IGSL Limited

O'Flynn Group Arup

Liffey Park Technology Campus

Factual Ground Investigation Report

Report No. 22150

February 2020



Report



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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 have been carried out by IGSL 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 14688-1:2018 Geotechnical Investigation and Testing Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2018 Geotechnical Investigation and Testing Identification and Classification of Soil, Part 2: Classification Principles
- EN ISO 14689-1:2018 Geotechnical Investigation and Testing Identification & Classification of Rock, Part 1: Identification & Description

## Reporting

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

# **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+A1:2011. 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 variations 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.

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# **Rotary Drilling Procedures**

Rotary drilling methods are used to recover very heavily over-consolidated glacial till and bedrock samples in line with Section 3.5 of IS EN 1997-2:2007 and IS EN ISO 22475-1. Open hole drilling methods (odex or symmetrix) are utilized to advance the drillholes through granular dominant superficial deposits, with coring in hard ('cemented') fine grained or cohesive glacial deposits and bedrock.

## In-Situ Testing

Standard penetration tests are conducted by IGSL 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+A1:2011 and the Energy Ratio ( $E_r$ ) 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+A1:2011).

## Groundwater

The depth of entry of any influx of groundwater is recorded during the course of boring or drilling 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.

## 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 1997-2:2007 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.

Where appropriate Class 1 thin wall undisturbed tube samples (UT100) are obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2007 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 1997-2:2007) is shown in Table A.

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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	19.
5.5.6	Particle Size Analysis	N/S	
5.5.7	Consistency Limits	4	So O
5.5.8	Density Index	N/S	5
5.5.9	Soil Dispersivity	N/S	
5.5.10	Frost Susceptibility	N/S	0
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.

## **Engineering Logging**

Soil and rock identification is based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2018 and IS EN ISO 14689-1:2018. Rock weathering classification conforms to IS EN ISO 14689-1:2018 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2018. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

## **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 company policy to discard soil samples one month after submission of our final report.

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# 1.0 Introduction and Objectives

It is proposed to construct a technology campus at Liffey Park, which is located approximately two kilometres south-west of Leixlip in Co. Kildare.

The site location is as shown on Figure 1 with the approximate site outline shown in red.

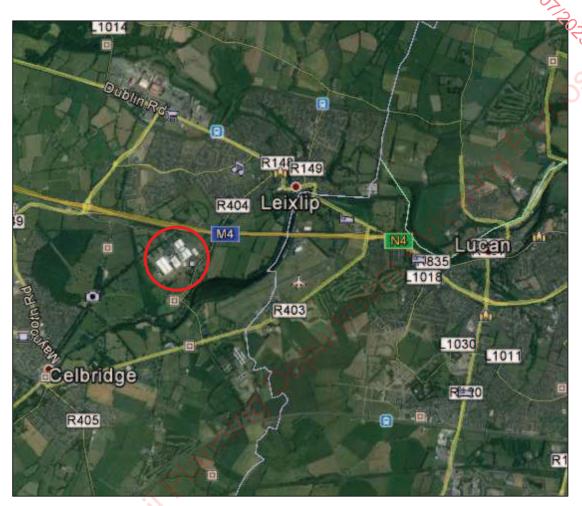


Figure 1 – Site Location (Base Mapping – Google Earth Professional)

IGSL Limited were appointed by Arup to conduct a ground investigation at the site. The objectives of the investigation were to ascertain the ground and groundwater conditions, and to produce a report which will assist in the geotechnical design of the new campus.

Fieldworks were undertaken during October to December 2019.

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## 2.0 Scope of Works

The programme of exploratory works included the following:

- 7 no. cable percussive boreholes
- 4 no. rotary coreholes
- 15 no. mechanically excavated trial pits
- 4 no. infiltration tests
- 8 no. plate bearing tests
- 5 no. dynamic cone penetrometer (DCP) tests
- Groundwater monitoring at borehole locations
- A programme of geotechnical and chemical laboratory testing

The exploratory hole locations are shown on the as-surveyed aerial plan in Appendix 11 of this report.

## 2.1 Cable Percussive Boreholes

Boreholes were constructed in seven locations (BH03, 05, 07, 08, 09, 10 and 11), using a Dando 2000 rig equipped with 200 mm casing.

A hand dug inspection pit was excavated at each location prior to commencing drilling works and the locations were scanned for services using a CAT detection tool.

During the course of boring, in-situ Standard Penetration Tests (SPT) were undertaken at regular intervals. Samples were also recovered to assist in the visual description of recovered soils and to provide specimens for laboratory testing.

Instances of groundwater ingress were recorded and monitored for a further 20 minutes to permit the water to rise.

The borehole records are presented in Appendix 1 of this report.

## 2.2 Rotary Coreholes

Geobor "S" rotary coring was undertaken in four locations (RC01, 04, 06 and 12) in order to recover high quality core samples of the overburden soils. Casing was installed to facilitate removal of the upper soils. Once installed, Geobor coring of overburden and the underlying bedrock was undertaken using a polymer gel flush to maximise recovery.

Cores of 102 mm diameter were recovered and placed securely in wooden storage boxes. The recovered core was inspected by a qualified engineering geologist and logged in detail at IGSL's laboratory. Records detailing the Total Core Recovery (TCR), Solid Core Recovery (SCR) and Rock Quality Designation (RQD) were produced. Core records also include a fracture log (spacing between successive core joints measured from the cores).

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All cores were labelled and photographed for inclusion in the report. Photographs are presented digitally for ease of browsing and to permit close examination at high resolution.

Standpipes were installed in all coreholes to permit long term groundwater monitoring 78/07/2023

The corehole records and photographs are included in Appendix 2 of this report.

## 2.3 **Trial Pits**

Trial pitting was performed at fifteen locations (TP01 to TP11 and TPSA01 to TPS04) using a wheeled JCB 8 tonne tracked excavator. The trial pits were logged and sampled by an IGSL geotechnical engineer in accordance with BS 5930 (1999+A2:2010).

Pit sidewalls were assessed in terms of their short term stability and any instances of groundwater ingress were recorded. Bulk soil samples were also recovered to provide specimens for laboratory testing.

The samples were placed in heavy duty polyethene bags and sealed before being transported to Naas for laboratory testing. For this project, environmental samples were obtained and placed in appropriate containers.

The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site geotechnical engineer. The trial pit logs in Appendix 3 include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls.

### 2.4 **Infiltration Tests**

Infiltration tests were performed in four trial pits (TPSA01 to TPSA04) to assess the suitability of the sub-soils for the dispersion of run-off water through a soakaway system. Testing was performed in accordance with BRE Digest 365 'Soakaway Design'.

To obtain a measure of the infiltration rate of the sub-soils, water is poured into the test pit, and records taken of the fall in water level against time. This procedure is repeated twice more to ensure saturation of the sub-soils. The infiltration rate is the volume of water dispersed per unit 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 cycle.

The infiltration test records are included in Appendix 4.

## 2.5 **Plate Bearing Tests**

Plate bearing tests were performed in eight trial pits to obtain an indication of the CBR value of the sub-soils. Each test is annotated with respect to the relevant pit (PT01, 03, PT04, PT05, PT06, PT07, PT09 and PT10). A 450 mm diameter plate was used, and tests were performed at depths of between 0.4 and 0.95 metres below existing ground level (m BGL).

Tests were performed in accordance with BS 1377 Part 9: 1990. "In-situ Tests". The incremental loading test (4.1.6.4.2) was used. The load was applied in five approximately equal increments. To measure recovery the load was removed in three increments. A second phase of loading and

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Calculation of Modulus of Sub-grade Reaction (k) and CBR values are in accordance with NRA HD25-26/10 Volume7: Pavement Design and Maintenance. K<sub>762</sub> is defined as the applied pressure divided by the displacement (1.25 mm) using a plate 762 mm in diameter. For other plate sizes, the Modulus of Sub-grade Reaction is determined using the appropriate conversion factor as shown on Figure 3.5 of HD25-26/1.

The plate bearing test records are presented in Appendix 5.

## 2.6 TRL Dynamic Cone Penetrometer

DCP testing was undertaken in five locations (PC01, 02, 03, 04A/B and PC05) in order to estimate the in-situ CBR values for the subgrade soils. Tests commenced on existing pavement construction (hardcore) at ground surface level.

The Dynamic Cone Penetrometer (DCP) apparatus was designed by TRL for the rapid in-situ measurement of the structural properties of existing road pavements. However, the apparatus is also widely used to obtain measurements of the CBR values of the sub-grade, particularly in granular soils which are too coarse for laboratory testing where the maximum particle size is limited to 20mm. The DCP-CBR relationship stipulated in TRRL Road Note 8 is based on publications by Kleyn and Van Heerden.

The results of each test are presented in terms of the DCP blow-count (mm/blow) against depth of penetration and the depth range for calculation purposes is generally related to a specific soil layer.

The DCP test records are included in Appendix 6. It is noted that the most onerous (weakest) depth range has generally been selected for the purpose of CBR calculation. However, alternative depth ranges can be selected and the equivalent CBR calculated using the equation provided on the record.

# 2.7 Groundwater Monitoring

Standpipes were installed in all coreholes in order to permit long term monitoring of groundwater levels. The site was re-visited post-fieldwork and readings taken of the groundwater levels in the standpipes. The standpipe installation details and groundwater monitoring results are presented in Appendix 7 and summarised on Table 1.

Location	Hole	Top of	Base of	Groundwater	Groundwater
	Depth	Response	Response	Level	Level
	(m BGL)	Zone (m BGL)	Zone (m BGL)	(12/11/2019)	(25/11/2019)
RC01	15.0	2.0	3.5	0.50	0.49
RC04	14.7	1.5	4.0	0.51	0.54
RC06	15.1	1.0	3.0	1.53	1.59
RC12	15.0	2.0	4.0	2.38	2.49

Table 1 – Summary of Groundwater Monitoring

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## 2.8 **As-Built Survey**

On completion of fieldworks, the location (x,y) and elevation (z) of each exploratory ocation was determined by detailed survey using GPS Realtime Kinetic survey instrument.

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# 3.0 Laboratory Testing

Laboratory test results are segregated and presented as follows:

- Appendix 8 Geotechnical Laboratory Testing
- Appendix 9 Rock Laboratory Testing
- Appendix 10 Chemical and Environmental Testing

## Geotechnical testing of soils comprised:

- Moisture Content
- Atterberg Limits (Plasticity Index)
- Particle Size Distribution (PSD)
- California Bearing Ratio (CBR)
- Moisture Condition Value (MCV)
- Dry Density / Moisture Content Relationship (Compaction Test)
- Triaxial Compression Test (Undrained Shear Strength)
- One dimensional Consolidation Test

# Rock testing comprised:

- Moisture Content
- Atterberg Limits (Plasticity Index)
- Point Load Index
- Uniaxial Compression Test
- Sulphur / Sulphate Test Suite in accordance with EN 1744 (Nicholls Colton)

## Chemical and environmental tests included:

- Sulphate and pH Analysis of soils (Chemtest Laboratory)
- Arup Test Suite A
- Arup Test Suite E
   Collinia

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## 4.0 References

- 1. BS 5930:2015 Code of Practice for Site Investigations; British Standards Institute
- 2. Manual of Contract Documents for Highway Works, Volume 5, Section 3, Ground Investigation, Part 4: Specification
- 3. BRE Special Digest 1: 2005 Concrete in aggressive ground
- EN 1997-3; Eurocode 7: Geotechnical Design Part 3: Design assisted by field testing; 1997
- 5. BS1377; British Standard Methods of Test for Soils for Civil Engineering Purposes; British Standards Institute;1990.
- 6. BRE Digest 365, September 1991, British Research Establishment
- 7. Manual of Contract Documents for Road Works, Volume 1: Specification for Road Works (March 2007)
- 8. Manual of Soil Laboratory Testing, Volume 3; K.H. Head
- 9. ISRM Suggested Methods for Determining Point Load Strength
- 10. ISRM Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials
- 11. TRL Report 447- Sulfate specification for structural backfills
- 12. CIRIA C580
- 13. Specification for Roadworks Series 600 Specification for Roadworks

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BOREHOLE NO. **BH03** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **RIG TYPE DANDO 2000 CO-ORDINATES** 698,560.26 E DATE COMMENCED 18/11/2019 **BOREHOLE DIAMETER (mm)** 734,688.40 N DATE COMPLETED 18/11/2019 **GROUND LEVEL (m AOD)** 54.24 **BOREHOLE DEPTH (m)** 3.00 SPT HAMMER REF. NO. CLIENT **BORED BY** W.BUTLER O' Flynn Group **ENGINEER ENERGY RATIO (%) PROCESSED BY** Arup 3.C Samples Standpipe Details (H  $\mathbb{E}$ Elevation Ref. Number Sample Type Recovery Field Test? Legend Depth ( Depth ( Description Depth (m) Results 0 TOPSOIL <u>,\l, 1,</u> 54.04 0.20 Soft brown sandy CLAY 53.04 1.20 N = 7(2, 3, 3, 2, 1, 1) Soft grey/brown sandy SILT/CLAY with some fine gravel 52.64 1.60 Soft to firm dark brown gravelly CLAY 52.24 2.00 N = 7Firm brown gravelly CLAY with some cobbles. (1, 0, 1, 1, 2, 3)51.74 2.50 Stiff black sandy gravelly CLAY with some cobbles. 9 51.24 3.00 N = 60/150 mm (30, 40, 10, 50) Obstruction End of Borehole at 3.00 m 4 5 6 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Water Rise Time Casing Sealed Time Comments Comments From (m) To (m) (h) Strike Depth То (min) 2.9 3 IGSL.GDT 29/11/19 1 No water strike **GROUNDWATER PROGRESS** Hole Casing Depth to Water **INSTALLATION DETAILS** Comments Date 22150.GPJ Depth Depth Tip Depth RZ Top RZ Base Туре 00 REMARKS CAT scanned location and hand dug inspection pit carried out . Sample Legend BH Sample
P - Undisturbed Piston Sample GSL mple (Jar + Vial + Tub) W - Water Sample



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BOREHOLE NO. **BH05** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **RIG TYPE DANDO 2000 CO-ORDINATES** 699,017.14 E DATE COMMENCED 06/11/2019 734,408.45 N **BOREHOLE DIAMETER (mm)** 200 DATE COMPLETED 06/11/2019 **GROUND LEVEL (m AOD)** 48.98 **BOREHOLE DEPTH (m)** 2.90 CLIENT O' Flynn Group SPT HAMMER REF. NO. **BORED BY** W.BUTLER **ENERGY RATIO (%) ENGINEER PROCESSED BY** 7F.C Arup Samples Standpipe Details (E  $\mathbb{E}$ Elevation Ref. Number Recovery Field Test Sample Depth ( Legend Description Depth ( Depth (m) Results . 0 TOPSOIL 71 14. 1/11 48.78 0.20 Soft to firm grey/brown sandy SILT/CLAY with some fine gravel AA120053 В 1.00 (2, 1, 2, 2, 3, 3) <u>-xa</u> 47.38 1.60 Very stiff brown gravelly CLAY with occasional 0 cobbles 46.98 2.00 N = 50/150 mm A12005 2.00 Very stiff to hard black sandy gravelly CLAY with (4, 4, 16, 34) some cobbles <u>.</u> 46.08 N = 50/75 mm AA120055 В 2.90 Obstruction (25, 50) End of Borehole at 2.90 m 4 5 6 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Water Time Casing Sealed Rise Time To (m) Comments Comments From (m) Strike Depth То (min) (h) 2.5 2.6 29/11/19 0.75 No water strike 2.9 28 2 .GDT IGSL. **GROUNDWATER PROGRESS** Hole Casing Depth to Water **INSTALLATION DETAILS** Comments 22150.GPJ Date Depth Depth Tip Depth RZ Top RZ Base Туре LOG REMARKS CAT scanned location and hand dug inspection pit carried out . Sample Legend BH B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Samo Sample
P - Undisturbed Piston Sample IGSL Sample (Jar + Vial + Tub) W - Water Sample



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BOREHOLE NO. **BH07** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **RIG TYPE DANDO 2000 CO-ORDINATES** 698,891.78 E DATE COMMENCED 11/11/2019 **BOREHOLE DIAMETER (mm)** 200 734,856.93 N DATE COMPLETED 11/11/2019 **GROUND LEVEL (m AOD)** 49.87 **BOREHOLE DEPTH (m)** 1.70 SPT HAMMER REF. NO. CLIENT **BORED BY** W.BUTLER O' Flynn Group **ENGINEER PROCESSED BY F.C** Arup **ENERGY RATIO (%)** Samples Standpipe Details (H  $\mathbb{E}$ Elevation Ref. Number Recovery Sample Field Test? Legend Depth ( Depth ( Description Depth (m) Results MADE GROUND consisting of reinforced 49.67 0.20 CONCRETE MADE GROUND (Comprised of angular stone fill) N = 50/225 mm (13, 15, 19, 17, 14) AA120062 В 1.00 48.67 1.20 Dense angular COBBLES and boulders 0 AA120063 В 1.50 0 48.17 1.70 N = 50/75 mm (25, 50) Obstruction End of Borehole at 1.70 m \_2 3 4 5 6 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Water Rise Time Casing Sealed Time To (m) Comments Comments From (m) (h) Strike Depth То (min) 1.4 1.7 0.5 IGSL.GDT 29/11/19 1.3 No water strike 1.5 15 **GROUNDWATER PROGRESS** Hole Casing Depth to Water **INSTALLATION DETAILS** Date Comments 22150.GPJ Depth Depth Tip Depth RZ Top RZ Base Туре 00 REMARKS CAT scanned location and hand dug inspection pit carried out . Sample Legend BH Sample
P - Undisturbed Piston Sample IGSL Sample (Jar + Vial + Tub) W - Water Sample



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BOREHOLE NO. **BH08** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **RIG TYPE DANDO 2000 CO-ORDINATES** 699,021.02 E DATE COMMENCED 13/11/2019 **BOREHOLE DIAMETER (mm)** 734,847.88 N DATE COMPLETED 13/11/2019 **GROUND LEVEL (m AOD)** 49.56 **BOREHOLE DEPTH (m)** 3.90 SPT HAMMER REF. NO. CLIENT **BORED BY** W.BUTLER O' Flynn Group **ENGINEER ENERGY RATIO (%) PROCESSED BY** Arup 3.C Samples Standpipe Details (H  $\mathbb{E}$ Elevation Ref. Number Recovery Sample Field Test? Legend Depth ( Description Depth ( Depth (m) Results MADE GROUND consisting of reinforced 49.36 0.20 CONCRETE MADE GROUND (Comprised of angular stone fill) AA120067 B 0.50 AA120068 В 1.00 48.36 Firm brown gravelly CLAY with some cobbles. 0 0 47.76 1.80 Stiff black sandy gravelly CLAY with some cobbles. N = 19 AA120069 2.00 \_2 (2, 3, 4, 5, 4, 6)N = 34 (4, 10, 7, 3, 3, 21) AA120070 В 3.00 3 45.66 3.90 AA120071 В 3.90 Obstruction (39, 50) End of Borehole at 3.90 m 5 6 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Water Rise Time Casing Sealed Time Comments Comments From (m) To (m) Strike Depth То (min) (h) 3.9 3.9 .GDT 29/11/19 1 No water strike IGSL. **GROUNDWATER PROGRESS** Hole Casing Depth to Water **INSTALLATION DETAILS** Date Comments 22150.GPJ Depth Depth Tip Depth RZ Top RZ Base Туре LOG REMARKS CAT scanned location and hand dug inspection pit carried out . Sample Legend BH Sample
P - Undisturbed Piston Sample IGSL sample (Jar + Vial + Tub) W - Water Sample



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BOREHOLE NO. **BH09** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **RIG TYPE DANDO 2000 CO-ORDINATES** 698,993.19 E DATE COMMENCED 12/11/2019 BOREHOLE DIAMETER (mm) 200 734,894.47 N DATE COMPLETED 12/11/2019 **GROUND LEVEL (m AOD)** 48.37 **BOREHOLE DEPTH (m)** 3.10 SPT HAMMER REF. NO. CLIENT **BORED BY** W.BUTLER O' Flynn Group **ENGINEER ENERGY RATIO (%) PROCESSED BY** 7F.C Arup Samples Standpipe Details (E  $\mathbb{E}$ Elevation Ref. Number Recovery Sample Field Test? Legend Depth ( Description Depth ( Depth (m) Results MADE GROUND consisting of reinforced 48.17 0.20 CONCRETE MADE GROUND (Comprised of angular stone fill) N = 41 (7, 8, 10, 10, 9, 12) AA120064 В 1.00 47.17 Very stiff black very sandy gravelly CLAY with occasional angular cobbles 46.57 1.80 Dense slightly clayey gravelly angular COBBLES -N = 51 AA120065 2.00 \_2 (10, 9, 9, 12, 15, 15) N = 70/150 mm (14, 14, 20, 50) 45.27 3.10 AA120066 В 3.00 Obstruction End of Borehole at 3.10 m 4 5 6 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Water Rise Time Casing Sealed Time Comments Comments From (m) To (m) Strike Depth То (min) (h) 2.9 3.1 .GDT 29/11/19 2 No water strike IGSL. **GROUNDWATER PROGRESS** Hole Casing Depth to Water **INSTALLATION DETAILS** Comments 22150.GPJ Date Depth Depth Tip Depth RZ Top RZ Base Туре 12-11-19 End of drilling 3.10 1.30 Nil LOG REMARKS CAT scanned location and hand dug inspection pit carried out . Sample Legend BH GSL P - Undisturbed Piston Sample sample (Jar + Vial + Tub) W - Water Sample



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BOREHOLE NO. **BH10** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **RIG TYPE DANDO 2000 CO-ORDINATES** 698,953.96 E DATE COMMENCED 15/11/2019 **BOREHOLE DIAMETER (mm)** 734,939.44 N DATE COMPLETED 15/11/2019 **GROUND LEVEL (m AOD)** 48.36 **BOREHOLE DEPTH (m)** 1.40 SPT HAMMER REF. NO. CLIENT **BORED BY** W.BUTLER O' Flynn Group **ENGINEER ENERGY RATIO (%) PROCESSED BY** Arup 3.C Samples Standpipe Details (H  $\mathbb{E}$ Elevation Ref. Number Recovery Sample Field Test? Depth ( Legend Description Depth ( Depth (m) Results MADE GROUND consisting of reinforced 48.16 0.20 CONCRETE MADE GROUND (Comprised of angular stone fill) 0.50 AA120072 B AA120073 В 0.90 47.16 1.20 Dense angular COBBLES and boulders (30)46.96 1.40 AA120074 1.40 Obstruction End of Borehole at 1.40 m 2 3 4 5 6 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Water Rise Time Casing Sealed Time To (m) Comments Comments From (m) Strike Depth То (min) (h) 1.4 1.4 IGSL.GDT 29/11/19 1 No water strike **GROUNDWATER PROGRESS** Hole Casing Depth to Water **INSTALLATION DETAILS** 22150.GPJ Date Comments Depth Depth Tip Depth RZ Top RZ Base Туре 00 REMARKS CAT scanned location and hand dug inspection pit carried out . Sample Legend BH Sample
P - Undisturbed Piston Sample sample (Jar + Vial + Tub) W - Water Sample



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COI	NTRA	СТ	Liffey	Park T	echnology Ca	mpus								BOREHO	DLE NO	<b>D</b> .	BH11 Sheet 1 of 1	
	ORDI		TES VEL (m /	735,	080.79 E 011.84 N 49.69	BOF		E DIAM E DEPT		(mm	) 2	0ANDO 2 00 .50	2000	DATE CO			08/11/2019 09/11/2019	
	ENT SINEE	R	O' Fly Arup	ynn Gro	up			MER REI						BORED I		Y O	W.BUTLER	
Depth (m)				De	scription			Legend	: : : :	Elevation	Depth (m)	Ref. Number	Sample S Type	Depth (m)	Recovery	F	rield Test Results	Standpipe Details
_ 0	MAD	to v		) (Comp	orised of angul	,	× × × × × × × × × × × × × × × × × × ×		48.49	9	1.20	AA120059	В	1.00	<u>(</u> )	2	105	
	Hard	oles		l/black ç	ravelly CLAY	with angular			46.19		3.50	AA120060		3.00			N = 28 2, 5, 6, 7, 7, 8) N = 50/150 mm (8, 9, 34, 16)	
5	End	of E	Borehole	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Juncil	Slauli												
				RING/CH Time	ISELLING			Wate	er C	Casin	na   S	Sealed	Ris	e Ti	me		STRIKE DET	AILS
Fron	n (m)	To	o (m)	(h)	Comments			Strik		<u>Deptl</u>		At	To		nin)	No w	rater strike	
	<b>TALL</b> Date		ON DETA		p RZ Base	Туре		Dat	e	Ho De		Casing Depth	De V	epth to Vater	<b>GF</b> Comme		OWATER PRO	GRESS
REM	MARK	S	CAT scar	nned loo	ation and han	nd dug inspec	tion pi	t carried	out .	[	D - Small [ B - Bulk Di	e Legen Disturbed (tub) sturbed Bulk Disturbe ronmental Sar	)	+ Vial + Tub)	Sam P - U	ple	ed 100mm Diameter I Piston Sample	

# Pendix 2 Ary Corehole Records Ary Corehole Records Ary Corehole Records Ary Corehole Records Ary Corehole Records

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CONTR			iffey	Park Tech		Camp	ous					DAN	LHOLE ET	NO	RC01 Sheet 1 o	of 2
CO-ORE			(mOl	698,543 735,084 <b>D)</b>				RIG TYPE FLUSH			Knebel Air/Mist		E DRILLE E LOGGE		23/10/20 24/10/20	
CLIENT		Α	rup	Γ	Т			INCLINATION CORE DIA		m)	-90 102		LED BY		Peters 0 O'SI	
Downhole Depth (m) Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac Log (mn	eing g n)	Non-intact Zone	Legend			Descrip	tion			Depth (m)	Elevation Standpipe Details	SPT (N Value)
1								as returns SYMMETI as returns SYMMETI as returns	of firm TC RIX DRILL of stiff ligh RIX DRILL of stiff to	ING: No re- PSOIL ING: No re- at brown sili ING: No re- very stiff da occasional o	covery, ob ty gravelly covery, ob rk greyish	served by o	driller driller		55.67 54.87 53.97	
2 2.00	100	27	9			<u> </u>		cobbles. S fine to coa limestone. Stiff, very	Sand is fine arse of vari . Cobbles a dark browi	andy grave c. Gravel is ous litholog are subrour n slightly sa	angular to pies, predo ided of lim indy grave	subrounde minantely estone. Ily CLAY w	onal ed, ith	2.30	53.67	1
4.40	100	68	48			<u> </u>		subrounded predominated limestoned.  Very strond thinly lamid grey/black	ed, fine to cantely lime  g to medic inated whe c, fine-grain	Sand is fine coarse of vestone. Cob im strong, the fissile mands, LIMES gularly (eve	arious lithous lithous are su hickly to the udstone/sl	ologies, ubrounded ninly bedde nale), grey/ gillaceous	of d (to dark			
6.00	100	66	14			\ \(\delta\) \\		calci-siltite stylolites, moderatel (2.78-2.89 5.38-5.40 8.41-8.54 10.63-10.7 12.45-12.4	e limestone pyrite pres ly weathere om, 4.04-4. m, 6.13-6.1 m, 9.52-9.5 71m, 11.58 47m & 12.6	e with subor ent), slightled at fissile 07m, 4.51- 15m, 6.64-6 53m, 9.72-9 8-11.59m, 1	dinate MU y weathers mudstone 4.56m, 4.6 5.66m, 7.50 9.73m, 10.4 2.18-12.19	JDSTONE, ed where in /shale zone 3-4.64m, 0-7.56m, 42-10.46m,	local tact, es at			0 0
7.50	100	99	75		y Ci			Discontinu locally rou tight to loc	uities are n igh, planar cally open, m), locally ined (1-15r	res through nedium to co to locally colocally clay slightly iron mm thick). I	losely spa urviplanar /gravel-fille -oxide sta	. Apertures ed (at ined, locall	are /			0
9.00	100	92	81	Ŀ	-	590.0000	00000000	locally 70							0 0 0	0 0 0
REMAR	100 KS	90	59		C	520			I					WΔ	TER STRIK	o o o
Hole cas		0.00-2	2.00r	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Со	omments lo water stri	
NSTAL	I ATI	ט ואכ	ETA	ıs					Date	Hole	Casing		0 Com	GR0 ment	OUNDWATI	ER DETAIL
Date 24-10-1	т		epth	RZ Top 2.00	RZ Base 3.50	9	Tyr 50mn		Date	Depth	Depth	Water	Com	meni		



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CO	NTR/	ACT	Li	ffey I	Park Tech	hnology	Camp	ous					DAIL.	LHOLE	NO	RC:	<b>01</b> et 2 of	2
		DINA		(mOI	698,543 735,084				RIG TYPE			Knebel	DATE	DRILL	()	23/1	0/2019 0/2019	)
CLI	ENT			rup		00.01			FLUSH INCLINATION CORE DIAI	, ,,	m)	Air/Mist -90 102	1	LED BY		0	eterser O'She	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lo (mi	cing og m)	Non-intact Zone	Legend			Descrip				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- - - - 11	10.50 12.00	100	78	59	F				thinly lami grey/black limestone calci-siltite stylolites, moderatel (2.78-2.89 5.38-5.40r 8.41-8.54r	nated whe , fine-grain grading re limestone pyrite pres y weathere m, 4.04-4. n, 6.13-6.1 n, 9.52-9.5	re fissile muned, LIMES gularly (event) with suborent), slightlyed at fissile 07m, 4.51-415m, 6.64-653m, 9.72-9	hickly to thir udstone/sha TONE (argil ery approx 0 dinate MUD y weathered mudstone/s 4.56m, 4.63 .66m, 7.50- .73m, 10.42 2.18-12.19r	ale), grey/ollaceous 0.10-1.10m 0STONE, I d where interpreted where interpreted with the shale zone 1-4.64m, 17.56m, 12-10.46m,	lark  i) into ocal act,	Q'	<i>S</i> .		
13	13.50	100	89	64	F				12.45-12.4 Many incip Discontinu locally rou tight to loc 3.10-3.25r calcite-vei	17m & 12.6 bient fractu lities are m gh, planar ally open, m), locally s ned (1-15r	61-12.66m). Ires through nedium to cl to locally cl locally clay, slightly iron- mm thick). E		ed, smooth Apertures a d (at ed, locally	are				
- 14	15.00	100	88	69	F				locally 70°	Osic	e at 15.00 n	1			15.00	40.97		
17 18		Ó	71,	7.	CO	Jn <sup>či</sup>	R	Ó										
	//ARI									10/-4		0		Time	WA <sup>-</sup>	TER ST	TRIKE	DETAILS
Hol	e cas	sed C	).00-2	2.00n	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)		ommen lo wate		erecorded
											<u> </u>				GR	OUND	VATER	DETAILS
										Doto	Hole	Casing	Depth to	Com				
	TALI Date				RZ Top			Тур		Date	Depth	Depth	Depth to Water	Com	nment	.5		



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	ଓଟ	L/														2	215	0
СО	NTR/	ACT	Li	ffey I	Park Tec	hnology	Camp	ous					· · · · · · · · · · · · · · · · · · ·	<b>L</b> HOLE	NO	RC	04	
CO	-ORE	NΑ.	TES		698,70	6 07 F							SHE	<del>~~</del>		She	et 1 of	2
				, 0.	734,33	1.35 N			RIG TYPE			Knebel		E DRILL E LOGG			0/2019	
	OUN IENT		VEL	(mOI	D)	52.58			FLUSH	ON (dea)		Air/Mist		LED BY	<u> </u>	7	eterser	
	GINE		A	rup					CORE DIA	,	m)	-90 102	I	GED BY		Ur /	O'She	
(E	n)									-							(2)	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lo (m	cing og m)	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 1											NG: No rec			driller	<b>Q</b>			
2	1.80	100	0	0					as returns gravelly C	of stiff to v LAY with o	NG: No rec ery stiff dar ccasional c	k greyish b obbles	rown silty	/		50.78		
3	2.90								cobbles. S fine to coa limestone.	Sand is fine arse of vari . Cobbles a	andy grave . Gravel is ous litholog are subroun	angular to s ies, predon ded of lime	subrounde ninantely estone.	ed,	2.90	49.68		
4		81	29	18					gravel of li	imestone v	ROCK hori vith gravelly m strong, th	clay			4.00	48.58	0 0	
	4.50				E				thinly lami grey/black limestone	nated whe , fine-grain grading re	re fissile muled, LIMES gularly (eve	idstone/sha ΓΟΝΕ (argi ry approx (	ale), grey/ llaceous ).10-1.10r	dark n) into				
5	6.00	100	97	75					moderatel (5.76-5.82 9.47-9.49r 13.62-13.6	y weathere m, 7.33-7 m, 9.82-9.8 64m & 13.7	ent), slightly ed at fissile 36m, 7.46-7 5m, 11.62- 74-13.76m). res through	mudstone/s 7.50m, 8.78 11.64m, 13	shale zon 3-8.84m,	es at				
7		100	82	67	F	Inci	510		Discontinu locally rou tight to loc iron-oxide	uities are m gh, planar ally open, stained, lo	nedium to cl to locally cu locally clay- cally calcite ery locally 7	osely spac Irviplanar. I smeared, l e-veined (1-	Apertures ocally slig	are htly				
8	7.50	100	83	75	C <sup>2</sup>		540										0 0	
9	9.00	9			E		/										0 0	
RF	MAR	100 KS	81	61											/v/v.	TEB 6.	O O	DETAILS
Hol	le cas		0.00-1	1.80n	n.					Water	Casing	Sealed	Rise	Time		mmen		DE I AILO
RE HO										Strike	Depth	At	То	(min)				e recorded
77 10											Шаја	Casina	Daniel 1				VATER	DETAILS
	Data					D7 Dag		Т	20	Date	Hole Depth	Casing Depth	Depth t Water	Com	ment	S		
29	<u>Date</u> -10-1		4.00		RZ Top 1.50	4.00	=	Typ 50mm										
<u> </u>																		



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	GS	L)			(	EUI	ECF	INIC	CAL CO	RE LOG	RECO	ΚD				2	215	0
СО	NTR	ACT	L	iffey I	Park Tecl	hnology	Camp	us					DRII SHE	LHOLE	NO	RC(	<b>04</b> et 2 of	2
co	-ORE	OINA	TES		698,700 734,33									E DRILL	ED.		0/2019	
GR	OUN	D LE	VEL	(mOI		52.58			RIG TYPE FLUSH			Knebel Air/Mist	DAT	E LOGG	ED)	25/1	0/2019	)
	IENT		^						INCLINATION			-90	I	LED BY		U /	eterser O'She	
	GINE	EK		rup					CORE DIA	WEIER (M	m)	102	LOG	GED B1		(1)	OSne	a
Downhole Depth (m)		T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lo (mi	cing og m)	Non-intact Zone	Legend			Descript				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10	10.50						( \ \ \ \ \ \	H	thinly lami	nated whe	m strong, thre fissile mu	idstone/sh	ale), grey/o	d (to dark	0	<i>O</i> .	0 0	
11	12.00	100	91	69					grey/black limestone calci-siltite stylolites, moderatel (5.76-5.82 9.47-9.49 13.62-13.6	s, fine-grain grading re e limestone pyrite presoly weathere 2m, 7.33-7. m, 9.82-9.8 64m & 13.7	ed, LIMES gularly (eve with subor- ent), slightly d at fissile 36m, 7.46-7 55m, 11.62- 74-13.76m). res through	FONE (arg ery approx ( dinate MUI weathered mudstone/ 7.50m, 8.78 11.64m, 13	illaceous 0.10-1.10n DSTONE, d where in shale zone 3-8.84m,	n) into local tact, es at				
13	13.10	100	97	83	F				locally rou tight to loc iron-oxide	igh, planar cally open, stained, lo	nedium to cl to locally cl locally clay- cally calcite ery locally 7	urviplanar. smeared, l -veined (1	Apertures ocally slig	are htly				
- 14	14.70	100	70	44	È		529.9999	99999999		Oec	dill		,		44.70	37.88		
16 16 18 19		٥	71,0	75	CO	nci	R	a	End	of Borehole	e at 14.70 m						-	
RE	MAR le cas		000	1 QOn	2					Water	Casing	Sealed	Rise	Time				DETAILS
RE Ho  INS	ie ca	ocu (	,.uu-							Strike	Depth	At	To	(min)	N		er strike	recorded
INS	STAL									Date	Hole Depth	Casing Depth	Depth to Water	Com	ment	S		
29	Date -10-1		Гір D 4.0		RZ Top 1.50	RZ Bas 4.00		Typ 50mn										
3																		



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CONTRACT   Liffey Park Technology Campus   CO-ORDINATES   698, 333.74   Fig. 174, 24.34   SO   CO-ORDINATES   698, 333.74   Fig. 174, 24.34   SO   CO-ORDINATES   698, 333.74   Fig. 174, 24.34   SO   CO-ORDINATES   699, 230.710, 2019   CO-ORDINATES   699, 2019   CO-ORDINATES	୍ରାପ୍ତ	3L/	4													2	215	J
GROUND LEVEL (mOD) 50.68  CLIENT ENGINEER Arup  CORE DIAMETER (mm) 102  Description  Fracture Spacing 1 of 2 of 2 of 2 of 3 of 3 of 3 of 3 of 3				iffey	Park Tec	hnology (	Camp	ous					` '<	/ _	NO			?
ENGINEER Arup  CORE DIAMETER (mm)  102  LOGGED BY  OSHER  Practure  Spacing Log (mn)  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of reinforced SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of clayey gravel [Diller notes Terma Membrane at 1.10m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of clayey gravel [Diller notes Terma Membrane at 1.10m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of gravel (Clause And Terma Membrane at 1.10m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of clayey gravel [Diller notes Terma Membrane at 1.10m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of gravel (Clause And Terma Membrane at 1.10m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of clayey gravel [Diller notes Terma Membrane at 1.10m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of clayey gravel [Diller notes Terma Membrane at 1.10m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of clayey gravel [Diller notes Terma Membrane at 1.10m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of clayey gravel [Diller notes Terma Membrane at 1.10m  To very storage to medium strong, bickly to thinly bedded to thinly laminated where fisteller mudstone/shale), greydark gravely lock fine to coarse at 1.00m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of clayey gravel [Diller notes Terma Membrane at 1.10m  To very storage to medium strong, bickly to thinly bedded to thinly laminated where fisteller mudstone/shale), greydark gravely lock fine to coarse at 1.00m  SymMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of claye				(mO	734,82	1.43 N												
SYMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of reinforced concrete as returns of MADE GROUND consisting of gravel (Clause SyMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of gravel (Clause SyMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of player gravel Driller notes ferram Membrane at 1:0m.  SYMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of player gravel Driller notes ferram Membrane at 1:0m.  SYMMETRIX DRILLING: No recovery, observed by driller as returns of driller years of the property of			A	Arup		T				, ,,	m)							1
as returns of MADE GROUND consisting of reinforced concrete SYMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of gravel (Clause) 11,80 and material) SYMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND consisting of clayery gravel (Diller notes Terram Membrane at 1.10m as returns of MADE GROUND consisting of clayery gravel Driller notes Terram Membrane at 1.10m as returns of MADE GROUND consisting of clayery gravel Driller notes Terram Membrane at 1.10m as returns of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravel Driller notes of MADE GROUND consisting of clayery gravely CLAY. Sand is fine. Gravel is angular to subrounded, fine to coarse of Various Manual and Clayery gravely CLAY. Sand is fine. Gravel is angular to subrounded, fine to coarse of Various Manual and Clayery gravely CLAY. Sand is fine. Gravely clayery gravely CLAY. Sand is gravely clayery gravely CLAY. Sand is gravely clayery gravely CLAY. Sand is gravely clayery grav	Core Run Depth (m)	T.C.R.%	S.C.R.%	O.D	Spa Lo (m	cing og m)	Non-intact Zone	Legend			Descrip	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
SYMMETRIX DRILLING. No recovery, observed by driller as returns of MADE GROUND consisting of clayey gravel price of the control of the contro		20							as returns concrete SYMMETF as returns	of MADE (	GROUND o	consisting of	of reinforce	ed driller	0.70	49.98		
Stiff, very dark brown slightly sandy gravelly CLAY. Sand is fine. Gravel is angular to subrounded, fine to coarse of various lithologies, predominantely limestone.  Very strong to medium strong, thickly to thinly bedded (to thinly laminated where fissile mudstone/shale), grey/dark grey/black, fine-grained, LIMESTONE (argillaceous limestone grading regularly (every approx 0.10-1.20m) into calcis-little limestone with subordinate MUDSTONE, local stylolites, pyrite present), slightly weathered where intact, moderately weathered at fissile mudstone/shale zones at (3.25-3.20m, 5.07-5.09m, 6.26-6.31m, 7.47-6.4m, 8.18-8.46m, 9.08-9.09m, 12.68-12.73m & 14.58-14.59m). Many inciplent fractures throughout.  Discontinuities are medium to closely spaced, smooth to locally rough, planar to locally curviplanar. Apertures are ignored to locally rough, planar to locally curviplanar. Apertures are ignored to locally rough, planar to locally curviplanar. Apertures are ignored to locally countries are medium to closely spaced, smooth to locally rough, planar to locally calves presented, locally slightly iron-oxide stained, locally calves presented, locally for more presented in the presented of the presented or more presented in the presented or more presented in the presented or presented in the present in the presented i	1.8	60							SYMMETE as returns Driller note SYMMETE as returns	RIX DRILLI of MADE ( es Terram RIX DRILLI of stiff to v	GROUND of Membrane NG: No red	consisting of at 1.10m covery, obs rk greyish b	of clayey g	ravel driller				
grey/black, fine-grained, LIMESTONE (arglillaceous limestone grading regularly (every approx 0.10-1.20m) into calci-sititle limestone grading regularly (every approx 0.10-1.20m) into calci-sititle limestone with subordinate MUDSTONE, local sylpidites, portion of the calcinose o			28	28	F L	4	<u> </u>		Stiff, very fine. Grave various lith Very stron	dark browr el is angula nologies, p g to mediu	n slightly sa ar to subrou redominant m strong, t	ndy gravell inded, fine ely limesto nickly to thi	to coarse ne. nly bedde	Sand is of				
8. 8.8.46m, 9.08-9.09m, 12.08-12.73m & 14.58-14.59m).  Many inciplent fractures throughout.  Discontinuities are medium to closely spaced, smooth to locally rough, planar to locally curviplanar. Apertures are tight to locally open, locally clay-smeared, locally slightly iron-oxide stained, locally calcite-veined (1-40mm thick).  Dips are 10°-20° & very locally 70°.  REMARKS  Hole cased 0.00-1.80m.  Water Casing Sealed Rise Time Comments  No water strike Depth At To (min)  No water strike Incomposition of the comments of			51	35	E				grey/black limestone calci-siltite stylolites,   moderatel	, fine-grain grading re e limestone pyrite prese y weathere	ed, LIMES gularly (eve with subor ent), slightly ed at fissile	TONE (argi ery approx ( dinate MUI / weathered mudstone/s	illaceous 0.10-1.20r DSTONE, d where ir shale zone	n) into local itact,				
7 7.30 8 8.90 100 100 100 100  REMARKS  WATER STRIKE DE Strike Casing Sealed Rise Time (min)  No water strike r	6.0		62	62	E	5	540		8.18-8.46r Many incip Discontinu locally rou tight to loc iron-oxide	m, 9.08-9.0 pient fractu uities are m gh, planar ally open, stained, lo	9m, 12.69- res through redium to co to locally colocally clay- cally calcite	12.73m & nout. losely spacurviplanar. -smeared, I	14.58-14.5 ed, smoot Apertures ocally slig	h to are htly			0 0	
8 8 90 100 74 74 8 8 8.90 100 100 100 100 100 100 100 100 100 1	7.3		50	45					Dips are 1	U -2U & V	ery locally i	70 .						
REMARKS Hole cased 0.00-1.80m.  Water Strike Depth At To Comments No water strike In GROUNDWATER DE			74	74	<u> </u>													
Hole cased 0.00-1.80m.  Water Strike Depth At To Comments  No water strike recommendation of the comments of t	3)		100	100		ļe	609.9999	99999999							18/8			VETAU 0
No water strike r			0.00-	1.80r	n.													ı⊑ ı AILS
											,				N	lo wate	r strike	recorde
Hole   Casing   Double to											Hole	Casing	Donth t	0			/ATER	DETAIL
INSTALLATION DETAILS     Date     Hole Depth     Casing Depth to Water     Depth Water     Comments						R7 Base	2	Tvr	ne	Date	1		Water	Com	ment	S		
30-10-19 3.00 1.00 3.00 50mm SP																		



REPORT NUMBER

Very strong to medium strong, thickly to thinly bedded (to thinly laminated where fissale mudstone/shale), grey/daw.  The string of the strong		50															
				iffey	Park Technolog	y Cam	pus					· · · · · · · · · · · · · · · · · · ·	1.	NO			2
CO-	-ORE	INA	ΓES					RIG TVDE			Knahal		/	<b>(</b>			
GR	OUN	D LE	VEL	(mOl	<b>D)</b> 50.6	8						DAT	E LOGG	<u>ED).</u>	30/1	0/2019	9
			^							1							
		EK		Tup			Т	CORE DIA	WEIER (M	m)	102	LOG	GED DI			OSne	a
	Core Run Depth (m	T.C.R.%	S.C.R.%	R.Q	Spacing Log (mm)	FS Non-intact Zone	Legend			·				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
	10 50						H	thinly lami	nated whe	re fissile m	udstone/sh	nale), grey/	d (to ′dark	0	<b>D</b> .		
	10.00							grey/black limestone	t, fine-grair grading re	ned, LIMES gularly (ev	STONE (arg ery approx	gillaceous 0.10-1.20ı	m) into			0	
11								stylolites,	pyrite pres	ent), slightl	y weathere	ed where ir	ntact,	9		0	
		100	73	68			H	moderatel (3.25-3.26	y weathere 3m, 5.07-5.	ed at fissile 09m, 6.26-	mudstone, 6.31m, 7.4	/shale zon 7-7.64m,	es at			0	
						Δάλ		8.18-8.46	m, 9.08-9.0	09m, 12.69	-12.73m &	14.58-14.	59m).			*	
12	12.10						H	] ' '		Ü		ced, smoot	th to			"	
							#	locally rou	igh, planar	to locally o	urviplanar.	Apertures	are			0 0	
12		100	95	94				iron-oxide	stained, lo	cally calcit	e-veined (1	1-40mm th	ick).				
	13 50						臣	Dips ale I	5 20 CCV	ory locally	. o . (contil	.aouj				1-	
	. 0.00															0 0	
14						690	H	1								0 0	
		100	87	78			丘									0 0	
	_						<b> </b>							45		0 0	
15	15.10							End	of Borehole	e at 15.10 r	n			15.10	<u>J</u> 35.58		
16						Q	O										
17					CONUC	) '											
18				S													
19		0	<i>.</i>														
					I		1	I	100					WA	TER S	TRIKE	DETAILS
Hol	e cas	sed 0	.00-	1.80r	n.									Co	ommen	ts	
														١	No wate	er strike	e recorde
										11-1-	0	F ::-		GR	OUND\	NATER	R DETAIL
									Date			Depth t Water	Com	ment	ts		
	<u>Date</u> -10-1		ip D 3.0		1.00 RZ Ba		Ty 50mn										



REPORT NUMBER

	ଓ୍ର	ட														2	215	00
СО	NTR	ACT	Li	ffey l	Park Tec	hnology	Camp	us					· · · · · · · · · · · · · · · · · · ·	<b>L</b> HOLE	NO	RC		
СО	-ORE	DINA.	ΓES		699,25								SHE	ET E DRILL	ED.		et 1 of 0/2019	
GR	OUN	D LE	VEL	(mOI	735,02 <b>)</b> )	5.34 N 49.45			RIG TYPE FLUSH			Knebel		E LOGG			0/2019	
	ENT				,				INCLINATION	ON (deg)		Air/Mist -90	DRII	LED BY	, ,		eterser	
EN	GINE	ER	A	rup					CORE DIAI	METER (m	m)	102	LOG	GED BY	<u>′</u>	~ (a)	O'She	a
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m <sub>0</sub> <sup>250</sup>	cing og m)	Non-intact Zone	Legend			Descrip	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
1									as returns SYMMETF	of firm silt RIX DRILL of firm to s	NG: No rec y TOPSOIL NG: No rec stiff brown s	covery, obs	erved by	driller 🚄	0.40	49.05		
2								0'  @  '    -	as returns	of stiff dar	NG: No red k greyish b					47.65		
	<ul><li>2.50</li><li>3.00</li></ul>	90	36	20			<u> </u>		\as returns	RIX DRILL of weak w	les NG: No red eathered R m strong, tl	OCK	•	/	2.50	47.05 46.95		
4	4.50	100	54	0	F		, ,		thinly lami grey/black limestone calci-siltite stylolites, moderatel (3.76-3.83 8.85-8.8m	nated when , fine-grain grading re e limestone pyrite prest y weathere m, 4.64-4. , 9.67-9.70	re fissile moded, LIMES gularly (every with suboremt), slightly at fissile 68m, 5.03-8 m & 14.07-	udstone/sh TONE (arg ery approx dinate MUI / weathere mudstone/ 5.03m, 5.1 14.14m).	ale), grey/ illaceous 0.10-1.20i DSTONE, d where ir shale zon	dark  n) into local itact,				
5	6.00	100	29	29			/ i x /		Discontinu locally rou tight to loc iron-oxide	lities are m gh, planar ally open, stained, lo	res through edium to cl to locally cl locally clay- cally calcite ery locally 7	osely spac urviplanar. smeared, e-veined (1	Apertures locally slig	are htly				
7	7.50	100	75	68			790											
8	9.00	100	82	82	_		540											
6	)	100	47	47													0 0	
RE Ho	MAR le ca		0.00-2	2.50n	n.					Water	Casing	Sealed	Rise	Time				DETAILS
RE Hol	_ 541			.5011						Strike	Depth	At	То	(min)		ommen lo wate		e recorded
_											Hole	Casing	Donth 4	0			VATER	RDETAILS
INS	TAL Date		ON D		LS RZ Top	R7 Rase	9	Тур	ne	Date	Depth	Depth	Depth t Water	Com	nment	s		
23	-10-1		4.00		2.00	4.00		50mm										
<u> </u>																		



REPORT NUMBER

GEOTECHNICAL CORE LOG RECORD												22150							
CONTRACT Liffey Park Technology Campus										DANA,HOLE N					NO	RC12 Sheet 2 of 2			
GROUND LEVEL (mOD) 49.45 FLUSH									RIG TYPE FLUSH INCLINATION	ON (deg)		Knebel Air/Mist -90	DATE DRILLED BY			21/10/2019 23/10/2019 Petersen			
										METER (m	m)	102	LOG	GED BY	<u>′</u>	(a)	O'She	a	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac Lo (mr 0 250	cing og m)	Non-intact Zone	Legend			Descrip				Depth (m)	Elevation	Standpipe Details	SPT (N Value)	
- 10	10.50 12.00	100	79	51	Ĺ				Very strong to medium strong, thickly to thinly bedded (to thinly laminated where fissile mudstone/shale), grey/dark grey/black, fine-grained, LIMESTONE (argillaceous limestone grading regularly (every approx 0.10-1.20m) into calci-siltite limestone with subordinate MUDSTONE, local stylolites, pyrite present), slightly weathered where intact, moderately weathered at fissile mudstone/shale zones at (3.76-3.83m, 4.64-4.68m, 5.03-5.03m, 5.11-5.25m, 8.85-8.8m, 9.67-9.70m & 14.07-14.14m). Many incipient fractures throughout.							<b>S</b> .			
- 13	13.50	100	98	98					locally rou tight to loc iron-oxide	Discontinuities are medium to closely spaced, smooth to coally rough, planar to locally curviplanar. Apertures are ight to locally open, locally clay-smeared, locally slightly ron-oxide stained, locally calcite-veined (1-15mm thick). Dips are 10°-20° & very locally 70°. (continued)									
- 14 - 14 15	15.00	100	65	65					End	of Borehole	e at 15.00 n	1			15.00	34.45			
16 - 17 - 17 - 18 19 - 19		Ó	7.0		Coi	Jn či	Q	(S)											
REI	WAR e cas		).00-2	2.50n	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)		TER SI		DETAILS	
REMARKS															N	lo wate	er strike	recorded	
M											Hole	Casing	Denth to	)   -		GROUNDWATER DETAILS			
INSTALLATION DETAILS										Date	Depth	Depth	Depth to Water	Com	nment	S			
23	-10-1	19	4.0	U	2.00	4.00		50mn	า 5۲										

# RC01 Box 1 of 9 - 2.00-3.10m



# RC01 Box 2 of 9 - 3.10-4.40m



# RC01 Box 3 of 9 - 4.40-6.00m



# RC01 Box 4 of 9 - 6.00-7.50m



# RC01 Box 5 of 9 - 7.50-9.00m



# RC01 Box 6 of 9 - 9.00-10.50m



# RC01 Box 7 of 9 - 10.50-12.00m



# RC01 Box 8 of 9 – 12.00-13.50m



RC01 Box 9 of 9 - 13.50-15.00m



# RC04 Box 1 of 9 - 1.80-2.90m



# RC04 Box 2 of 9 - 2.90-4.50m



# RC04 Box 3 of 9 - 4.50-6.00m



## RC04 Box 4 of 9 - 6.00-7.50m



## RC04 Box 5 of 9 - 7.50-9.00m



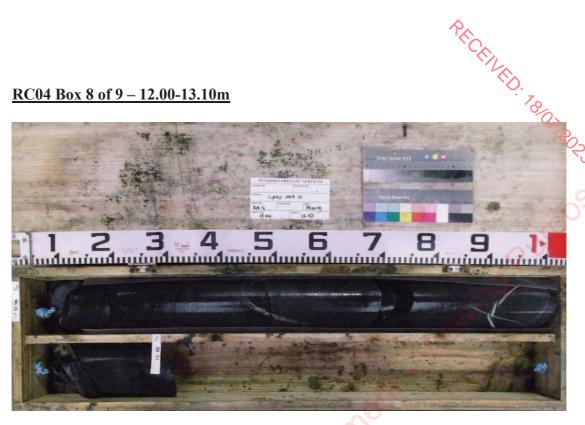
## RC04 Box 6 of 9 - 9.00-10.50m



## RC04 Box 7 of 9 - 10.50-12.00m



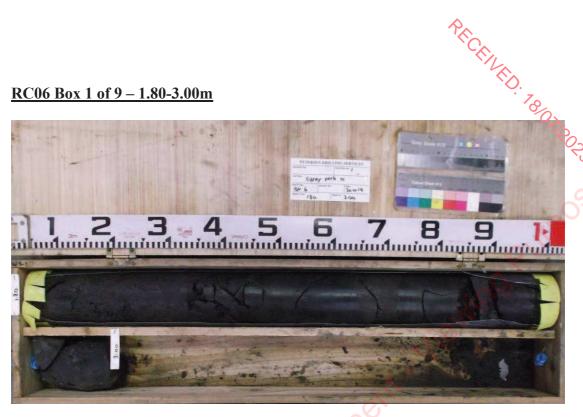
RC04 Box 8 of 9 - 12.00-13.10m



# RC04 Box 9 of 9 - 13.10-14.70m



## RC06 Box 1 of 9 - 1.80-3.00m



## RC06 Box 2 of 9 - 3.00-4.50m



## RC06 Box 3 of 9 - 4.50-6.00m



### RC06 Box 4 of 9 - 6.00-7.30m



## RC06 Box 5 of 9 - 7.30-8.90m



## RC06 Box 6 of 9 - 8.90-10.50m



<u>RC06 Box 7 of 9 – 10.50-12.10m</u>



## RC06 Box 8 of 9 - 12.10-13.50m



RC06 Box 9 of 9 - 13.50-15.10m



## RC12 Box 1 of 8 - 1.80-3.00m



# RC12 Box 2 of 8 - 4.50-6.00m



# RC12 Box 3 of 8 - 6.00-7.50m



## RC12 Box 4 of 8 - 7.50-9.00m



## RC12 Box 5 of 8 - 9.00-10.50m



## RC12 Box 6 of 8 - 10.50-12.00m



## RC12 Box 7 of 8 - 12.00-13.50m



# RC12 Box 8 of 8 – 13.50-15.00m



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. rial Pit Records Report No. 22150 16 | Page



REPORT NUMBER

22150

CON	TRACT	Liffey Park Technology Ca	mpus					TRIM, P	IT NO.	TP0		
			CO-ORDINAT	ES	698.86	32.77 E		DATE ST	ADTED		et 1 of 1 1/2019	
LOGGED BY Victoria Lowe				735,057.67 N				DATE CO	OMPLETE	<b>ED</b> 07/1	1/2019	
CLIEI ENGI		O' Flynn Group Arup	GROUND LE	GROUND LEVEL (m) 50.83					EXCAVATION JCB 8T METHOD			
									Samples	120	کے	eter
		Geotechnical Descr	intion				ê e				Vane Test (KPa)	Hand Penetrometer
		Geoleci ilicai Desci	ριιοπ	pue	Ę.	Elevation	Water Strike	eld		£ (	Test	d Pene
				Legend	Depth (m)	Elev	Wate	Sample Ref	Туре	Depth	Vane	Hano
0.0		ROUND: TARMACADAM ROUND comprised of medi	um dense black		0.10	50.73			Q	<i>O.</i> .		
	sandy cla	yey GRAVEL. Sand is med ar to subrounded, fine to m	ium to fine. Gravel is									
	MADE GI	ROUND comprised of medi	um dense dark grey		0.40	50.43		lin.				
	\ subangul	RAVEL. Sand is fine to med ar, fine to med	ium. Gravel is		0.55	50.28	N.	AA123646	В	0.50		
	Geomem Firm brov	vn mottled grev sandy grave	elly CLAY with a high									
		ontent. Sand is fine to medit ar, fine to medium. Cobble ar				Ä						
1.0	Geomem				. <	(O)		AA123647	В	1.10		
			II. 01 AV	- · · · · ·	1.30	49.53			_			
	with a me	mottled black slightly sand edium cobble content and a with occasional very large b	medium boulder		1.50	49.33	\$	AA123648	В	1.40		
1	Sand is fi coarse. C	ne to medium. Gravel is su cobbles are rounded to and	bangular, fine to		1.50	49.55	(Rapid)					
		to subrounded. ial Pit at 1.50m										
2.0			18/1									
		hity Council										
3.0		Ex.										
3.0												
0												
	ndwater Co inflow at 1.											
Stabi Jnsta	l <b>lity</b> able at 1.4r	mbal										
Gene	eral Remari	ks										



REPORT NUMBER

22150

TRIAL PIT NO. TP02 CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 698,897.79 E DATE STARTED 31/10/2019 **LOGGED BY** Victoria Lowe 734,973.03 N DATE COMPLETED 31/10/2019 GROUND LEVEL (m) 50.03 **EXCAVATION** JCB 8T CLIENT O' Flynn Group METHOD **ENGINEER** Arup Hand Penetrometer (KPa) Samples /ane Test (KPa) Nater Strike Geotechnical Description Elevation Sample Ref Legend Depth (m) Depth TOPSOIL: Brown slightly sandy clay with occasional roots and rootlets. 1/ 1/1/ 1 AA11862 0.15 Env 0.30 49.73 MADE GROUND comprised of medium dense black 0.40 49.63 sandy clayey GRAVEL. Sand is medium to fine. Gravel is \subangular to subrounded, fine to medium. 0.55 49.48 Firm to stiff dark brown mottled grey slightly sandy gravelly CLAY with a low cobble content and occasional boulders. Sand is fine to medium. Gravel is subrounded 0.70 AA118622 В to subangular, fine to coarse. Cobbles are subrounded to AA118623 0.70 subangular. Boulders are rounded to subrounded. Stiff black slightly sandy gravelly CLAY with a high cobble and medium boulder content. Sand is fine to coarse. 1.0 Gravel is subrounded to subangular, fine to coarse. Cobbles are subrounded to subangular. Boulders are rounded to subrounded. 1.70 48.33 End of Trial Pit at 1.70m AA118624 В 1.70 AA118625 1.70 2.0 3.0 **Groundwater Conditions** 25/11/19 Dry

22150.GPJ IGSL.GDT

IGSL TP LOG

Stability Stable

General Remarks



REPORT NUMBER

22150

TRIM, PIT NO. **TP03** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 698.715.38 E DATE STARTED 01/11/2019 **LOGGED BY** Sean Cunningham 734,959.85 N DATE COMPLETED 01/11/2019 GROUND LEVEL (m) 52.93 **EXCAVATION** JCB 8T CLIENT O' Flynn Group **METHOD ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa Water Strike Geotechnical Description Elevation Depth (m) Depth Type MADE GROUND: TARMACADAM 0.10 52.83 MADE GROUND comprised of a compact light grey clayey sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to subrounded, fine to medium. (Binding 0.25 AA108753 В 0.20 52.68 MADE GROUND comprised of medium dense black sandy clayey GRAVEL. Sand is medium to fine. Gravel is AA108754 В 0.40 0.50 52.43 subangular to subrounded, fine to medium. 0-0 0 MADE GROUND comprised of coarse subrounded to 0 ص AA108755 0.70 В rounded clayey GRAVEL. 0.85 52.08 Firm to stiff greyish brown slightly sandy very gravelly CLAY with a high cobble and a medium boulder content 1.0 and occasional large boulders. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse. Cobbles are subrounded to subangular. Boulders are rounded to subrounded. Liner grid AA108756 В 1.50 2.0 AA108757 2.30 В 2.50 50.43 End of Trial Pit at 2.50m 3.0 **Groundwater Conditions** Dry

Stability

Slightly unstable in made ground.

General Remarks

TP LOG 22150.GPJ IGSL.GDT 25/11/19

IGSL



REPORT NUMBER

22150

TRIM, PIT NO. **TP04** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 698,808.80 E DATE STARTED 07/11/2019 **LOGGED BY** Victoria Lowe 734,863.89 N DATE COMPLETED 07/11/2019 GROUND LEVEL (m) 51.56 **EXCAVATION** JCB 8T CLIENT O' Flynn Group **METHOD ENGINEER** Arup Hand Penetrometer (KPa) Samples /ane Test (KPa Nater Strike Geotechnical Description Elevation Depth (m) Depth Type MADE GROUND: TARMACADAM 0.10 51.46 MADE GROUND comprised of medium dense black sandy clayey GRAVEL. Sand is medium to fine. Gravel is subangular to subrounded, fine to medium. 0.20 AA123642 В 0.30 51.26 Firm brown mottled grey sandy gravelly CLAY with a high cobble and a low boulder content. Sand is fine to medium. Gravel is subangular, fine to medium. Cobble is subrounded to subangular. Boulders are rounded to subrounded. 0.70 A123643 В Geomembrane 0.90 50.66 Firm grey mottled black slightly sandy very gravelly CLAY with a medium cobble content and a medium boulder 1.0 content. Sand is fine to medium. Gravel is subangular, fine to coarse. Cobbles are rounded to angular. Boulders are rounded to subrounded. AA123644 В 1.20 1.60 49.96 Stiff black sandy very gravelly CLAY with a high cobble and medium boulder content. Sand is fine to medium. ō AA123645 В 1.70 Gravel is subangular, fine to coarse. Cobbles are rounded 1.80 49.76 to angular. Boulders are rounded to subrounded. End of Trial Pit at 1.80m 2.0 3.0 **Groundwater Conditions** Dry

Stability

Slightly unstable to 0.3m. Stable below

General Remarks



REPORT NUMBER

22150

TRIAL PIT NO. **TP05** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 698,522.70 E DATE STARTED 04/11/2019 **LOGGED BY** Sean Cunningham 734,945.92 N DATE COMPLETED 04/11/2019 GROUND LEVEL (m) 55.97 EXCAVATION JCB 8T O' Flynn Group **CLIENT** METHOD **ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa) Water Strike Geotechnical Description Elevation Legend Depth (m) Depth TOPSOIL: Brown slightly sandy clay with occasional roots and rootlets. 11 11/1 1 0.25 55.72 SUBSOIL: Brown sandy gravelly CLAY. ō 0.60 55.37 Firm to stiff brownish grey sandy very gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to medium. 1.0 AA116285 В 1.10 1.70 54.27 Firm to stiff brownish grey sandy very gravelly CLAY with medium. Sand is fine to coarse. Gravel is subangular to subrounded, fine to medium. 2.0 4A116286 2.20 2.60 53.37 End of Trial Pit at 2.60m 3.0 **Groundwater Conditions** Groundwater at 2.1mbgl

Stability

Slightly unstable

**General Remarks** 



REPORT NUMBER

22150

/IC	BL/									22	150	
CONT	TRACT	Liffey Park Technology Camp	us					TRIAL, P	IT NO.	TP0	<b>6</b> t 1 of 1	
LOGGED BY Victoria Lowe					698,561.49 E 734,805.08 N			DATE ST	TARTED OMPLETE	D 01/11/2019		
CLIENT O' Flynn Group ENGINEER Arup			GROUND LEV	GROUND LEVEL (m) 54.49				EXCAVATION JCB 8T METHOD				
									Samples			
		Geotechnical Descripti	on	Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Туре	Depth	Vane Test (KPa)	Hand Penetrometer
0.0	GRAVE	GROUND comprised of loose gr L. Sand is medium to fine. Grav ded, fine to medium.	rey sandy vel is subangular to		0.25	54.24		AA108758	В	0.20		
	MADE GROUND comprised of sandy GRAV fine to coarse. Gravel is subangular to subro coarse.		GRAVEL. Sand is subrounded, fine to		0.25	54.24		AA108759	В	0.40		I
	high cob subang	nt brown mottled grey sandy gra oble content. Sand is fine to me ular, fine to medium. Cobble is s	dium. Gravel is		0.55	53.94	j	(8)				İ
1.0	subangu	ılar.				an'i		AA103760 AA108760	B B	0.80 0.80		1
					115							1
	cobble a	stiff black slightly sandy gravelly and boulder content <350mm. S . Gravel is subangular, fine to n ded to subangular. Boulders ar ded.	Sand is fine to nedium. Cobble is		1.40	53.09		AA103761	В	1.70		
2.0	End of T	rial Pit at 1.90m	ins		1.90	52.59		AA108761	В	1.70		I
3.0	COL	inty Conucil by										
		Conditions ade ground								l		
<b>Stabi</b> Unsta	<b>lity</b> able in ma	ade ground. Stable below.										
Gene	ral Rema	rks										



REPORT NUMBER

22150

TRIAL PIT NO. **TP07** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 698,495.70 E DATE STARTED 04/11/2019 **LOGGED BY** Sean Cunningham 734,757.26 N DATE COMPLETED 04/11/2019 GROUND LEVEL (m) 54.55 **EXCAVATION** JCB 8T CLIENT O' Flynn Group METHOD **ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa) Water Strike Geotechnical Description Elevation Depth (m) Depth MADE GROUND comprised of medium dense black sandy clayey GRAVEL. Sand is medium to fine. Gravel is subangular to subrounded, fine to medium. AA116287 В 0.20 0.30 54.25 MADE GROUND comprised of subrounded to rounded 0.40 54.15 coarse GRAVEL AA116288 0.40 Firm brown mottled grey sandy gravelly CLAY with a high cobble and a low boulder content. Sand is fine to medium. Gravel is subangular, fine to medium. Cobble is subrounded to subangular. Boulders are rounded to subrounded. 1.0 AA116289 В 1.00 1.60 52.95 End of Trial Pit at 1.60m 2.0 3.0 **Groundwater Conditions** Dry

Stability

Unstable in made ground.

General Remarks



REPORT NUMBER

22150

TRIAL PIT NO. **TP08** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 698,657.13 E DATE STARTED 05/11/2019 **LOGGED BY** Sean Cunningham 734,528.32 N DATE COMPLETED 05/11/2019 GROUND LEVEL (m) 54.11 **EXCAVATION** JCB 8T CLIENT O' Flynn Group METHOD **ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa) Water Strike Geotechnical Description Elevation Legend Depth (m) Depth TOPSOIL: Brown slightly sandy clay with occasional roots 11 11/1 1 0.25 53.86 MADE GROUND comprised of brown sandy gravelly CLAY with occasional plastic and iron pipes, red bricks and plastic fragments. Sand is fine to coarse. Gravel is ר \*Q \* } } \*Q \* subangular to subrounded, fine to coarse. 0.50 A116273 В 1.0 AA116274 В 1.00 3 1.50 52.61 Firm to stiff brown mottled grey slightly sandy gravelly AA116275 1.50 CLAY with medium cobble and boulder content AA116276 В 1.50 -0 2.0 2.30 51.81 Firm to stiff brown mottled grey sandy gravelly CLAY with a high cobble and a low boulder content. Sand is fine to medium. Gravel is subangular, fine to medium. Cobble is AA116277 2.30 2.30 B B AA116278 \_\_\_\_\_\_ subrounded to subangular. Boulders are rounded to 2.60 51.51 subrounded. End of Trial Pit at 2.60m 3.0 **Groundwater Conditions** Medium seepage at 1.2m

Stability Stable

General Remarks



REPORT NUMBER

22150

TRIAL PIT NO. **TP09** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 698,835.69 E DATE STARTED 05/11/2019 **LOGGED BY** Victoria Lowe 734,298.25 N DATE COMPLETED 05/11/2019 GROUND LEVEL (m) 51.02 **EXCAVATION** JCB 8T CLIENT O' Flynn Group METHOD **ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa) Water Strike Geotechnical Description Elevation Legend Depth (m) Depth TOPSOIL: Brown slightly sandy clay with occasional roots and rootlets. 1/ 1/1/ 1 0.20 50.82 <u></u> SUBSOIL: Brown sandy gravelly CLAY. ō 0.45 50.57 Firm to stiff light brown mottled grey sandy gravelly CLAY with a medium cobble and a low boulder content. Sand is fine to medium. Gravel is subangular, fine to medium. Cobble is subrounded to subangular. Boulders are 0.70 4A116279 В rounded to subrounded. AA116280 0.70 1.0 (Rapid) 2.0 AA116281 AA116282 2.00 2.00 B B 2.40 48.62 Stiff dark grey to black sandy very gravelly CLAY with a medium cobble and boulder content. Sand is fine to \_\_\_\_\_ AA116283 2.50 В medium. Gravel is subangular, fine to medium. Cobble is AA116284 2.50 subrounded to subangular. Boulders are rounded to 2.70 48.32 subrounded. End of Trial Pit at 2.70m 3.0 **Groundwater Conditions** Medium seepage at 1.1m. Fast inflow at 1.3m

Stability

Unstable at 1.1m

**General Remarks** 



REPORT NUMBER

22150

CON	TRACT	Liffey Park Technology Campus						TRIM, P	11 NO.	TP1 Shee	et 1 of 1	
LOGGED BY Sean Cunningham			<b>CO-ORDINATES</b> 699,053.49 E 734,505.50 N				DATE STARTED         29/10/2019           DATE COMPLETED         29/10/2019					
CLIEI	NT NEER	O' Flynn Group Arup	GROUND LE	/EL (m)	48.58			EXCAVA METHOD		JCB	8T	
								Samples				eter
		Geotechnical Description	1	Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Туре	Depth	Vane Test (KPa	Hand Penetrometer
0.0	with a lo is subar subrour SUBSO Firm bro cobble o	GROUND comprised of dark grey ow cobble content. Sand is fine to ngular to subrounded, fine to coar ided to subrounded. IL: Light grey sandy CLAY. own mottled grey sandy gravelly Content and occasional boulders of nedium. Gravel is subangular, fine	coarse. Gravel se. Cobble is CLAY with low <450mm. Sand is		0.25 0.35 0.45	48.33 48.23 48.13		AA118605	B	0.20		
1.0	Cobble rounded Firm grecobble coarse. coarse.	is subrounded to subangular. Bot d to subrounded. eyish brown sandy gravelly CLAY content and occasional boulders. Gravel is subangular to subround Cobble is subrounded to subangular to subrounded.	with a medium Sand is fine to led, fine to		.×.	eri		AA118606	В	0.80		
	Gravel i Cobble	stiff brown sandy gravelly CLAY wand low boulder content. Sand is a subangular to subrounded, fine is subrounded to subangular. Boud to subrounded.	to coarse.		1.45	47.13		AA118607	В	1.60		
2.0	End of 1	Trial Pit at 2.70m	SIL.		2.70	45.88	(Seepage)	AA118608	В	2.60		
3.0	CO	Inity										
		Conditions Seepage at 2.6m.										
<b>Stabi</b> Sligh		ole to 0.25m. Stable after 0.25m										
Gene	eral Rema	rks										





REPORT NUMBER

22150

TRIM, PIT NO. **TP11** CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 699,023.51 E DATE STARTED 31/10/2019 **LOGGED BY** Sean Cunningham 734,676.58 N DATE COMPLETED 31/10/2019 GROUND LEVEL (m) 50.00 **EXCAVATION** JCB 8T CLIENT O' Flynn Group **METHOD ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa) Nater Strike Geotechnical Description Elevation Legend Depth (m) Depth TOPSOIL: Brown slightly sandy CLAY 11.11.1 0.25 49.75 MADE GROUND comprised of dark grey to black sandy gravelly CLAY with a low cobble content and boulder .ר content (<500mm) with occasional plastic wire, wood ×Q 5×, (Q,) (Q,) fragments, breeze blocks and large pieces of polystyrene. A118614 В 0.50 (Reworked black boulder CLAY) (Q × (Q × (Q × 1.0 AA118615 В 1.00 Q Reinforced concrete and polystyrene 8 1.50 48.50 MADE GROUND comprised of loose to medium dense AA118616 В 1.50 clayey very gravelly SAND with occasional polystyrene fragments. Sand is fine to coarse. Gravel is subangular to rounded, fine to medium. 2.0 2.10 47.90 Stiff black sandy gravelly CLAY with a medium cobble and boulders content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse. Cobble is subrounded to subangular. Boulders are rounded to subrounded. AA118617 2.60 В AA118618 2 60 3.0 3.20 46.80 End of Trial Pit at 3.20m AA118619 В 3.20 AA118620 В 3.20 **Groundwater Conditions** 

Dry

Stability

Very unstable at 1.1m

**General Remarks** 

Reinforced concrete and polystyrene at 1.3m

25/11/19 GPJ IGSL TP LOG IGSL



REPORT NUMBER

22150

TRIAL PIT NO. TPSA01 CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 698,516.40 E DATE STARTED 06/11/2019 **LOGGED BY** Sean Cunningham 735,156.12 N DATE COMPLETED 06/11/2019 GROUND LEVEL (m) **EXCAVATION** JCB 8T CLIENT O' Flynn Group METHOD **ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa Water Strike Geotechnical Description Elevation Legend Depth (m) Depth TOPSOIL: Brown slightly sandy CLAY with occasional roots and rootlets. 1/ 1/1/ 1 0.25 55.95 SUBSOIL: Brown sandy gravelly CLAY. 0.40 55.80 Firm brown mottled grey mottled black sandy gravelly CLAY with a medium cobble and a low boulder content. A128606 ō В 0.50 Sand is fine to medium. Gravel is subangular, fine to medium. Cobble is subrounded to subangular. Boulders are rounded to subrounded. 1.0 AA128607 В 1.00 1.20 55.00 Firm to stiff dark grey mottled black sandy gravelly CLAY with a medium cobble and a low boulder content. Sand is fine to medium. Gravel is subangular, fine to medium. Cobble is subrounded to subangular. Boulders are rounded to subrounded. AA128608 В 1.50 2.0 2.00 AA128609 В 2.45 53.75 End of Trial Pit at 2.45m 3.0 **Groundwater Conditions** Dry

Stability Stable

**General Remarks** 



REPORT NUMBER

22150

TRIAL PIT NO. TPSA02 CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 698,854.61 E DATE STARTED 30/10/2019 **LOGGED BY** Sean Cunningham 734,565.04 N DATE COMPLETED 30/10/2019 GROUND LEVEL (m) 51.86 **EXCAVATION** JCB 8T CLIENT O' Flynn Group METHOD **ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa) Water Strike Geotechnical Description Elevation Legend Depth (m) Depth TOPSOIL: Brown slightly sandy gravelly CLAY 1/ 1/1/ 1 11/2 11/2 <u>À</u> 0.30 51.56 \*8 MADE GROUND comprised of grey brown sandy gravelly CLAY with occasional concrete fragments. Sand is fine to medium. Gravel is subangular, fine to coarse. A118609 В 0.60 Q Ø 1.0 3 1.20 50.66 Firm grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded. AA118610 1.30 В 1.50 50.36 Firm to stiff brown mottled grey slightly sandy gravelly CLAY with a medium cobble content and occasional boulders <500mm. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse. Cobble is subrounded to subangular. Boulders are rounded to AA118611 В 1.80 subrounded. 2.0 AA118612 В 2.60 2.90 48.96 End of Trial Pit at 2.90m 3.0 **Groundwater Conditions** 

Seepage at 1.0m and 1.2m

Stability Stable

**General Remarks** 

25/11/19 .GDT 22150.GPJ IGSL. TP LOG IGSL



REPORT NUMBER

22150

TRIAL PIT NO. TPSA03 CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 699,153.06 E DATE STARTED 29/10/2019 **LOGGED BY** Sean Cunningham 734 803 73 N DATE COMPLETED 29/10/2019 GROUND LEVEL (m) **EXCAVATION** JCB 8T CLIENT O' Flynn Group METHOD **ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa Nater Strike Geotechnical Description Elevation Sample Ref Legend Depth (m) Depth Type TOPSOIL: Brown slightly sandy CLAY with occasional 1/ 1/1/ 0.20 49.06 MADE GROUND comprised of brownish grey slightly 8 sandy gravelly CLAY with rare plastic and wood .ר. 0.30 AA11860 fragments. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse. Cobble is subrounded to Ø subangular. Boulders are rounded to subrounded. 0.60 48.66 Firm brown mottled black sandy gravelly CLAY with a medium cobble content and occasional boulders <450mm. Sand is fine to coarse. Gravel is subangular to AA118602 В 0.80 subrounded, fine to coarse. Cobble is subrounded to subangular. Boulders are rounded to subrounded. 1.0 1.50 47.76 Firm to stiff dark grey slightly sandy very gravelly CLAY with a medium cobble content and occasional boulders. Sand is fine to coarse. Gravel is subangular to AA118603 В 1.70 subrounded, fine to coarse. Cobble is subrounded to subangular. Boulders are rounded to subrounded. 2.0 AA118604 В 2.80 2.90 46.36 End of Trial Pit at 2.90m 3.0 **Groundwater Conditions** Seepage at 0.5m

Stability Stable

**General Remarks** 

25/11/19 .GDT IGSL .GPJ TP LOG IGSL



REPORT NUMBER

22150

TRIM, PIT NO. TPSA04 CONTRACT Liffey Park Technology Campus SHEET Sheet 1 of 1 **CO-ORDINATES** 699.223.71 E DATE STARTED 06/11/2019 **LOGGED BY** Victoria Lowe 735 091 01 N DATE COMPLETED 06/11/2019 GROUND LEVEL (m) 50.93 **EXCAVATION** JCB 8T CLIENT O' Flynn Group **METHOD ENGINEER** Arup Hand Penetrometer (KPa) Samples Vane Test (KPa) Water Strike Geotechnical Description Elevation Legend Depth (m) Depth Type TOPSOIL: Brown slightly sandy CLAY with occasional roots and rootlets. 1/ 1/1/ 1 11/2 11/2 AA128601 0.20 В چ ب 0.30 50.63 MADE GROUND comprised of brown sandy gravelly \*% CLAY with geomembrane and occasional brick .ר fragments. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse. , Ø. ,0 × 0 ,0 × 0 AA128602 В 0.60 \*Q.\*G 0.90 50.03 MADE GROUND comprised of dark grey to black sandy × Q × X very gravelly CLAY with a medium cobble and boulder 1.0 content with concrete and plastic fragments. (Reworked , ذ, ( black boulder CLAY) Q.8 AA128603 В 1.40 () ×Q 1.90 49.03 Firm brown mottled grey sandy gravelly CLAY with low cobble content and occasional boulders <450mm. Sand is 2.0 fine to medium. Gravel is subangular, fine to medium. Cobble is subrounded to subangular. Boulders are rounded to subrounded. AA128604 В 2.20 2.50 48.43 Stiff black sandy gravelly CLAY with a medium cobble content and a medium boulder content. Sand is fine to AA128605 В 2.60 coarse. Gravel is subangular to subrounded, fine to 2.70 48.23 coarse. Cobble is subrounded to subangular. Boulders are rounded to subrounded. End of Trial Pit at 2.70m 3.0 **Groundwater Conditions** Seepage at 0.9m

Stability Stable

**General Remarks** 

25/11/19 GDT IGSL GPJ TP LOG IGSL

TP01 - 1 of 4



TP01 - 2 of 4



TP01 - 3 of 4



TP01 – 4 of 4



TP02 - 1 of 4



TP02 - 2 of 4



TP02 - 3 of 4



**TP02 – 4 of 4** 



TP03 - 1 of 4



TP03 - 2 of 4



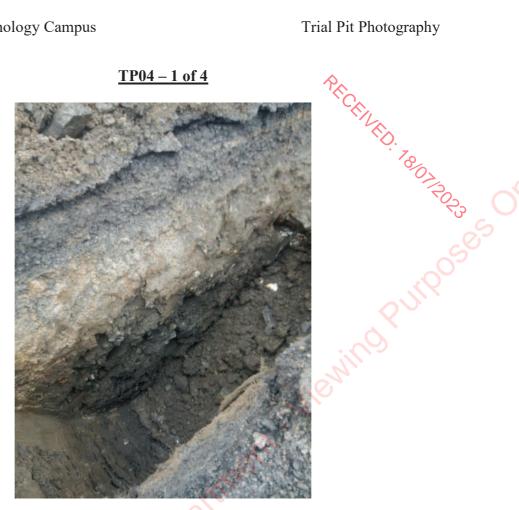
TP03 - 3 of 4



**TP03 – 4 of 4** 



TP04 - 1 of 4



 $\underline{TP04 - 2 \text{ of } 4}$ 



TP04 - 3 of 4



TP04 - 4 of 4



TP05 - 1 of 3



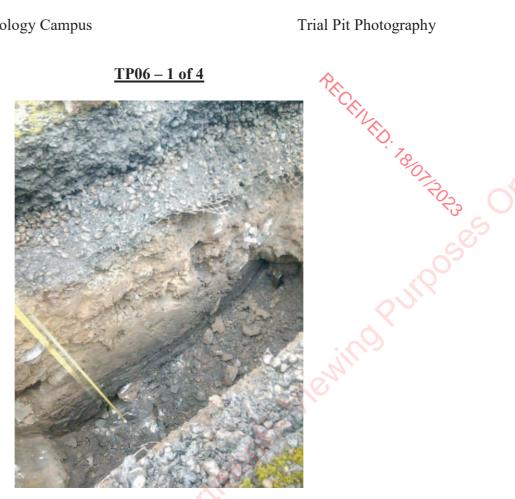
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TP05 - 3 of 3



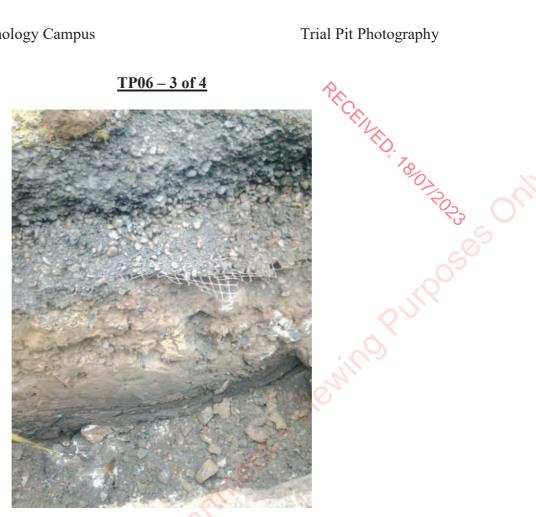
**TP06 – 1 of 4** 



TP06 - 2 of 4



TP06 - 3 of 4



**TP06 – 4 of 4** 



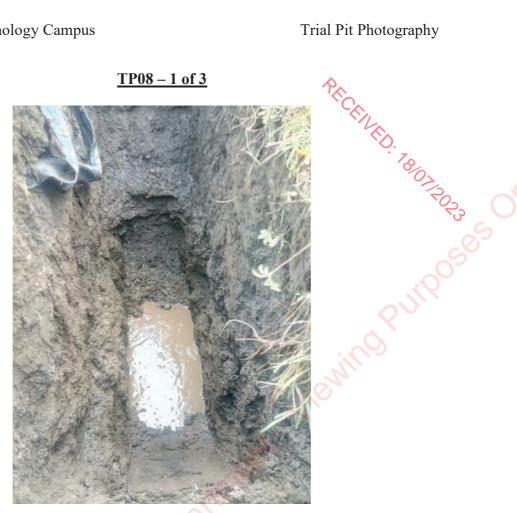
 $\underline{TP07-1\ of\ 2}$ 



TP07 - 2 of 2



TP08 - 1 of 3



TP08 - 2 of 3



TP08 - 3 of 3



**TP09 – 1 of 4** 



 $\underline{TP09 - 2 \text{ of } 4}$ 



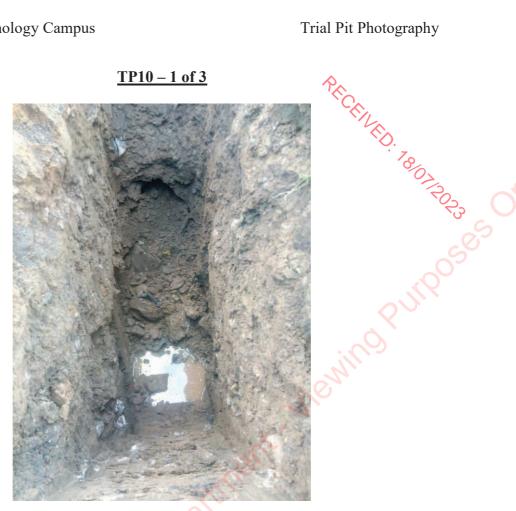
 $\underline{TP09 - 3 \text{ of } 4}$ 



TP09 – 4 of 4



TP10 - 1 of 3



TP10-2 of 3



TP10 - 3 of 3



 $\underline{TP11-1\ of\ 4}$ 



TP11 – 2 of 4



TP11 - 3 of 4



TP11 – 4 of 4

