U	2175	%	0.010	[A] 0.023			[A] 0.026		[A] 0.046
Sulphur (Elemental)	U	2180	mg/kg	1.0		[A] < 1.0	[A] 3.3		[A] 1.7	
Chloride (Water Soluble)	U	2220	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010			< 0.010		< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50		[A] < 0.50	[A] < 0.50		[A] < 0.50	
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50		[A] 5.3	[A] 5.3		[A] 5.4	
Ammonium (Water Soluble)	U	2220	g/l	0.01	< 0.01			< 0.01		< 0.01
Sulphate (Acid Soluble)	U	2430	%	0.010	[A] 0.048	[A] 0.036	[A] 0.072	[A] 0.063	[A] 0.064	[A] 0.060
Arsenic	U	2450	mg/kg	1.0		14	18		16	
Barium	U	2450	mg/kg	10		33	15		28	
Cadmium	U	2450	mg/kg	0.10		0.97	0.71		0.81	
Chromium	U	2450	mg/kg	1.0		9.3	5.7		7.0	
Molybdenum	U	2450	mg/kg	2.0		3.4	< 2.0		< 2.0	
Antimony	N	2450	mg/kg	2.0		< 2.0	< 2.0		< 2.0	
Copper	U	2450	mg/kg	0.50		16	11		17	
Mercury	U	2450	mg/kg	0.10		< 0.10	< 0.10		< 0.10	
Nickel	U	2450	mg/kg	0.50		28	25		22	
Lead	U	2450	mg/kg	0.50		10	4.0		7.0	
Selenium	U	2450	mg/kg	0.20		< 0.20	< 0.20		0.20	
Zinc	U	2450	mg/kg	0.50		29	28		21	
Chromium (Trivalent)	N	2490	mg/kg	1.0		9.3	5.7		7.0	
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50		< 0.50	
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10		< 10	< 10		< 10	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	

Results - Soil

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL			**Chemtest Job No.:**		21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693			**Chemtest Sample ID.:**		1234404	1234405	1234406	1234407	1234408	1234409
Order No.:			Client Sample Ref.:		AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
			Sample Location:		TP01	TP03	TP04	TP05	TP06	TP06
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.40	0.50	1.50	0.50	0.50	1.60
			Asbestos Lab:			COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		[A] < 5.0	[A] < 5.0		[A] < 5.0	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		[A] < 5.0	[A] < 5.0		[A] < 5.0	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		[A] < 10	[A] < 10		[A] < 10	
Benzene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Toluene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Ethylbenzene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
m & p-Xylene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
o-Xylene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Naphthalene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Acenaphthylene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Acenaphthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Fluorene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Phenanthrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Anthracene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Fluoranthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] 0.082		[A] < 0.010	
Pyrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] 0.11		[A] < 0.010	
Benzo[a]anthracene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Chrysene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[b]fluoranthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[k]fluoranthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[a]pyrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Coronene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Total Of 17 PAH's	N	2800	mg/kg	0.20		[A] < 0.20	[A] < 0.20		[A] < 0.20	
PCB 28	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 52	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	

Results - Soil

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL					**Chemtest Job No.:**	21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693					**Chemtest Sample ID.:**	1234404	1234405	1234406	1234407	1234408	1234409
Order No.:					Client Sample Ref.:	AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
					Sample Location:	TP01	TP03	TP04	TP05	TP06	TP06
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.40	0.50	1.50	0.50	0.50	1.60
					Asbestos Lab:		COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
PCB 90+101	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 118	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 153	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 138	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 180	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
Total Phenols	U	2920	mg/kg	0.10		< 0.10	< 0.10		< 0.10	

Results - Single Stage WAC

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	21-23005						
Chemtest Sample ID:	1234405						
Sample Ref:	AA159748						
Sample ID:							
Sample Location:	TP03						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.26	3	5	6
Loss On Ignition	2610	U	%	2.8	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 congeners)	2815	N	mg/kg	[A] < 0.0010	1	--	--
TPH Total WAC	2670	U	mg/kg	[A] < 10	500	--	--
Total Of 17 PAH's	2800	N	mg/kg	[A] < 0.20	100	--	--
pH	2010	U		9.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.031	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0002	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0006	0.0060	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.010	0.10	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.43	4.3	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	62	620	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	3.1	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

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

Results - Single Stage WAC

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	21-23005						
Chemtest Sample ID:	1234406						
Sample Ref:	AA159746						
Sample ID:							
Sample Location:	TP04						
Top Depth(m):	1.50						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 1.8	3	5	6
Loss On Ignition	2610	U	%	3.0	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 congeners)	2815	N	mg/kg	[A] < 0.0010	1	--	--
TPH Total WAC	2670	U	mg/kg	[A] < 10	500	--	--
Total Of 17 PAH's	2800	N	mg/kg	[A] < 0.20	100	--	--
pH	2010	U		9.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.027	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0002	0.0023	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0010	0.0098	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.011	0.11	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.35	3.5	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	53	530	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	4.0

Waste Acceptance Criteria

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

Results - Single Stage WAC

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	21-23005						
Chemtest Sample ID:	1234408						
Sample Ref:	AA159732						
Sample ID:							
Sample Location:	TP06						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.69	3	5	6
Loss On Ignition	2610	U	%	2.7	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 congeners)	2815	N	mg/kg	[A] < 0.0010	1	--	--
TPH Total WAC	2670	U	mg/kg	[A] < 10	500	--	--
Total Of 17 PAH's	2800	N	mg/kg	[A] < 0.20	100	--	--
pH	2010	U		9.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.014	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0002	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0009	0.0087	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0072	0.072	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.28	2.8	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	55	550	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.6	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	6.9

Waste Acceptance Criteria

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

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1234404	AA159737		TP01		A	Amber Glass 250ml
1234404	AA159737		TP01		A	Plastic Tub 500g
1234405	AA159748		TP03		A	Amber Glass 250ml
1234405	AA159748		TP03		A	Plastic Tub 500g
1234406	AA159746		TP04		A	Amber Glass 250ml
1234406	AA159746		TP04		A	Plastic Tub 500g
1234407	AA159741		TP05		A	Amber Glass 250ml
1234407	AA159741		TP05		A	Plastic Tub 500g
1234408	AA159732		TP06		A	Amber Glass 250ml
1234408	AA159732		TP06		A	Plastic Tub 500g
1234409	AA159734		TP06		A	Amber Glass 250ml
1234409	AA159734		TP06		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measurememrnt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.

Test Methods

SOP	Title	Parameters included	Method summary
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

Appendix 7

EN1744 Chemical Test Records – Upper Rockhead

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

IGSL
Unit F
M7 Business Park
Naas

Analytical Test Report: L21/02368/IGS/21-19643

Your Project Reference:	**23415 Grangecastle**	Samples Received on:	14/07/2021
Your Order Number:	19324	Testing Instruction Received:	14/07/2021
Report Issue Number:	1	Sample Tested:	14/07 to 26/07/2021
Samples Analysed:	1 aggregate sample	Report issued:	26/07/2021

Signed

Peter Swanston
Environmental Laboratory Manager
Nicholls Colton Group

Notes:

General

Please refer to Methodologies tab for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Samples were supplied by customer, results apply to the samples as received.

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Accreditation Key

UKAS = UKAS Accreditation, u = Unaccredited

Date of Issue 10/12/2020
Owned by Emily Blissett - Customer Services Supervisor
Authorised by James Gane - Commercial Manager
J:\Public\Projects\2021\L21\IGS - IGSL\L21-2368-IGS\[L21-02368-IGS - 21-19643.XLSX]Cover Sheet

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

L21/02368/IGS/21-19643

Project Reference - 23415 Grangecastle

Analytical Test Results - Aggregate Testing

NC Reference	**178672**
Client Sample Reference	A21/3392
Material	Aggregate
Source/Client Ref	TP2 @ 1.9
Sample Description	Brown crushed rock

	Units	**Accreditation**	
EN 1744 Determinations			
Total Sulphur content (as S)	(%)	UKAS	0.03
Acid soluble sulphate content (as SO_3)	(%)	UKAS	0.05
Acid soluble sulphate content (as SO_4)	(%)	u	0.06
Water soluble sulphate content (as SO_3)	(%)	UKAS	0.03
Water soluble sulphate content (as SO_3)	(mg/l)	u	127
Water soluble sulphate content (as SO_4)	(%)	u	0.03
Water soluble sulphate content (as SO_4)	(mg/l)	u	152

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

L21/02368/IGS/21-19643

Project Reference - 23415 Grangecastle

Analysis Methodologies and Notes

Determinant	Test method and notes
EN 1744 Total Sulphur	Testing was in accordance with BS EN 1744-1:2009 + A1:2012 clause 11.
EN 1744 Acid Soluble Sulphate	Testing was in accordance with BS EN 1744-1:2009 + A1:2012 clause 12.
EN 1744 Water Soluble Sulphate	Testing was in accordance with BS EN 1744-1:2009 + A1:2012 clause 10.

Appendix 8

Exploratory Hole Location Plan

Project Appollo (Substation)

Exploratory Hole Location Plan

Legend

- Dynamic Probe
- Plate Bearing Test
- Soakaway Test (to BRE365)
- Trial Pit

DP16
DP17
DP18
DP19
PT02
TP03
DP15
DP20
DP14
TP02
PT01
DP13
DP12A
DP12
TP01
PT03
DP11
DP06
SA01
DP08
DP07
TP04
DP09
DP10
TP05
PT04
TP06
PT05
DP05
DP04
DP03
DP02
DP01

N

50 m

Google Earth

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