

Arklow Bank Wind Park

LF2 Landfall Feasibility Study

June 2022

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Client Name:	Sure Partners Ltd
Client Document Reference:	LF100034-ENG-CV-REP-0001
Document Reference:	WIE16435-103-R-1-3-3
Project Number:	WIE16435-103

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

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1-2-3	May 2022	L. Phin Geotechnical Engineer	G. Anton Principal Engineer	C. Gell Technical Director
1-3-3	June 2022	G. Anton Principal Engineer	C. Gell Technical Director	C. Gell Technical Director

Comments		
1-1-3	16/03/22	Issued to SPL as DRAFT for comment
1-2-3	04/05/22	Issued to SPL as FINAL
1-3-3	01/06/22	Issued to SPL as FINAL

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1. Introduction

1.1 Background

Sure Partners Ltd ('SPL'), a subsidiary of SSE Plc ('SSE') are investigating the engineering feasibility of progressing with the second phase (Phase 2) development of the offshore Arklow Bank Wind Park ('ABWP') development, located on the Arklow Bank some 11.50km off the east coast of Ireland in the Irish Sea.

The export circuit will comprise of 2No. 220kV cables with each cable having a nominal Outside Diameter (OD) of 263.5mm. A representative cable data sheet is contained in Appendix A, as provided by SPL.

Waterman Infrastructure & Environment Ltd ('WIE') have been appointed by SPL to undertake a Feasibility Study to demonstrate a cable landfall by using a Horizontal Directional Drilling ('HDD') technique at a site located to the north of Arklow, referenced as LF2.

The feasibility study must demonstrate the design viability of the following SPL requirements:

- Minimise cover depth as far as practical, with an absolute maximum cover depth of 10m below ground level ('bgl');
- Cover depth must be sufficient to demonstrate the risk of hydrofracture is minimal;
- HDD punchout location to be at a minimum water depth 6m Lowest Astronomical Tide ('LAT') (ideally 7m LAT) to assist with offshore works;
- HDD punchout location to be a maximum 300m horizontal distance from a water depth 7m LAT (ideally 10m LAT) to assist with offshore cable installation works; and
- Landfall to allow for 2 No. Circuits.

1.2 Objectives

This Feasibility Report includes the following:

- Summarise readily available information in the form of a Desk Study;
- Develop a Conceptual Ground Model on the basis of the information acquired as part of the Desk Study and ground investigation review;
- Produce a Geotechnical Risk Register for the trenchless landfall;
- Develop a Conceptual HDD design for the landfall in accordance with SPL's criteria; and
- Provide recommendations to assist with the subsequent detailed design of the landfall.

1.3 Limitations

The information contained in this report is based on 3rd party information sources, the accuracy of which WIE can accept no liability for.

The ground conditions presented are based solely on published information, examination of photographs and data provided by SPL. Correspondingly, the conclusions presented in this study, including Conceptual Designs, are based on information available during the course of review and may require to be revised in light of additional information obtained from further investigations to be undertaken at the site.

Detailed consideration of ecological, environmental and archaeological constraints are beyond the scope of this report, which relates to a desk-based review of ground information to determine geotechnical ground risks and suitability of existing information.

With the exception of cover depth and minimum spacing, both provided by SPL, consideration of cable rating impacts are beyond the scope of this report and should be confirmed by the project electrical engineer / cabling engineer.

WIE has endeavoured to assess all information provided to them during the course of this study but makes no guarantees or warranties as to the accuracy or completeness of this information.

2. Data Correction

2.1 Geodetic Data

The topographical and bathymetric data sets used in the study were obtained in a variety of co-ordinate systems. All data sets have been converted to Irish Transverse Mercator (ITM) 1995 with ETRS89 Datum. Levels converted further to m AOD (Malin Head). The level conversions are presented in Table 1 below. The conversion factor between Chart Datum (CD) and Malin Head (OD) is -1.13m.

LAT is considered most relevant for offshore elements of the works, representing the minimum water depth and hence limiting the draught of offshore support vessels.

Table 1: Levels Conversion Table*

Arklow Harbour	Chart Datum (m CD)	Malin Head (m OD)
HAT	1.60	0.47
MHWS	1.40	0.27
MHWN	1.20	0.07
MSL	1.03	-0.10
MLWN	0.90	-0.23
MLWS	0.60	-0.53
LAT	0.20	-0.93

*From Admiralty Tide Table UK & Ireland, NP201B, Volume 1B, 2019, Page xxxix [1]

3. Desk Study Review

3.1 Site Location and Description

The proposed LF2 site is located approximately 5km northeast of the town of Arklow, in the Republic of Ireland, close to Ennereilly Beach and can be centred by an approximate Ordnance Survey Ireland Grid Reference E327143, N177246 (ITM: E727083, N677276).

The boundary between the off-shore and on-shore works are defined by the high-water mark, which is broadly in line with the Highest Astronomical Tide (HAT) level, located on the foreshore below steep coastal cliffs. For a trenchless technique, the proposed site compound is to be located within a field on undulating agricultural land located behind the cliffs, to the west of the R750 single track road. The site location is shown in Figure 1.

Figure 1: Site Location Plan



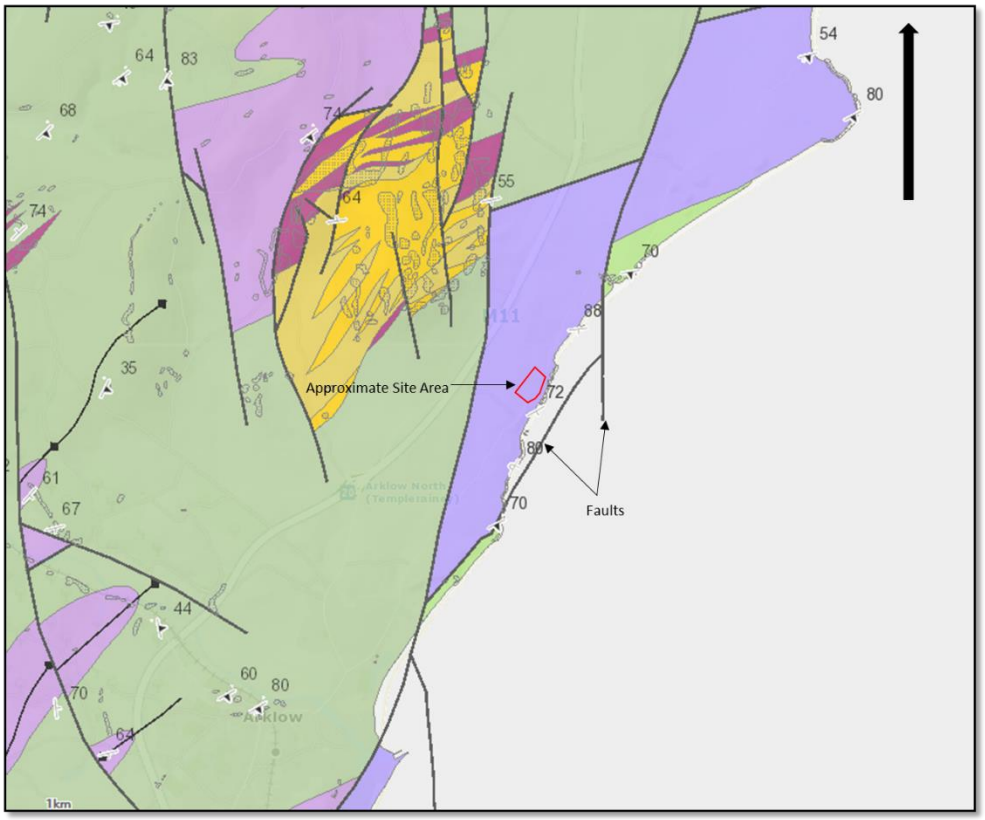
The compound area consists of 2 separate fields to the west of the R750, however, only approximately half of the northern field is located within the red line boundary provided by SPL. The northern field area within the site boundary is roughly rectangular in shape and approximately 185m wide and approximately 170m in length. The southern field is roughly trapezoidal in shape with a length of approximately 240m and width of approximately 195m at the northern end narrowing to approximately 100m at the southern end. The fields are at an elevation ranging 12 – 20m Above Ordnance Datum (m AOD). Access is provided by means of a gate, directly off the R750 which is a single-track road of around 4m in width. A pond is located in the north-western corner adjacent to the site boundary. A small watercourse runs between the two fields.

The foreshore, located below the cliffs, comprises of sand and shingle storm beach deposits which overlie steeply dipping foliated metamorphic rocks. The rock outcrops at isolated locations on the foreshore and forms the cliffs which bound the foreshore to the west.

3.2 Geology

The Geological Survey of Ireland (GSI) interactive mapping tool [2] has been accessed to ascertain the geological conditions below site and the 1:100,000 scale geological map and accompanying memoir [3] purchased from GSI. An extract of the GSI map is presented as Figure 2. The map aligns with the information obtained from the 1:100,000 scale geological map. It should be noted that the geological memoir contains a sketch map which indicates the area around the site to be underlain by the Oaklands Formations consisting of red purple slate and siltstone. This is at odds with the GSI online mapping tool [2] and the accompanying geological map to the memoir. The memoir presents the geology in a regional context and as such the 1:100,000 geology map and GSI mapping tool [2] indicate a higher level of detail and should be given preference. Intrusive ground investigation, discussed in Section 3.11, broadly agrees with the GIS mapping tool.

Figure 2: GSI Geological Map Extract [2]



Geological Survey Ireland (GSI) is free for use under the conditions of Creative Commons Attribution 4.0 International license.

3.2.1 Onshore

The foreshore and most of the land to the east of the R750 road is noted as bedrock with no superficial deposit. The land to the west of the R750 is recorded as being underlain by Irish Sea Till derived from lower Palaeozoic sandstones and shales. Beach areas to the north and south are noted as Marine Sand.

1:100,000 scale mapping indicates the solid geology below site to consist of dark grey-blue grey slate, phyllite and schist of the Maulin Formation. Bands of siltstone, granite and orthoquartzite are also common.

Strike and dip information available from the geological map indicates that the Maulin Formation is very

steeply dipping (72° to 88°) to the south and southeast, which appears to be validated by review of photographs freely available on Google Maps [4] and further confirmed by intrusive ground investigation as discussed in Section 3.11.

An anticline axis is located approximately 15km west of the site trending southwest to northeast. The Courtown – Tramore fault line, also trending southwest to northeast, is located approximately 25km to the south of site.

3.2.2 Offshore

The Marine Environmental Mapping Programme (MAREMAP) [5] was accessed in order to ascertain the nearshore geology which indicates Marine Deposits of silt, sand and gravel over Mudstone, Siltstone, Slate and Volcanoclastic igneous rock.

Two faults are shown off-shore to the east striking north - south approximately parallel to the shoreline at distances of 0.30km and 0.70km respectively. These are shown on the 1:100,000 scale geological map and are not in an area where seismic activity is considered a risk.

3.3 Historical Mapping

Historical mapping accessed through the GeoHive online mapping portal [6], has been reviewed and is presented in Table 2 below.

Table 2: Historic Mapping

Source	Site	Surroundings
1837 - 1842, 6 -Inch	Site consists of a single field of same shape and size as current field. A road is on shown on similar alignment to existing R750.	Three buildings to the south of site forming the hamlet Johnstown South.
1888 - 1913, 25 - Inch	Drainage channel shown along northern boundary and passing below road. Three ponds are indicated on the western field boundary. One pond is within the site boundary, one straddles the boundary and one is just beyond the site boundary.	No significant changes.
Latest Aerial Photography	The ponds appear to have been replaced with semi mature trees and vegetation however, the vegetation may just be obscuring the ponds.	More buildings in Johnstown South (approximately 9 in total).

3.4 Hydrology and Hydrogeology

3.4.1 Rainfall

Review of the “climate and weather” website [7] indicates the average total rainfall for Arklow is approximately 885mm per year with the lowest rainfall averages falling April to July.

3.4.2 Watercourses

No watercourses are visible on aerial photography however, the GSI interactive mapping tool [2] has

been accessed to ascertain any surface water data at site. There is a stream shown to the north of site flowing west to east which discharges on Ennereilly Beach. Two streams are also located approximately 500m to the west of site, one flowing to the north and the other to the south. An unnamed informal watercourse is also expected to lie in between the two fields.

A pond in the western portion of site is present.

3.5 Flood Risk

The National Flood Hazard Mapping resource for Ireland [8] was accessed and indicates that the site area is not at risk of flooding from rivers or the sea nor is there any historical records of past flooding at site.

3.5.1 Aquifers and Water Resources

The GSI interactive mapping tool [2] has been accessed to ascertain the information regarding the hydrogeology below site and confirms the following:

- The bedrock is a locally important aquifer which is moderately productive only in local areas;
- There are two groundwater extraction boreholes close to the site boundaries to the north and south, the locations are given as 327340,177640 and 326700,177130 respectively. It should be noted that the locational accuracy of the northern well is within 50m and the southern to within 1km. The distance from the site boundary is therefore difficult to ascertain but they could be within 50m of the site boundaries. The northern well was drilled in 1899 and the southern 1971. Both are noted as poor yield;
- It is not within a public supply protection area; and
- Groundwater vulnerability is low to extremely high (becoming lower towards the west of the R750, which is likely attributable to the fact that to the west of the R750 the superficial deposits are expected to be clay (low permeability) as opposed to the increasingly permeable beach deposits to the east).

3.6 Mining and Mineral Extraction

The GSI interactive mapping tool [2] was accessed to confirm any mineral or active quarrying occurrences below site. None are identified. The bedrock is not of coal bearing strata and as such underground coal mining is not considered a risk.

3.7 Contaminated Land

As the site has not been previously developed, any potential risk may be associated with unknown hazards or historical use. However, from the available information, the risk is currently considered low. This should be further assessed as part of detailed design.

3.8 Unexploded Ordnance

An Unexploded Ordnance (UXO) Pre-Desk Study Assessment has been undertaken by Zetica Ltd which concludes that a detailed desk study is not necessary in the case of the onshore landfall (see Appendix B). However, the UXO desk study does not include the offshore realms of the works and therefore this should be considered further by all offshore contractors.

3.9 Archaeological Sites

The Irish National Monuments Service was accessed in order to access the Historic Environment Viewer

[9]. There are no historic points of interest noted for site however it would be prudent for SPL to confirm any specific archaeological requirements or restrictions with the relevant local authorities prior to undertaking works.

3.10 Environmental and Ecological Consultation

Detailed consideration of environmental and ecological constraints is beyond the scope of this report. As part of subsequent design development and pre-construction works, a Construction Phase Environmental Management Plan (or equivalent) should be prepared and adhered to. However, an online search of the National Parks and Wildlife Service [10] website which includes links to National Heritage Areas, Special Areas of Conservation, Special Protection Areas, OSPAR Sites, National Parks and Nature Reserves did not indicate any conflicts within the site location. The Buckroney - Brittas Dunes and Fen area is, however, located approximately 500m north and is a Special Area of Conservation which extends north for a distance of some 8.50km.

3.11 Previous Ground Investigation and Interpretative Reports

3.11.1 GSI Ground Investigations

Two previous ground investigation reports were downloaded through the GSI mapping tool [2] however, these were from sites between 3.5km and 4km north of site, as detailed below:

- GSI Report 1957: European Golf Clubhouse (approximately 3.8km north of site)
- GSI Report 6724: Brittas Bay Commercial/Residential (approximately 4.2km north of site)

The data contained within the reports is limited to basic soil strata descriptions and given the distances from site are of limited relevance.

Nonetheless, the closest historical borehole records available are located 3.8km to the north of site and were sunk in association with another ground investigation (GSI Report 1957: European Golf Clubhouse). Whilst of limited relevance to the site location, this indicates that rockhead is between 4.70m and 7.30m below surface and is overlain by clay.

3.11.2 Irish Drilling Ltd Ground Investigation (2020) [11]

Irish Drilling Ltd (IDL) were instructed by SPL to undertake a Ground Investigation within the proposed landfall site area, a copy of the Ground Investigation Factual Report [11] is included within Appendix C. The Ground Investigation included:

- 5 No. rotary cored boreholes;
- 12 No. machine excavated trial pits;
- Downhole acoustic survey in all boreholes;
- Prolonged groundwater monitoring in 3 No. selected boreholes using standpipe installations;
- 1 No. Soil resistivity test; and
- A suite of Geotechnical Laboratory Testing undertaken on soil and rock samples obtained from the exploratory holes.

Superficial Deposits

Superficial deposits were encountered in all exploratory holes down to a maximum depth 9m bgl (BH04). Typical descriptions of the superficial deposits were as follows:

Firm to stiff orangish brown slightly sandy slightly gravelly CLAY with cobbles; or

Stiff brownish green slightly sandy gravelly CLAY; or

Orangish brown silty fine and medium SAND; or

Firm grey mottled orangish brown slightly gravelly SILT with low cobble content; or

Stiff brownish bluish grey slightly gravelly organic SILT with low cobble content and some rootlets and some shell fragments; or

Firm damp light orangish brown slightly gravelly sandy SILT with low cobble content and low boulder content; or

Very stiff mottled brownish bluish grey slightly gravelly organic SILT with rootlets and some shell fragments.

All these descriptions would indicate that Glacial Till is present at the site, overlying bedrock.

Solid Geology

The solid geology was encountered in all boreholes and within 2 No. trial pits at a minimum depth of 2.3m bgl (BH03) and a maximum depth of 9.0m bgl (BH04). The solid geology was proven up to a maximum depth of 20.2m bgl (BH03).

Typical descriptions of the solid geology were as follows:

Medium strong locally strong and weak thinly laminated greenish grey and grey fissile fine-grained SHALE; or

Medium strong locally weak and strong thinly laminated grey and dark grey fissile fine-grained SHALE with 'anastomosing' quartz; or

Strong locally weak and very strong thinly laminated brown and greenish grey fine to coarse SANDSTONE.

A zone of no recovery was also encountered within BH03 from 6.8 to 11.2m bgl and was recorded as non-intact as medium strong thinly laminated dark grey fissile fine-grained shale with much grey silt and orange and orangish brown iron stain and powder.

The encountered rock is listed predominately as medium strong, however, in-situ point load tests indicated on borehole logs do note rock as weak in the majority of instances. There are also quartz veins noted within the logs and apparent when reviewing the acoustic televiewer logs which are likely to present potential hard drilling conditions.

Discontinuities were typically encountered as closely spaced very steeply dipping (80° to 90°) with 0.5mm to 3mm silt or clay smear.

Rock Quality Designation (RQD) values presented on the borehole logs indicate a range of 0% to 64% with an average of 7% can be expected for the solid geology. This would indicate the designation of rock quality to be predominately very poor.

No weathering state details were included.

Geotechnical Testing

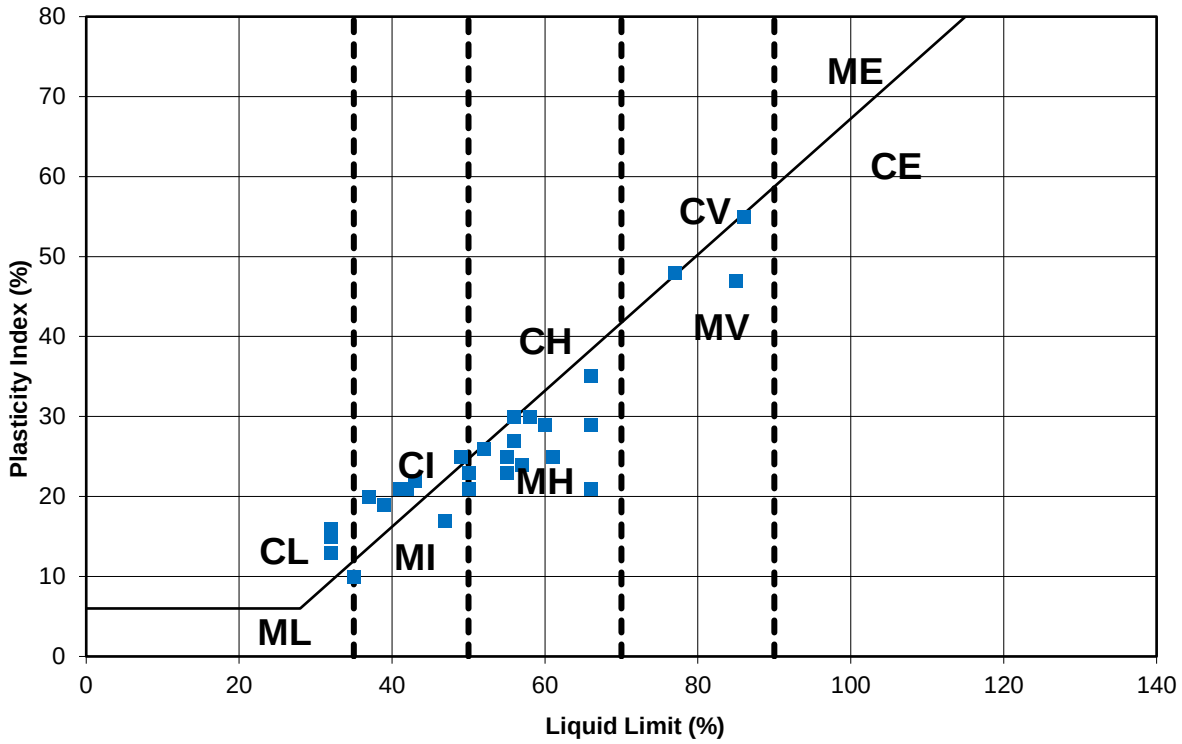
A suite of geotechnical testing, both in-situ and laboratory, was carried out on samples obtained from the ground investigation.

Glacial Till

74 No. Moisture Content tests were undertaken on samples obtained from the Glacial Till, the minimum recorded was 4.7%, maximum recorded 37% and average 20%.

28 No. Atterberg Limits tests were undertaken on samples obtained from the Glacial Till, the Liquid Limit ranged from 32% to 86% with an average 53%, Plastic Limit ranged from 16% to 45% with an average 27% and subsequently the Plasticity Index ranged from 10% to 55% with an average 26%. The results do not consistently lie within a single definable classification when plotted on a Plasticity Chart with both low plasticity clay and silts indicated as well as high plasticity silts, as presented in Figure 3. Analysing the results in terms of a trend against depth, the results do indicate samples obtained at shallow depths (<1m) typically lie within the higher plasticity range compared with those obtained at deeper depths (>1m). However, given the variable nature of Glacial Till deposits there are a few anomalies to this trend and thus any conclusions drawn from this trend should be taken with a level of uncertainty.

Figure 3: Atterberg Limits Plasticity Chart



31 No. Particle Size Distribution (PSD) tests were undertaken on samples obtained within the Glacial Till strata, the results indicate primary components of clay and silt, a secondary component of sands and minor component of gravel. No cobbles were encountered in PSD samples although cannot be discounted as there is low content noted within the exploratory hole logs. Table 3 below summaries the PSD results.

Table 3 Particle Size Distribution Test Results Summary

	Cobbles (%)	Gravels (%)	Sands (%)	Silts (%)	Clays (%)	Silts & Clays (%)

Average	0	1.2	21.2	34.4	46.5	57.5

11 No. in-situ Standard Penetration Tests (SPT) were undertaken within Glacial Till deposits, the SPT 'N' value ranged from 13 to 32 with an average 23. Considering a conservative Stroud and Butler correlation factor of 4.5, results in an undrained shear strength ranging from 59kN/m^2 to 144 kN/m^2 with an average 103kN/m^2.

17 No. Hand Shear Vane Tests were undertaken within the trial pits at shallow depths which result in an undrained shear strength ranging from 15kN/m^2 to 27kN/m^2 with an average 20kN/m^2.

7 No. Triaxial Tests were undertaken on samples obtained from Glacial Till deposits, the undrained shear strength was identified ranging from 29kN/m^2 to 144kN/m^2 with an average 70kN/m^2.

Solid Geology

21 No. Point Load Tests have been carried out on rock samples, the I_{s50} values recorded range from 0.1 to 1.5 MPa with an average 0.6 MPa. Considering a conservative conversion factor of 10 (Alitalesh et al [12]), corresponding UCS values can be determined, these range 1 MPa to 15 MPa with an average 6 MPa. The data indicates no discernible trend of increasing UCS with depth.

A single UCS test was also undertaken and recorded a result of 6.5 MPa which is consistent with the conversion carried out on the above Point Load Test results. It is therefore deemed that the rock is Very Weak to Moderately Weak across all samples.

Groundwater

Groundwater monitoring was carried out at 3 No. standpipe locations installed within boreholes BH01, BH03 and BH04. Monitoring of these standpipes indicated groundwater levels ranging 0.65m bgl (BH03) to 8.83m bgl (BH04).

3.12 Topography

A topographic survey of the onshore and foreshore site area, undertaken by Murphys Survey Ltd ('Murphys'), has been provided to WIE by SPL. The survey works comprised both land-based GPS surveying and aerial surveying using an Unmanned Aerial Vehicle (UAV). Land-based GPS methods were undertaken to an accuracy of ±25mm in the horizontal and ±10mm in the vertical for hard details and the UAV to an accuracy of ±50mm in the horizontal and ±75mm in the vertical. The survey works were undertaken between 9th and 20th December 2019.

3.13 Bathymetry

Offshore bathymetric survey data supplied by SPL of the nearshore area, undertaken by Gavin & Doherty Geosolutions ('GDG') in 2020 [13], and data obtained from GSI [2] have been incorporated with the topographic data acquired by Murphys in AutoCAD Civil 3D to form a combined seabed and topographical profile along the proposed bore path (Appendix G). The bathymetric data was captured from survey vessels and as such a near shore data gap of approximately 120m exists due to insufficient water depths for the draught of survey vessel employed.

3.14 Existing Infrastructure

Existing infrastructure is limited to that associated with houses belonging to the hamlet of Johnstown at the junction of the R750 and the L95115, the two houses above Ennereilly Beach, and the R750 road (single track) itself.

SPL have provided a PAS128:2014 Type B detection utilities survey undertaken by Scantech Ltd (Appendix D) which indicates telecoms services and unknown services / anomalies running along the length of the R750. A possible culvert running beneath is also indicated at the point where the watercourse running between the two fields meets the R750. There are also overhead lines present along the R750 road.

WIE have requested utilities plans from statutory service providers, as presented in Appendix E, and only telecoms utilities are noted within the site boundary. Water service plans have not been obtained at the time of writing however, they are currently considered unlikely to indicate anything different from the Scantech Ltd survey..

3.15 Grid Infrastructure Options Assessment (GIOA) GIS Files

SPL provided GIS files which came from publicly available sources collated as part of GIOA report produced by Cathie and RPS of potential constraints over both the onshore and offshore site areas as well as the surrounding vicinity.

The only onshore constraints considered to impact the site area is landslide susceptibility which is noted as ‘moderately high’ along the coastline, as per the designation provided by GSI Landslide susceptibility report [14], and groundwater vulnerability which is noted as ‘High’ along the coastline, as per GSI definitions. In both cases it is expected this designation has been the result of the topographic level change and are therefore unlikely to have a significant impact on the works.

The only offshore constraints identified from the GIS files within the nearshore area are involving nursey fishing grounds, seals, and porpoises habitat areas. Any detailed ecology considerations are out with the scope of this feasibility study.

In summary, WIE have reviewed the GIS data provided for the site area and foreshore and have found no significant constraint that would have an impact on the feasibility design (Appendix F).

4. Ground Model

From the information obtained by Desk Study and Ground Investigation data review, a conceptual ground model has been developed.

4.1 Onshore Conceptual Ground Model

Table 4: Conceptual Landfall Geological Model

Stratum	Area Covered	Estimated Thickness	Typical Description
Topsoil	West and East of R750	0 – 0.30m	Topsoil
Glacial Till	West and East of R750	2.30 – 9.0m	Firm to stiff orangish brown slightly sandy slightly gravelly to gravelly CLAY with cobbles; or Orangish brown silty fine and medium SAND; or Firm to very stiff brownish bluish grey slightly gravelly organic SILT with low cobble content and some rootlets and some shell fragments; or
Beach Deposits	East of R750	0.00 – 5.00m	Gravelly Sand
Maulin Formation	Entire Site	>18m	Medium strong locally strong and weak thinly laminated greenish grey and grey fissile fine-grained SHALE; or Strong locally weak and very strong thinly laminated brown and greenish grey fine to coarse SANDSTONE. Quartz veins noted throughout and areas of non-intact rock present.

Groundwater is somewhat variable across the site, most likely due to the undulation in ground levels and variability of glacial till thickness. A conservative groundwater level of 1m bgl is considered appropriate for design.

A schematic ground model is presented in Figure 4 below and a sketch cross section based on the Irish Drilling Ground Investigation is presented in Figure 5.

Figure 4: LF2 Landfall: Schematic Ground Model

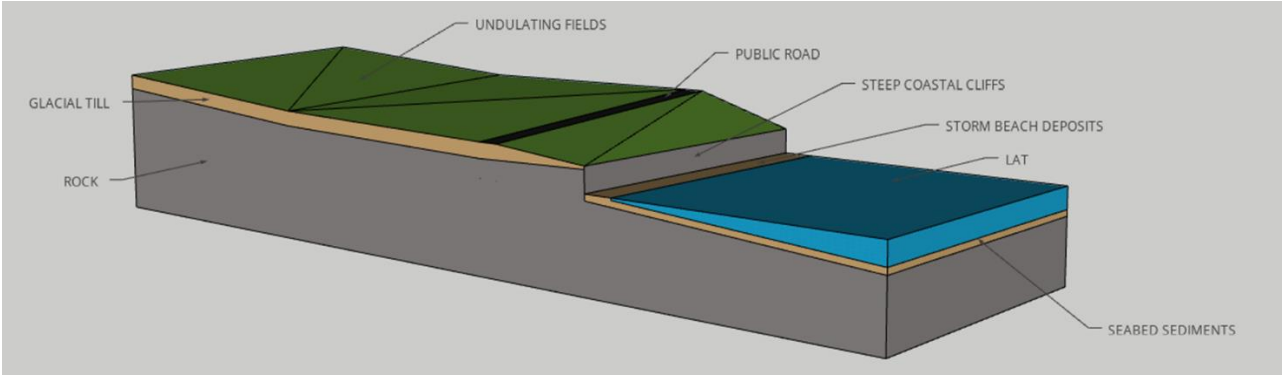
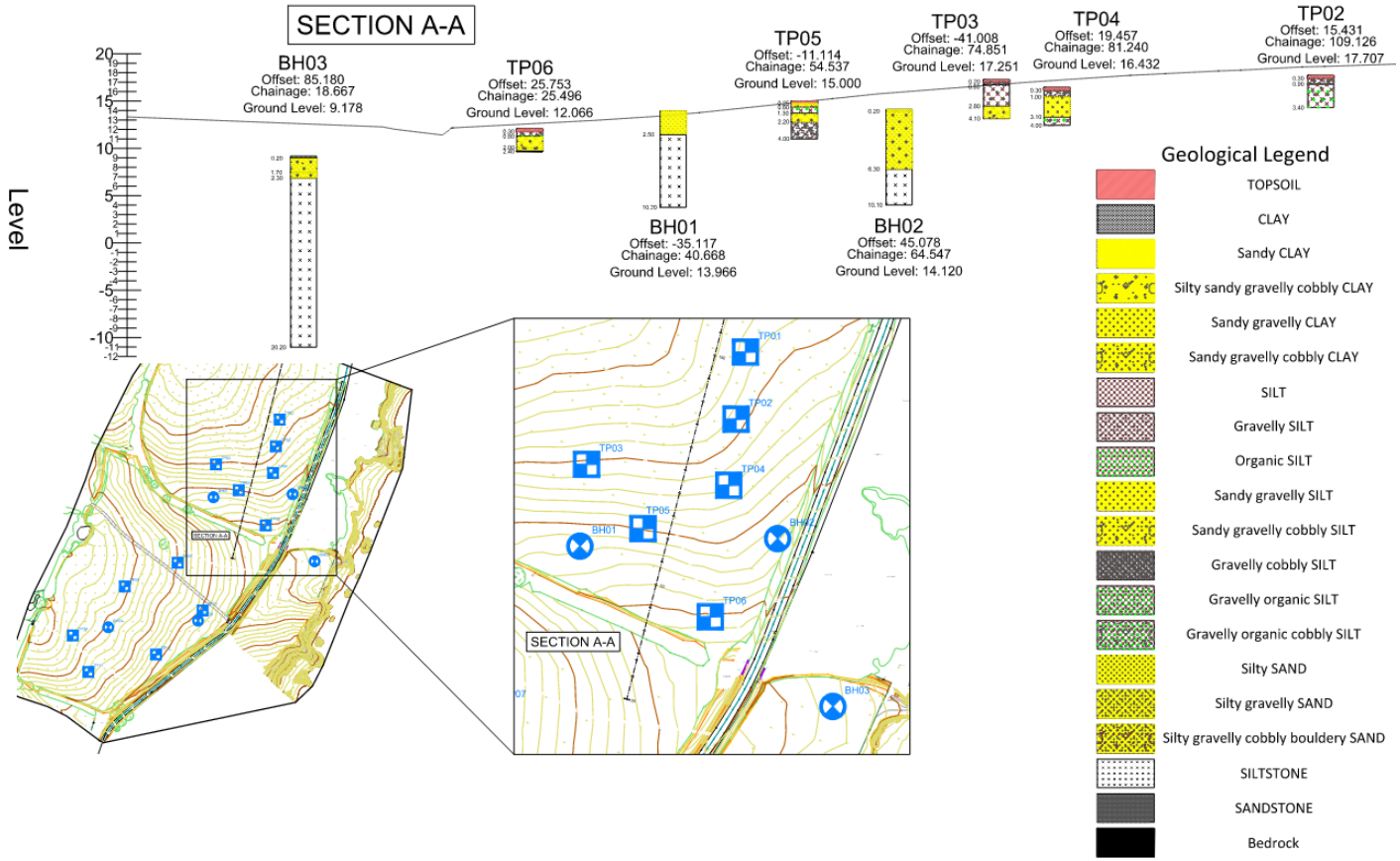


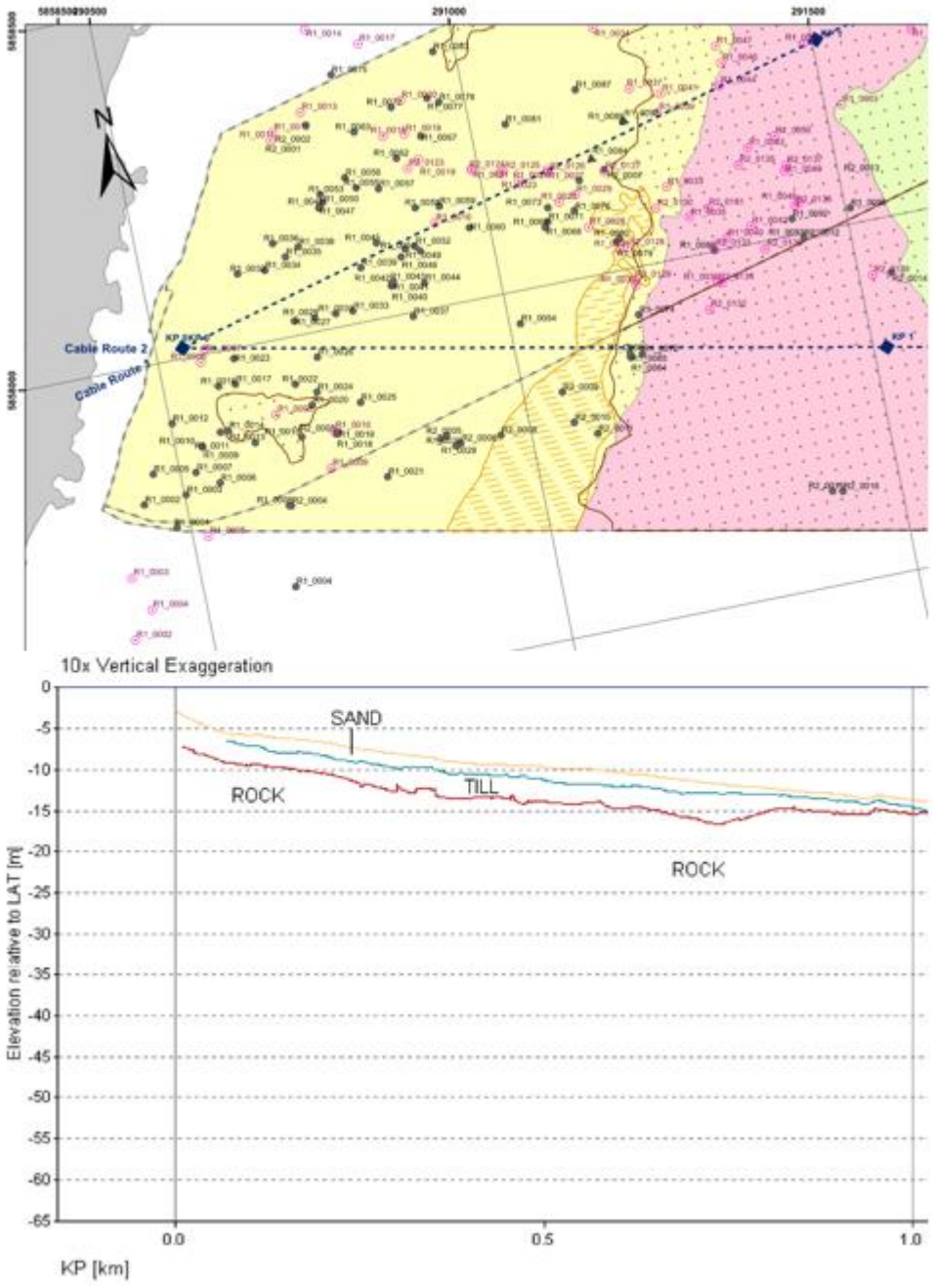
Figure 5: Geotechnical Cross Section Sketch



4.2 Offshore Conceptual Ground Model

Drawing No. UHC19004-REV00-05, as presented in the Ultrabeam Hydrographic [15] report, shows the interpreted geophysics around the area of the consented cable route junction and proposed punch out location (see Figure 6). This indicates approximately 1.50m of Sand is expected to sit above approximately 2.00m of Till which sits on rockhead. This therefore indicates a maximum sediment thickness in the order of 3.50m. The sediment thickness would require to be confirmed through intrusive ground investigation.

Figure 6: Extract from Drawing No UHC19004-REV00-05 of Interpreted Geophysics



5. Geotechnical Risk and Hazard Assessment

5.1 Geotechnical Risk Evaluation Matrix

Based on information available, a specific review of the geotechnical risks associated with the landfall installation works has been undertaken and the risks evaluated using a risk evaluation matrix.

The risk register, detailed in the following tables, lists the anticipated ground hazards associated with the works and the associated consequences of those hazards in order to determine the level of risk presented. The risk before control of the hazard has been assessed quantitatively and following the implementation of specific control to each risk. The register should remain a 'live' document, updated as construction works progress.

The level of risk is calculated to be up to a value of 25 (Critical Risk). The maximum value can be reduced to 5 (Medium Risk) and with implementation of the recommended controls during construction may be reduced further.

Probability (P) x Impact (I) = Risk Rating (R)

PROBABILITY OF OCCURRING		IMPACT ON PROJECT COST / PROGRAMME
Very Likely	5	Substantial (>50% Cost/ Programme increase)
Likely	4	High (30% to 50% Cost/ Programme increase)
Probable	3	Moderate (10% to 30% Cost/ Programme increase)
Unlikely	2	Minor (< 10% Cost/ Programme increase)
Highly Unlikely	1	Negligible (0% Cost/ Programme increase)

PROBABILITY (P)	IMPACT (I) 5	4	3	2	1
5	25	20	15	10	5
4	20	16	12	8	4
3	15	12	9	6	3
2	10	8	6	4	2
1	5	4	3	2	1

1 to 4	Low Risk
5 to 10	Medium Risk
11 to 16	High Risk
≥ 17	Critical Risk

Geotechnical Risk Register

Arklow LF2 Landfall										
No	Hazard	Consequence	Risk before Control			Recommended Mitigation Measures to be implemented	Risk after Control			Comments
			P	I	R		P	I	R	
1	Unknown thickness and composition of marine sediments.	Encountering unforeseen ground conditions and incorrect design leading to impact on progress, programme and costs. Bore path may need to be abandoned and re-drilled leading to programme and cost impacts. Depending on offshore sediment thickness drilling from offshore to onshore may be required. Potential for "Frac-out" to occur leading to programme and cost impacts. Damage/ environmental incident	5	5	**25**	Further investigation required through nearshore GI including boreholes and tight grid of CPT's at proposed punch-out.	2	5	**10**	
2	Public Utilities	Risk of death or injury. Potential costs and programme impacts.	5	5	**25**	Utilities search and consultations has been carried out to date. Up to date enquires to be submitted at Construction Stage.	1	5	**5**	Utility plans should be updated every 3 months. Private landowners should

Arklow LF2 Landfall										
No	Hazard	Consequence	Risk before Control			Recommended Mitigation Measures to be implemented	Risk after Control			Comments
			P	I	R		P	I	R	
						Any contractors employed on site should undertake their own searches and satisfy themselves that all utilities have been identified and cleared.				be approached for details of any private utilities.
3	Extraction Wells	Contamination of drinking water resource.	4	5	**20**	Undertake detailed hydrogeological investigations.	1	4	**4**	
4	Weak rock with potential non-intact bands.	Potential for “Frac-out” to occur leading to programme and cost impacts as rock may behave like gravel. Potential for collapse or significant amounts of debris within the bore during HDD if loose non-intact material is present.	3	5	**15**	Further investigation required through nearshore GI including boreholes and tight grid of CPT’s at proposed punch-out.	2	5	**10**	
5	Variable rock conditions due to quartz veins.	Potential for hard drill conditions within a predominately weak rock leading to programme and cost impact.	3	5	**15**	Specialist Contractor should select an appropriate drilling head to deal with potential hard drill conditions.	2	5	**10**	

Arklow LF2 Landfall										
No	Hazard	Consequence	Risk before Control			Recommended Mitigation Measures to be implemented	Risk after Control			Comments
			P	I	R		P	I	R	
6	Potential for UXO unknown.	Risk of death or injury. Programme delays and cost increases.	3	5	**15**	Specialist UXO pre desk study has been undertaken and risk onshore considered Low. Offshore risk should be considered as part of offshore contractors risk assessments and method statement.	1	5	**5**	
7	Offshore geological faults approximately 300m and 700m from the shore.	Potential for “Frac-out” to occur along fault planes leading to programme and cost impacts. Damage/ environmental incident. Potential for chocking / collapse of bore in unstable rock.	3	4	**12**	Designed route unable to exit before the 300m fault due to water depth requirements (7m LAT) at the punch-out. The profile has therefore been designed to extend minimum 50m past the 300m faultline to maintain minimum 5m cover depth and thus reduce likelihood of frac-out within the potential plane of weakness. All drill fluids to be self-flocculating and environmentally inert.	2	4	**8**	
8	Offshore geological faults accuracy.	Potential for offshore geological faults to be indicated inaccurately based on desk study review of information.	3	4	**12**	Offshore ground investigation targeting HDD punch-out locations should be undertaken to determine they are not located within a fault zone	2	4	**8**	

Arklow LF2 Landfall										
No	Hazard	Consequence	Risk before Control			Recommended Mitigation Measures to be implemented	Risk after Control			Comments
			P	I	R		P	I	R	
		Result in Risk No. 7 having increased probability.								
9	Shallow Groundwater	Temporary works stability. Influence on HDD duct design (buoyancy).	3	4	**12**	Shallow groundwater measures to be considered within temporary works design.	1	4	**4**	
10	Landslide Susceptibility identified as 'Moderately High' by GSI	Potential unstable ground leading to landslip. Potential risk of death or injury	1	5	**5**	Contractor to frequently check weather forecasts and cease work should weather warnings for heavy rain / snow be in place. No operatives should work in over steep parts of site including coastal cliffs.	1	3	**3**	
11	Groundwater Vulnerability identified as 'High' by GSI	Potential for "Frac-out" to occur along fault planes leading to programme and cost impacts. Damage/ environmental incident.	1	5	**5**	All drill fluids to be self-flocculating and environmentally inert. Contractor to have appropriate site controls to be in place in areas where frac-out is deemed unavoidable (in the latter stages of the HDD).	1	3	**3**	

6. Horizonal Directional Drilling (HDD) Concept Design

6.1 General

Based on the desk study review of site constraints, topographic levels and bathymetric levels, an HDD Concept Design has been derived to demonstrate feasibility of a cable landfall within the site boundary.

Within the design, consideration was given to the SPL requirements which includes:

- Minimise cover depth as far as practical, with an absolute maximum cover depth of 10m bgl;
- Cover depth must be sufficient to demonstrate the risk of hydrofracture is minimal;
- HDD punchout location to be at a minimum water depth 6m LAT (ideally 7m LAT) to assist with offshore works;
- HDD punchout location to be a maximum 300m horizontal distance from a water depth 7m LAT (ideally 10m LAT) to assist with offshore cable installation works by limiting the floating cable length due to risks associated with controlling the floating bight; and
- Landfall to allow for 2 No. Circuits.

A feasibility stage design alignment and profile has been developed meeting the above criteria and is presented on design drawings 16435-103-WIE-ZZ-XX-DR-C-91001 & 16435-103-WIE-ZZ-XX-DR-C-91002 (Appendix G).

Initial considerations identified the cover depth requirements as the critical aspect of the bore profile design and as such the headland at the north end of the site was identified as the optimal location given the change in topographic levels at the cliffs is not as abrupt as elsewhere.

At this location a suitable compound area within the northern field has been identified. This also allows space for stringing out product pipe behind the compound, aided with the use of rollers, if required. However, through design development, it is considered more likely that the duct would be prefabricated and floated offshore prior to being pulled back through the HDD after reaming operations.

For the proposed cable specification, a data sheet for which is contained in Appendix A, based on 263.5mm outside cable diameter each bore path will require to be of a minimum 659mm internal diameter. This is based on the current industry standard of minimum 2.5 times cable outside diameter, which is to mitigate the risk of any gravel or sediments pulled into the duct during the cable installation phase damaging the cable, based on WIE's previous experience this requirement is predominately based on the cable suppliers insurance policy. It is however commented that appropriate controls should be in place to prevent this, such as a positive water pressure and outflow of water from the duct during cable pulling coupled with a series of roller brushes at the duct entry point.

Due to available duct sections, and assuming HDPE SDR 21, a nominal 800mm diameter duct will be required. The initial HDD pilot hole would therefore be reamed out from circa 311mm ($12^{1/4}$") diameter to 1118mm (44") diameter prior to the 800mm duct being pulled through the bore.

Figures 7 to 9 show a typical HDD set-up for an HDD Cable Landfall.

Figure 7: Typical HDD Rig and Control Cabin Setup (image courtesy of Stockton Drilling Ltd)



Figure 8: Typical HDD Rig and Control Cabin Setup (image courtesy of Stockton Drilling Ltd)



Figure 9: Typical HDD Compound Setup (image courtesy of Stockton Drilling Ltd)



6.2 Site Compound Area

The site compound area is proposed to be located within a gently undulating agricultural field to the west of the R750 road and will be accessed directly from the R750. At the site location the R750 is a single-track road estimated to be around 4m in width.

The proposed entry compound currently sits between levels 19.5m AOD in the south-eastern corner to 22.2m AOD in the north-western corner. The location of the entry pits / transition joint bays currently lies at an approximate level ranging 19.8m AOD to 20.6m AOD. Minor earthworks will be required to achieve level working area(s), the detailed design should consider the drilling contractors specific requirements.

A 3.5m to 4.0m wide temporary access track suitable for the equipment to be employed will need to be formed through the field from the access off the public road to the compound. This will require the placing of a suitable depth of imported clean angular stone, such as SHW Type A to Clause 801 (Transport Infrastructure Ireland, Specification for Roads Works Series 800, Road Pavements [16], placed on top of a geotextile separation membrane. Alternatively, temporary metal roadway could be used.

For a typical HDD application, an ideal compound size of 70m x 70m will typically be required with level and stable terrain which will require minor earthworks on site with approximately 2m of cut and fill required. It is not anticipated that earthworks will require substantial excavation of solid deposits and detailed design should consider adding a step(s) in the site compound to minimise earthworks as far as practically possible, the drilling contractor should be consulted during this aspect of the design.

The compound is required to site a variety of containers which contain welfare, offices, storage, mud labs, mud mixing, mud recycling units and workshops. In typical HDD applications a minimum of 100m space by 20m wide behind the entry pit is used to facilitate stringing out the product pipe with the support of stilts and rollers, albeit in this instance the proposal at this stage would be to float the ducts offshore and pull the ducts in from the offshore end after reaming of the boreholes. This will require duct fabrication to

be undertaken at a marine yard (Arklow) and floated to the “punch-out” location for pulling back to shore. This operation will be weather dependant.

6.3 Entry Points

Entry angles of 8.5° (-15.0%) and 8.3° (-14.5%) are indicated at Circuit 1 and Circuit 2 respectively. These angles have predominately been selected to aid with achieving minimum cover depths whilst also ensuring a significant cover-depth at the base of the coastal cliffs to mitigate hydrofracture. The entry angle is also sufficiently steep to mitigate the risk of the drill head skipping off rockhead at the till / rockhead interface.

On the basis that the compound area is positioned circa 20m above the beach the selected entry angles result in a maximum cover depth of 9.93m below the sea cliff on Circuit 2. The entry points shall be approximately 160m from the toe of the cliffs inside the site compound field (see Drawing No. 16435-103-WIE-ZZ-XX-DR-C-91001 (Appendix G).

The entry points are shown with a 10m separation and then diverge along the length of the drill. This is to mitigate the risk of the two drill paths converging due to any unforeseen steering influence resulting from the geological structure within the fabric of the bedrock. However, should a wider separation be required then this should be reviewed at detailed design.

6.4 Entry Pits

For each bore, an entry pit should be formed for the containment of drill fluids and may require temporary support. Given that the overburden at site consists of Glacial Till, with some granular content, there may be issues with leakage of the drill fluid which should be overcome through lining the pit with an impermeable barrier such as visqueen sheeting, so as to form a sump.

The entry pits are anticipated to be constructed to a level of approximately 17.5m AOD (2.5m depth), and is expected to be constructed within the overburden, when considering the closest exploratory hole within the IDL ground investigation (2020) has 3.7m overburden depth.

6.5 HDD Radius

A minimum radius of R500m has been detailed, as is typical for this drilling technique in these ground conditions and over the proposed drill length. The proposed cable has a minimum bending radius of 4m and is therefore well within the designed drill profile. A technical data sheet for the proposed cable is presented within Appendix A.

6.6 Offshore Exit Points

The offshore exit points are indicatively shown on Drawing No. 16435-103-WIE-ZZ-XX-DR-C-91001 (Appendix G) at CH514 on Circuit 1 and CH510 on Circuit 2. Circuit 1 has an exit point coordinate of 727647, 677204 and Circuit 2 has an exit point coordinate of 727650, 677232. The exit pits have a separation of 28m. The desired offshore exit points and spacing between bores should be considered further at detailed design phase. If required, a horizontal steer in the drill path can be introduced to achieve the desired offshore spacing.

To meet the design criteria, punchout locations have been selected where water depth is approximately 7.5m LAT and within a 300m horizontal distance from 10m LAT at both Circuits. In order to achieve these criteria a faultline has to be passed whilst drilling, this is deemed unavoidable to meet ideal water depth requirements. In any case, the bore profiles have been designed to have minimum 5m cover depth at the indicated fault location and do not punch-out until around 50m thereafter. This is considered appropriate

given the rock would be expected to be free from significant fault influences at this distance. Further consideration should be given to the faultline at detailed design stage as frac-out of drill fluids may be more likely at this location. Furthermore, the position of the faultline has been downloaded from GSI[1] and thus is expected to have a reasonable level of accuracy, however, the proposed punch-out locations should be subject to offshore ground investigation to confirm avoidance of the fault zone. All drill fluids employed on the project should be self-flocculating and environmentally inert.

The borepath could be designed to punchout prior to the Faultline, however this would result in a water depth of circa 6m LAT at the punchout location and a horizontal distance of 300m would only achieve a water depth of circa 9.3m LAT. In order to reach the desired water depth of 10m LAT a horizontal cable distance of 400m would be required post punch-out. The trade-off between the punch out water depth and the horizontal distance to 10m LAT should be considered at detailed design.

6.7 HDD Outline Calculations

Preliminary calculations have been carried out to determine the likelihood of hydrofracture and the indicative pulling forces associated with the duct and cable installations. All calculations have been undertaken based on the Circuit 2 bore profile, as presented on drawing 16435-103-WIE-ZZ-XX-DR-C-91002, as the critical cover depth lies within this profile as well as the more critical pulling forces. In any case, the number of assumptions within the calculations as well as similarity in each profile, regarding entry angles and drill length, the results are comparable throughout. All preliminary calculations are presented within Appendix H.

6.7.1 Hydrofracture Calculations

Hydro-fracture (frac-out) occurs if during the drilling process the drilling fluid pressure in the borehole exceeds the resistance of the overburden soils resulting in a breakout at the surface. In this case, there is a potential risk that this could occur within the sea leading to a pollution incident. Drilling mud pressure within the HDD bore should not exceed that which can be supported by the surrounding soils to prevent hydro-fracture.

The geology along the borepath is expected to consist of steeply dipping rock with the potential that discontinuities may provide a plane of weakness leading to the occurrence of frac-out. Furthermore, bands of weak non-intact rock were encountered during historic ground investigation which would exacerbate the occurrence of frac-out. This would likely be a result of fluid migration through granular bands and worsened by shallow groundwater within the overburden material which may mix with the drilling fluids preventing it setting and creating a seal through the soils.

Typically, increasing cover depth of the bore path to give a larger overburden pressure is the best way to mitigate this issue, but, in this instance a maximum limit of 10m cover has been specified. Calculations showing the maximum allowable downhole pressures exerted by the drilling annulus have been determined based on the Circuit 2 bore profile and using assumed conservative ground parameters for a weathered, weak, fractured mudstone (i.e. treating as a gravel with some cohesion) selected based on the IDL ground investigation (2020)[11], which encountered the majority of the rock as very weak. It should be noted the Circuit 2 bore profile shown on drawing 16435-103-WIE-ZZ-XX-DR-C-91002 (Appendix G), represents the centreline and as such levels have been adjusted to represent the soffit level and thus worst-case scenario within these calculations.

There are several possible methodologies, but this analysis has been based upon the widely used ‘Dutch’ method which was developed by Luger & Hergarden (1988) assuming a cavity expansion. The main parameters used in this assessment are set out in Table 5.

Table 5: Hydrofracture Calculations Geotechnical Parameters

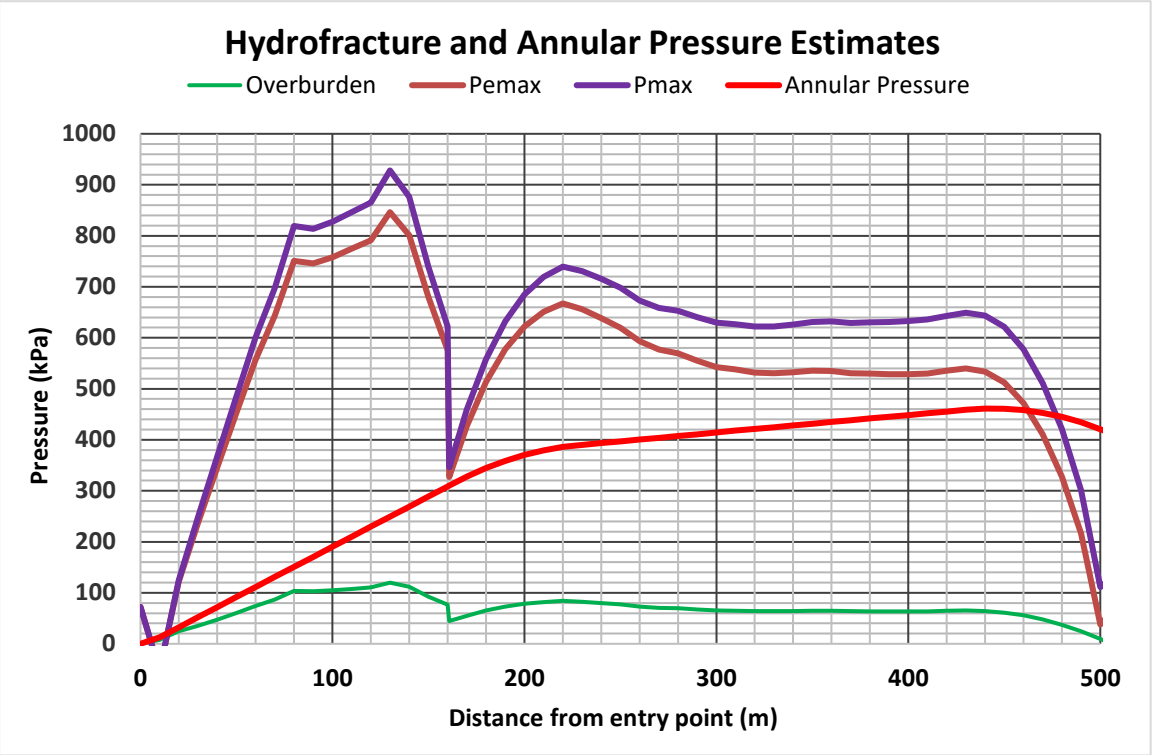
Parameter	
Gravity (m/s/s)	9.81
Density of Water (kg/m^3)	1000
Density of Drilling Mud (kg/m^3)	1300
Soil Density (kg/m^3)	2200
Cohesion (kN/m^2)	75
Friction Angle (°)	15
Poission's Ratio	0.35
Elasticity Modulus (kPa)	50000
Drill Bit Diameter (m)	1.118
Drill Pipe OD (m)	0.279
Allowable Plastic Radius Factor	0.50

Based on the groundwater monitoring undertaken within the IDL ground investigation (2020) [11], which recorded groundwater levels ranging 0.65m bgl (BH03) to 8.83m bgl (BH04), the ground water has been assumed as 1m bgl meaning buoyant soil conditions are predominately considered. Offshore the water level has been taken as Lowest Astronomic Tide (LAT). The proportion of soil cover set as the plastic allowance is 0.5 (worst case scenario), thus the actual depths will vary significantly and rapidly as the borehole approaches the surface at either end.

Calculation sheets are presented in Appendix H and are based on a 1.118m reamed borehole.

The variation in pressures along the borehole are shown in Figure 10, where it can be seen the permissible boreholes pressures P_{emax} and P_{max} graphs fall rapidly beneath the cliffs due to the topographic level change and thus loss of cover depth. Another feature to note on this graph is that the permissible pressures are significantly larger than the overburden pressure and this is due to the nature of the assumptions in the 'Dutch' model. The difference between P_{emax} and P_{max} arises from consideration of the water table level and the added confinement pressure due to its hydrostatic effect.

Figure 10: HDD Permissible Borehole Pressures



The most significant line on Figure 10 is the Annular Pressure which is the pressure in the borehole due to the drill fluid return flow. This pressure varies as the borehole progresses and is the sum of the static head and friction (flow) head. For most of the distance the annular pressure is well below P_{emax} but as it approaches the cliffs level (CH160) it becomes marginal for risk of hydrofracture. Appropriate site controls such as sandbagging should therefore be considered at this location by the Contractor and all drill fluids to be self-flocculating and environmentally inert, an appropriate drilling fluid data sheet is presented within Appendix J. In the final stages of the bore profile the calculations show hydrofracture is likely as the profile begins to lose cover depth shortly before punch-out, this is unavoidable and will require appropriate site controls to be in place.

6.7.2 Duct Pulling Calculations

On completion of the HDD bore the product pipe will most likely be inserted by pulling after floating offshore to the HDD exit point. Within the industry pulling is preferred as the pipe acts in tension, which eliminates potential issues of buckling associated with the compressive forces created from the pushing method. In this particular instance it is expected that pulling the product pipe from offshore to onshore is most likely the best solution, as such, product pipe pulling calculations have been carried out to understand the likely forces involved with such an installation.

Within this analysis, the frictional forces, hydrodynamic forces and gravitational forces have been considered. Furthermore, the profile of the borehole has been considered as a series of sections to best represent the additional forces associated with areas of curvature within the borehole. As will be apparent, the required force to move the pipe will increase as the pipe progresses through the borehole.

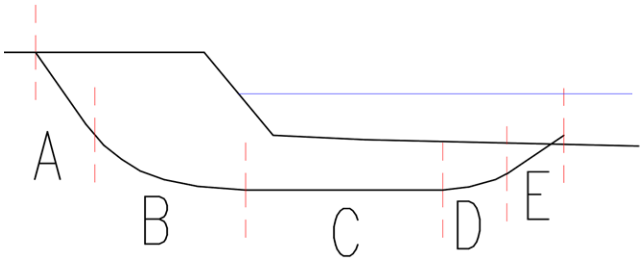
Note that there can be a considerable difference between the static and kinematic coefficients of friction. It is assumed that normally the pipe insertion will be undertaken in one continuous operation thus the kinematic coefficient of friction would apply throughout. However, if the operation is stopped then in order

to get the pipe moving again the static coefficient of friction will apply. This could be 2 or 3 times the kinematic coefficient value. Depending on the duration of the interruption, other factors such as the thixotropic properties of bentonite may also increase the force required to move the pipe.

Also, it should be noted that within this analysis the frictional forces associated prior to entering the borehole have been considered as a nominal value of 50kN. This force is assumed and should be assessed at the design stage when the method of installation has been determined.

All calculations have been considered using the Circuit 2 borepath determined within drawing 16435-103-WIE-ZZ-XX-DR-C-91002 (Appendix G), and a breakdown of the considered section can be seen in Figure 11 below.

Figure 11: HDD Bore Path Schematic



A summary of the HDD borehole geometry can be seen in Table 6, note that as mentioned previously it is assumed that the pipe is pulled from Section E back towards Section A.

Table 6: HDD Bore Path Geometry

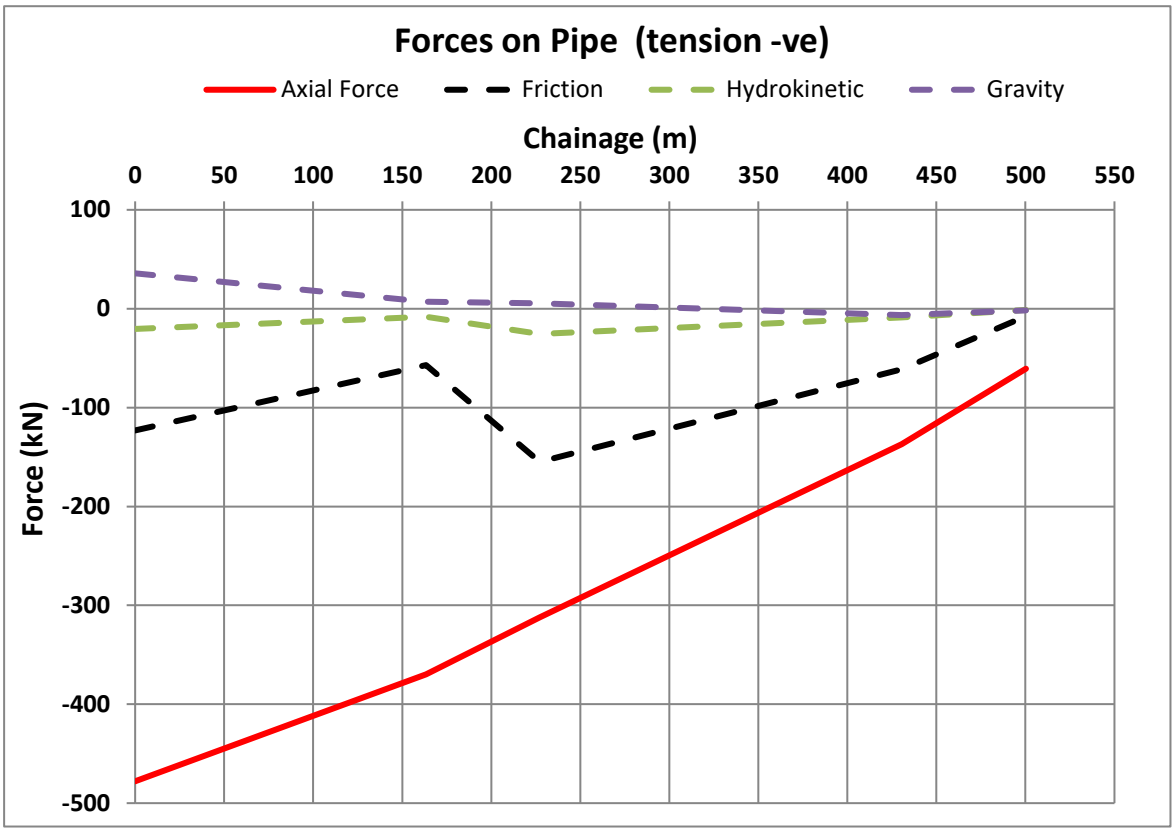
	A	A:B	B:C	C:D	D:E	E
Ch	0.00	163.40	227.24	430.49	500.29	510.27
mOD	19.83	-3.89	-9.08	-12.62	-8.97	-7.75
Radius		500		500		
Slope	-8.26		-1.00		6.97	

Based on information received from SPL the proposed product pipe is to be minimum circa 663.5mm, meaning that due to available pipe sections a nominal 800mm diameter HDPE pipe is considered. It is assumed that the HDD drill will be circa 311mm then reamed out to a diameter circa 1118mm.

Dependent on project specifics the pipe is sometimes filled with ballast water whilst installing to counteract buoyancy. For the purpose of these calculations, it has been assumed that the pipe is filled with ballast water and is unpressurised (typical when pulling) as this is the most feasible approach for the drill profile. When designing the pipe installation this should be reassessed by determining the buoyant forces and considering if ballast water is required.

Using the proposed Circuit 2 profile and properties of the product pipe the pulling forces shown in Figure 12 were obtained.

Figure 12: HDD Product Pipe Pulling Forces



The main feature shown in Figure 12 is the Axial Force, which is a combination of the friction, gravity and hydrokinetic components. The friction arises from the action of the pipe against the soil/rock in the borehole but is somewhat lubricated by the bentonite. The gravity component is initially of resistance when pulling as the profile is of a downwards trajectory and the pipe is buoyant but then assists when the profile begins to rise. The hydrokinetic force arises from the displacement of the bentonite as the pipe is pulled through the borehole. As seen within Figure 12, the gravity and hydrokinetic components are minor when compared to friction component and have only been considered as good practice.

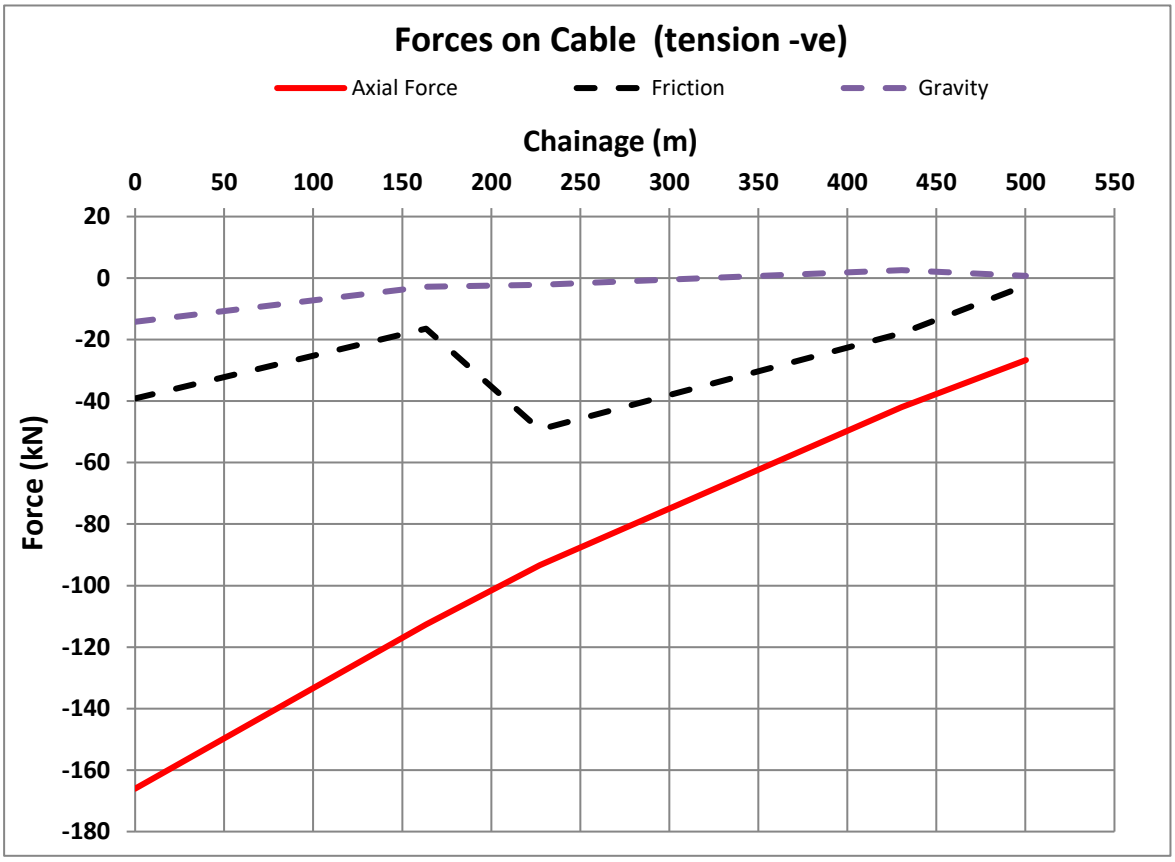
From the analysis a Maximum Required Axial Force of 478kN has been determined, however, as the forces associated with pulling the pipe from the offshore tethering area to the start of the borehole have been considered as a nominal force, 50kN and that cautious assumptions have been made regarding pipe and soil properties, then this analysis should be revised as the design process is carried out and the variables become known. Furthermore, it is assumed throughout this analysis that no obstructions are present on the basis that the reaming and fluid should, in theory, keep the bore clear. However, if this is not the case with obstructions in the bore such as debris dislodged from the soffit of the borehole, or otherwise, then the additional pulling forces required will likely be significant.

From the maximum axial force required a maximum axial stress of approximately 5.3N/mm^2 can be derived, the nominal yield strength of SDR11 HDPE pipe is approximately 24N/mm^2 and from review of advisable safe pulling strength for HDD applications an axial stress of 7.5N/mm^2 to 9N/mm^2 is a limiting factor, thus the HDD pulling calculations are acceptable in terms of tensile stresses. However, these calculations should be reviewed after variables become more defined through the design process.

6.7.3 Cable Pulling Calculations

From the data sheet provided by SPL (Appendix A), the cable outside diameter is 263.5mm. All calculations have been considered using the Circuit 2 borepath determined within drawing 16435-103-WIE-ZZ-XX-DR-C-91002 (Appendix G), and a breakdown of the considered section can be seen in Figure 11 above and the HDD borehole geometry presented in Table 6. For clarity, the cable pulling calculations have been carried out on the basis that the installation will occur from Section E (offshore) back to Section A (onshore) as per the Duct Pulling operation. The results are presented on the cable forces graph Figure 13.

Figure 13: HDD Cable Forces



From the analysis a Maximum Required Axial Force of 166kN has been determined for the cable. From the cable data sheet provided by SPL (Appendix A) an allowable pulling force of 400kN is stated. Therefore, with reference to Figure 13, the calculated pulling force is acceptable for the proposed cable.

Within the calculations, the forces associated with pulling the cable from the stringing out area to the start of the borehole have been considered as a nominal force of 25kN. Further, an assumption of the friction factor between the pipe and cable has been used. The required cable pulling forces should therefore be revised as the design process develops and the variables become known.

6.8 Budget Cost and Outline Programme

Working with a specialist drilling contractor, Stockton Drilling Ltd, a budget cost estimate and outline programme for the HDD works has been established (this is indicative only).

- For the installation of the two circuits the Budget Cost Estimate is in the order of €12M to €17M; and

- Outline programme including site set up, drilling of pilot hole, reaming and duct installation is in the order of 275 days.

7. Conclusions and Recommendations

WIE have been appointed by SPL to undertake a Feasibility Study to demonstrate a cable landfall by using a Horizontal Directional Drilling (HDD) technique. Within this design, consideration was to be given to the SPL requirements which included:

- Minimise cover depth as far as practical, with an absolute maximum cover depth of 10m bgl;
- Cover depth must be sufficient to demonstrate the risk of hydrofracture is minimal;
- HDD punchout location to be at a minimum water depth 6m LAT (ideally 7m LAT) to assist with offshore works;
- HDD punchout location to be a maximum 300m horizontal distance from a water depth 7m LAT (ideally 10m LAT) to assist with offshore cable installation works by limiting the floating cable length due to risks associated with controlling the floating bight; and
- Landfall to allow for 2 No. Circuits.

This study concludes the following:

- 2 No. bore profiles have been designed with a maximum cover depth of 9.34m at approximately CH217 on Circuit 1 and 9.93m at approximately CH130 on Circuit 2;
- 2 No. bore profiles have been designed with a minimum cover depth of 4.83m at approximately CH164 on Circuit 1 and 3.53m at approximately CH160 on Circuit 2;
- Hydrofracture calculations considering the Circuit 2 bore profile, which has the most critical cover depth at the coastal cliffs, have indicated the profile to pass the hydrofracture check, albeit marginally at the minimum cover depth at circa CH160;
- The HDD punchout locations on both bore profiles are at approximate water depths of 7.9m LAT at CH514 and CH510 on the Circuit 1 and 2 respectively; and
- The HDD punchout locations have horizontal distances of 300m and 273m from 10m LAT on Circuit 1 and Circuit 2 respectively.

The feasibility stage design is presented in plan and profile on Drawings 16435-103-WIE-ZZ-XX-DR-C-91001 & 16435-103-WIE-ZZ-XX-DR-C-91002 presented in Appendix G.

7.1 Recommendations

The following recommendations are made in relation to developing detailed design for the cable landfall:

- A campaign of nearshore intrusive ground investigation is required, and supplementary onshore ground investigation is required along the LF2 route;
- For the onshore ground investigation, it is considered that cable percussive boreholes with rotary core follow-on would suffice to build on data already collected specifically targeting the site compound area and proposed bore paths. All boreholes should be marginally offset from the proposed bore paths to avoid the creation of potential weak zones that may impact “frac-out”;
- Boreholes should be sunk to at least 5m below the proposed bore path depth;
- A suite of suitable laboratory testing should be completed, including rock strength testing and soils classification testing, with all results to be presented in a Ground Investigation Factual Report;
- For the nearshore ground investigation, it is recommended that further nearshore refraction geophysics is undertaken. It is recommended that the offshore ground investigation comprises cable percussive boreholes with rotary core follow-on, potentially with interspersed with CPTu data from a jack-up (or similar) barge in order to ascertain the ground conditions from the proposed exit point back

to the beach/ base of cliffs;

- Although accessible to farm traffic, due to the narrow nature of the access road (R750) it would be prudent to undertake a route study which includes a swept path analysis, traffic surveys, a review of any culvert/ bridge crossings and overhead utilities. This study should target local roads on the assumption access to the general area can be acquired via the M11. An indicative delivery vehicle of length 20m, width 2.6m, body height 3.9m, and weight circa 25t should be considered, all these values should be confirmed by the Contractor at detailed design stage; and
- A supplemental bathymetric survey should be considered subject to the findings of the intrusive ground investigation, using suitable vessels with a shallow draught, to cover the data gap in the existing survey.
- The borepath could be designed to punchout prior to the Faultline, however this would result in a water depth of circa 6m LAT at the punchout location and a horizontal distance of 300m would only achieve a water depth of circa 9.3m LAT. In order to reach the desired water depth of 10m LAT a horizontal cable distance of 400m would be required post punch-out. The trade-off between the punch out water depth and the horizontal distance to 10m LAT should be considered at detailed design.

8. References

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APPENDICES

A. Cable Datasheet

1.1 Design data for TKRA 245 kV 3x1x2000 mm² KQ + FO

Conductor	Diameter of conductor Key stone shaped copper conductor filled with a water-blocking semiconducting compound	51.9 mm
Conductor screen	Extruded layer of semiconducting crosslinked polyethylene	
Insulation	Nominal thickness Diameter over insulation Extruded layer of insulating crosslinked polyethylene (XLPE)	22.0 mm 99.4 mm
Insulation screen	Extruded layer of semiconducting crosslinked polyethylene	
Longitudinal water-block	Semiconducting water-swellable tape	
Lead sheath	Nominal thickness The sheathing material is lead alloy	2.1 mm
Inner sheath	Nominal thickness Extruded sheath of semiconducting polyethylene	2.2 mm
Laying up	The cores are laid up. Extruded PE fillers and possibly one fiber optic cable are located in the interstices between the cores.	
Armour bedding	Nylon tapes	
Armour	Shape of armour wires Diameter of armour wires Number of armour wires, approx. One layer of round galvanized steel wires	Round 5.6 mm ⌀ 138
Outer serving	Two layers of polypropylene yarn and bitumen	
Diameter	Diameter of cable, approx.	266 mm
Weight	Total weight of cable, approx.: - in air - submerged	 139 kg/m 92 kg/m

1.2 Mechanical data for TKRA 245 kV 3x1x2000 mm² KQ + FO

Bending radius	Minimum permissible bending radius during laying	4.0 m
Pulling tension	Maximum permissible pulling tension (no bending)	400 kN

1.3 Electrical data for TKRA 245 kV 3x1x2000 mm² KQ + FO in HDD

Current rating	Current rating in Bentonite filled HDD	950 A
Conductor temperature	Max. permissible conductor temperature	90 °C
Ambient conditions	Max. ambient temperature for the cable in seabed at burial depth Max. burial depth in seabed Thermal resistivity of seabed Thermal resistivity of Bentonite Inner diameter of HDD Outer diameter of HDD Lead sheaths and armour are bonded and earthed at both ends	10 °C 10.0 m 1.0 K.m/W 0.65 K.m/W 705 mm 660 mm
Frequency	Frequency	50 Hz
Load factor	Load factor	100 %
Short circuit current	Permissible thermal short circuit current: - in the conductor for 1.0 sec - in the lead sheaths for 1.0 sec	 286 kA 3x18 kA
Rated voltage	Rated RMS system voltage (U) Rated RMS voltage between conductor and screen (U_o)	220 kV 127 kV
Highest voltage	Highest continuous RMS system voltage (U_m)	245 kV
Basic insulation level	Lightning impulse withstand voltage (1.2/50 µsec.)	1050 kV
Electrical stress	Maximum electrical stress in insulation at rated voltage U_o	7.8 kV/mm
Conductor resistance	Max. d.c. resistance at 20 °C a.c. resistance at 90 °C	0.0090 Ω/km 0.0181 Ω/km
Cable impedance	Cable impedance at 940 A	0.03 + j0.11 Ω/km
Zero impedance	Zero sequence impedance at 940 A	0.16 + j0.09 Ω/km
Capacitance	Capacitance between conductor and screen	0.24 µF/km
Charging current	Charging current at 220 kV	9.5 A/km
Loss angle	Maximum value at ambient temperature and rated voltage	0.001
Losses	Losses at 220 kV and 940 A in HDD: - conductor losses - dielectric losses - sheath losses - armour loss Total losses per cable	 3x16.0 W/m 3x1.2 W/m 3x8.1 W/m 8.4 W/m *) 84.3 W/m

*) Assumed reduced armouring losses

1.3.1 Electrical data for TKRA 245 kV 3x1x2000 mm^2 KQ + FO in seabed

Current rating	Current rating in sebed	1140 A
Conductor temperature	Max. permissible conductor temperature	90 °C
Ambient conditions	Max. ambient temperature for the cable in seabed at burial depth Max. burial depth in seabed Thermal resistivity of seabed Lead sheaths and armour are bonded and earthed at both ends	15 °C 1.0 m 1.0 K.m/W
Frequency	Frequency	50 Hz
Load factor	Load factor	100 %
Short circuit current	Permissible thermal short circuit current: - in the conductor for 1.0 sec - in the lead sheaths for 1.0 sec	 286 kA 3x18 kA
Rated voltage	Rated RMS system voltage (U) Rated RMS voltage between conductor and screen (U_o)	220 kV 127 kV
Highest voltage	Highest continuous RMS system voltage (U_m)	245 kV
Basic insulation level	Lightning impulse withstand voltage (1.2/50 µsec.)	1050 kV
Electrical stress	Maximum electrical stress in insulation at rated voltage U_o	7.8 kV/mm
Conductor resistance	Max. d.c. resistance at 20 °C a.c. resistance at 90 °C	0.0090 Ω/km 0.0181 Ω/km
Cable impedance	Cable impedance at 940 A	0.03 + j0.11 Ω/km
Zero impedance	Zero sequence impedance at 940 A	0.15 + j0.09 Ω/km
Capacitance	Capacitance between conductor and screen	0.24 µF/km
Charging current	Charging current at 220 kV	9.5 A/km
Loss angle	Maximum value at ambient temperature and rated voltage	0.001
Losses	Losses at 220 kV and 940 A in seabed: - conductor losses - dielectric losses - sheath losses - armour loss Total losses per cable	 3x15.3 W/m 3x1.2 W/m 3x8.8 W/m 8.1 W/m *) 84.0 W/m

*) Assumed reduced armouring losses

B. UXO Consultation

Pre-Desk Study Assessment

Site:	Land near Ennereilly Beach, Arklow, County Wicklow
Client:	Waterman Group
Contact:	Lewis Phin
Date:	11th May 2022
Pre-WWI Military Activity on or Affecting the Site	None identified.
WWI Military Activity on or Affecting the Site	None identified.
WWI Strategic Targets (within 5km of Site)	The following strategic targets were located in the vicinity of the Site: ■ Arklow Harbour. ■ Transport infrastructure and public utilities.
WWI Bombing	None identified on the Site.
Interwar Military Activity on or Affecting the Site	None identified.
WWII Military Activity on or Affecting the Site	None identified.
WWII Strategic Targets (within 5km of Site)	The following strategic targets were located in the vicinity of the Site: ■ Arklow Harbour. ■ Transport infrastructure and public utilities.
WWII Bombing Decoys (within 5km of Site)	None.
WWII Bombing	Despite declaring neutrality, the Republic of Ireland was bombed on several occasions by the Luftwaffe between August 1940 and July 1941. The first bombs were dropped on County Wexford and the heaviest bombing occurred during January and May 1941 in Dublin. No readily available records have been found to indicate that the Site was bombed.
Post-WWII Military Activity on or Affecting the Site	None identified.
Recommendation	A detailed desk study, whilst always prudent, is not considered essential in this instance.
Further information	For information about Zetica's detailed UXO desk studies and other UXO services, please visit our website: www.zeticauxo.com. Details and downloadable resources covering the most common sources of UXO hazard affecting sites in the UK can be found **here**. If you have any further queries, please don't hesitate to get in contact with us at uxo@zetica.com or 01993 886 682.

This summary is based on a cursory review of readily available records. Caution is advised if you plan to action work based on this summary.

C. Irish Drilling Ltd Ground Investigation Factual Report (2020)

Project Title	Arklow Bank Wind Park Phase 2
Document Reference Number	LF100034-ENG-GT-ONX-RPT-0001

Onshore Ground Investigations: Landfall Site - Factual Report

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Rev	Date	Reason for Issue	Originator	Checker	Approver
01	22/01/2020	Approved for Use	Irish Drilling Limited	Arup	

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LOUGHREA, CO. GALWAY, IRELAND

CONTRACT DRILLING
SITE INVESTIGATION

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ARKLOW BANK WIND PARK ONSHORE GROUND INVESTIGATIONS

LANDFALL SITE INVESTIGATIONS FACTUAL REPORT

Sure Partners Ltd,
South County Business Park,
Leopardstown,
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ARUP,
Consulting Engineers,
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	Prepared by	Approved by	Rev. Issue Date:	Revision No.
	Ronan Killeen	Declan Joyce	22nd January 2021	20 WW_101/02c
Signature	RK	DJ		

Report No.: LF100034-ENG-GT-ONX-RPT-0001

FOREWORD

The borehole and trial pit records have been compiled from an examination of the samples by a Geotechnical Engineer and from the Drillers' descriptions.

The report presents an opinion on the configuration of the strata within the site based on the borehole and trial pit results. The assumptions, though reasonable, are given for guidance only and no liability can be accepted for changes in conditions not revealed by the boreholes and trial pits.

The fieldwork was carried out in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations with precedence given to IS EN 1997-2 where applicable.

Contents:

1.0 Introduction
2.0 The Site & Geology
3.0 Fieldwork
4.0 Laboratory Testing

Book 1 of 1

Appendix 1 Borehole Records (Rotary Core)

Appendix 2 Trial Pit Records

Appendix 2A Thermal Resistivity/Conductivity Records

Appendix 3 Acoustic Televiewer Survey

Appendix 4 Soil Resistivity Tests

Appendix 5 Groundwater Readings

Appendix 6 Laboratory Test Results

Appendix 6A Laboratory Tests (Environment)

Appendix 7 Photographs (Trial Pits)

Appendix 8 Photographs (Rotary Core)

Appendix 9 'As-Built' Drawings

Appendix 10 Digital Data

1.0 Introduction.

Irish Drilling Ltd. (IDL) was instructed by Sure Partners Limited (SPL), to carry out a site investigation at the site of the proposed landfall site for the Arklow Bank Wind Park (ABWP) Onshore Grid Infrastructure Project.

This site investigation was carried out to provide detailed factual geotechnical information of the underlying ground conditions at the proposed landfall site.

The fieldwork commenced on October 13th 2020 and was completed on November 4th 2020.

2.0 Site & Geology

The site is located north of Arklow Town and comprises of an area circa 200m by 200m in dimension and this is proposed to be used to accommodate the proposed subsea cable.

The site can be generally described as arable farmland with sloping and undulating topography.

A Site Plan, prepared by the client's representatives and amended by IDL to show 'as-built' locations, is included with this report as Appendix 9.

The following were the main published information sources used:

Subsoil Geology
General Classification:
Cable Percussive borehole, Trial Pit data, the Teagasc Subsoil Mapping (2004) and the Quaternary Geology of Ireland – Sediments Map: 1 to 50,000 were reviewed to obtain information on subsoil classifications within the proposed locations.

Solid Geology
General Classification:
The 1:100,000 scale map series Geological Survey of Ireland: A geological Description: Sheet 16 and the Geological Survey of Ireland Map Viewer were used to establish the probable geological rock formations underlying the proposed location.

Site investigation data is available as point source data along the proposed route, and the majority of the ground in between the points can only be assumed to follow the characteristics of the nearest available data.

A summary of the ground conditions recorded in published data for the region (including GSI database) is outlined as follows:

Glacial Till:
Generally, glacial till is what was often referred to as Boulder Clay. Here we have the calcareous Irish Sea till, a diverse material that has been largely deposited sub-glacially and has a wide range of characteristics due to the variety of parent materials and processes of deposition. Tills are generally tightly packed, unsorted, heterogeneous, unbedded, and can have a wide range of particle sizes and types, which are often but not exclusively angular or sub-angular.

Bedrock:
The GSI database shows the site to be underlain by the Maulin Formation (identified as dark blue grey slates, phylites and schists).

3.0 Fieldwork.

3.1 Fieldwork Plant:

The following plant was mobilised to site to carry out fieldwork operations:

Hyundai 140x Excavator.
DeltaBase 520 Rotary Core Drill Rig.

Fieldwork carried out to date has included the following:

3.2 Rotary Core Boreholes:

Five rotary core boreholes were carried out to establish overburden conditions and rockhead and to establish the nature and integrity of the underlying rock.

The rotary core boreholes were carried out as 'stand-alone' boreholes and used a water based flush system as the drilling medium while a biodegradable polymer gel was also used where necessary to aid the drilling and soil / rock recovery process.

The boreholes were predominantly completed using wireline drilling techniques, with PQ and GeoboreS size (84mm core/123mm hole diameter and 100mm core / 155mm hole diameter) drill strings to recover soil and rock core samples.

The samples were stored in wooden boxes and returned to the laboratory where there were logged and photographed by a Geotechnical Engineer and presented for testing.

A downhole acoustic survey was carried out in all the boreholes and on completion of the acoustic televiewer surveys a 50mm diameter standpipe was installed in the following rotary core boreholes to allow for the monitoring of groundwater levels over a prolonged period of time: BH 01, BH 03 and BH 04.

The rotary core boreholes were carried out to depths ranging from 10.10m to 20.20m below ground level.

3.3 Trial Pits:

Twelve trial pits were excavated on site using a 13T wide-padded tracked excavator. The pits were logged and photographed by an Engineer with observations made on ground conditions, pit stability, water ingress and services encountered.

Small and bulk disturbed soil samples were recovered at each change in strata and returned to the laboratory and presented for testing.

Shear Vane Tests were carried out in-situ where applicable or on irregular lump samples recovered from trial pit arisings.

In-Situ tests consisting of thermal conductivity/thermal resistivity were also carried out at the following trial pit locations: TP 03-TP 12.

The tests were carried out using a TLS-100 Portable Thermal Conductivity/Thermal Resistivity Meter and the results are included as Appendix 2a of this factual report.

3.4 Acoustic Televiewer Survey:

An Acoustic Televiewer Survey was carried out by European Geophysical Surveys Limited.

The surveys were carried out at the following five rotary core locations: BH 01, 02, 03, 04 and 05.

The survey was carried out in the boreholes at depths ranging from 0.20m to 20.20m below ground level and consisted of the following: Optical Imager, Acoustic Imager, Natural Gamma,

Caliper, Focused Resistivity, Fluid Temperature and Conductivity, Impeller Flowmeter and Full Wave Sonic.

The records of the televiewer survey are included as a 'stand-alone' report in appendix 3 of this report.

3.5 Soil Resistivity Test:

One soil resistivity test (SR 07) was carried out on site.

The test was carried out using a Megger Resistivity Unit with electrode spacings of 1m, 2m and 3m used to complete the test.

The records of the soil resistivity test are included as Appendix 4 of this factual report.

3.6 Surveying:

The borehole and trial pit locations were set out on site using a Trimble CU Bluetooth GPS Surveying Unit and the co-ordinates are included on the logs presented in the appendices. All fieldwork co-ordinates are reported to Irish Transverse Mercator (ITM) with Reduced Levels recorded relative to Malin Head Datum and with an accuracy level of + or – 0.10m.

3.7 General Summary:

Ground conditions encountered during the completion of the fieldwork were typical and as expected for this region and predominantly consisted of Irish Sea Tills overlying Bedrock. The Tills in general consisted of slightly sandy slightly gravelly silt/clay with cobbles and boulders.

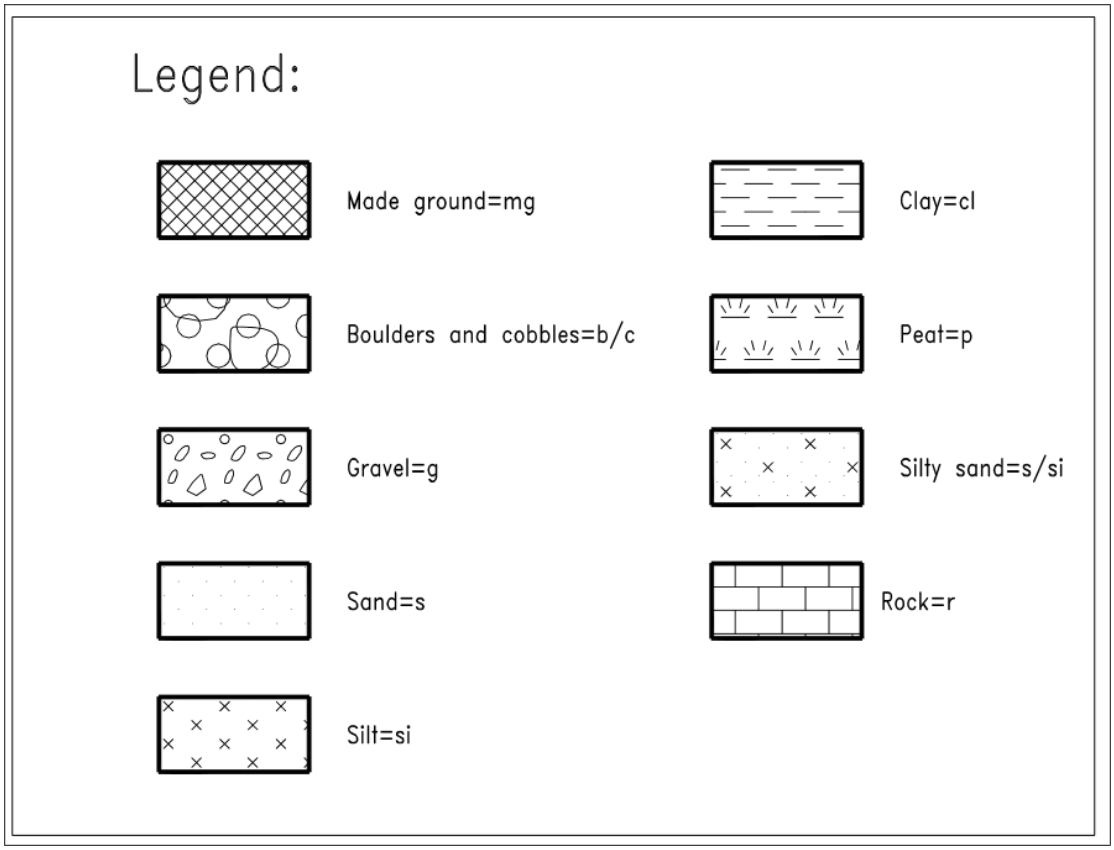
Intact bedrock in general is described as grey, fine-grained, thinly laminated shale.

Bedrock was encountered in the rotary core boreholes at depths varying from 2.30m to 9.00m below ground level and for detailed descriptions of bedrock please refer to the engineering logs included in the appendices to this report.

Reference should be made to the engineering logs for a detailed description of the ground conditions encountered.

The fieldwork was carried out in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations with precedence given to IS EN 1997-2 where applicable.

The following Key Legend Table details the symbology used on the engineering logs to describe ground conditions encountered:



4.0 Laboratory Testing

Representative samples recovered from the boreholes and trial pits were scheduled for testing in the laboratory.

The test schedules were prepared by the Client's Engineer and included some or all of the following tests on disturbed and/or undisturbed soil samples recovered from the trial pits:

* 30nr Natural Moisture Content.
* 25nr Atterberg Limits.
* 27nr Particle Size Distribution.
* 23nr Sedimentation.
* 12nr Chemical (pH, Sulphate, Total Sulphur).
* 8nr Compaction.
* 8nr Moisture Content Relationship.
* 24nr Environmental Suite.
* 12nr Thermal Resistivity.

The test schedules also included some or all of the following tests on soil and/or rock core samples recovered from the boreholes:

* 10nr Natural Moisture Content.
* 9nr Atterberg Limits.
* 10nr Particle Size Distribution.
* 9nr Sedimentation.
* 7nr Triaxial.

* 46nr Point Load Tests.
* 5nr Unconfined Compressive Strength (UCS).
* 6n Natural Water Content (rock core).
* 6nr Flakiness Index.
* 2nr Frost Heave.
* 2nr Resistance to Freezing and Thawing.
* 14nr Rebound Hardness.
* 4nr Petrographic Analyses

A full summary of the soil and rock test results is included as Appendix 6 of this report.

A number of laboratory test results not available on issuance of this report will be presented as an Addendum to this report accordingly.

The test schedules were carried out predominantly at the IDL Laboratory located at Loughrea, County Galway.

A number of specialist tests not available at the IDL laboratory were carried out by designated laboratories on a subcontract basis as follows:

Laboratory chemical and environmental tests were carried out by Alcontrol Laboratories, UK.
Triaxial soil tests were carried out by NMTL, Carlow.
Specialist rock tests were carried out by Celtest Laboratories, UK.

The soil and rock descriptions as noted on the borehole and trial pit logs are in general visual descriptions as observed and logged by our Engineers and are described in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations.

Soils descriptions (cohesive or otherwise) are also initially assessed based on the texture and ‘feel’ of the soil materials as witnessed by our Geotechnical Engineers.

Where laboratory classification tests have been carried out on soil or rock samples then these visual descriptions have been amended accordingly to take into account the results of these classification tests.

The records of all fieldwork, laboratory test results completed to date and photographs are included in the appendices of this Factual Report.

Ronan Killeen
Chartered Engineer
Irish Drilling Limited
January 22nd 2021

Appendix 1 Borehole Records (Rotary Core)

Irish drilling LTD

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Arklow Bank Wind Park-Landfall Site Investigations	Arklow, County Wicklow	**BH01**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2020WW102	20-10-20 21-10-20	13.97	E 727,115.2 N 677,281.4

Engineer	Sheet	Rev.
ARUP	1 of 1	DRAFT1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities / Detail	Main	Geology	Instrument/ Backfill
0.00	75 (-) -	NA			(2.50)	0.00 - 2.50 m: overburden	Stiff orangish brown slightly sandy CLAY. Sand is fine to medium.		
2.00		2.00 (15)	11.47		2.50				
3.50	100 (54) 0					2.50 - 10.20 Discontinuities, apparently closely spaced, locally extremely and very closely spaced, dipping 18 to 20 and 84 to 86°, planar, smooth, with 0.5 to 6mm thick orangish brown clay smear and orange and orangish brown iron stain and powder. 2.51 - 10.20 Non-intact as closely spaced, locally extremely and very closely spaced discontinuities.	Medium strong locally strong and weak thinly laminated greenish grey and grey fissile fine grained SHALE.		
20.10 4.70	100 (45) 0						4.20-4.34m: Point Load Test-Weak.		
21.10 5.20	100 (0) 0								
6.70	100 (64) 0	NI			(7.70)		5.70-5.80m: Point Load Test-Weak. 6.30m to 7.00m: with fine to coarse gravel sized white quartz clasts.		
8.20	100 (63) 21						7.00m to 10.20m: dark grey. 7.00-7.20m: Point Load Test- Very weak. 7.80-7.90m: Point Load Test-Weak.		
9.70	100 (61) 0						8.52-8.66m: Point Load Test-Weak.		
21.10 10.20	100 (54) 0		3.77		10.20		9.90-10.40m: Point Load Test-Weak.		
							BH terminated at 10.20m bgl on REs instruction.		

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
20-10-20	16.00	4.70	4.70	146	102		
21-10-20	08.30	4.70	4.70	146	102		
21-10-20	13.00	10.20	4.70	146	102		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	10.20	polymer	100

GENERAL REMARKS

10 litres polydrill used. Acoustic televiewer works carried out. 50mm standpipe installed. Response zone 4.00m to 7.00m bgl.

All dimensions in metres Scale 1:68.75	Client: Sure Partners Limited	Method/ Plant Used: DeltaBase	Bit Design: GBS	Driller: DK	Logged By: EAT

IDL AGS UK DH (SPTS) ARKLOW BANK RC LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IDL TP TEMPLATE.GDT 7/4/21

Irish drilling LTD

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Arklow Bank Wind Park-Landfall Site Investigations	Arklow, County Wicklow	**BH02**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2020WW102	21-10-20 21-10-20	14.12	E 727,198.8 N 677,284.6

Engineer	Sheet	Rev.
ARUP	1 of 1	DRAFT1

RUN DETAILS				STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology / Instrument/ Backfill
0.00			13.92		0.20	0.00 - 6.30 m: overburden	Firm orangish brown slightly sandy CLAY.	
	75 (-) -						Stiff orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse of quartz chert and shale.	
2.00		2.00 (14)					2.00m to 6.30m: dark orangish brown.	
	100 (-) -							
3.50		NA			(6.10)			
	100 (-) -	3.50 (27)						
5.00		5.00 (27)						
	38 (-) -							
6.30			7.82		6.30			
	100 (30) 0					6.30 - 9.40 Discontinuities, apparently medium spaced, locally closely spaced, dipping 84 to 86°, planar, locally stepped, smooth, with 0.5 to 2mm thick brown silt smear and orange and dark orangish brown iron stain and powder.	Medium strong locally strong thinly laminated greenish brownish grey fissile fine grained SHALE.	
21.10 7.70								
21.10	100 (0) 0	NI			(3.80)			
8.50								
	100 (31) 0							
9.40						9.40 - 10.10 Discontinuities, apparently medium spaced, locally closely spaced, dipping 38 to 40°, planar, smooth, with 0.5 to 1mm thick orangish brown clay smear, open.	9.40m to 10.10m: medium strong, locally weak thinly laminated light grey and grey. 9.68-9.75m: Point Load Test-Weak.	
	100 (80) 64	4						
21.10 10.10			4.02		10.10		BH terminated at 10.10m bgl on REs instruction.	

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
21-10-20	12.00	7.70	7.70	146	102		
21-10-20	17.00	10.10	7.70	123	84		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	10.10	polymer	100

GENERAL REMARKS

10 litres polydrill used. Acoustic televiewer works carried out. BH backfilled with grout.

All dimensions in metres Scale 1:68.75	Client: Sure Partners Limited	Method/ Plant Used: DeltaBase	Bit Design: GBS/PQ	Driller: DK	Logged By: EAT

IDL AGS UK DH (SPTS) ARKLOW BANK RC LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IDL TP TEMPLATE.GDT 7/4/21

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Arklow Bank Wind Park-Landfall Site Investigations	Arklow, County Wicklow	**BH03**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2020WW102	22-10-20 27-10-20	9.18	E 727,222.2 N 677,213.6

Engineer	Sheet	Rev.
ARUP	1 of 2	DRAFT1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument/ Backfill
0.00			8.98		0.20	0.00 - 2.30 m: overburden	Grass over firm orangish brown CLAY.		
	70 (-) -	NA			(1.50)		Firm orangish brown sandy gravelly CLAY with cobbles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of quartz chert and shale. Cobbles are of chert and shale.		
1.70			7.48		1.70				
	100 (41) 18	2.00 (20)	6.88		(0.60) 2.30		Stiff brownish green slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of grey shale.		
22.10 3.20		15				2.30 - 20.20 Discontinuities, apparently closely spaced, locally extremely and very closely spaced, dipping 58 to 60 and 18 to 20°, stepped, smooth, with 0.5 to 3mm thick grey silt smear. 3.00 - 4.70 Non-intact as closely spaced and very closely spaced discontinuities.	Medium strong locally weak and strong thinly laminated grey and dark grey fissile fine grained SHALE. 3.00-3.20m: Point Load Test-Weak.		
22.10 3.80	100 (30) 0	NI					3.50-3.65m: Point Load Test-Weak.		
	100 (52) 18	4					4.80-4.93m: Point Load Test-Weak.		
5.30		15							
	100 (37) 16	16					6.46-6.60m: Point Load Test-Weak.		
22.10 6.80									
23.10	85 (20) 0	NR/NI				6.80 - 11.20 No recovery as washout of fines during drilling. No record of cavity. Non-intact as closely spaced and very closely spaced discontinuities.	6.80m to 11.20m: Non-intact as medium strong thinly laminated dark grey fissile fine grained shale with much grey silt and orange and orangish brown iron stain and powder. 7.00m: dark grey.		
8.20									
	86 (0) 0								
9.70									
	80 (0) 0	NR/NI							

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
22-10-20	12.00	3.20	3.20	146	102		
22-10-20	17.00	6.80	3.20	123	84		
23-10-20	08.30	6.80	3.20	123	84		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	20.20	polymer	100

GENERAL REMARKS

15 litres polydrill used. Acoustic televiewer works carried out. 50mm standpipe installed. Response zone 16.00m to 19.00m bgl.

All dimensions in metres Scale 1:68.75	Client: Sure Partners Limited	Method/ Plant Used: DeltaBase	Bit Design: GBS/PQ	Driller: DK	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Arklow Bank Wind Park-Landfall Site Investigations	Arklow, County Wicklow	**BH03**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2020WW102	22-10-20 27-10-20	9.18	E 727,222.2 N 677,213.6

Engineer	Sheet	Rev.
ARUP	2 of 2	DRAFT1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities	Detail	Main	Geology	Instrument/ Backfill
11.20					(17.90)			Medium strong locally weak and strong thinly laminated grey and dark grey fissile fine grained SHALE. *(continued)* 11.20m to 20.20m: with 'anastomosing' quartz. 11.80-12.00m: Point Load Test-Weak.		
	100 (47) 15	13								
12.70		7						12.80-13.00m: Point Load Test-Weak.		
	100 (68) 33	15								
23.10 14.20						14.00 - 20.20 Non-intact as closely spaced and very closely spaced discontinuities.		14.00m to 20.20m: Non-intact as medium strong and weak thinly laminated fissile with much dark grey silt. 14.80-15.00m: Point Load Test-Very weak.		
27.10 15.70	100 (25) 0									
	100 (50) 0							15.80-15.94m: Point Load Test-Weak.		
17.20		NI								
	100 (54) 21									
18.70								18.70-18.90m: Point Load Test-Weak.		
	100 (42) 0									
27.10 20.20			-11.02		20.20					
								BH terminated at 20.20m bgl on REs instruction.		

Drilling Progress and Water Observations							
Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
23-10-20	16.30	14.20	3.20	123	84		
27-10-20	08.30	14.20	3.20	123	84		
27-10-20	13.00	20.20	3.20	123	84		

Rotary Flush			
From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

15 litres polydrill used. Acoustic televiewer works carried out. 50mm standpipe installed. Response zone 16.00m to 19.00m bgl.

All dimensions in metres Scale 1:68.75	Client: Sure Partners Limited	Method/ Plant Used: DeltaBase	Bit Design: GBS/PQ	Driller: DK	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Arklow Bank Wind Park-Landfall Site Investigations	Arklow, County Wicklow	**BH04**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2020WW102	15-10-20 19-10-20	19.64	E 727,004.1 N 677,143.9

Engineer	Sheet	Rev.
ARUP	1 of 2	DRAFT1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities	Detail	Main	Geology	Instrument/ Backfill
0.00	100 (-) -					0.00 - 9.00 m: overburden		Firm dark orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of quartz chert and shale.		
2.00	63 (-) -	2.00 (32)								
3.50	100 (-) -	3.50 (18)			(9.00)			3.70m: stiff brown.		
5.00	60 (-) -	5.00 (31)								
6.50	20 (-) -	6.50 (31)								
8.00	60 (-) -	8.00 (13)								
8.50	60 (10) 0		10.64		9.00					
9.50	80 (25) 0	9.50(60/150mm)				9.00 - 13.60 Discontinuities, apparently very closely and closely spaced, dipping 84 to 86 and 18 to 20°, planar, smooth, with 0.5 to 3mm thick orangish brown clay smear and orangish brown iron stain and powder. 9.01 - 11.30 No recovery as washout of fines during drilling. No record of		Medium strong and strong thinly laminated greenish bluish grey fissile fine grained SHALE.		
10.50 15.10 16.10	88 (19)	NR/NI								

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
15-10-20	17.00	10.50	10.50	146	102		
16-10-20	08.30	10.50	10.50	146	102		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	13.60	polymer	100

GENERAL REMARKS

5 gallons polydrill used. Acoustic televiewer works carried out. 50mm standpipe installed. Response zone 9.00m to 12.00m bgl.

All dimensions in metres Scale 1:68.75	Client: Sure Partners Limited	Method/ Plant Used: DeltaBase	Bit Design: GBS	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Arklow Bank Wind Park-Landfall Site Investigations	Arklow, County Wicklow	**BH04**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2020WW102	15-10-20 19-10-20	19.64	E 727,004.1 N 677,143.9

Engineer	Sheet	Rev.
ARUP	2 of 2	DRAFT1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION Discontinuities Detail	Main	Geology	Instrument/ Backfill
11.30	0				(4.60)	cavity. Non-intact as very closely spaced and closely spaced discontinuities.	Medium strong and strong thinly laminated greenish bluish grey fissile fine grained SHALE. *(continued)*		
12.80	100 (31) 0	NI							
16.10 13.60	100 (0) 0		6.04		13.60		BH terminated at 13.60m bgl on REs instruction.		

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
16-10-20	13.00	13.60	4.70	146	102		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

5 gallons polydrill used. Acoustic televiewer works carried out. 50mm standpipe installed. Response zone 9.00m to 12.00m bgl.

All dimensions in metres Scale 1:68.75	Client: Sure Partners Limited	Method/ Plant Used: DeltaBase	Bit: GBS Design	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Arklow Bank Wind Park-Landfall Site Investigations	Arklow, County Wicklow	**BH05**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2020WW102	19-10-20 20-10-20	14.28	E 727,098.9 N 677,150.9

Engineer	Sheet	Rev.
ARUP	1 of 1	DRAFT1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument/ Backfill
0.00			14.08		0.20	0.00 - 3.00 m: overburden	Grass over firm orangish brown CLAY.		
	65 (-) -	NA			(2.50)		Firm orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of quartz chert and shale.		
2.00		2.00 (22)	11.58		2.70				
	67 (18) 0		11.28		3.00		Orangish brown silty fine and medium SAND.		
3.50						3.00 - 10.40 Discontinuities, apparently closely and very closely spaced, dipping 86 to 90 °, planar, smooth, with 0.5 to 1mm thick black silt smear and orange and dark orangish brown iron stain and powder.	Medium strong,locally weak thinly laminated greenish grey fissile fine grained SHALE.		
	100 (13) 0				(1.70)				
19.10 4.70			9.58		4.70		4.50-4.66m: Point Load Test-Weak.		
20.10 5.30	100 (35) 0						Strong locally weak and very strong thinly laminated brown and greenish grey fine to coarse SANDSTONE. 5.20m to 5.30m: white quartz. 5.50-5.67m: Point Load Test-Weak.		
	100 (52) 27				(2.10)				
6.80		NA	7.48		6.80				
	100 (38) 12						Medium strong,locally weak thinly laminated dark grey and brownish grey fissile fine grained SHALE. 7.50-7.74m: Point Load Test-Weak.		
8.30					(3.60)				
	100 (17) 0								
9.70							9.80-10.06m: Point Load Test-Weak.		
	100 (80) 35								
20.10 10.40		NI	3.88		10.40				
							BH terminated at 10.40m bgl on REs instruction.		

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
19-10-20	17.00	4.70	4.70	146	102		
20-10-20	08.30	4.70	4.70	146	102		
20-10-20	09.30	4.70	4.70	123	84		
20-10-20	13.00	10.40	4.70	123	84		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	10.40	polymer	100

GENERAL REMARKS

11 litres polydrill used. Acoustic televiewer works carried out. BH backfilled with grout.

All dimensions in metres Scale 1:68.75	Client: Sure Partners Limited	Method/ Plant Used: DeltaBase	Bit Design: GBS/PQ	Driller: DK	Logged By: EAT

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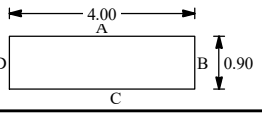
Appendix 2 Trial Pit Records

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP01**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates: E 727,185.2 N 677,363.4**
ENGINEER: ARUP	**Rig: Hyundai 140LC9**
Ground level: 18.26m O.D.	**Rev: DRAFT1**
	DATE: 15.10.20

GROUNDWATER

Water strikes: Rose to after:
1st: dry
2nd:
3rd:

PIT DIRECTION: 030-210
PIT DIMENSION: 0.90 * 4.00m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0									
							17.96	0.30	TOPSOIL: Grass over firm brown slightly gravelly SILT with some rootlets. Gravel is subangular to subrounded fine to coarse of quartz shale and assorted volcanic clasts.
			S 1 B 2 VANE	0.40-0.50 0.40-0.50 0.60	19mm vane used 20 kN/m² in situ		17.46	0.80	Firm grey mottled orangish brown slightly gravelly SILT with low cobble content. Gravel is subangular to rounded fine to coarse of chert quartz and shale. Cobbles are subangular to rounded of chert quartz and shale.
1			S 3 B 4	1.40-1.50 1.40-1.50					Stiff brownish bluish grey slightly gravelly organic SILT with low cobble content and some rootlets and some shell fragments. Gravel is subrounded to rounded fine to coarse of chert quartz and shale. Cobbles are subrounded to rounded of chert quartz and shale.
2			B 5	2.40-2.50					
3			B 6	3.60-3.70			14.56	3.70	
						END			TP terminated at 3.70m bgl on REs instruction - very stiff strata.
4									
5									

Remarks: TP dry on excavation. TP backfilled with arisings.
Shear Vanes carried out in-situ on trial pit side walls at 0.60m bgl.

Scale: 1:27.5

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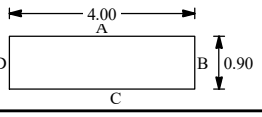
TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations		**TRIALPIT: TP02**
LOCATION: Arklow, County Wicklow		**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates:**	**Rig: Hyundai 140LC9**
ENGINEER: ARUP	**E 727,181.2 N 677,335.1**	**Rev: DRAFT1**
Ground level: 17.71m O.D.		**DATE: 15.10.20**

GROUNDWATER

Water strikes: **Rose to after:**
1st: dry
2nd:
3rd:

PIT DIRECTION: 030-210
PIT DIMENSION: 0.90 * 4.00m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							17.41	0.30	TOPSOIL: Grass over firm damp brown slightly gravelly SILT. Gravel is subangular to rounded fine to coarse of chert shale and quartz.
			BS 1 B 2 VANE	0.50-0.60 0.50-0.60 0.60	19mm vane used 17 kN/m² in situ		16.81	0.90	Firm damp grey mottled orangish brown slightly gravelly SILT with some rootlets. Gravel is subrounded to rounded fine to coarse of chert shale and quartz.
1									Stiff brown mottled bluish grey slightly gravelly SILT with some shell fragments. Gravel is subrounded to rounded fine to coarse of chert shale and quartz.
			BS 3 B 4	1.40-1.50 1.40-1.50					
2									
			B 5	2.50-2.60					
3									3.20m to 3.40m: with 0.5mm thick fine to medium sand laminae.
			B 6	3.30-3.40			14.31	3.40	
						END			TP terminated at 3.40m bgl on REs instruction - very stiff strata.
4									
5									

Remarks: TP dry on excavation. TP backfilled with arisings.
Shear Vanes carried out in-situ on trial pit side walls at 0.60m bgl.

Scale: 1:27.5

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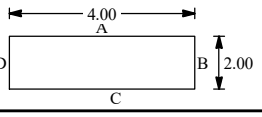
TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP03**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates: E 727,118.0 N 677,316.0**
ENGINEER: ARUP	**Rig: Hyundai 140LC9**
Ground level: 17.25m O.D.	**Rev: DRAFT1**
	DATE: 15.10.20

GROUNDWATER

Water strikes: Rose to after:
1st: dry
2nd:
3rd:

PIT DIRECTION: 200-020
PIT DIMENSION: 2.00 * 4.00m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							17.05	0.20	TOPSOIL: Grass over firm brown SILT with rootlets.
			VANE	0.40	19mm vane used 16 kN/m² in situ		16.75	0.50	Firm grey mottled orangish brown slightly gravelly SILT with low cobble content and some rootlets. Gravel is subrounded to rounded fine to coarse of shale chert and quartz. Cobbles are subrounded to rounded of shale chert and quartz.
			ES 1	0.50-0.60					Stiff brown mottled grey slightly gravelly SILT. Gravel is subrounded to rounded fine to coarse of shale chert and quartz.
			B 2	0.50-0.60					
			VANE	0.80	19mm vane used 21 kN/m² in situ				
1			D 3	1.10-1.20					
			ES 4	1.50-1.60					
			B 5	1.50-1.60					
2							14.45	2.80	
			B 6	2.80-2.90					Firm damp light orangish brown slightly gravelly sandy SILT with low cobble content and low boulder content. Gravel is subrounded to rounded fine to coarse of shale chert and quartz. Cobbles are subrounded to rounded of shale chert and quartz. Boulders are subrounded of shale chert and quartz. Boulders are up to 250mm in length.
3									
4							13.15	4.10	
						END			TP terminated at 4.10m bgl on REs instruction.
5									

Remarks: Shear Vanes carried out in-situ on trial pit side walls at 0.40m and 0.80m bgl.Thermal resistivity carried out at 1.20m bgl.
TP dry on excavation. TP backfilled with arisings.

Scale: 1:27.5

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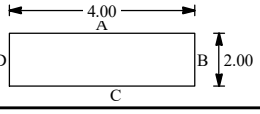
TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP04**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates: E 727,178.2 N 677,307.1**
ENGINEER: ARUP	**Rig: Hyundai 140LC9**
Ground level: 16.43m O.D.	**Rev: DRAFT1**
	DATE: 15.10.20

GROUNDWATER

Water strikes: **Rose to after:**
1st: 3.10m **20min** 3.10m
2nd:
3rd:

PIT DIRECTION: 020-200
PIT DIMENSION: 2.00 * 4.00m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							16.13	0.30	TOPSOIL: Grass over firm damp brown slightly gravelly SILT. Gravel is subangular to rounded fine to coarse of shale and quartz.
			BS 1 B 2 VANE	0.40-0.50 0.40-0.50 0.50	19mm vane used 16 kN/m² in situ		15.43	1.00	Firm damp grey mottled orangish brown slightly gravelly SILT with low cobble content. Gravel is subrounded to rounded fine to coarse of shale and assorted volcanic clasts. Cobbles are subrounded to rounded of shale and assorted volcanic clasts.
1			VANE D 3	1.10 1.10-1.20	19mm vane used 18 kN/m² in situ				TP NORTH: Damp brownish orange silty fine to medium SAND. Apparent dip of stratum 40°. TP SOUTH: Firm greyish orangish brown clayey SILT.
			BS 4 B 5 B 6	1.40-1.50 1.40-1.50 1.40-1.50					
2									
			B 7	2.40-2.50					
3		▽					13.33	3.10	
									Very stiff mottled brownish bluish grey slightly gravelly organic SILT with rootlets and some shell fragments. Gravel is rounded to well rounded fine to medium of shale and assorted volcanic clasts.
			B 8	3.70-3.80					
4							12.43	4.00	
						END			TP terminated at 4.00m bgl on REs instruction.
5									

Remarks: Shear Vanes carried out in-situ on trial pit side walls at 0.50m and 1.10m bgl.Thermal resistivity carried out at 1.20m bgl.
Ingress of water at 3.10m bgl. TP backfilled with arisings.

Scale: 1:27.5

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TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

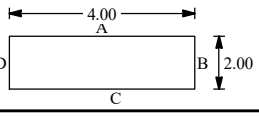
PROJECT: Arklow Bank Wind Park-Landfall Site Investigations
LOCATION: Arklow, County Wicklow
TRIALPIT: TP05
Sheet 1 of 1

CLIENT: Sure Partners Limited
ENGINEER: ARUP
Co-ordinates: E 727,141.9 N 677,288.8
Rig: Hyundai 140LC9
Rev: DRAFT1

Ground level: 15.00m O.D.
DATE: 15.10.20

GROUNDWATER
Water strikes: Rose to after:
1st: dry
2nd:
3rd:

PIT DIRECTION: 010-190
PIT DIMENSION: 2.00 * 4.00m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							14.75	0.25	TOPSOIL: Grass over firm brown slightly gravelly SILT. Gravel is subangular to rounded fine to coarse of shale chert and quartz.
			S 1 B 2	0.40-0.50 0.40-0.50			14.40	0.60	Firm grey mottled orangish brown slightly gravelly sandy SILT. Sand is fine. Gravel is subangular to rounded fine to coarse of shale chert and quartz.
1			VANE D 3	1.10 1.10-1.20	19mm vane used 21 kN/m² in situ		13.70	1.30	Stiff brownish grey SILT with some rootlets.
			S 4 B 5	1.50-1.60 1.50-1.60			12.80	2.20	Firm orangish brown slightly gravelly sandy SILT. Sand is fine to medium. Gravel is subrounded to rounded fine to coarse of shale and chert.
2									
3			B 6	2.60-2.70					Stiff brown mottled bluish grey slightly gravelly SILT with low cobble content and 10mm thick fine to medium sand laminae. Gravel is subrounded to rounded fine to coarse of shale and chert. Cobbles are subrounded to rounded of shale and chert.
			B 7	3.80-3.90			11.00	4.00	
4						END			TP terminated at 4.00m bgl on REs instruction - very stiff strata.
5									

Remarks: Shear Vanes carried out in-situ on trial pit side walls at 1.10m bgl.Thermal resistivity carried out at 1.20m bgl.
TP dry on excavation. TP backfilled with arisings.

Scale: 1:27.5

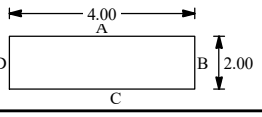
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TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP06**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates: E 727,170.4 N 677,251.5**
ENGINEER: ARUP	**Rig: Hyundai 140LC9**
Ground level: 12.07m O.D.	**Rev: DRAFT1**
	DATE: 14.10.20

GROUNDWATER
Water strikes: Rose to after:
1st: dry
2nd:
3rd:

PIT DIRECTION: 020-200
PIT DIMENSION: 2.00 * 4.00m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							11.77	0.30	TOPSOIL: Grass over firm damp brown slightly gravelly SILT with some rootlets. Gravel is subangular to subrounded fine to coarse of shale and quartz.
			S 1 B 2 VANE	0.40-0.50 0.40-0.50 0.50	19mm vane used 19 kN/m² in situ		11.27	0.80	Firm grey mottled orangish brown slightly gravelly SILT with low cobble content and some rootlets. Gravel is subrounded to rounded fine to coarse of shale and assorted volcanic clasts. Cobbles are subrounded to rounded of shale and assorted volcanic clasts.
1			D 3 VANE S 4 B 5	1.10-1.20 1.20 1.40-1.50 1.40-1.50	19mm vane used 22 kN/m² in situ		10.07	2.00	Stiff orangish brownish grey slightly gravelly slightly sandy SILT with low cobble content and low boulder content. Sand is medium to fine. Gravel is subrounded to rounded fine to coarse of shale and assorted volcanic clasts. Cobbles are subrounded to rounded of shale and assorted volcanic clasts. Boulders are rounded of shale and assorted volcanic clasts. Boulders are up to 230mm in length.
2			B 6	2.10-2.20			9.72	2.35	Damp orangish brown slightly gravelly silty medium to fine SAND. Gravel is angular to subangular fine to coarse of shale.
			B 7	2.35-2.40		END	9.67	2.40	Probable weathered SHALE rock. Recovered as angular to subangular fine to coarse gravel and cobble sized clasts of grey shale with slightly clayey silty sand. TP terminated at 2.40m bgl as probable rock.
3									
4									
5									

Remarks: Shear Vanes carried out in-situ on trial pit side walls at 0.50m and 1.20m bgl.Thermal resistivity carried out at 1.20m bgl.
TP dry on excavation. TP backfilled with arisings.

Scale: 1:27.5

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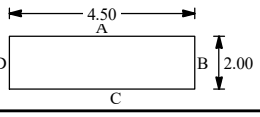
TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP07**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates:** **Rig: Hyundai 140LC9**
ENGINEER: ARUP	**E 727,077.3 N 677,212.0** **Rev: DRAFT1**
Ground level: 17.43m O.D.	**DATE: 13.10.20**

GROUNDWATER

Water strikes: **Rose to after:**
1st: dry
2nd:
3rd:

PIT DIRECTION: 280-100
PIT DIMENSION: 2.00 * 4.50m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							17.13	0.30	TOPSOIL: Grass over firm damp brown silty CLAY.
			ES 1	0.40-0.50					Damp greyish brown slightly gravelly SILT with low cobble content. Gravel is subrounded to rounded fine to coarse of shale and assorted volcanic clasts. Cobbles are subrounded to rounded of shale and assorted volcanic clasts.
			B 2	0.40-0.50					
1			VANE D 3	1.10 1.10-1.20	19mm vane used 21 kN/m² in situ				
			ES 4	1.50-1.60					
			B 5	1.50-1.60					
2			B 6	2.40-2.50					
3			B 7	3.40-3.50			13.83	3.60	
									Stiff damp brownish grey slightly gravelly SILT. Gravel is subrounded to rounded fine to medium of shale and assorted volcanic clasts.
4			B 8	4.40-4.50			12.93	4.50	
						END			TP terminated at 4.50m bgl on REs instruction.
5									

Remarks: Shear Vanes carried out in-situ on trial pit side walls at 1.10m bgl.Thermal resistivity carried out at 1.20m bgl. TP dry on excavation. TP backfilled with arisings.

Scale: 1:27.5

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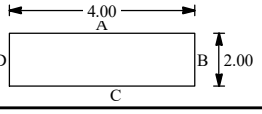
TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP08**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates: E 727,021.5 N 677,187.2**
ENGINEER: ARUP	**Rig: Hyundai 140LC9**
Ground level: 20.19m O.D.	**Rev: DRAFT1**
	DATE: 13.10.20

GROUNDWATER

Water strikes:		Rose to after:	
1st:	0.70m	20min	0.37m
2nd:	1.70m	20min	0.90m
3rd:	2.55m	20min	1.45m

PIT DIRECTION: 240-060
PIT DIMENSION: 2.00 * 4.00m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							19.89	0.30	TOPSOIL: Grass over firm damp brown clayey SILT.
		1	S 1	0.40-0.50					Stiff damp orange mottled greyish brown slightly gravelly SILT with rootlets. Gravel is subrounded to rounded medium to coarse.
			B 2	0.40-0.50					
		1							
		2							
1			D 3	1.10-1.20					Pocket penetrometer @ 1.10m: 3.50 kg/cm^2; 2.50 kg/cm^2.
		3							
			S 4	1.50-1.60					
		2	B 5	1.50-1.60					
2									
		3	B 6	2.50-2.60					
3									
			B 7	3.60-3.70			16.29	3.90	
4									Firm damp light greyish brown SILT.
			B 8	4.40-4.50			15.69	4.50	
						END			TP terminated at 4.50m bgl on REs instruction.
5									

Remarks: Shear Vanes carried out in-situ on trial pit side walls at 0.60m bgl.Thermal resistivity carried out at 1.20m bgl. TP dry on excavation. TP backfilled with arisings.

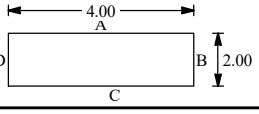
Scale: 1:27.5

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TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP09**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates: E 726,966.6 N 677,135.3**
ENGINEER: ARUP	**Rig: Hyundai 140LC9**
Ground level: 20.89m O.D.	**Rev: DRAFT1**
GROUNDWATER Water strikes: 1st: dry 2nd: 3rd: Rose to after:	**DATE: 13.10.20**
PIT DIRECTION: 220-040 **PIT DIMENSION: 2.00 * 4.00m** **LOGGED BY: PC**	Shoring/Support: N/A Stability: Pit stable.



Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							20.59	0.30	TOPSOIL: Grass over firm damp slightly gravelly SILT with low cobble content. Gravel is subrounded to rounded medium to coarse of quartz chert and assorted volcanic clasts. Cobbles are subrounded to rounded of quartz chert and assorted volcanic clasts.
			VANE	0.50	19mm vane used 15 kN/m² in situ				Firm damp grey mottled orangish brown slightly gravelly slightly sandy SILT. Sand is coarse. Gravel is subrounded to rounded medium to coarse of shale quartz chert and assorted volcanic clasts.
			ES 1	0.50-0.60					
			B 2	0.50-0.60			20.19	0.70	
1			VANE	0.90	19mm vane used 23 kN/m² in situ				Stiff damp mottled greyish brown slightly gravelly SILT with low cobble content. Gravel is subrounded to rounded fine to coarse of assorted volcanic clasts chert and shale. Cobbles are subrounded to rounded of assorted volcanic clasts chert and shale.
			D 3	1.10-1.20					
			ES 4	1.50-1.60					
			B 5	1.50-1.60					
2									
			B 6	2.40-2.50					
3									
4							16.89	4.00	
						END			TP terminated at 4.00m bgl on REs instruction - very stiff strata.
5									

Remarks: Thermal resistivity carried out at 1.20m bgl. TP dry on excavation. TP backfilled with arisings.

Scale: 1:27.5

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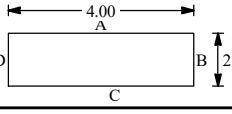
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TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP10**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates: E 727,103.7 N 677,161.5**
ENGINEER: ARUP	**Rig: Hyundai 140LC9**
Ground level: 14.64m O.D.	**Rev: DRAFT1**
	DATE: 14.10.20

GROUNDWATER
Water strikes: Rose to after:
1st: dry
2nd:
3rd:

PIT DIRECTION: 170-350
PIT DIMENSION: 2.00 * 4.00m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit unstable. Sidewall collapse from 1.80m bgl.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							14.44	0.20	TOPSOIL: Grass over firm damp brown slightly gravelly SILT. Gravel is subrounded to rounded fine to coarse of shale and quartz.
			S 1 B 2	0.40-0.50 0.40-0.50					Firm damp grey mottled orangish greyish brown slightly gravelly SILT with low cobble content and some rootlets and some shell fragments. Gravel is subangular to subrounded fine to coarse of shale and assorted volcanic clasts. Cobbles are subrounded to rounded of shale and assorted volcanic clasts.
1			D 3 VANE S 4 B 5	1.10-1.20 1.20 1.40-1.50 1.40-1.50	19mm vane used 23 kN/m² in situ		12.84	1.80	
2			B 6	2.00-2.10			11.94	2.70	Light orangish brown slightly gravelly silty medium to fine SAND with low cobble content and low boulder content. Gravel is subrounded to rounded fine to coarse of shale and assorted volcanic clasts. Cobbles are subrounded to rounded of shale and assorted volcanic clasts. Boulders are subrounded to rounded of shale and assorted volcanic clasts. Boulders are up to 400mm in length.
			B 7	2.80-2.90			11.74	2.90	Probable weathered SHALE rock. Recovered as angular to subangular fine to coarse gravel cobble and boulder sized clasts of grey shale with grey sandy gravel. Boulders are up to 250mm in length.
3						END			TP terminated at 2.90m bgl as probable rock.
4									
5									

Remarks: Thermal resistivity carried out at 1.20m bgl. TP dry on excavation. TP backfilled with arisings.

Scale: 1:27.5

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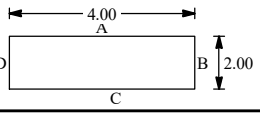
TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP11**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates:** **Rig: Hyundai 140LC9**
ENGINEER: ARUP	**E 726,983.1 N 677,096.6** **Rev: DRAFT1**
Ground level: 18.86m O.D.	**DATE: 14.10.20**

GROUNDWATER

Water strikes: **Rose to after:**
1st: dry
2nd:
3rd:

PIT DIRECTION: 140-320
PIT DIMENSION: 2.00 * 4.00m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							18.56	0.30	TOPSOIL: Grass over firm damp slightly gravelly SILT with low cobble content. Gravel is subrounded to rounded fine to coarse of shale chert and assorted volcanic clasts. Cobbles are subrounded to rounded of shale chert and assorted volcanic clasts.
			S 1 B 2 VANE	0.40-0.50 0.40-0.50 0.50	19mm vane used 20 kN/m² in situ		18.16	0.70	Firm damp mottled light grey orange brown slightly gravelly SILT with some rootlets. Gravel is subrounded to rounded fine to coarse of shale chert and assorted volcanic clasts.
1			VANE D 3 S 4 B 5	1.10 1.10-1.20 1.40-1.50 1.40-1.50	19mm vane used 27 kN/m² in situ		16.86	2.00	Stiff damp mottled greyish brown slightly gravelly slightly sandy SILT with low cobble content. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of assorted volcanic clasts granite and shale. Cobbles are subrounded to rounded of assorted volcanic clasts granite and shale.
2			B 6	2.50-2.60					Very stiff brownish bluish grey slightly gravelly organic SILT with 10mm thick sandy silty laminae. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of shale.
3			B 7	3.80-3.90			14.96	3.90	
4						END			TP terminated at 3.90m bgl on REs instruction.
5									

Remarks: Thermal resistivity carried out at 1.20m bgl. TP dry on excavation. TP backfilled with arisings.

Scale: 1:27.5

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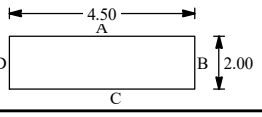
TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

PROJECT: Arklow Bank Wind Park-Landfall Site Investigations	**TRIALPIT: TP12**
LOCATION: Arklow, County Wicklow	**Sheet 1 of 1**
CLIENT: Sure Partners Limited	**Co-ordinates: E 727,054.6 N 677,115.1**
ENGINEER: ARUP	**Rig: Hyundai 140LC9**
Ground level: 15.31m O.D.	**Rev: DRAFT1**
	DATE: 14.10.20

GROUNDWATER

Water strikes: Rose to after:
1st: dry
2nd:
3rd:

PIT DIRECTION: 130-310
PIT DIMENSION: 2.00 * 4.50m
LOGGED BY: PC



Shoring/Support: N/A
Stability: Pit stable.

Depth (m)	Date	Water	Samples	Depth (m)	In-situ Vane Tests	LEGEND	Elevation m O.D.	Depth (m)	DESCRIPTION
0							15.06	0.25	TOPSOIL: Grass over firm damp brown slightly gravelly SILT with low cobble content. Gravel is subangular to rounded fine to coarse of shale assorted volcanic clasts and quartz. Cobbles are subrounded to rounded of shale assorted volcanic clasts and quartz.
			ES 1 B 2 VANE	0.50-0.60 0.50-0.60 0.60	19mm vane used 17 kN/m² in situ		14.51	0.80	Firm grey mottled orange gravelly clayey sandy SILT with low cobble content. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of shale and assorted volcanic clasts. Cobbles are subrounded to rounded of shale and assorted volcanic clasts.
1			D 3 VANE ES 4 B 5	1.10-1.20 1.20 1.40-1.50 1.40-1.50	19mm vane used 20 kN/m² in situ		13.21	2.10	Stiff damp brown mottled grey slightly gravelly SILT with low cobble content. Gravel is subrounded to rounded fine to coarse of shale and assorted volcanic clasts. Cobbles are subrounded to rounded of shale and assorted volcanic clasts.
2			B 6	2.40-2.50			11.81	3.50	Stiff damp greyish brown slightly gravelly sandy SILT with low cobble content and some shell fragments and 150mm thick layers of fine to medium sand. Gravel is subrounded to rounded fine to coarse of shale and assorted volcanic clasts. Cobbles are subrounded to rounded of shale and assorted volcanic clasts.
3			B 7	3.50-3.60			11.71	3.60	Probable weathered SHALE rock. Recovered as angular to subangular fine to coarse gravel cobble and boulder sized clasts of grey shale with grey slightly sandy clayey gravel. Boulders are up to 400mm in length.
						END			TP terminated at 3.60m bgl as probable rock.
4									
5									

Remarks: Thermal resistivity carried out at 1.20m bgl. TP dry on excavation. TP backfilled with arisings.

Scale: 1:27.5

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TRIAL PIT VANE & WL RISES ARKLOW BANK TPS LANDFALL ALL FILE DRAFT 1 DEC 11 2020.GPJ IRISHDRL.GDT 7/4/21

Appendix 2A Thermal Resistivity/ Conductivity Records

IRISH DRILLING LTD.
Loughrea Co. Galway

Tel: (091) 841274 Fax: (091) 880861

Project: Arklow Bank Wind Park - Onshore Grid Infrastructure
Client: Sure Partners Ltd (SSE)
Location: Landfall Site, County Wicklow
Date: 02/12/2020
Sheet No. 1
Checked: RK

Thermal Conductivity / Thermal Resistivity Records

Date	Location	Depth m(bgl)	Thermal Conductivity (W/m.K) K	Thermal Resistivity (K.m/W) R	Temperature Celcius
15/10/2020	TP 03	1.20	1.296	0.772	13.035
			1.462	0.684	12.871
			1.284	0.779	12.846
15/10/2020	TP 04	1.20	1.751	0.571	12.915
			2.27	0.44	12.847
			2.456	0.407	12.807
15/10/2020	TP 05	1.20	1.504	0.665	13.005
			1.42	0.704	12.934
			1.467	0.682	12.96
14/10/2020	TP 06	1.20	1.609	0.622	12.83
			1.39	0.719	12.842
			1.339	0.747	12.892
13/10/2020	TP 07	1.20	1.225	0.816	12.891
			1.656	0.604	12.801
			1.524	0.656	12.592
13/10/2020	TP 08	1.20	1.466	0.682	13.03
			1.498	0.667	13.163
			1.316	0.76	12.95
13/10/2020	TP 09	1.20	1.447	0.691	13.035
			1.571	0.636	13.007
			1.49	0.671	12.876
14/10/2020	TP 10	1.20	1.395	0.717	12.922
			1.379	0.725	12.863
			1.201	0.833	12.85
14/10/2020	TP 11	1.20	1.56	0.641	13.055
			1.64	0.61	13.022
			1.838	0.544	12.775
14/10/2020	TP 12	1.20	1.265	0.79	13.015
			1.278	0.783	13.01
			1.286	0.778	12.99

Appendix 3 Acoustic Televiewer Survey

EUROPEAN GEOPHYSICAL SERVICES

REPORT ON THE

GEOPHYSICAL LOGGING

OF

FIVE BOREHOLES

AT

ARKLOW BANK,

Co. WICKLOW

Prepared For:

IRISH DRILLING LIMITED

Old Galway Road
Loughrea
Co. Galway
IRELAND

NOV2020/IDR2001_ rpt/IRE

	Name	Date
Logged by:	Adam White	Various
Report by:	Rhys Powell	27.11.20
Checked by:	Myles Kynaston	27.11.20

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4. BOREHOLE LOGGING CONSTRAINTS 6

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Appendix 2 Geophysical Logs

1.0 INTRODUCTION

At the request of Irish Drilling Ltd., geophysical logging was carried out in five boreholes at Arklow Bank, Co. Wicklow.

The work was carried out by European Geophysical Services between the 30th of October and the 3rd of November 2020.

BH	Logs	From (m)	To (m)
1	Optical Imager, Acoustic Imager, Natural Gamma, Caliper, Focused Resistivity, Fluid Temperature & Conductivity, Impeller Flowmeter, Full-Wave Sonic	1.3	10.3
2	Optical Imager, Acoustic Imager, Natural Gamma, Caliper, Focused Resistivity, Fluid Temperature & Conductivity, Impeller Flowmeter, Full-Wave Sonic	0.2	10.3
3	Optical Imager, Acoustic Imager, Natural Gamma, Caliper, Focused Resistivity, Fluid Temperature & Conductivity, Impeller Flowmeter, Full-Wave Sonic	0.2	20.2
4	Optical Imager, Acoustic Imager, Natural Gamma, Caliper, Focused Resistivity, Fluid Temperature & Conductivity, Impeller Flowmeter, Full-Wave Sonic	0.4	13.5
5	Optical Imager, Acoustic Imager, Natural Gamma, Caliper, Focused Resistivity, Fluid Temperature & Conductivity, Impeller Flowmeter, Full-Wave Sonic	0.5	10.3

2.0 THE GEOPHYSICAL LOGGING METHODS

The Equipment and Field Procedure

A fully digital logging system with a 600m capacity motorised winch mounted in a 4x4 van was used.

All logging data was recorded digitally for reprocessing and archiving purposes.

The optical imager survey was carried out first to avoid the disturbance of the fluid by the geophysical logs which may affect water clarity.

Acoustic Borehole Imager (Amplitude and Travel Time)

This tool scans the borehole wall through 360 degrees and records the acoustic reflection of the resulting signal in terms of amplitude and transit time (the travel time from the tool to the borehole wall). This technique requires a fluid filled borehole with a minimum of suspended solids, polymers or muds within the fluid column.

This sensitive technique responds to small diameter changes, rugosity and the acoustic nature of the borehole wall. It is primarily used for detecting fractures and other discontinuities. The resultant images are orientated (to magnetic North) 0° through 90°, 180° and 270° back to 0°.

The logging tool is centralised during data acquisition by two sets of bow springs. The bow springs are adjusted to a variety of borehole diameters prior to acquisition. The image is viewed on the way down the borehole to allow fine tuning of the acquisition parameters. The settings are then adjusted and the image recorded on the way up the borehole which ensures a constant line speed during acquisition.

Images and associated data are viewed in real time during the data acquisition.

The orientation system employs a flux gate magnetometer and therefore the recorded data within approximately one metre of magnetic steel casing is un-orientated. This is corrected manually during the post-processing stage

2.0 THE GEOPHYSICAL LOGGING METHODS

Optical Borehole Imager (Optical)

A precision-machined prism and CCD camera assembly permits a high definition video image of the borehole wall to be captured in a variety of horizontal and vertical resolutions. The resulting image is digitised in the sonde for transmission to the surface acquisition system.

The image is then orientated to Magnetic North and displayed as an unwrapped image log. This enables a detailed structural interpretation to be made if required.

For the best results the optical imager should be run above the water level or in clean, clear fluid. The logging tool is centralised during data acquisition by two sets of bow springs. The bow springs are adjusted to a variety of borehole diameters prior to acquisition. The image is recorded on the way down the borehole to limit disturbance to the clarity of the water in the borehole by the logging tool.

Images and associated data are viewed in real time during the data acquisition.

The orientation system employs a flux gate magnetometer and therefore the recorded data within approximately one metre of magnetic steel casing is un-orientated. This is corrected manually during the post-processing stage

Fluid Temperature (T)

There is a natural geothermal gradient of increasing temperature with depth. This gradient varies with the thermal conductivity of the geological formation and is modified by water flowing in, out or vertically though the borehole.

This log is used to determine any flow pattern within the borehole and to identify flow zones.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

Fluid Conductivity (EC or EC25)

The electrical conductivity (EC) of the water is related to its salinity and dissolved solids and is therefore a measure of the quality of the borehole water. The shape of the log trace can indicate zones of inflow.

Using data from the temperature log the electrical conductivity is corrected to 25°C (EC25).

This log is used to identify different zones of water quality.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

2.0 THE GEOPHYSICAL LOGGING METHODS

Impeller Flowmeter (FV)

This log is used to determine any flow pattern within the borehole and identify flow zones. The tool uses an impeller and is normally run at a constant logging speed against the anticipated flow for the best response. The data is corrected for logging speed and a fluid velocity (FV) log is produced.

Caliper (Cal)

This tool measures the mean diameter of the borehole. It is used to check the integrity of the borehole lining, and where the borehole is unlined to identify zones of washout, breakout or fissures.

Natural Gamma (Gam)

The tool measures the naturally occurring gamma radiation found in rocks and sediments. It is mainly used to detect the clays that contain potassium K^{40}, though the U^{238} series of elements and the Th^{232} series of elements also emit gamma radiation.

The higher the concentration of these clay minerals the greater the responses on the natural gamma log.

Focused Resistivity Log (Res Deep and Res Shallow)

The Focused Resistivity tool uses Guard Electrodes to focus the current into the formation. This gives excellent vertical resolution and good penetration, especially in highly conductive borehole fluids where a Normal Resistivity Sonde would not be as effective.

The tool has two electrode spacing's to allow a deep and shallow depth of investigation.

The response of this log is a function of porosity, type of formation / mineralogy and its pore water quality. These logs aid in the identification of strata and quality of the pore water.

Full Wave Sonic (FWS) - unlined

This tool has been specially designed to provide a full wave form recording of sonic signals and uses fixed spaced transmitter – receivers.
The received signals are digitised at a fast sampling rate with high resolution. Data may be sampled at typically 5cm or 10cm intervals dependant upon resolution required.

The data is processed for P wave velocity (or transit time) and amplitude.
This tool can only be used in fluid filled unlined boreholes.

3.0 PROCESSING AND PRESENTATION OF IMAGER RESULTS

Detailed logs of the imager data have been produced at a vertical scale of 1:10.

Constructional details and information on each borehole are given in the headers of each log.

All images have been referenced to Magnetic North.

The borehole's azimuth and tilt are plotted alongside the images.

The image of the borehole wall is presented in an unwrapped form with a horizontal scale marked 0° - North, through 90° - East, 180° - South, 270° - West, back to North.

Structural features and discontinuities have been picked from the images in the form of colour coded sinusoidal projections - see Appendix 1 for details. This 'Discontinuities' log is also presented with a horizontal scale marked 0° - North, through 90° - East, 180° - South, 270° - West, back to North.

Structure picking is not a definitive analysis of all the features within a borehole. Only the discontinuities that have a linear dip and direction are 'picked' and used in the analysis of the discontinuities. Features that do not have a regular sinusoidal shape do not have a linear dip and direction, 'best fit' picking of these features is done if approximately 80% coverage of the sinusoid can be achieved. Below this percentage the inaccuracy of the picking is too great and if included in any structural analysis may adversely skew the results. Vughs, solution holes, and angular break outs are examples of features not picked.

The apparent azimuth and apparent dip (i.e. relative to the borehole's azimuth and tilt) of the discontinuities are calculated using the diameter of the borehole and the geometric parameters of the sinusoids overlaid on the discontinuities. The final processing stage is to correct these apparent values to true azimuth (in relation to Magnetic North) and true dip (from horizontal) by correcting for the borehole's azimuth and tilt.

The final results are presented as a 'tadpole' plot (Discontinuities - True°). The horizontal position of the tadpole's head gives the defect's true dip angle and its tail points in the direction of the defect's azimuth. These logs are presented with a horizontal scale in degrees. By convention the top of the page is North (Magnetic) and the right hand edge of the paper is East.

The true structural data has been presented in digital format as an excel file (xls).

Taking into account the accuracies of the manufacturer's transducers and dependent upon tool centralisation, borehole rugosity, borehole eccentricity and picking techniques etc the overall accuracy of the technique is estimated at +/- 5 degrees for azimuth and +/- 2 degrees for dip.

5.0 BOREHOLE LOGGING CONSTRAINTS

- **Vehicle access restrictions**
  None

- **Tool access restrictions**
  None

- **Borehole conditions / risk to equipment**
  Good stable boreholes, casing to rock head.

- **Lack of fluid filled column / cloudy fluid**
  Acoustic televiewer ran in boreholes with cloudy borehole fluid.

- **Time constraint**
  None

- **Borehole construction / casing**
  Steel casing to rockhead.

Appendix 1

Discontinuity Classification.

Discontinuity	Colour	Classification Parameters
Major Fracture or Fissure	Blue	An open break in the formation, that is **continuous** across the entire image.
Minor Fracture or Fissure	Turquoise	A thin or closed break in the formation, that is **continuous or discontinuous** across the image.
Vein	Green	That may be **continuous or discontinuous** across the entire image.
Fabric	Red	Defines a feature generally metamorphic, igneous or sedimentary in origin that may be **continuous or discontinuous** across the image, such as bedding and cross-bedding, schistosity or gneissosity.
Intrusions	Purple	Intrusive features such as dykes and sills, generally **continuous** across the image
Unknown	Black	Faint features which **can not** be classified.

Appendix 2

Geophysical Logs

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH1**

Log Type: ***Composite***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

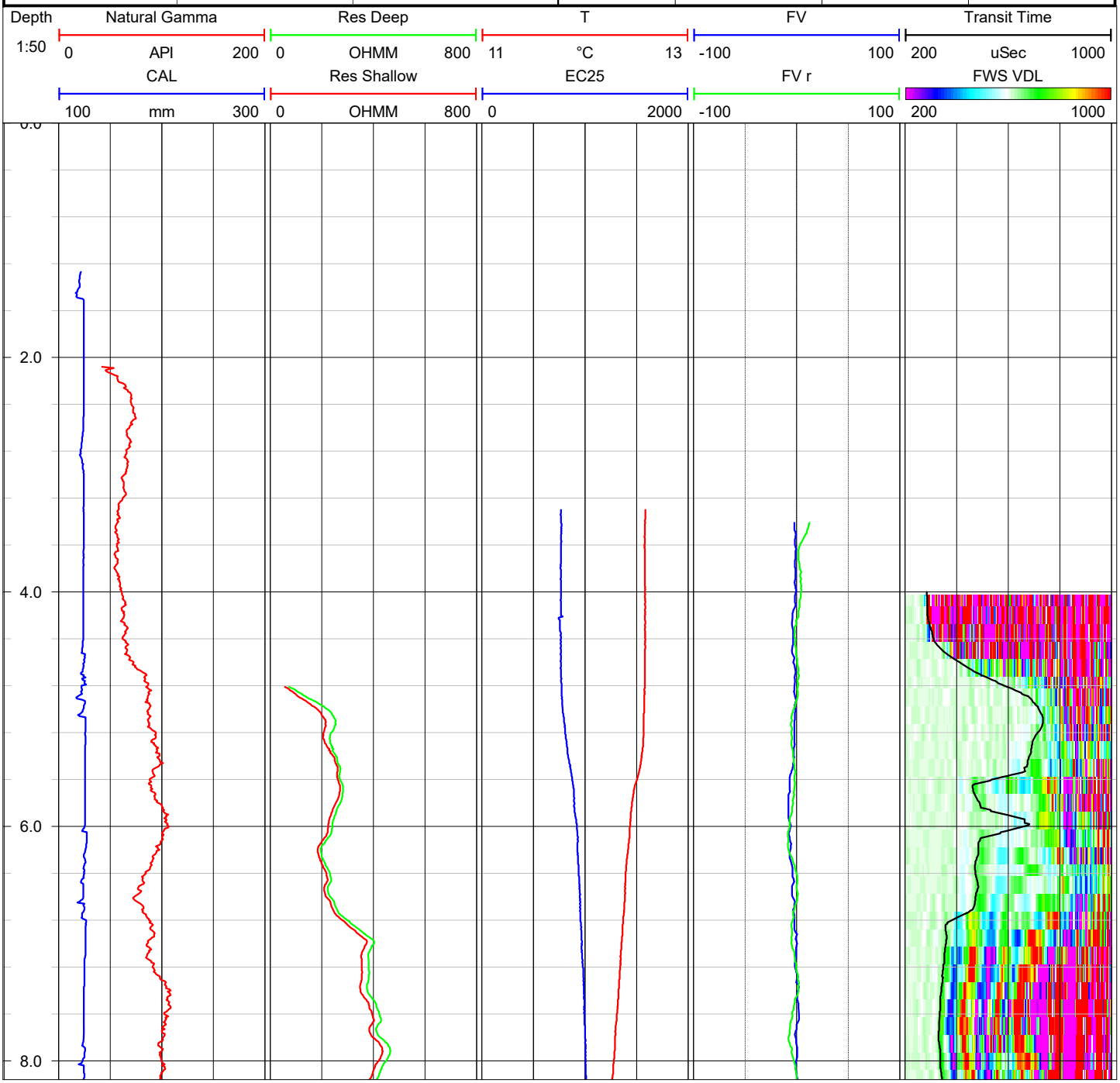
Drilled Depth: (m)		Date:	**02.11.20**
Logged Depth: (m)	**10.1**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**1.3 - 10.1**		
Fluid Level: (m)	**3.2**		

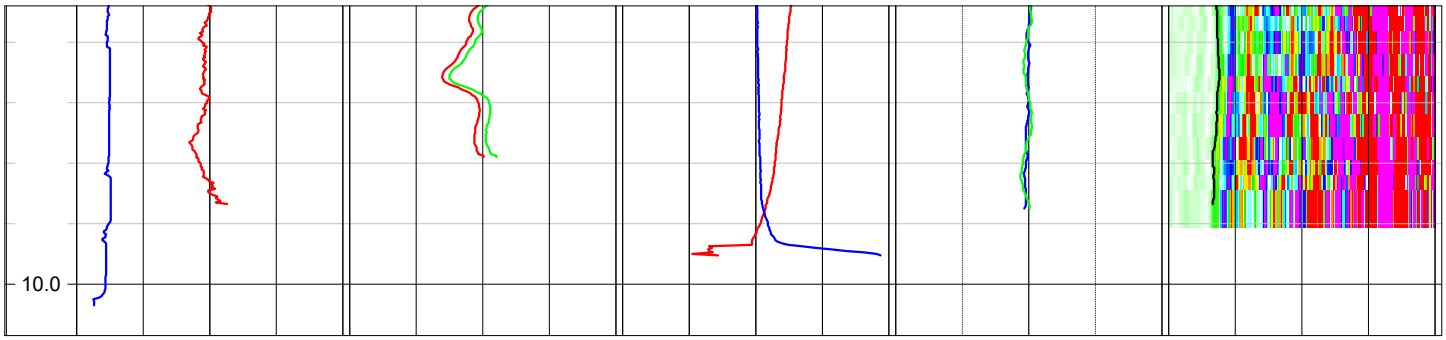
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
120	**4.8**	**10.1**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**122**	**0.0**	**4.8**




10.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH1**

Log Type: ***Image***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

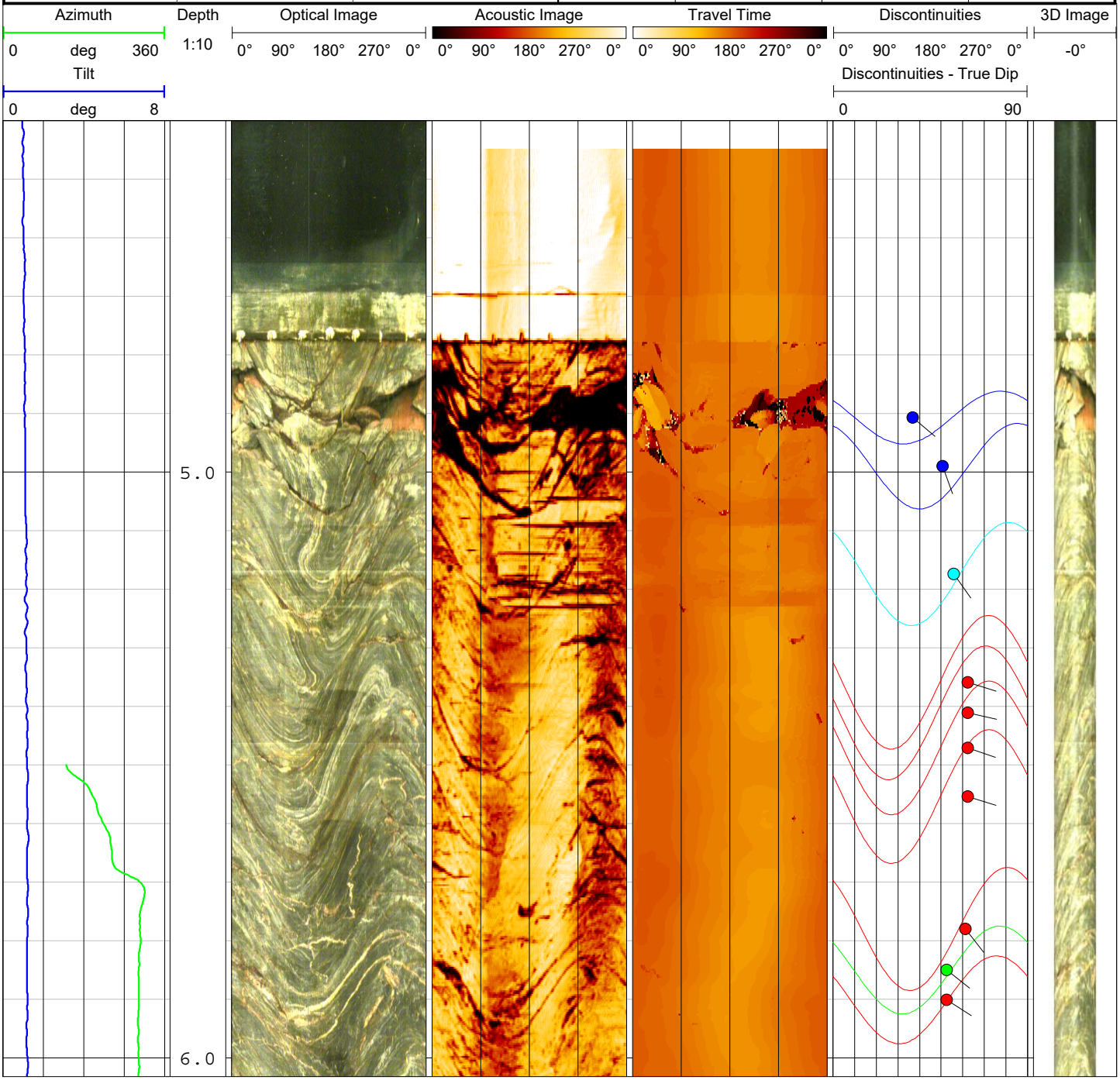
Drilled Depth: (m)		Date:	**02.11.20**
Logged Depth: (m)	**10.3**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**4.8 - 10.3**		
Fluid Level: (m)	**3.3**		

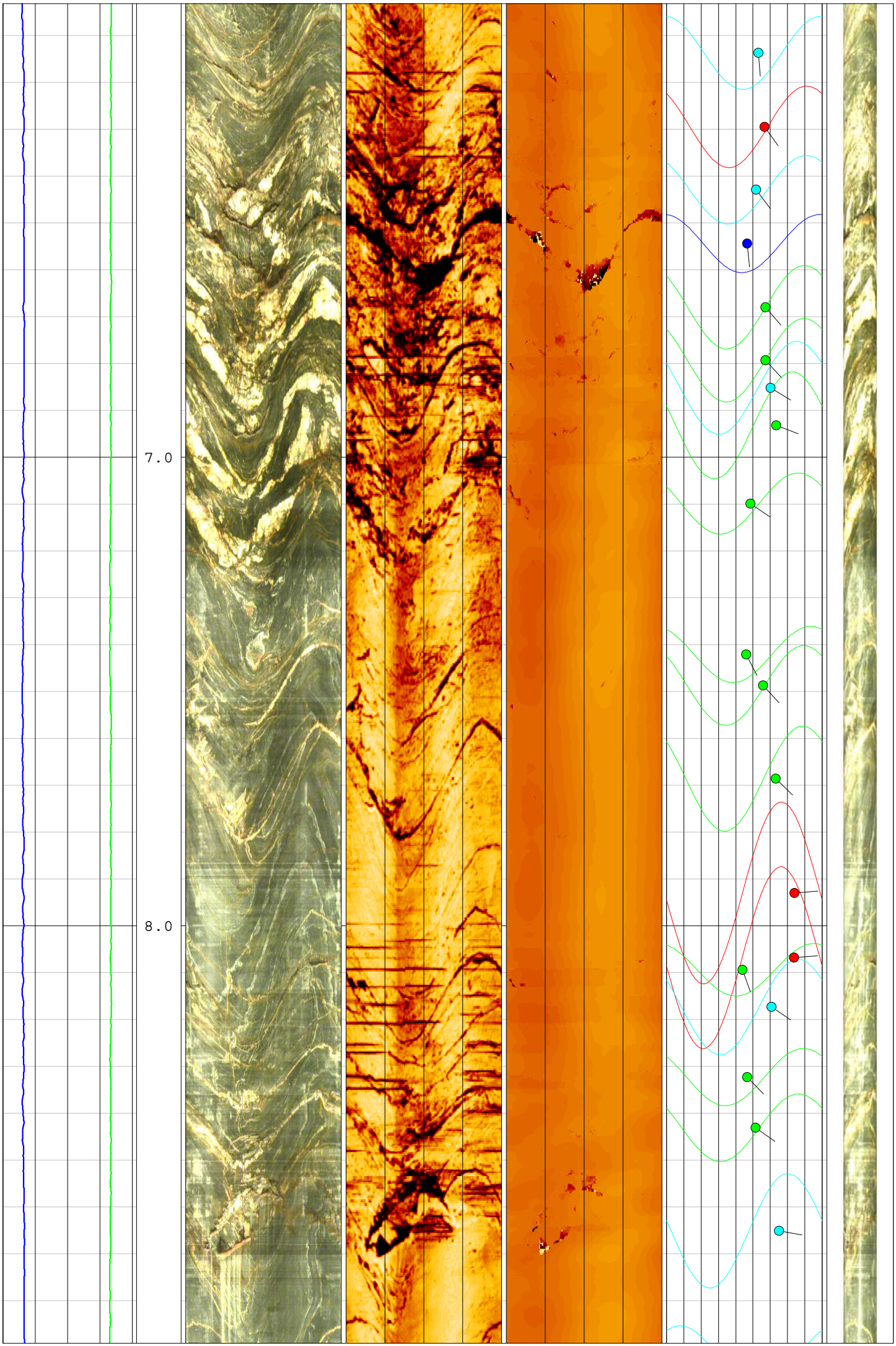
BOREHOLE RECORD

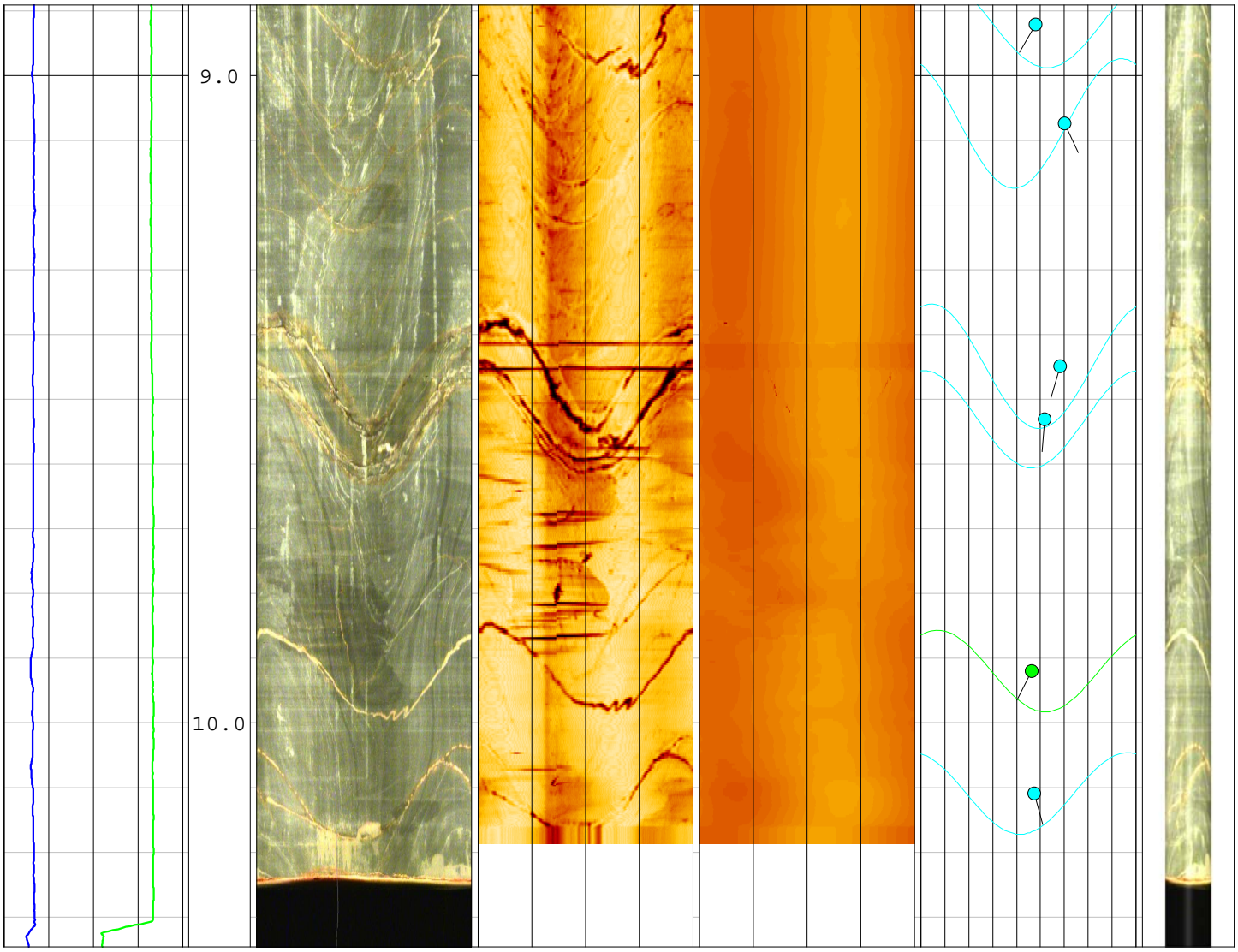
Bit: (mm)	From: (m)	To: (m)
120	**4.8**	**10.3**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**120**	**0.0**	**4.8**




7.0
8.0


9.0
10.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH2**

Log Type: ***Composite***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

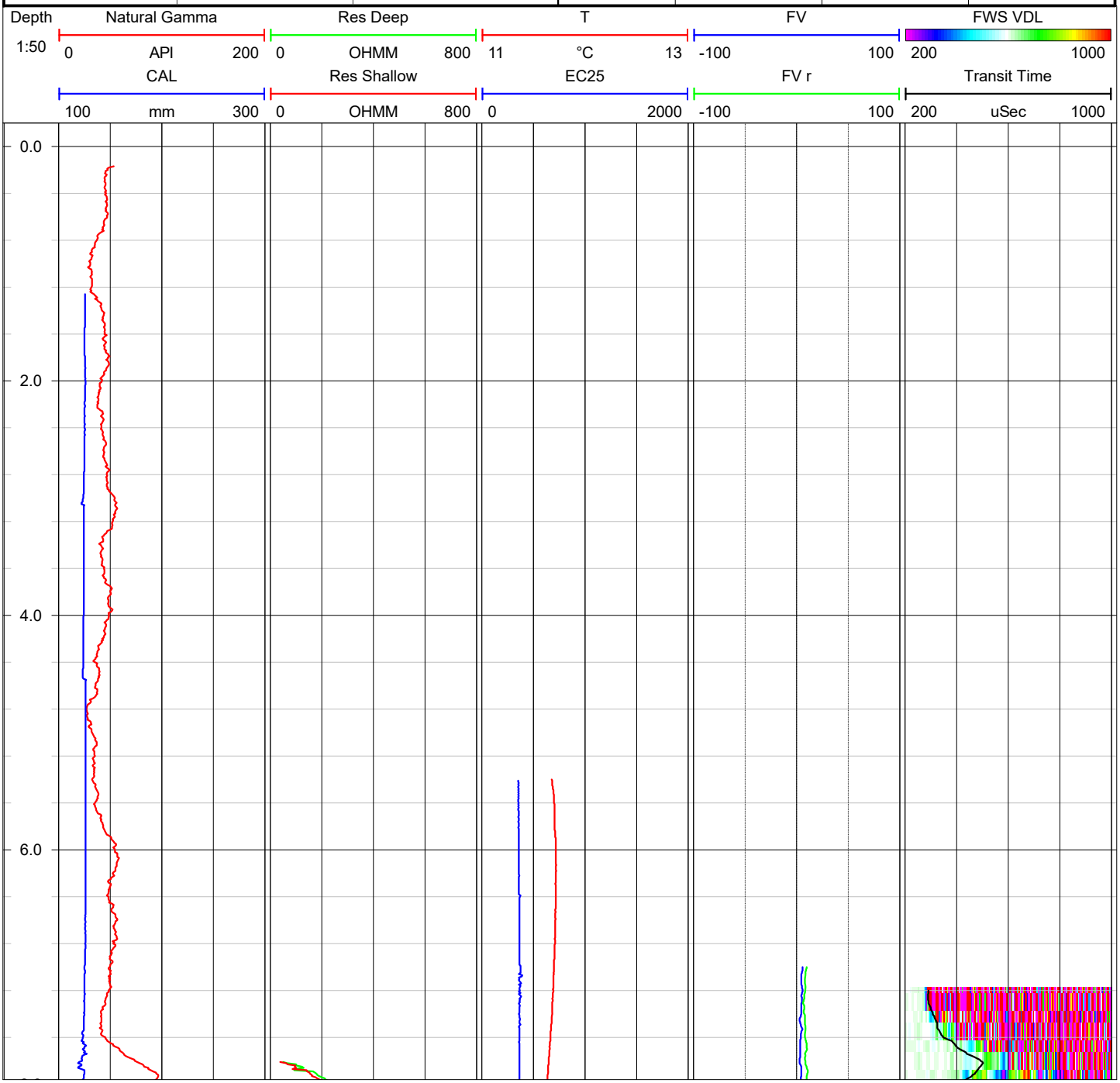
Drilled Depth: (m)	-	Date:	**03.11.20**
Logged Depth: (m)	**10.3**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0.2 - 10.3**		
Fluid Level: (m)	**5.4**		

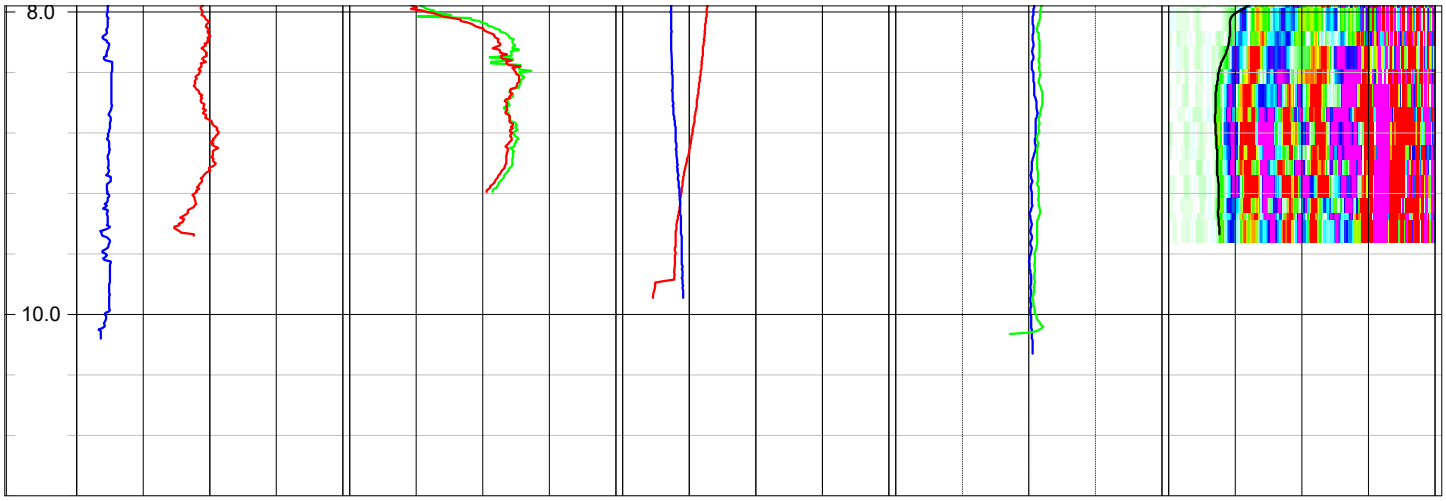
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
120	**7.8**	**10.3**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**125**	**0.0**	**7.8**




8.0
10.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH2**

Log Type: ***Image***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

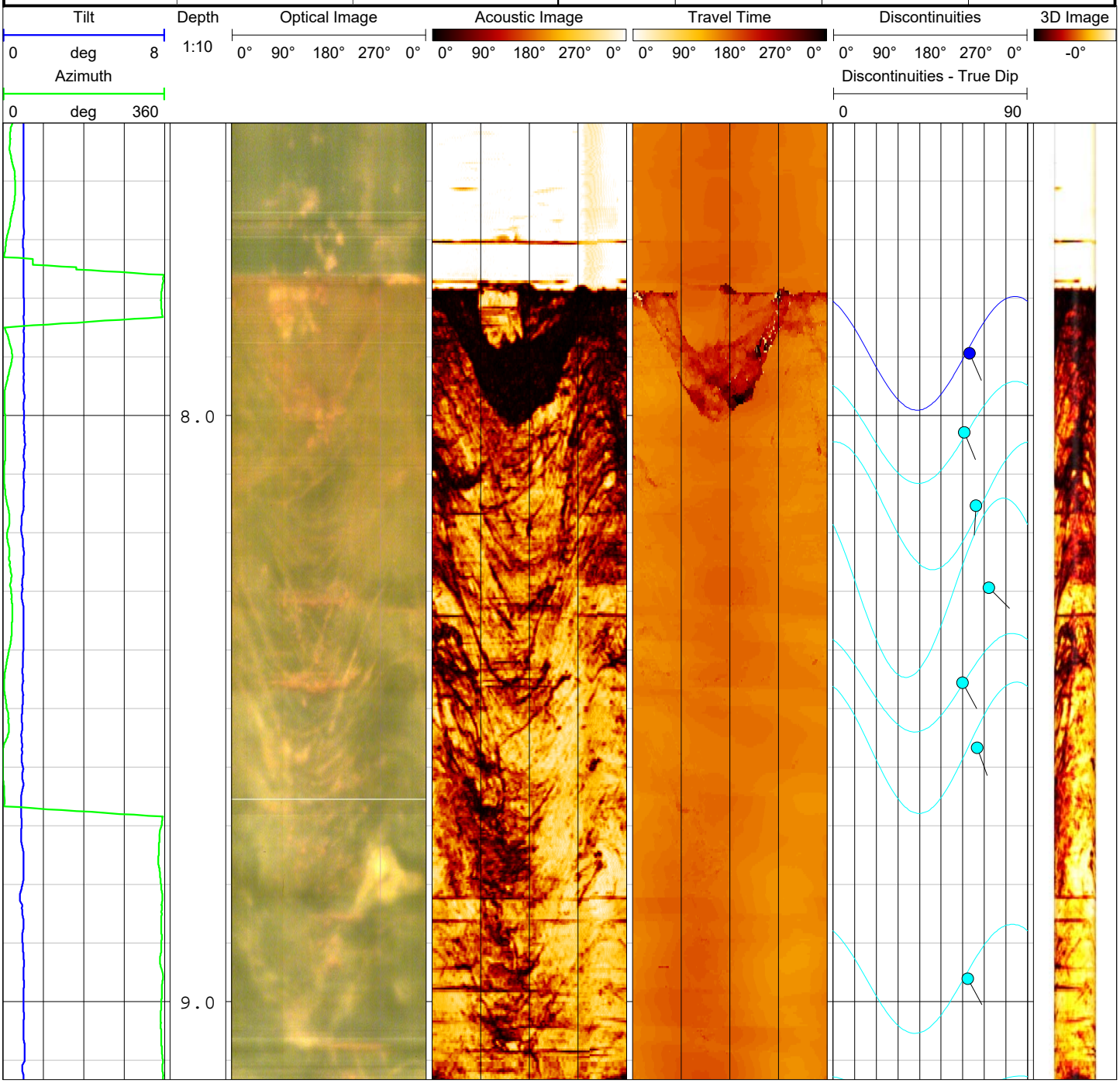
Drilled Depth: (m)	-	Date:	**03.11.20**
Logged Depth: (m)	**10.3**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**7.8 - 10.3**		
Fluid Level: (m)	**5.4**		

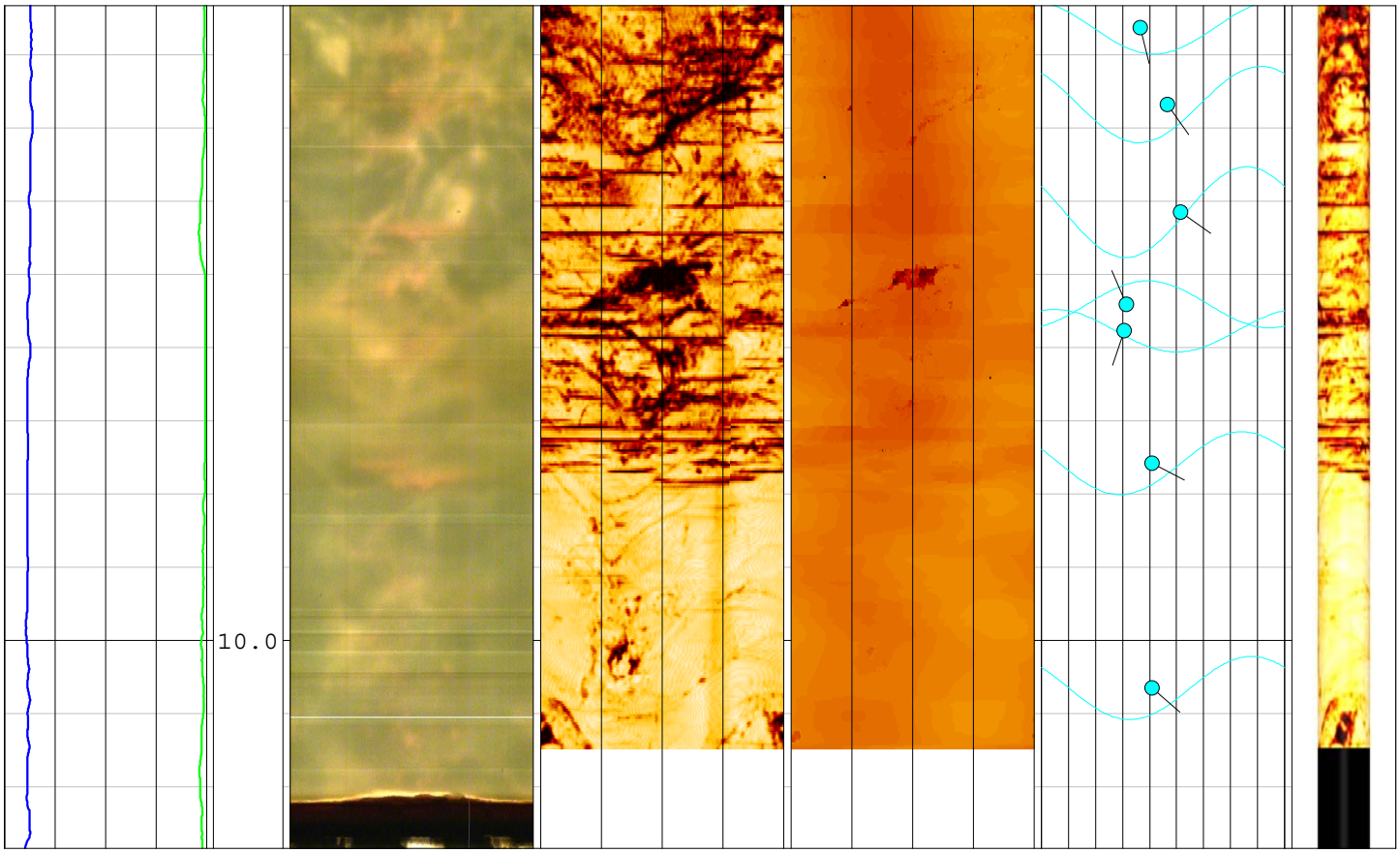
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
120	**7.8**	**10.3**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**125**	**0.0**	**7.8**




10.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH3**

Log Type: ***Composite***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

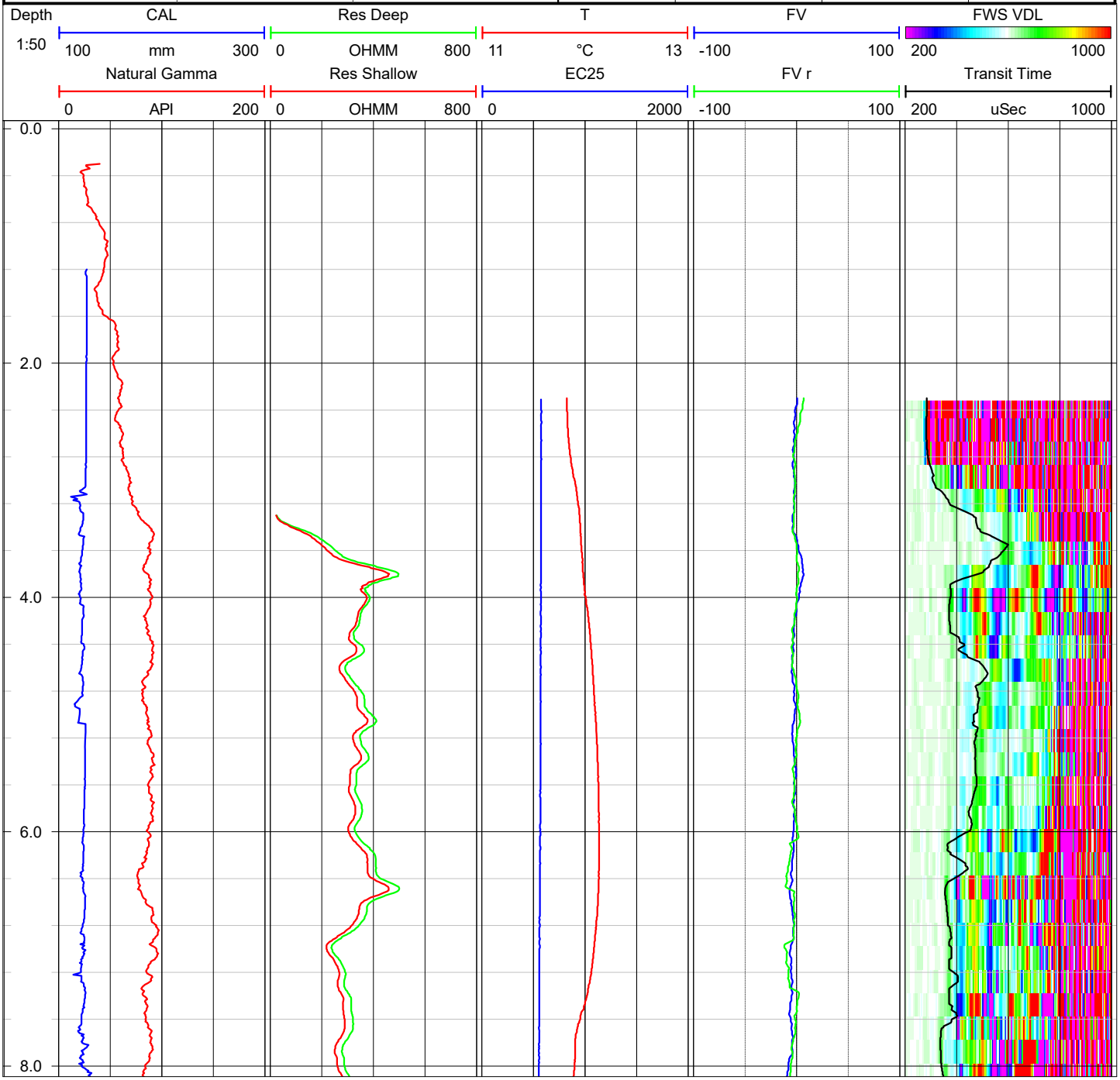
Drilled Depth: (m)		Date:	**03.11.20**
Logged Depth: (m)	**20.2**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0.4 - 20.2**		
Fluid Level: (m)	**1.7**		

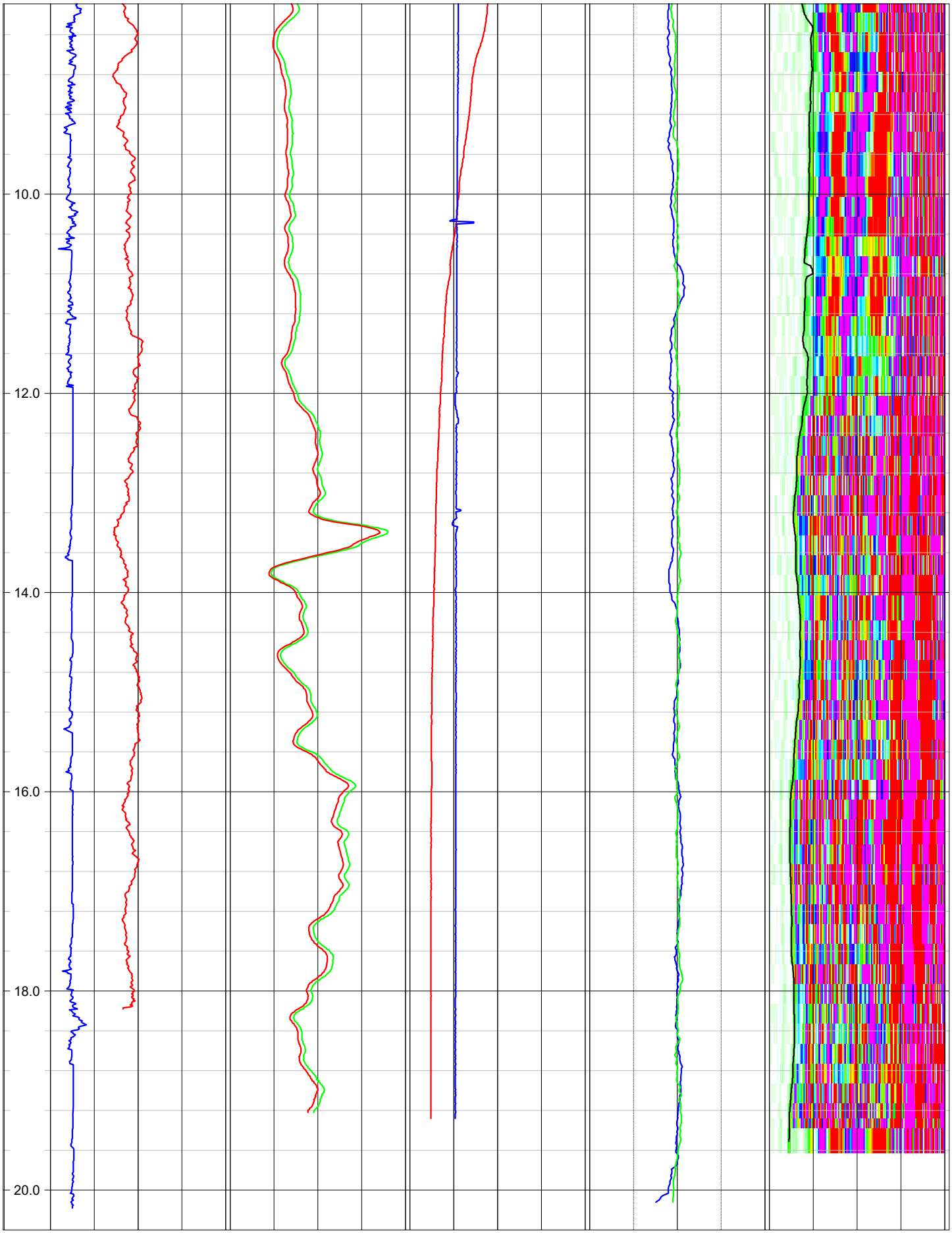
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
120	**3.3**	**20.2**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**125**	**0.0**	**3.3**




10.0
12.0
14.0
16.0
18.0
20.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH3**

Log Type: ***Image***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

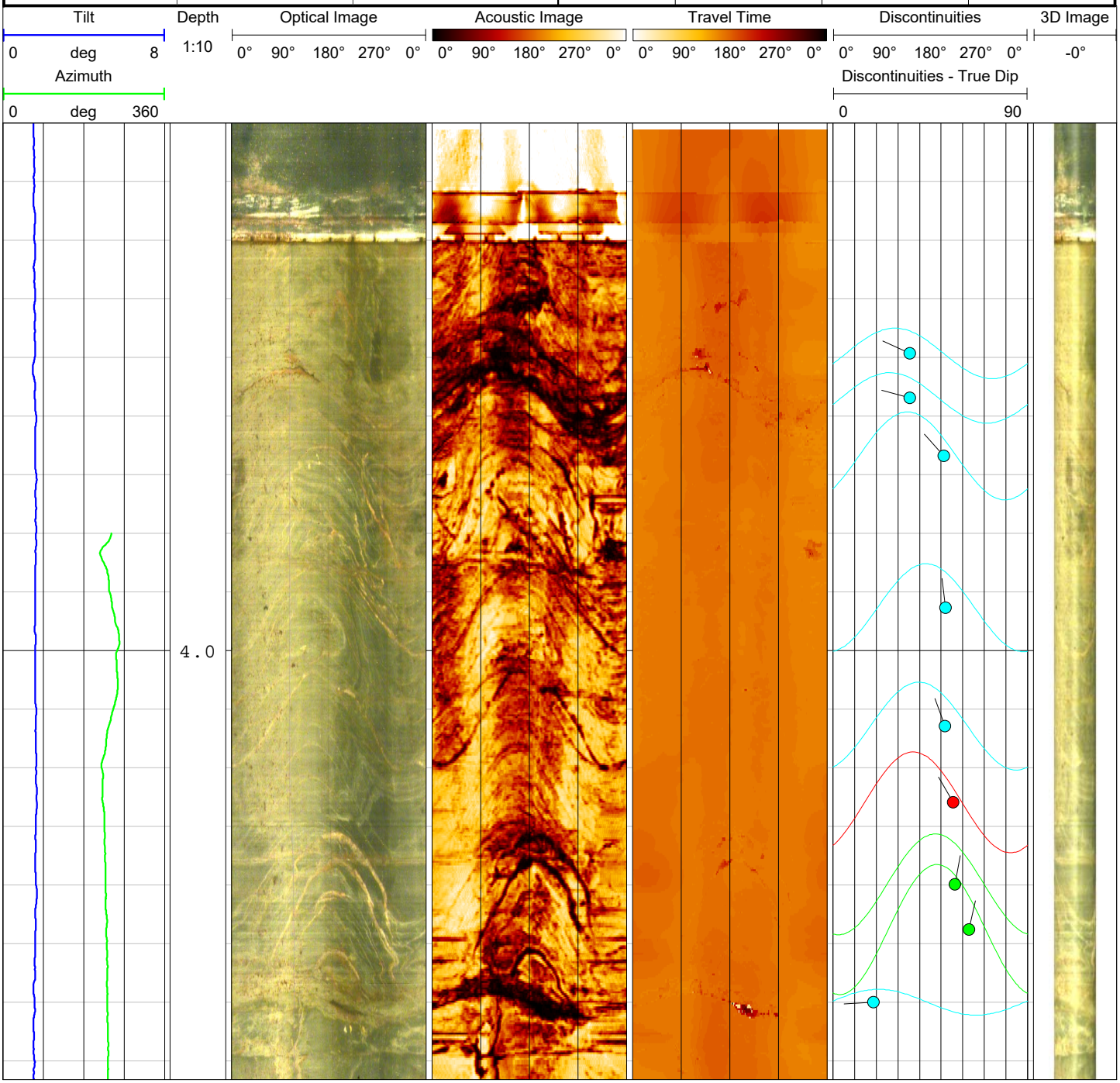
Drilled Depth: (m)		Date:	**03.11.20**
Logged Depth: (m)	**20.2**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**3.3 - 20.2**		
Fluid Level: (m)	**1.7**		

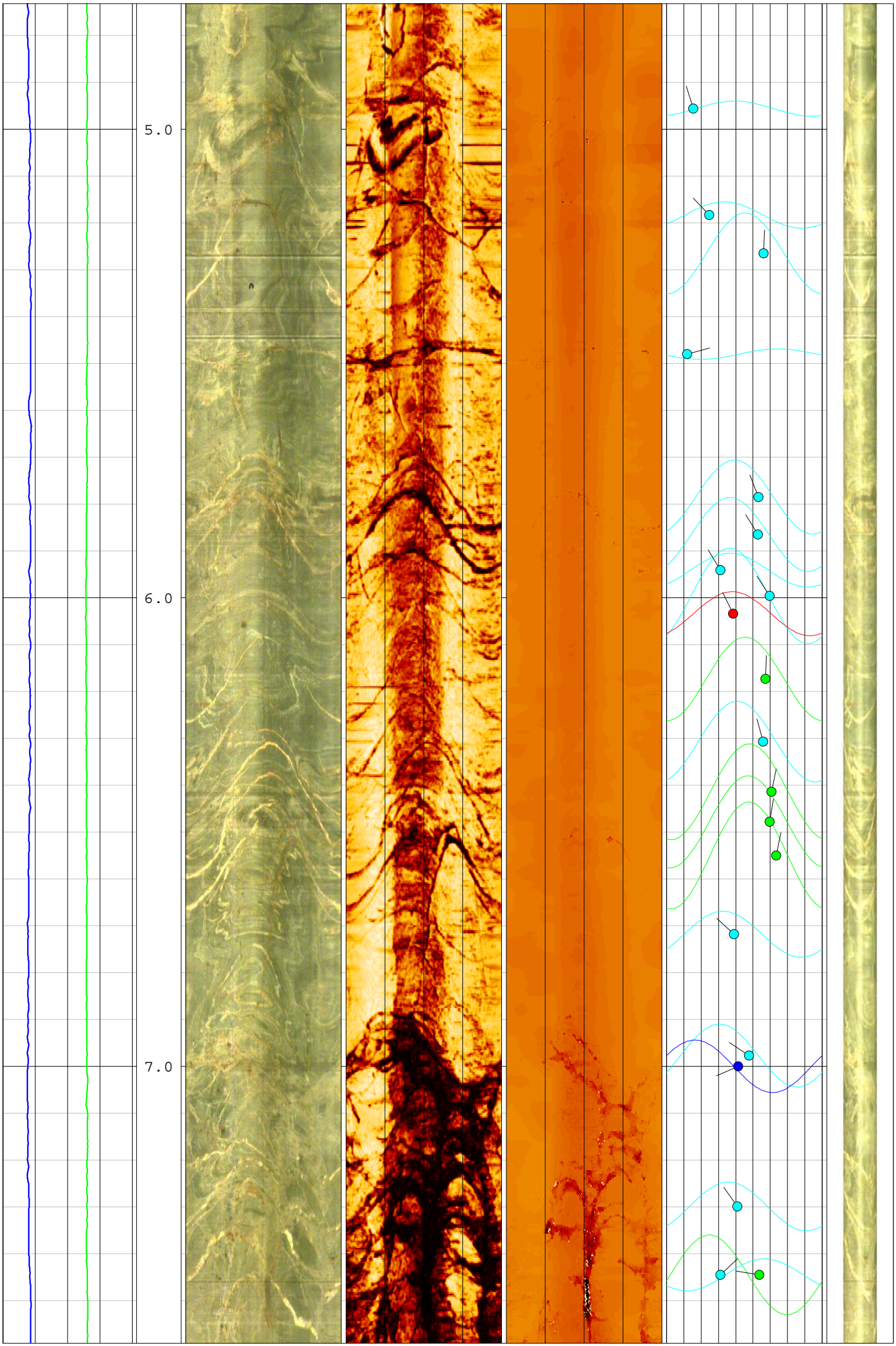
BOREHOLE RECORD

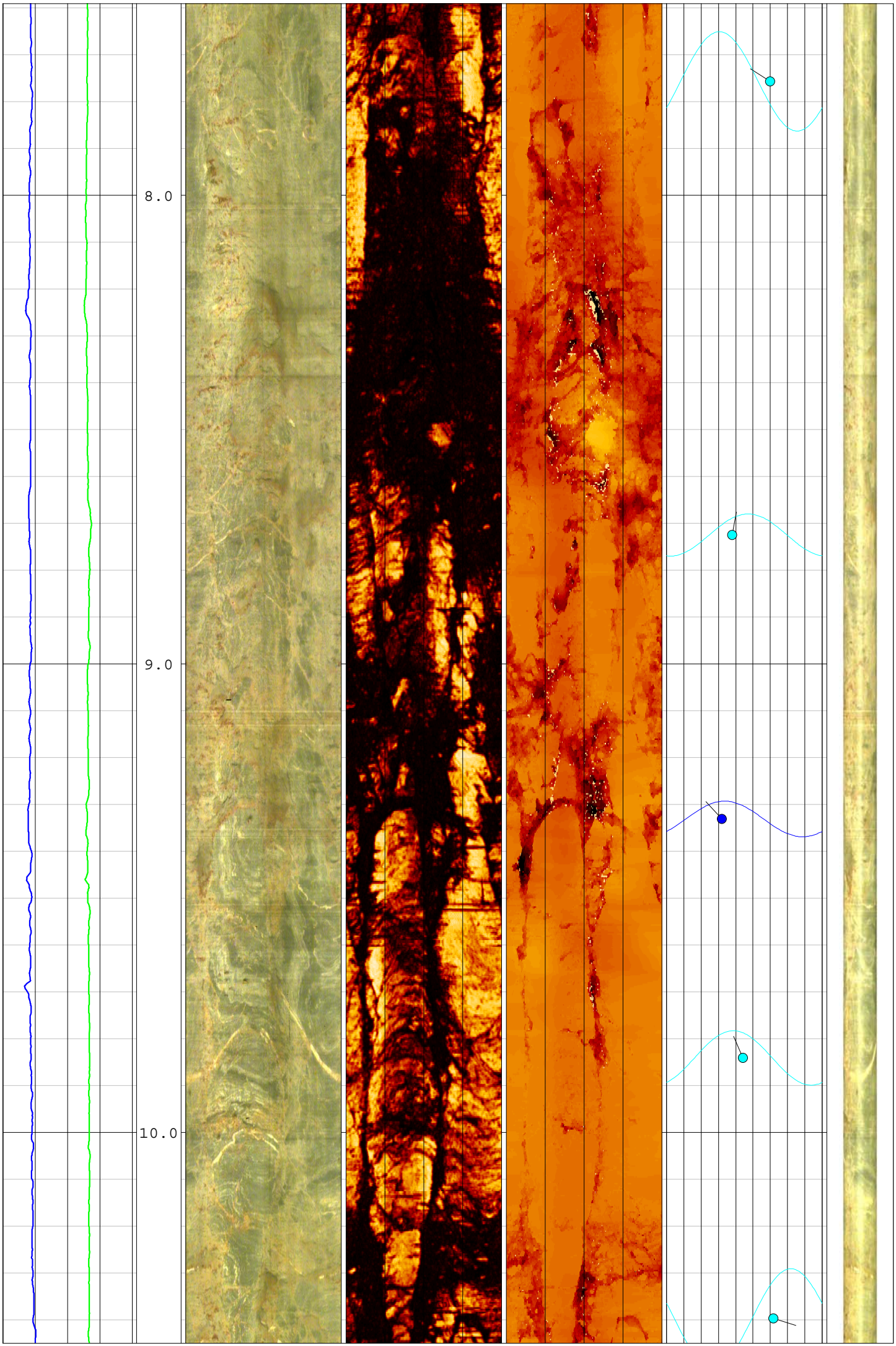
Bit: (mm)	From: (m)	To: (m)
120	**3.3**	**20.2**

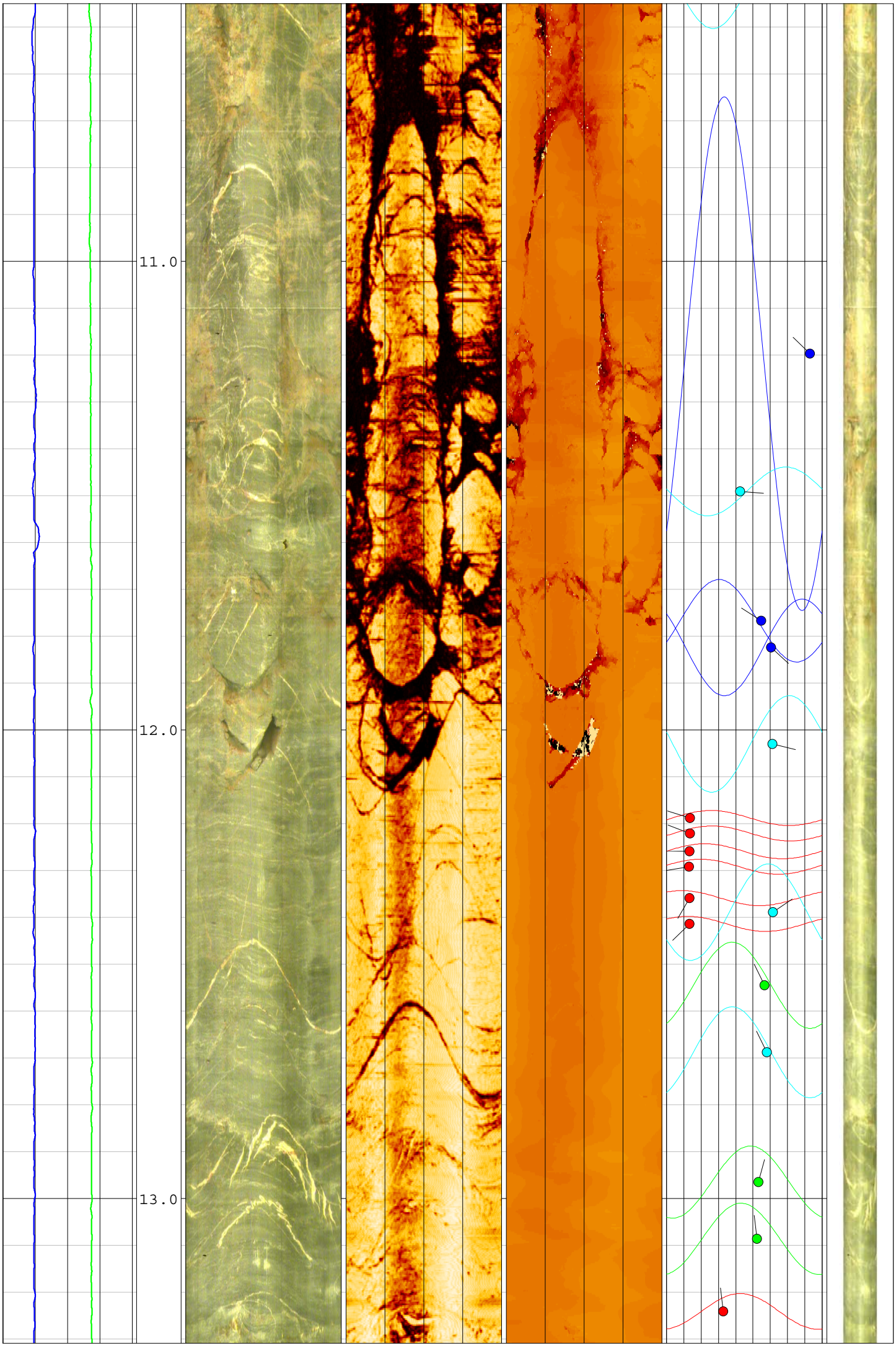
CASING RECORD

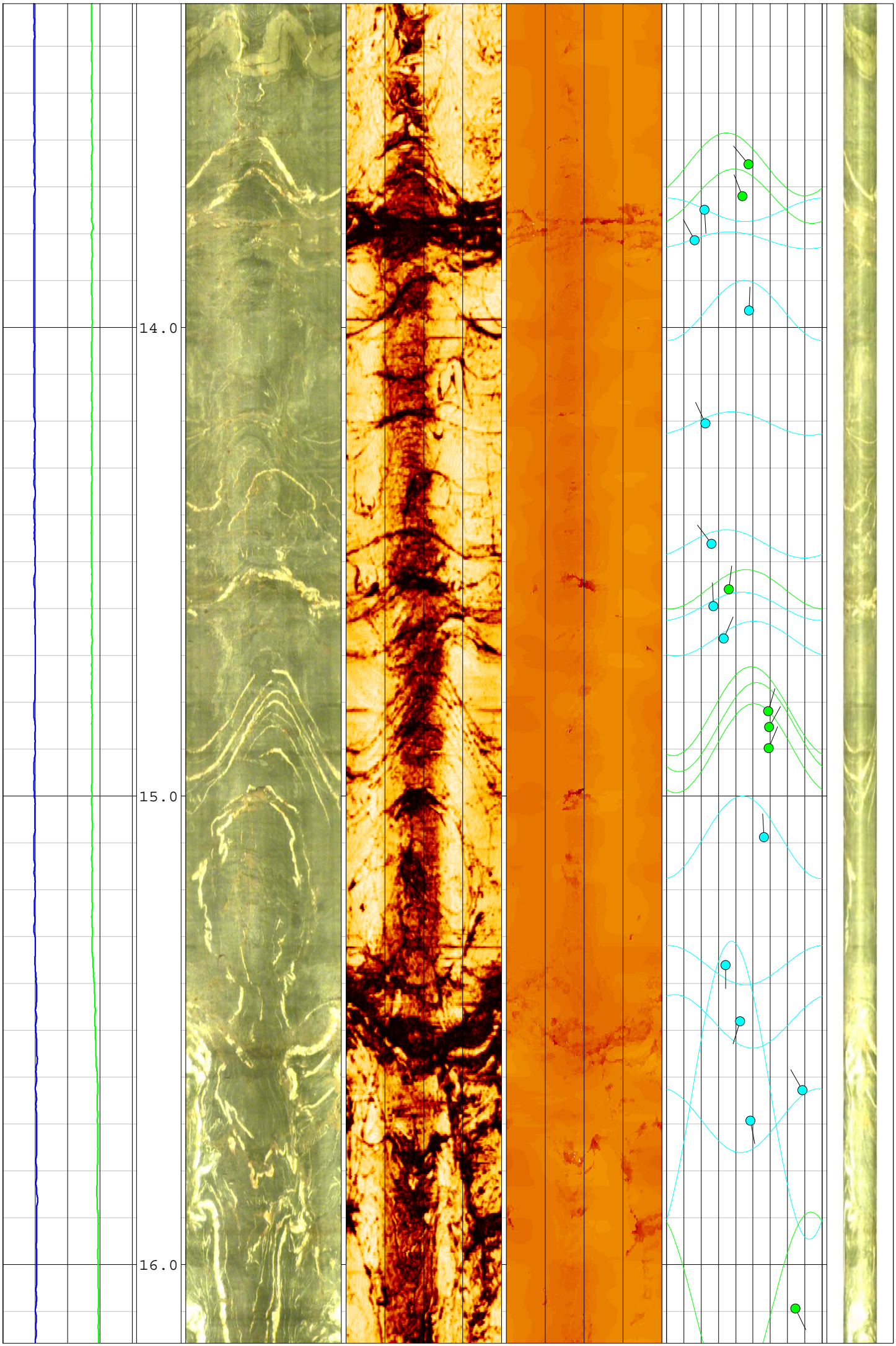
Type	Size: (mm)	From: (m)	To: (m)
Steel	**125**	**0.0**	**3.3**

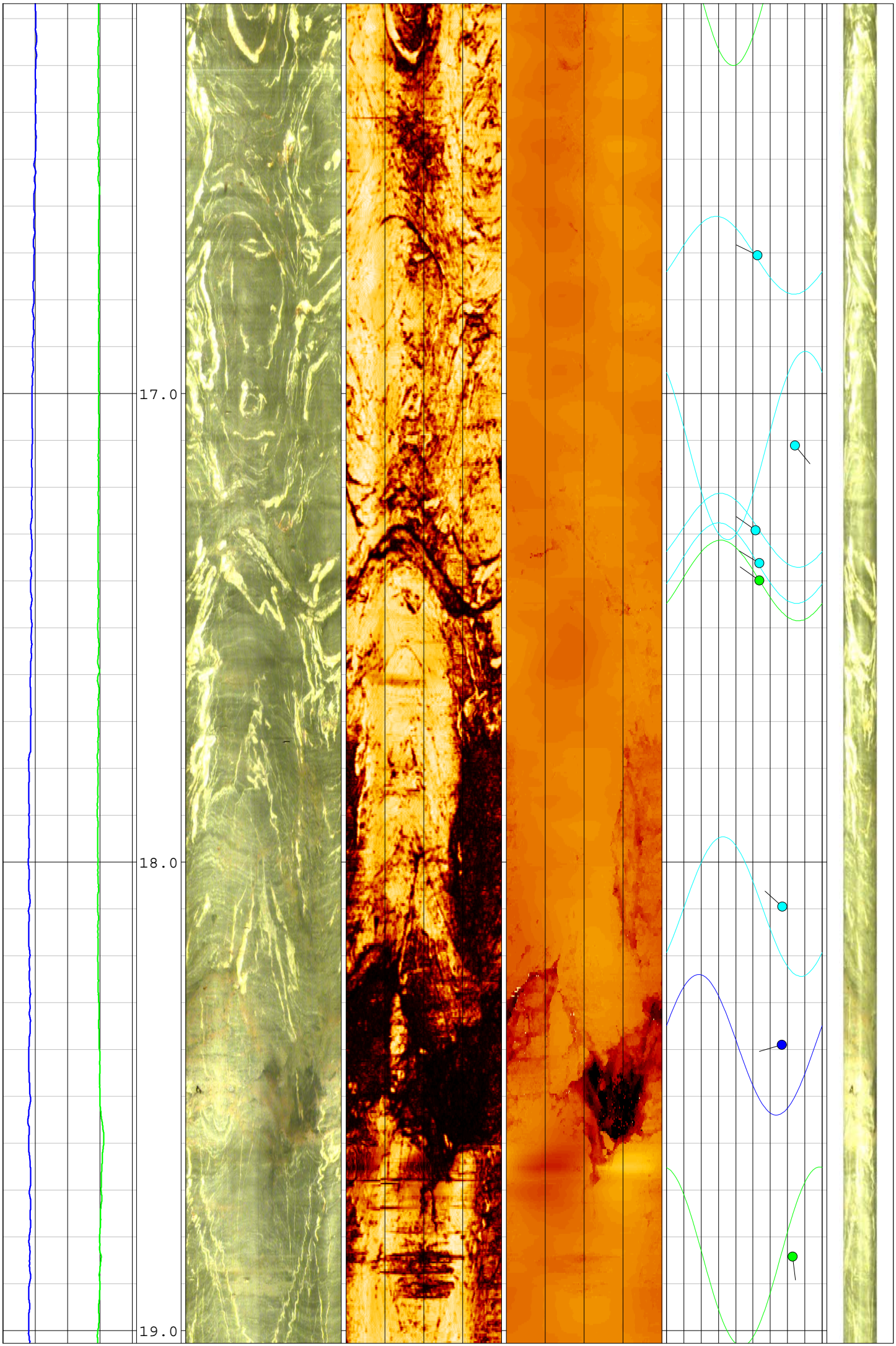


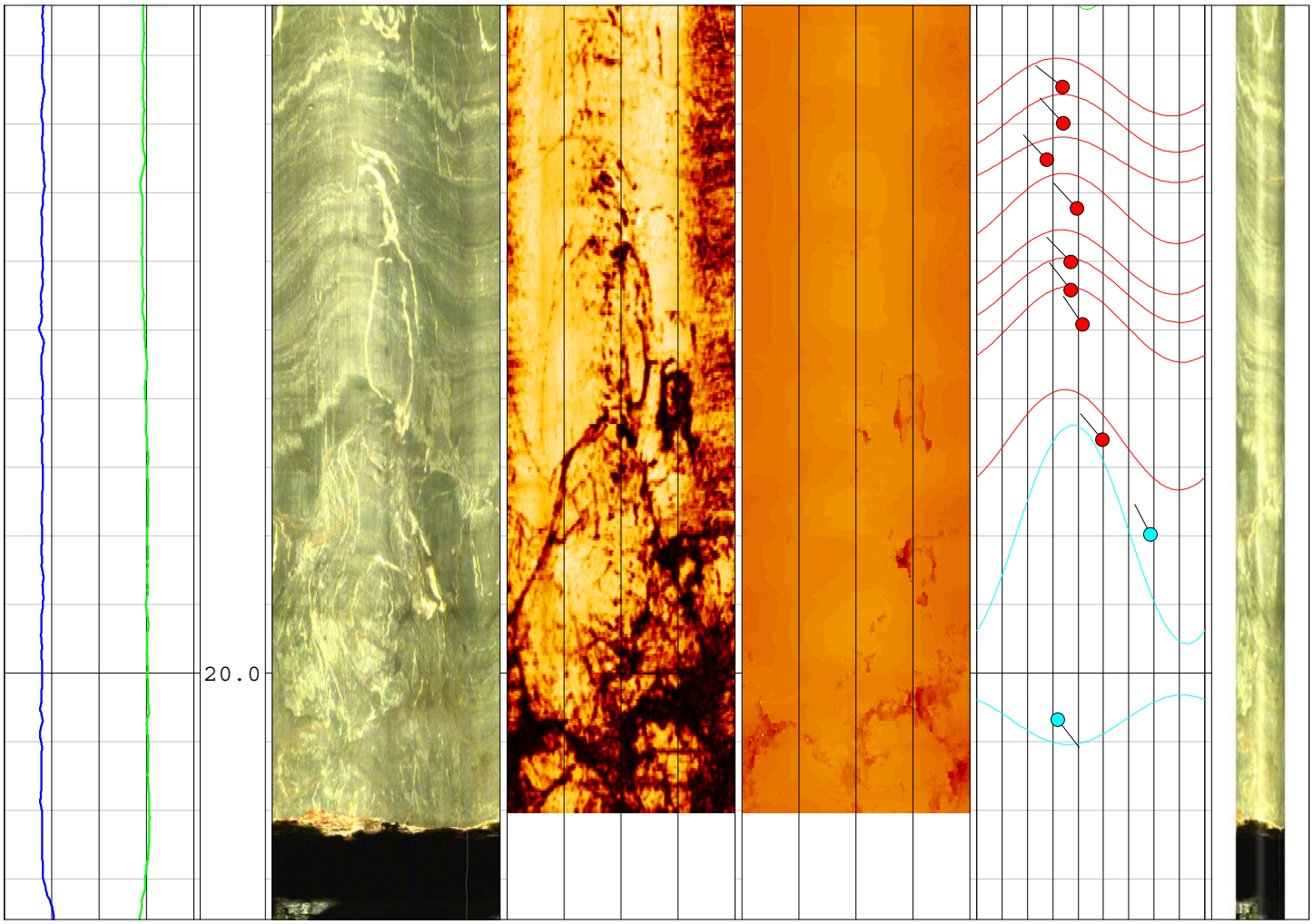

5.0
6.0
7.0


8.0
9.0
10.0


11.0
12.0
13.0


14.0
15.0
16.0


17.0
18.0
19.0


20.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH4**

Log Type: ***Composite***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

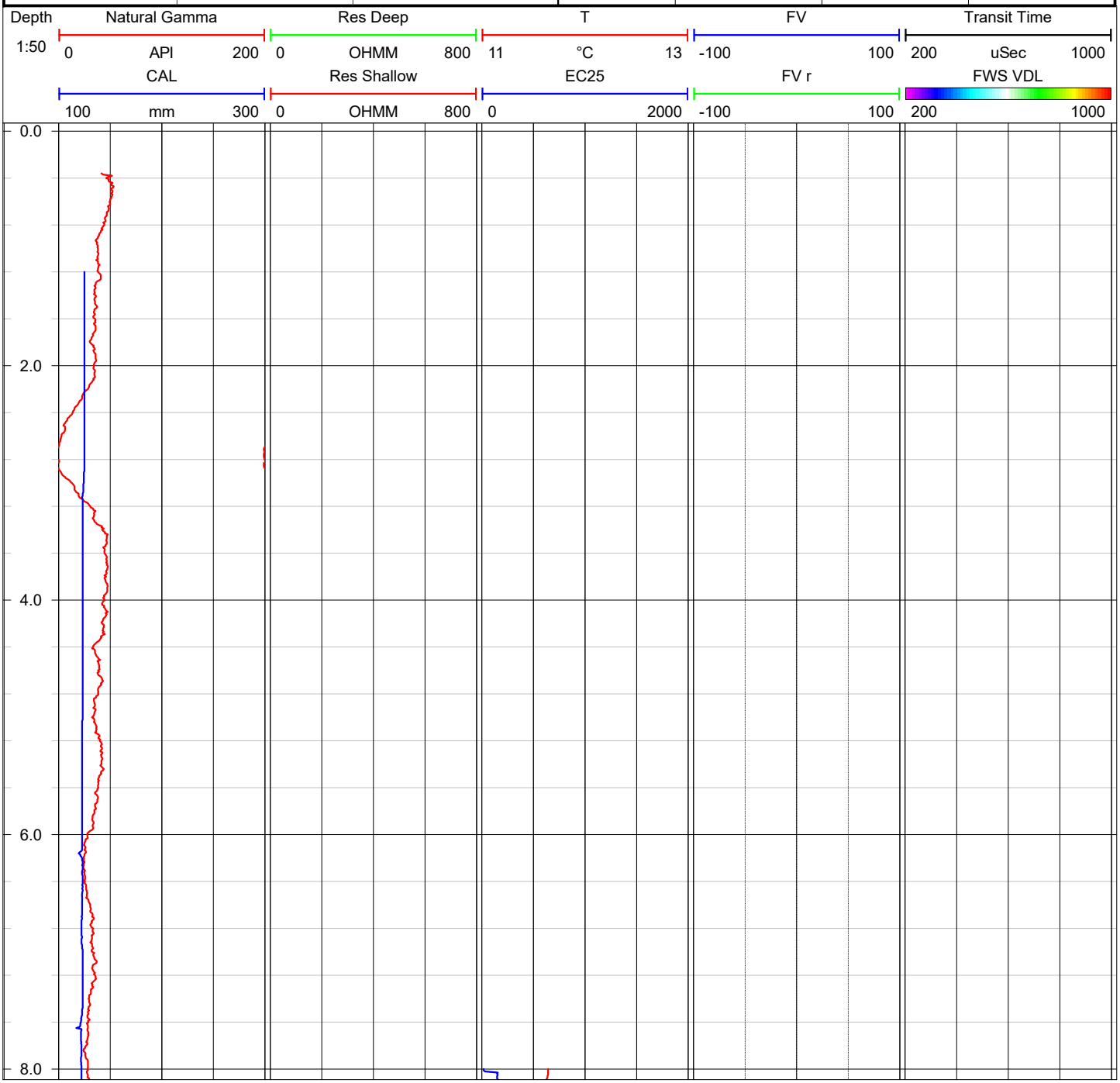
Drilled Depth: (m)		Date:	**02.11.20**
Logged Depth: (m)	**13.5**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0.4 - 13.5**		
Fluid Level: (m)	**8.1**		

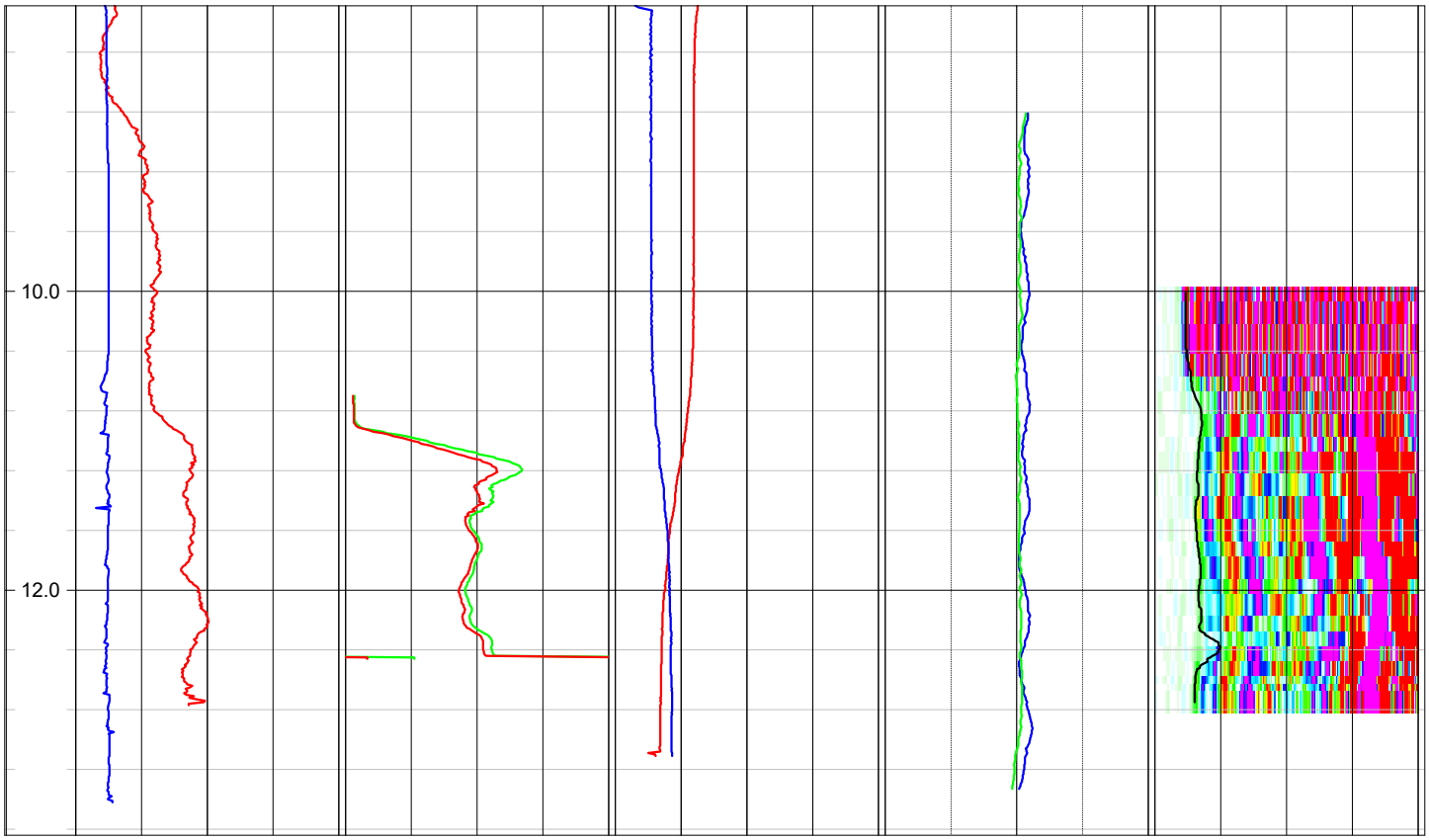
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
120	**10.7**	**13.5**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**125**	**0.0**	**10.7**




10.0
12.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH4**

Log Type: ***Image***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

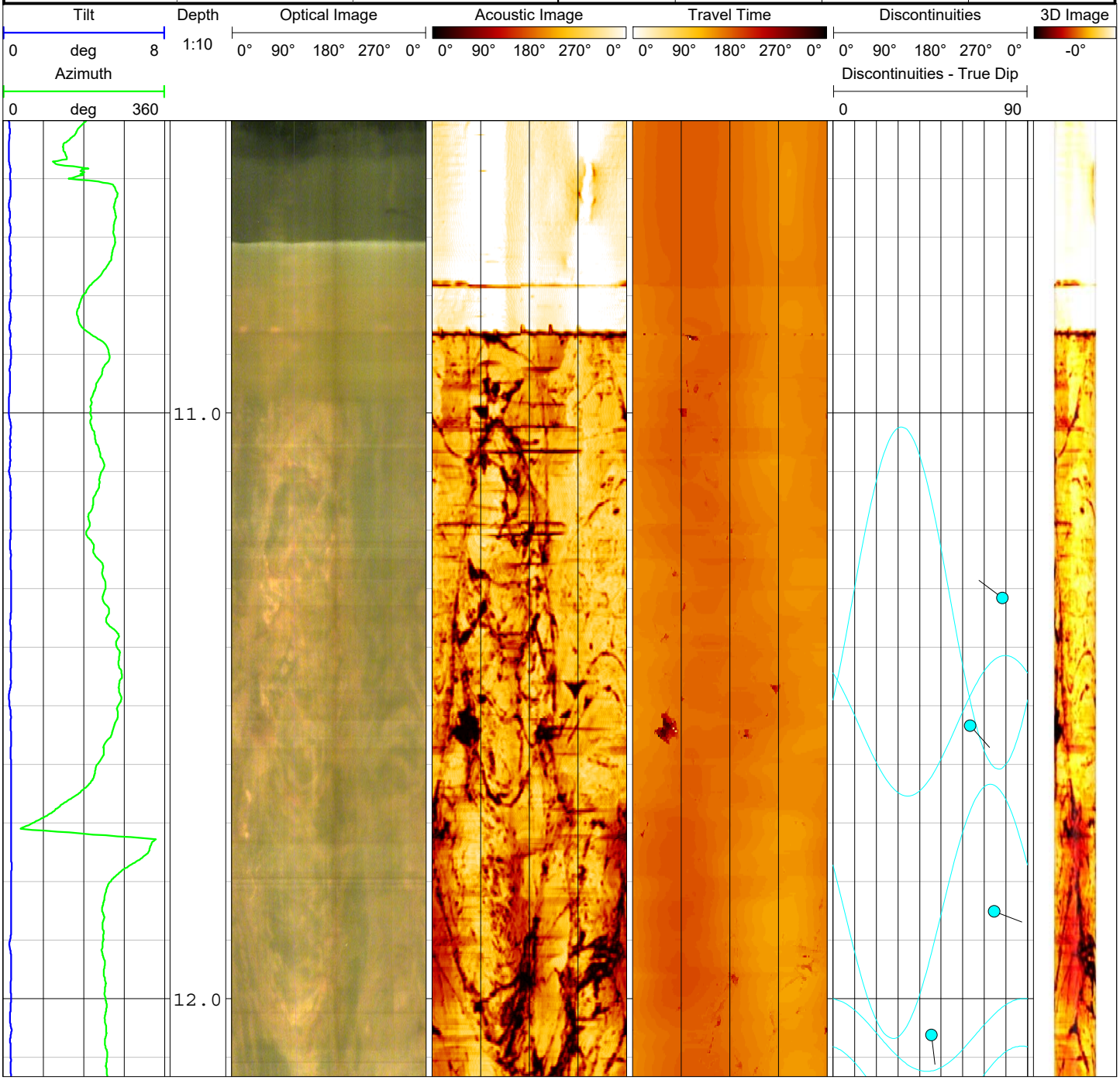
Drilled Depth: (m)		Date:	**02.11.20**
Logged Depth: (m)	**13.5**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**10.9 - 13.5**		
Fluid Level: (m)	**8.1**		

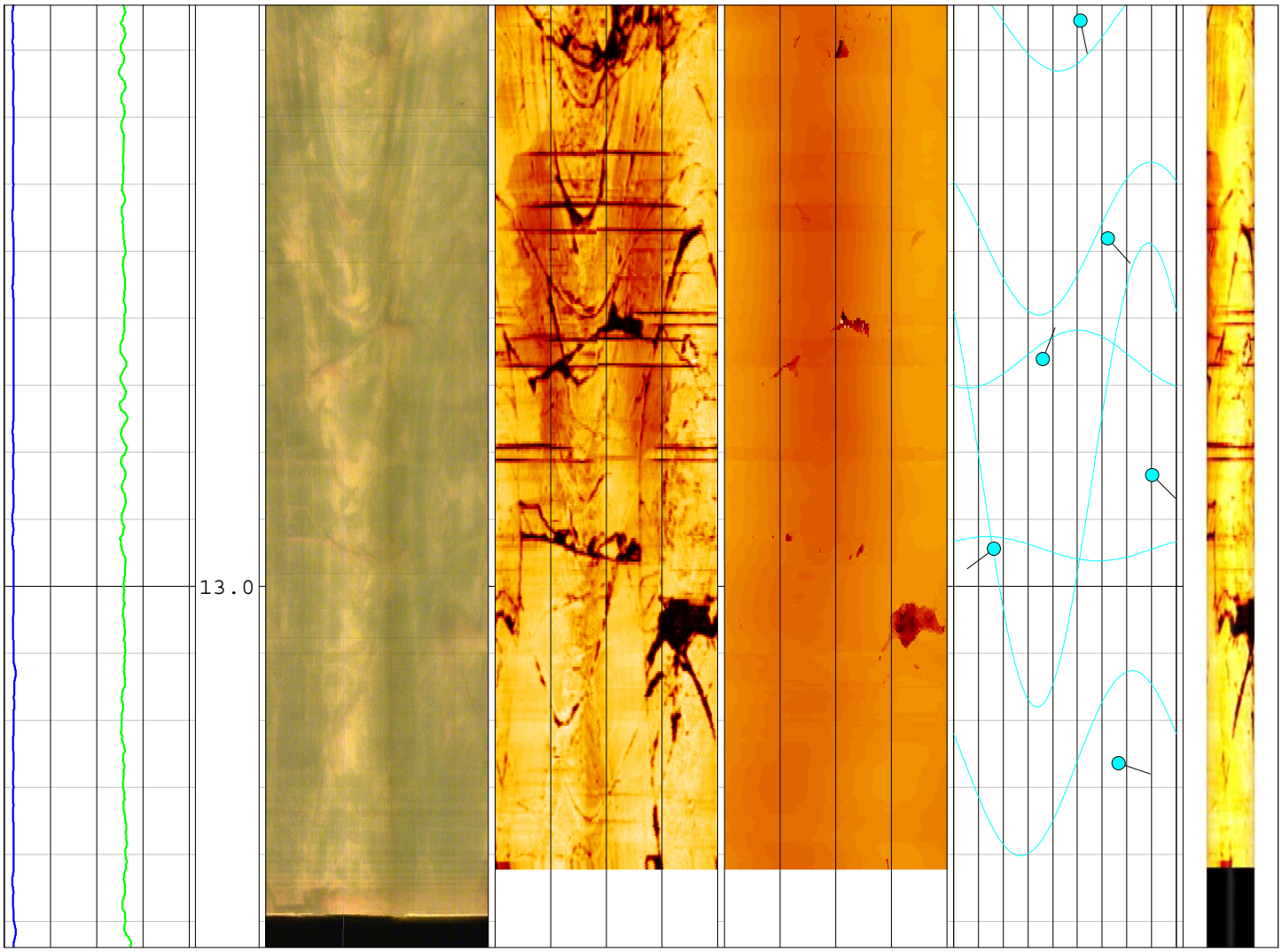
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
120	**10.9**	**13.5**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**125**	**0.0**	**10.9**




13.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH5**

Log Type: ***Composite***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

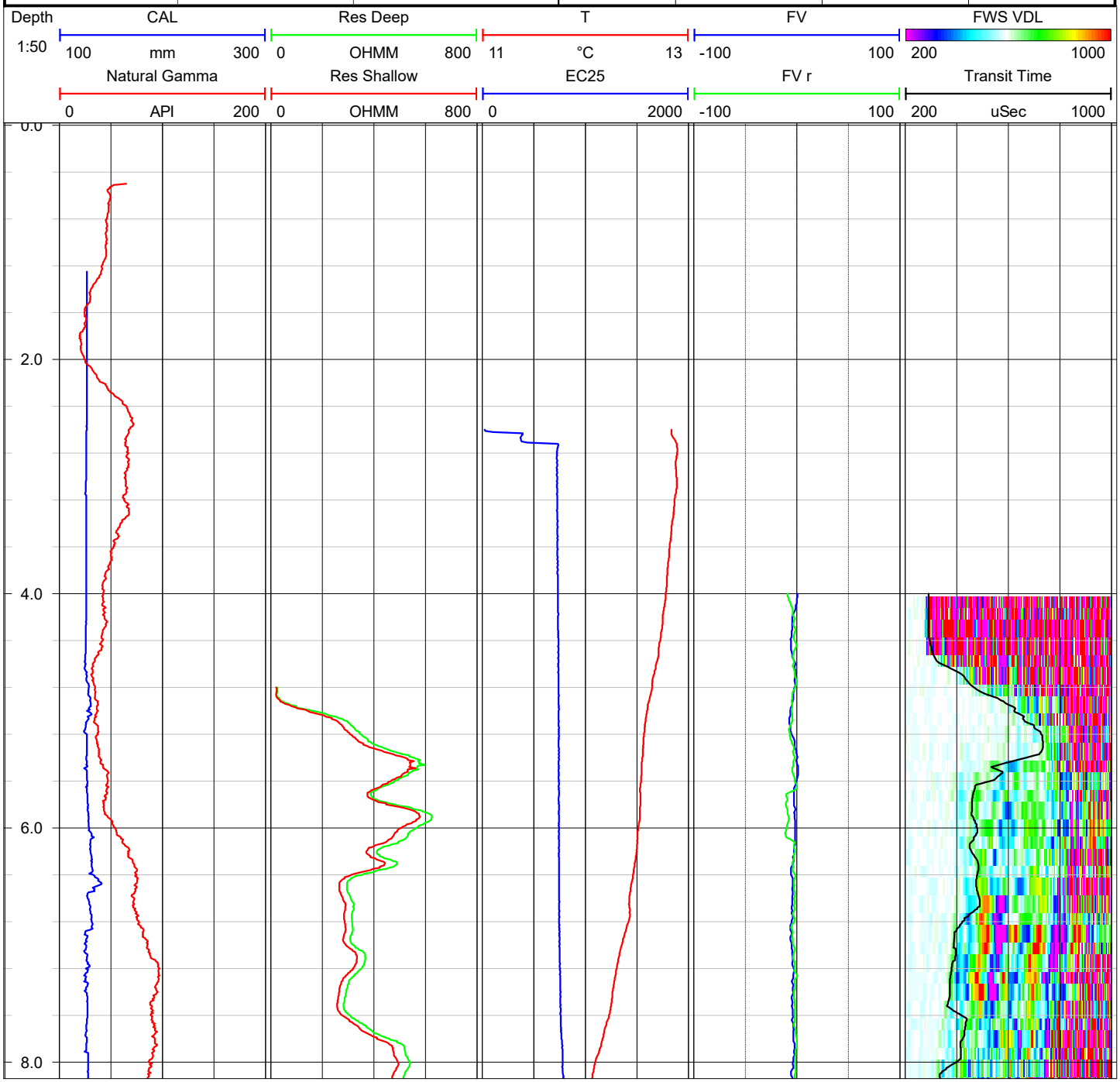
Drilled Depth: (m)	**10.5**	Date:	**30.10.20**
Logged Depth: (m)	**10.3**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**0.5 - 10.3**		
Fluid Level: (m)	**2.6**		

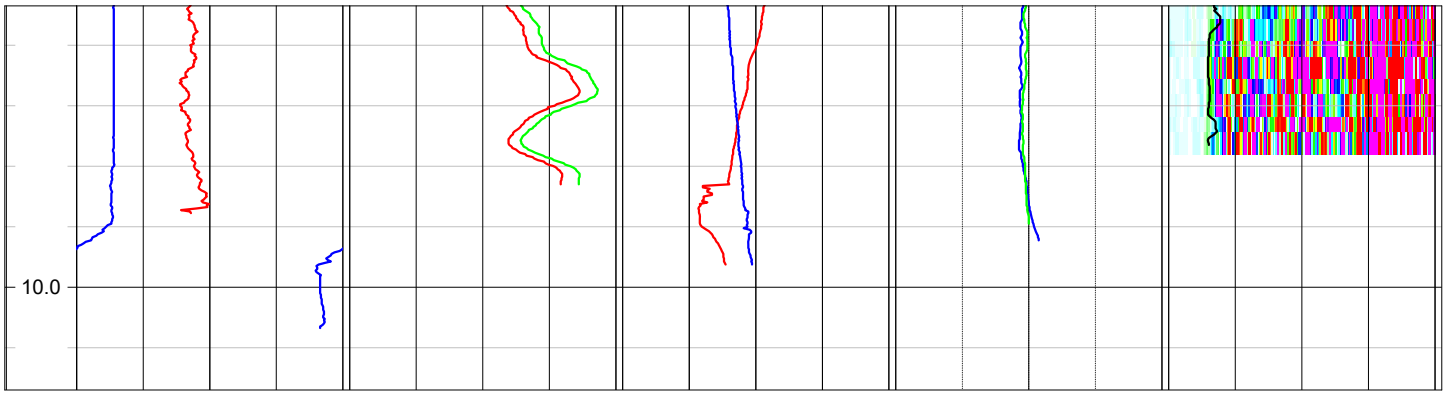
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
123	**4.9**	**10.5**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**125**	**0.0**	**4.9**




10.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Irish Drilling**

Borehole: **BH 5**

Log Type: ***Image***

Location: **Arklow Bank** Area: **Co. Wicklow** Grid Ref: Elevation:

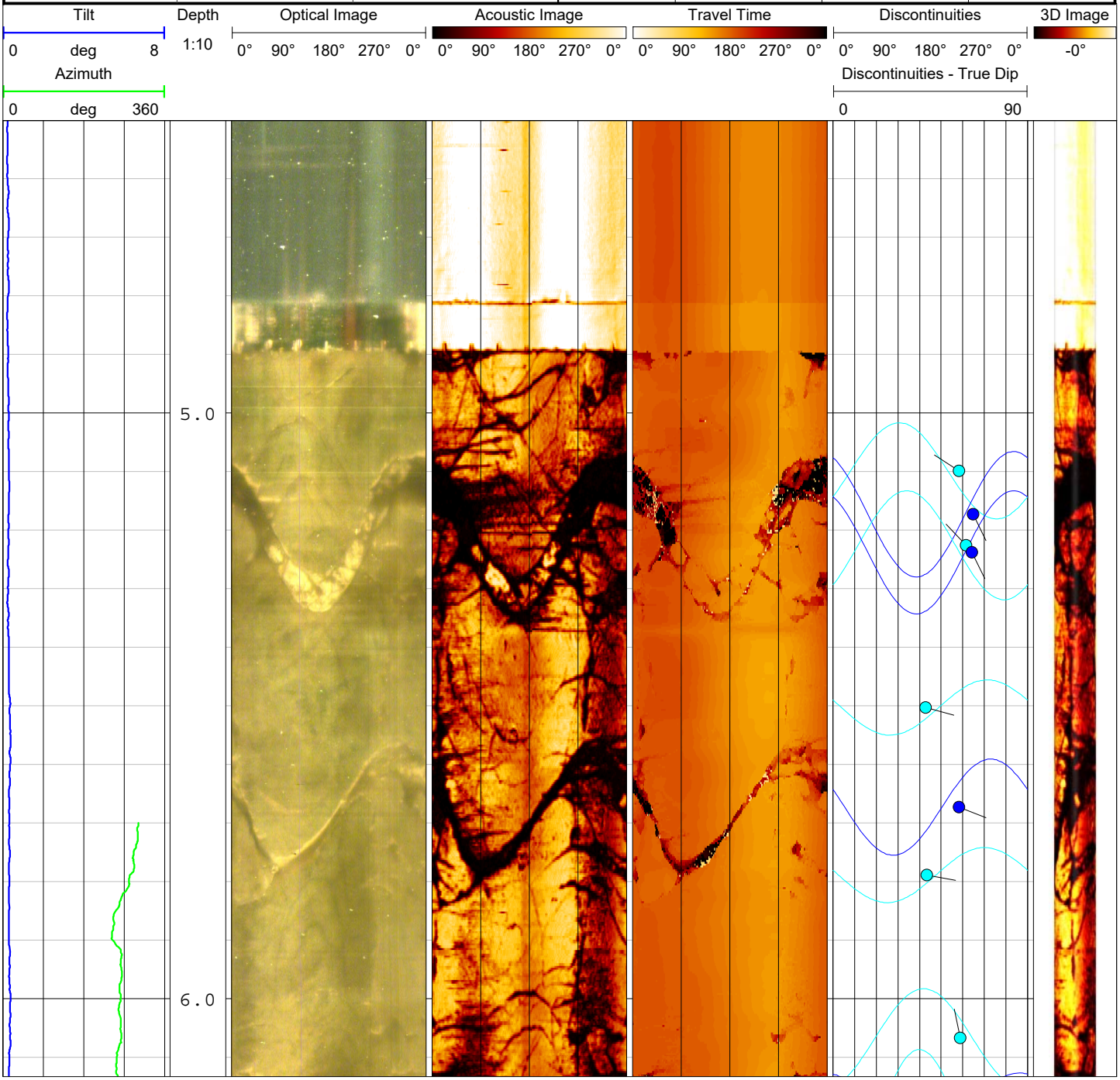
Drilled Depth: (m)	**10.5**	Date:	**30.10.20**
Logged Depth: (m)	**9.9**	Recorded By:	**A. White**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**4.9 - 9.9**		
Fluid Level: (m)	**2.7**		

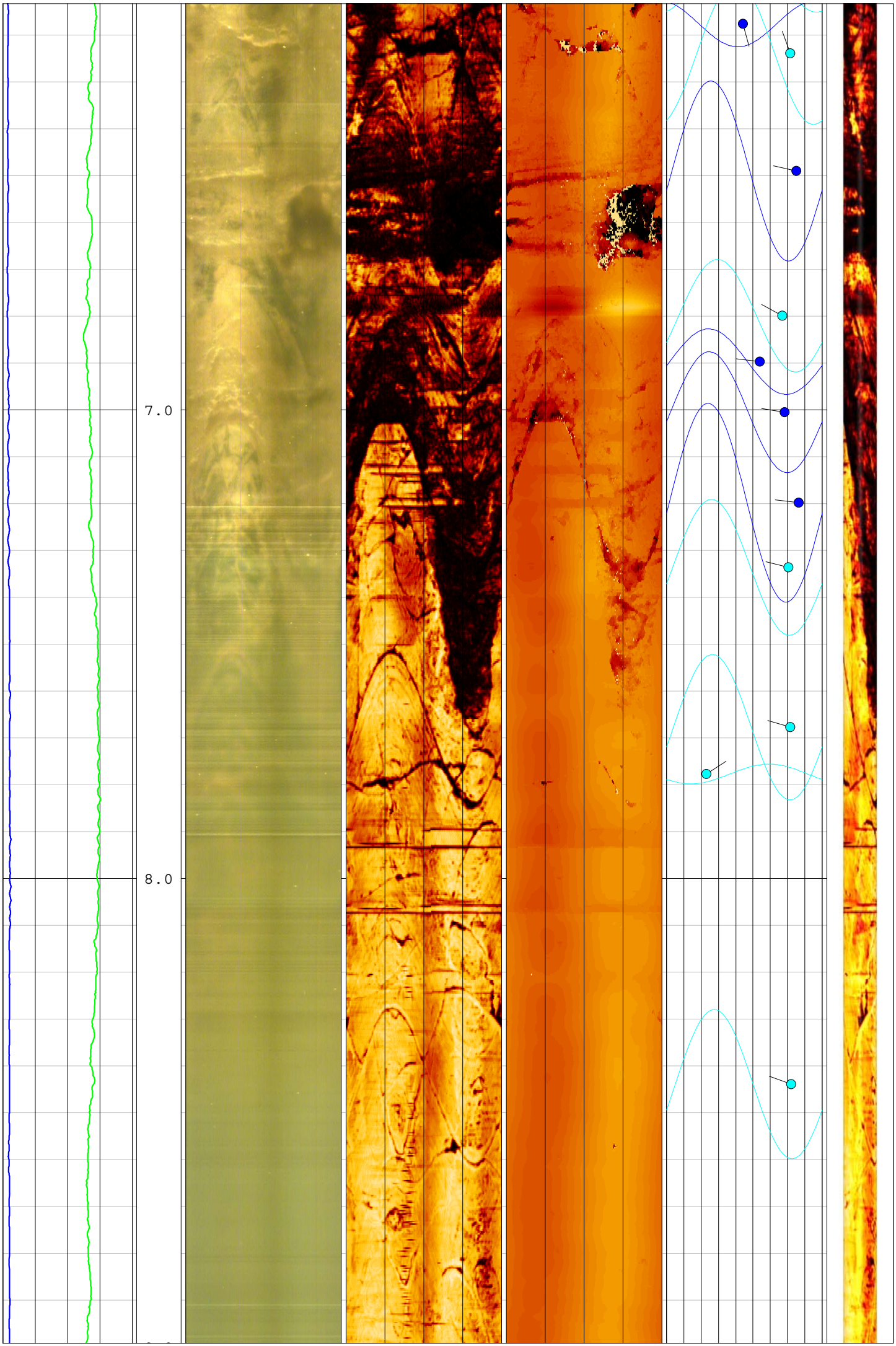
BOREHOLE RECORD

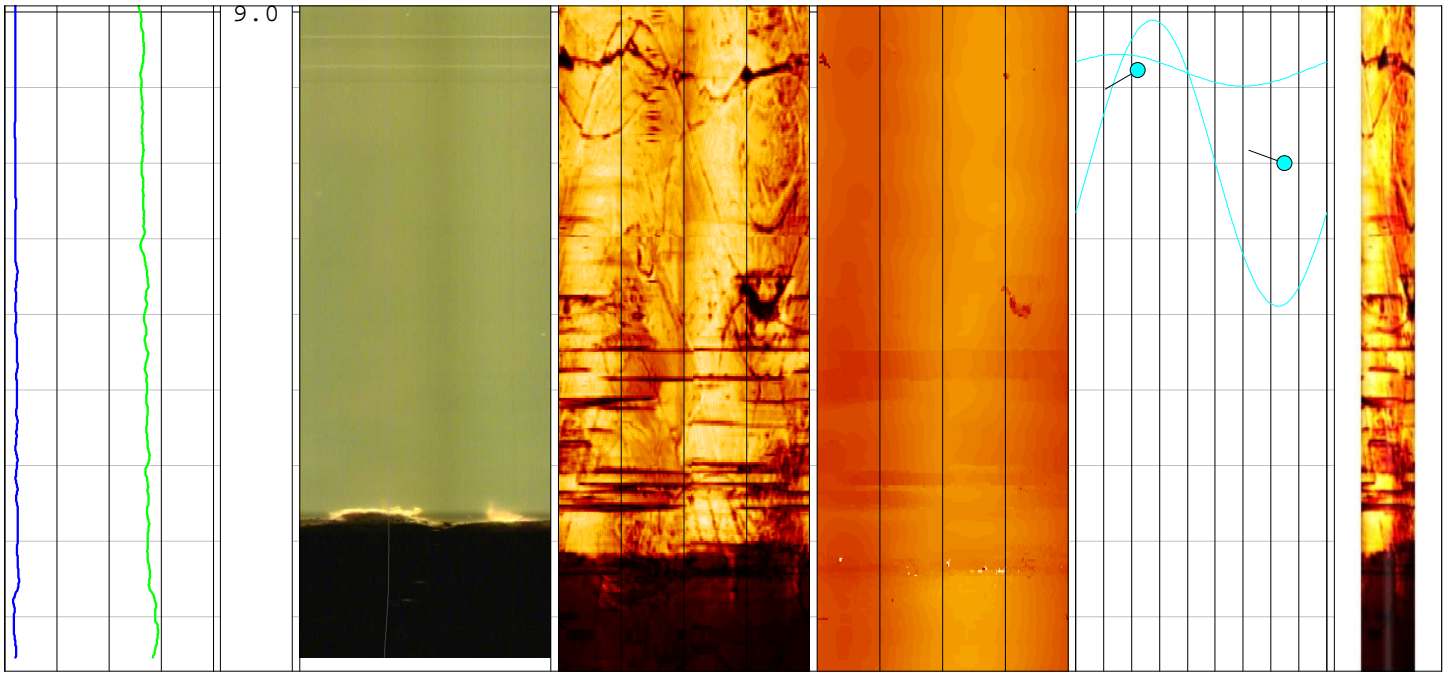
Bit: (mm)	From: (m)	To: (m)
123	**4.9**	**10.5**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**125**	**0.0**	**4.9**




7.0
8.0


9.0

Appendix 4 Soil Resistivity Tests

IRISH DRILLING LTD. Loughrea Co. Galway Tel: (091) 841274 Fax: (091) 880861	Project:	Arklow Bank Wind Park - Onshore Grid Infrastructure	
	Client:	Sure Partners Ltd (SSE)	
	Location:	Landfall Site, County Wicklow	
	Date:	02/12/2020	Sheet No. 1 Checked: RK

Soil Resistivity Survey

Date	Location	Orientation	Spacing	Reading in Ohms	Notes
04.11.2020	SR07	N/S	1.0m	1.85	C1 electrode located at South end
			2.0m	1.01	
			3.0m	0.93	
		E/W	1.0m	1.99	C1 electrode located at East end
			2.0m	0.89	
			3.0m	0.76	

Appendix 5 Groundwater Readings

IRISH DRILLING LTD.
Loughrea Co. Galway

Tel: (091) 841274 Fax: (091) 880861

Project: Arklow Bank Wind Park - Onshore Grid Infrastructure
Client: SSE
Location: County Wicklow
Date: 02/12/2020 Sheet No. 1
Checked: RK

Water Levels in Standpipes

Date	Location	Depth	Comments	Remarks
17.11.2020	BH01	3.10m	before purge	
		2.43m	after purge	50mm standpipe, Rotary Core Borehole
	BH03	0.94m	before purge	
		5.86m	after purge	50mm standpipe, Rotary Core Borehole
	BH04	7.92m	before purge	
		7.01m	after purge	50mm standpipe, Rotary Core Borehole
25.11.2020	BH01	3.10m	Data Logger installed at 5.00m bgl (Logger No. 31228).	
	BH03	1.00m	Data Logger installed at 15.00m bgl (Logger No. 31226).	
	BH04	7.94m	Data Logger installed at 10.50m bgl (Logger No. 31227).	

Remarks:
All readings record depth from ground level to top of water level.

Appendix 6 Laboratory Tests Results

Summary of Classification Test Results

Project No.: 2020WW102

Project Name: Arklow Bank Windpark

Hole No.	Sample Ref	Top	Base	Type		Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Remarks
BH01		2.00	3.50	C		Dark brown slightly gravelly slightly sandy SILT.			21.0	90	41	20	21		CI
BH02		2.00	3.50	C		Dark brown slightly sandy SILT.			26.0	98	50	29	21		MH
BH04		2.00	3.50	C		Dark brown slightly gravelly slightly sandy SILT.			17.0	93	32	17	15		CL
BH05		0.00	2.00	C		Brown sandy SILT. Sand is fine and medium.			19.0	92	52	26	26		CH
TP01	2	0.40	0.50	B		Brown slightly sandy SILT.			34.0	99	77	29	48		CV
TP01	6	3.60	3.70	B		Dark brown slightly sandy SILT.			26.0	99	55	30	25		MH
TP02	2	0.50	0.60	B		Light brown slightly sandy SILT.			37.0	99	66	45	21		MH
TP02	4	1.40	1.50	B		Dark brown slightly sandy SILT.			28.0	97	61	36	25		MH
TP02	6	3.30	3.40	B		Dark brown slightly sandy SILT.			29.0	100	56	26	30		CH
TP03	2	0.50	0.60	B		Light brown slightly sandy SILT.			34.0	99	66	37	29		MH
TP03	5	1.50	1.60	B		Dark brown slightly gravelly slightly sandy SILT.			24.0	93	47	30	17		MI
TP03	6	2.80	2.90	B		Brown slightly gravelly slightly sandy SILT.			21.0	96	32	19	13		CL
TP04	2	0.40	0.50	B		Brown slightly sandy silty CLAY.			31.0	99	66	31	35		CH
TP04	5	1.40	1.50	B		Brown gravelly very silty fine SAND.			13.0	92					NP
TP04	6	1.40	1.50	B		Brown slightly gravelly slightly sandy SILT.			22.0	95	37	17	20		CI
TP04	8	3.70	3.80	B		Mottled brown-grey slightly gravelly slightly sandy SILT.			18.0	90	60	31	29		MH
TP05	2	0.40	0.50	B		Orange-brown slightly sandy SILT.			28.0	98	58	28	30		CH
TP05	3	1.10	1.20	D		Brown slightly sandy SILT.			21.0						
TP05	5	1.50	1.60	B		Brown slightly sandy SILT.			30.0	97	35	25	10		CI
TP05	6	2.60	2.70	B		Brown slightly sandy SILT.			28.0	99	56	29	27		MH
TP06	2	0.40	0.50	B		Orange-brown slightly gravelly slightly sandy SILT.			22.0	96	50	27	23		MH
TP06	6	2.10	2.20	B		Orange-brown sandy SILT. Sand is medium and fine.			24.0	95					
TP07	2	0.40	0.50	B		Brown slightly gravelly slightly sandy SILT.			27.0						
TP07	5	1.50	1.60	B		Brown slightly sandy SILT.			24.0	95	55	32	23		MH
TP07	8	4.40	4.50	B		Dark brown slightly sandy SILT.			27.0	99	49	24	25		CI
TP08	2	0.40	0.50	B		Brown slightly sandy SILT.			27.0	96	86	31	55		CV

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

Key: w = water content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index

Density test: wd - water displacement; wi - immersion in water

Linear measurement unless : 4pt cone unless : 1pt - single point test; NP - Non Plastic

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

Date Printed: 13/01/2021

QC From No: R1

Approved By: DCD

Table 1 sheet 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

Summary of Classification Test Results

Project No.: 2020WW102

Project Name: Arklow Bank Windpark

Hole No.	Sample Ref	Top	Base	Type		Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Remarks
TP08	8	4.40	4.50	B		Dark brown slightly sandy SILT.			27.0	99	39	20	19		CI
TP09	5	1.50	1.60	B		Brown slightly sandy SILT.			24.0	95	43	21	22		CI
TP10	2	0.40	0.50	B		Brown slightly sandy SILT.			33.0						
TP10	6	2.00	2.10	B		Brown silty medium and fine SAND.			14.0	88					
TP11	2	0.40	0.50	B		Brown slightly sandy SILT.			31.0	96	57	33	24		MH
TP11	6	2.50	2.60	B		Dark brown slightly sandy SILT.			28.0	99	85	38	47		MV
TP11	7	3.80	3.90	B		Dark brown slightly sandy SILT.			19.0	99	42	21	21		CI
TP12	6	2.40	2.50	B		Brown slightly gravelly sandy SILT. Sand is fine.			17.0	94	32	16	16		CL

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

Key: w = water content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index

Density test: wd - water displacement; wi - immersion in water

Linear measurement unless : 4pt cone unless : Liquid Limit; 1pt - single point test; NP - Non Plastic

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

Date Printed: 13/01/2021

QC From No: R1

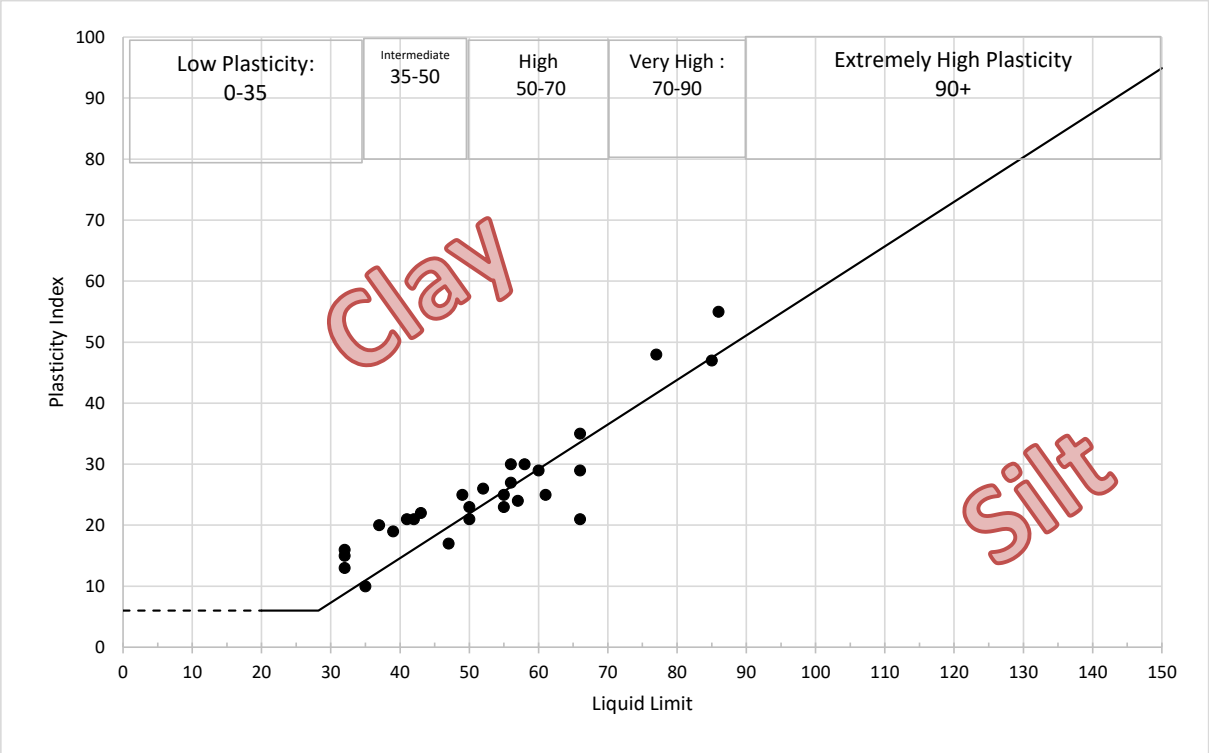
Approved By: DCD

Table 1 sheet 2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Plasticity (A-Line) Chart	Project Number
Project Name:	**Arklow Bank Windpark**	
Location:		2020WW102



Abreviations in the remarks column of the Classification Summary Sheet: C = Clay, M = Silt

Plasticity abeviations: L = Low, I = Intermediate = H = High, V = Very High, E = Extremely High.

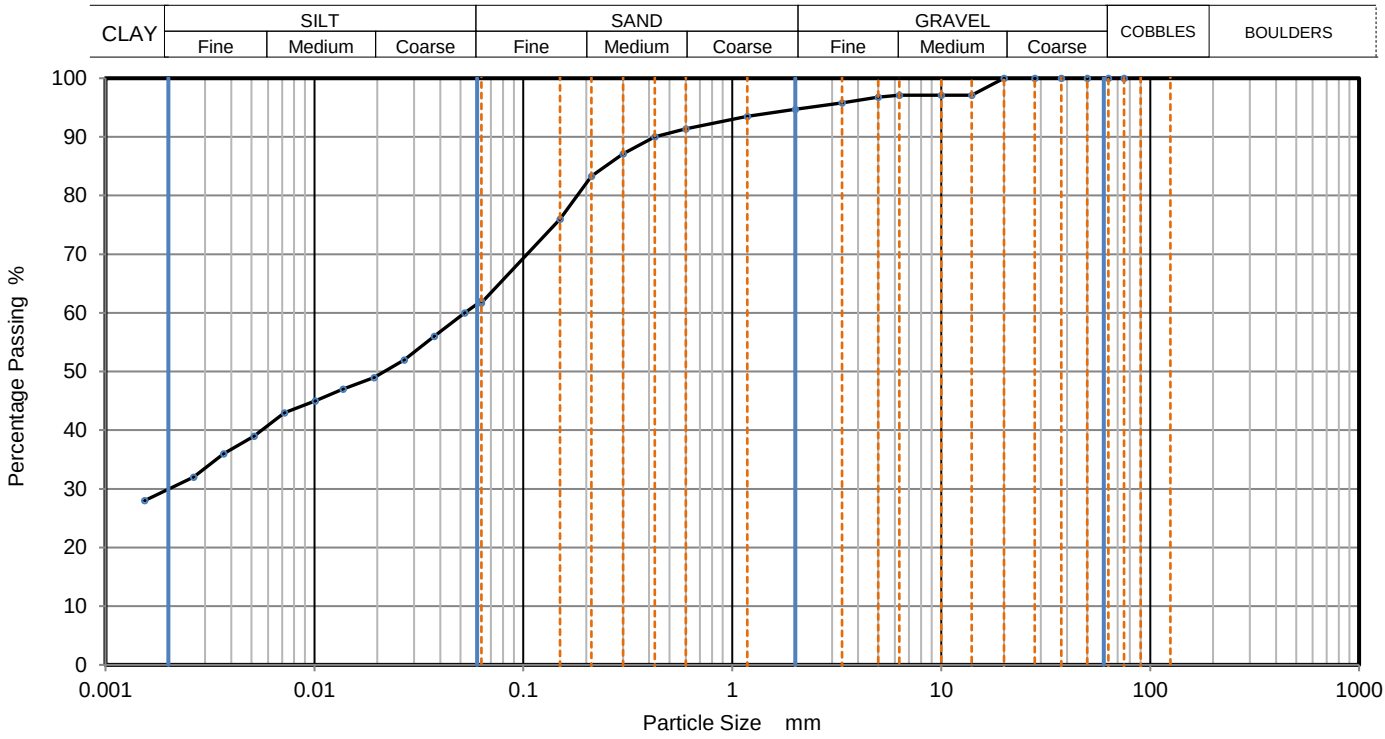
The letter O is added to the symbol of any material containing a significant proportion of organic material.

Chart taken from BS5930: 2010

Approved By: DCD

QC Form: R1

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	BH01
Site Name	Arklow Bank Windpark			Sample No.	
Soil Description	Dark brown slightly gravelly slightly sandy SILT.			Depth, m	2.00
Specimen Reference		Specimen Depth	m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202011069



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	62
		0.0523	60
75	100	0.0375	56
63	100	0.0269	52
50	100	0.0193	49
37.5	100	0.0137	47
28	100	0.0101	45
20	100	0.0072	43
14	97	0.0051	39
10	97	0.0037	36
6.3	97	0.0026	32
5	97	0.0015	28
3.35	96		
2	95		
1.18	94		
0.6	91	Particle density (assumed)	
0.425	90	2.65 Mg/m3	
0.3	87		
0.212	83		
0.15	76		
0.063	62		

Dry Mass of sample, g	835

Sample Proportions	% dry mass
Very coarse	0
Gravel	5
Sand	33
Silt	32
Clay	30

Grading Analysis		
D_{100}	mm	
D_{60}	mm	0.0532
D_{30}	mm	0.00204
D_{10}	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

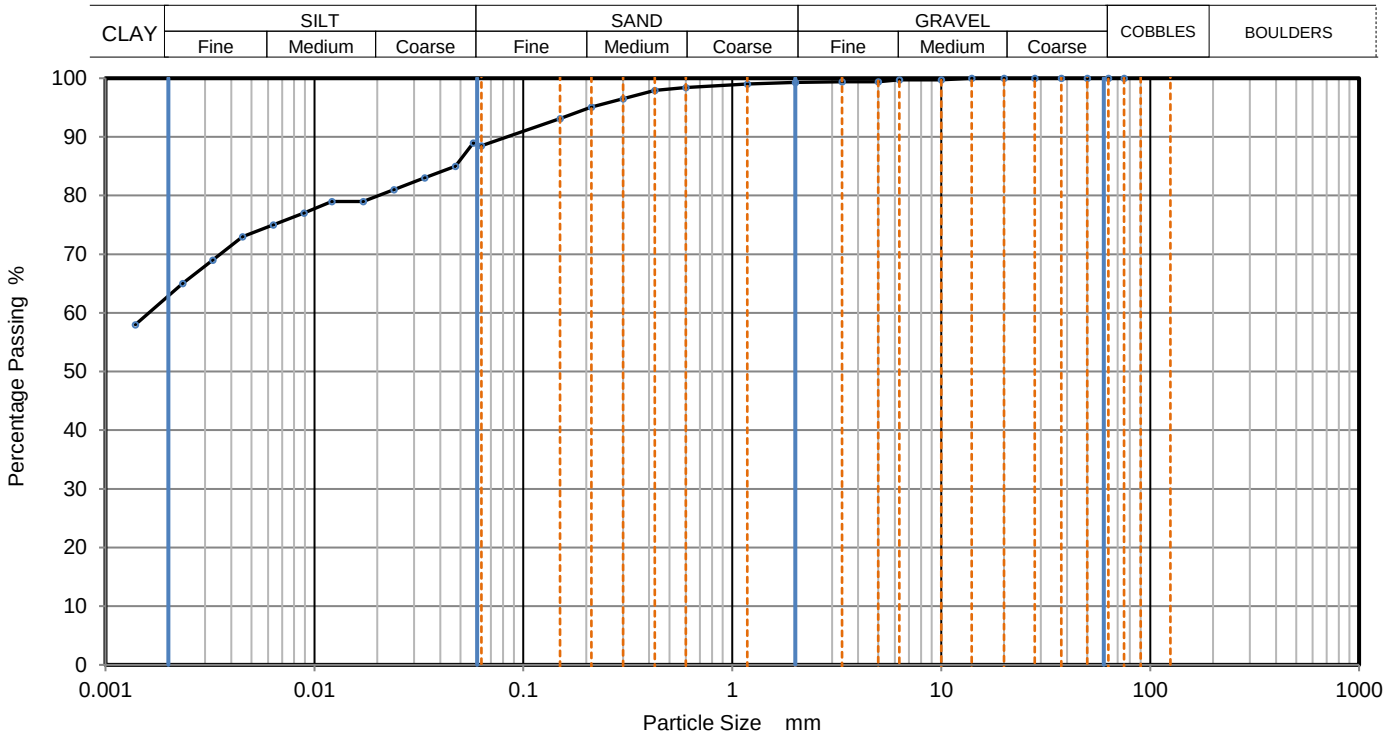
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 16:47	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	BH02
Site Name	Arklow Bank Windpark			Sample No.	
Soil Description	Dark brown slightly sandy SILT.			Depth, m	2.00
Specimen Reference		Specimen Depth	m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020110618



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0575	89
		0.0472	85
75	100	0.0337	83
63	100	0.0240	81
50	100	0.0171	79
37.5	100	0.0121	79
28	100	0.0089	77
20	100	0.0064	75
14	100	0.0045	73
10	100	0.0033	69
6.3	100	0.0023	65
5	99	0.0014	58
3.35	99		
2	99		
1.18	99		
0.6	98	Particle density (assumed)	
0.425	98	2.65 Mg/m3	
0.3	97		
0.212	95		
0.15	93		
0.063	89		

Dry Mass of sample, g	424

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	11
Silt	25
Clay	63

Grading Analysis		
D100	mm	
D60	mm	0.00162
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

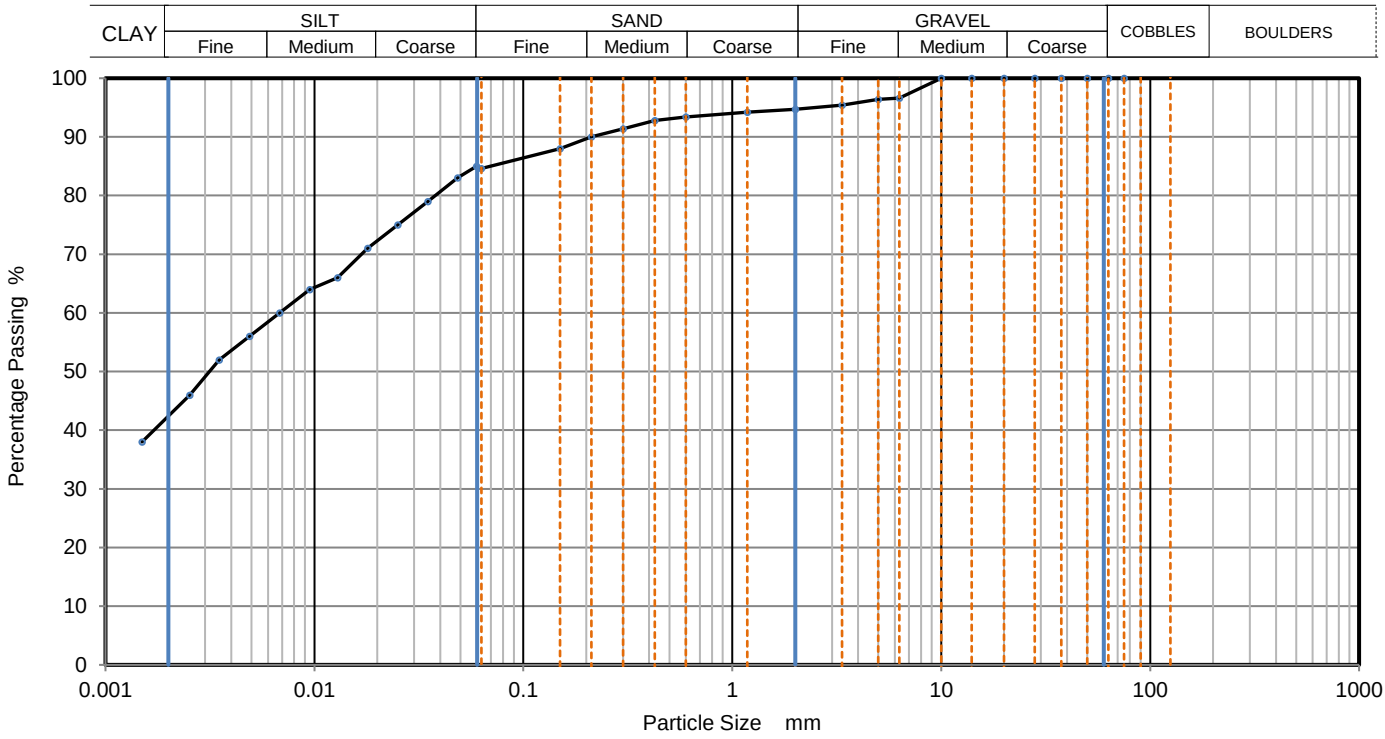
Preparation and testing in accordance with BS1377 unless noted below

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Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	BH04
Site Name	Arklow Bank Windpark			Sample No.	
Soil Description	Dark brown slightly gravelly slightly sandy SILT.			Depth, m	2.00
Specimen Reference		Specimen Depth	m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020110644



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0596	85
		0.0485	83
75	100	0.0348	79
63	100	0.0250	75
50	100	0.0180	71
37.5	100	0.0129	66
28	100	0.0095	64
20	100	0.0068	60
14	100	0.0049	56
10	100	0.0035	52
6.3	97	0.0025	46
5	96	0.0015	38
3.35	95		
2	95		
1.18	94		
0.6	93	Particle density (assumed)	
0.425	93	2.65 Mg/m3	
0.3	91		
0.212	90		
0.15	88		
0.063	85		

Dry Mass of sample, g	527

Sample Proportions	% dry mass
Very coarse	0
Gravel	5
Sand	10
Silt	42
Clay	43

Grading Analysis		
D100	mm	
D60	mm	0.00658
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

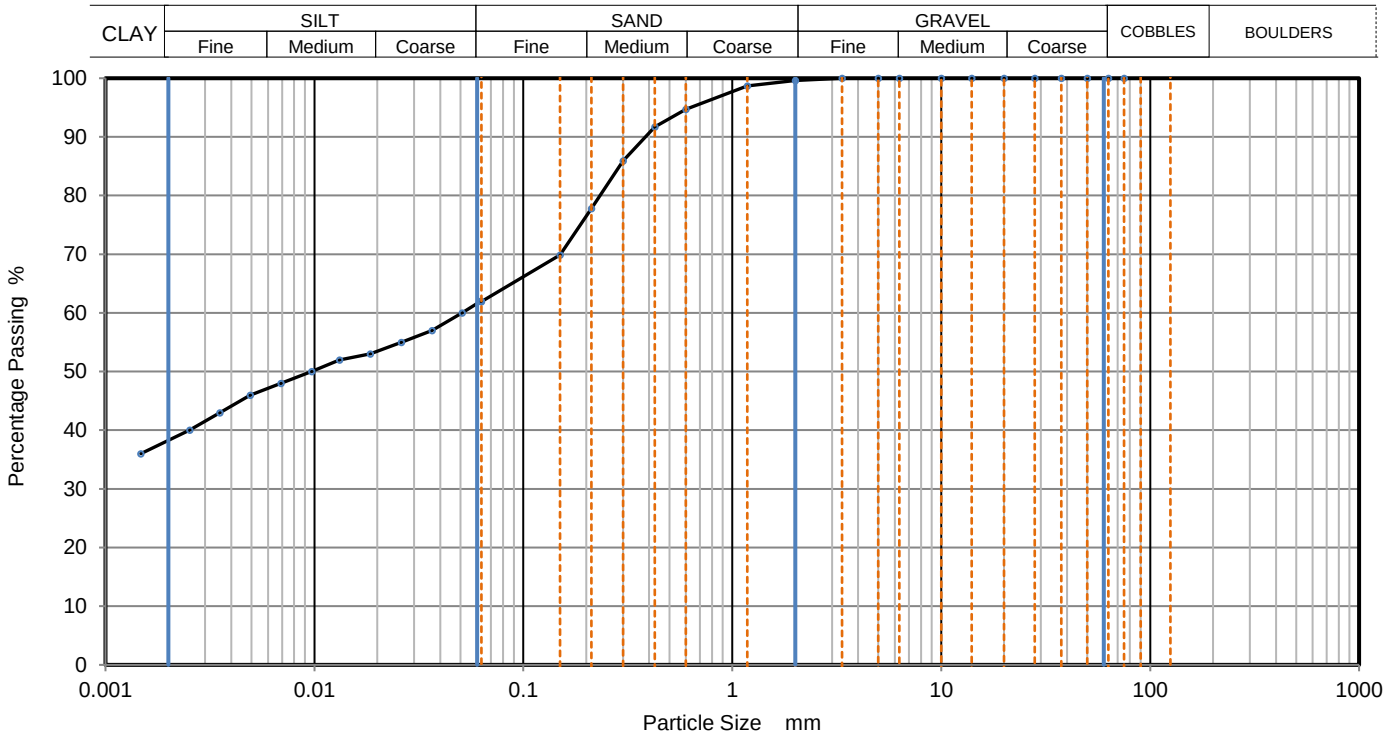
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Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	BH05
Site Name	Arklow Bank Windpark			Sample No.	
Soil Description	Brown sandy SILT. Sand is fine and medium.			Depth, m	0.00
Specimen Reference		Specimen Depth	m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020110660



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0626	62
		0.0509	60
75	100	0.0365	57
63	100	0.0260	55
50	100	0.0185	53
37.5	100	0.0132	52
28	100	0.0097	50
20	100	0.0069	48
14	100	0.0049	46
10	100	0.0035	43
6.3	100	0.0025	40
5	100	0.0015	36
3.35	100		
2	100		
1.18	99		
0.6	95	Particle density (assumed)	
0.425	92	2.65 Mg/m3	
0.3	86		
0.212	78		
0.15	70		
0.063	62		

Dry Mass of sample, g	370

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	38
Silt	24
Clay	38

Grading Analysis		
D100	mm	
D60	mm	0.05
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

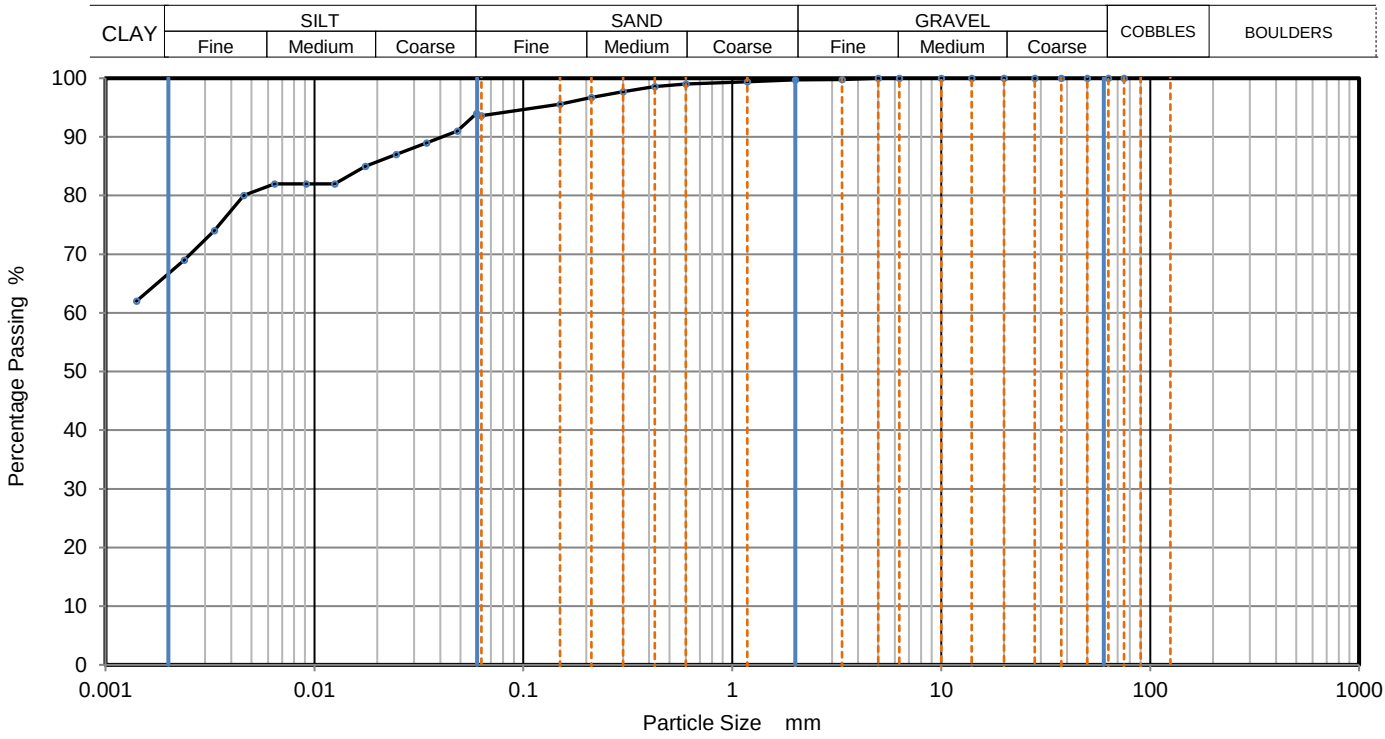
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ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:14	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP01
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202010291



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0596	94
		0.0483	91
75	100	0.0345	89
63	100	0.0246	87
50	100	0.0175	85
37.5	100	0.0125	82
28	100	0.0091	82
20	100	0.0064	82
14	100	0.0046	80
10	100	0.0033	74
6.3	100	0.0024	69
5	100	0.0014	62
3.35	100		
2	100		
1.18	99		
0.6	99	Particle density (assumed)	
0.425	99	2.65 Mg/m3	
0.3	98		
0.212	97		
0.15	96		
0.063	94		

Dry Mass of sample, g	226

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	6
Silt	27
Clay	67

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

Remarks

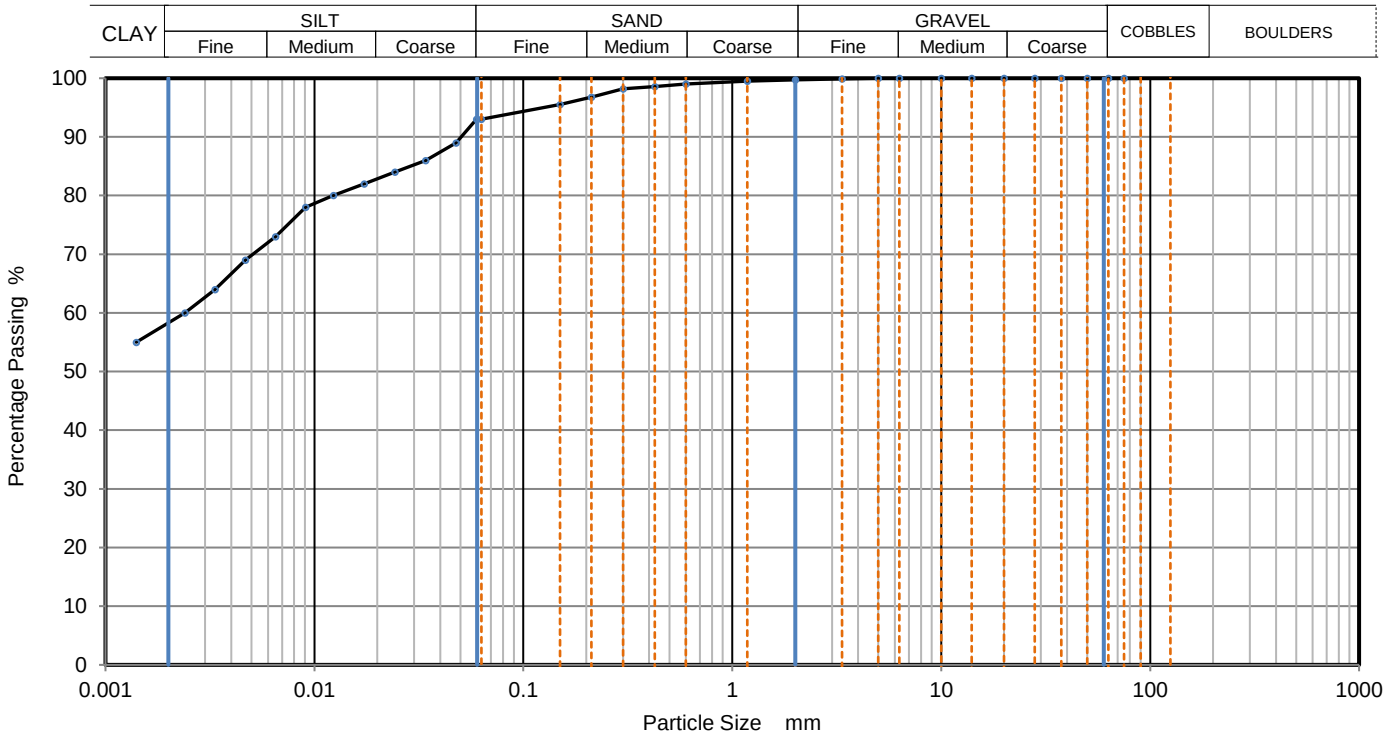
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
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Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP01
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Dark brown slightly sandy SILT.			Depth, m	3.60
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202010296



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0596	93
		0.0477	89
75	100	0.0340	86
63	100	0.0242	84
50	100	0.0173	82
37.5	100	0.0123	80
28	100	0.0091	78
20	100	0.0065	73
14	100	0.0047	69
10	100	0.0033	64
6.3	100	0.0024	60
5	100	0.0014	55
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	98		
0.212	97		
0.15	96		
0.063	93		

Dry Mass of sample, g	427

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	7
Silt	35
Clay	58

Grading Analysis		
D100	mm	
D60	mm	0.00244
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

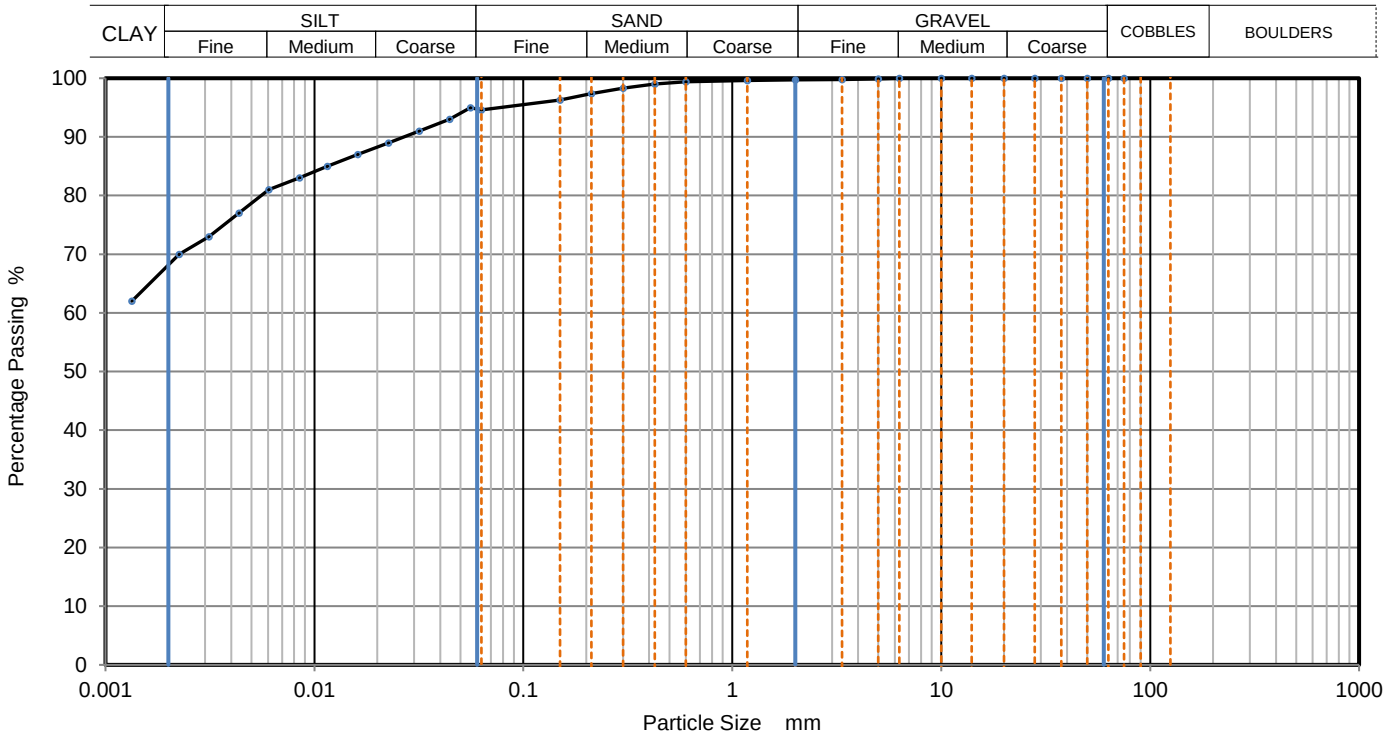
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Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:16	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP02
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Light brown slightly sandy SILT.			Depth, m	0.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202010298



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0559	95
		0.0444	93
75	100	0.0317	91
63	100	0.0226	89
50	100	0.0161	87
37.5	100	0.0115	85
28	100	0.0085	83
20	100	0.0061	81
14	100	0.0044	77
10	100	0.0031	73
6.3	100	0.0022	70
5	100	0.0013	62
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density (assumed)	
0.425	99	2.65 Mg/m3	
0.3	98		
0.212	97		
0.15	96		
0.063	95		

Dry Mass of sample, g	474

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	5
Silt	27
Clay	68

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

Remarks

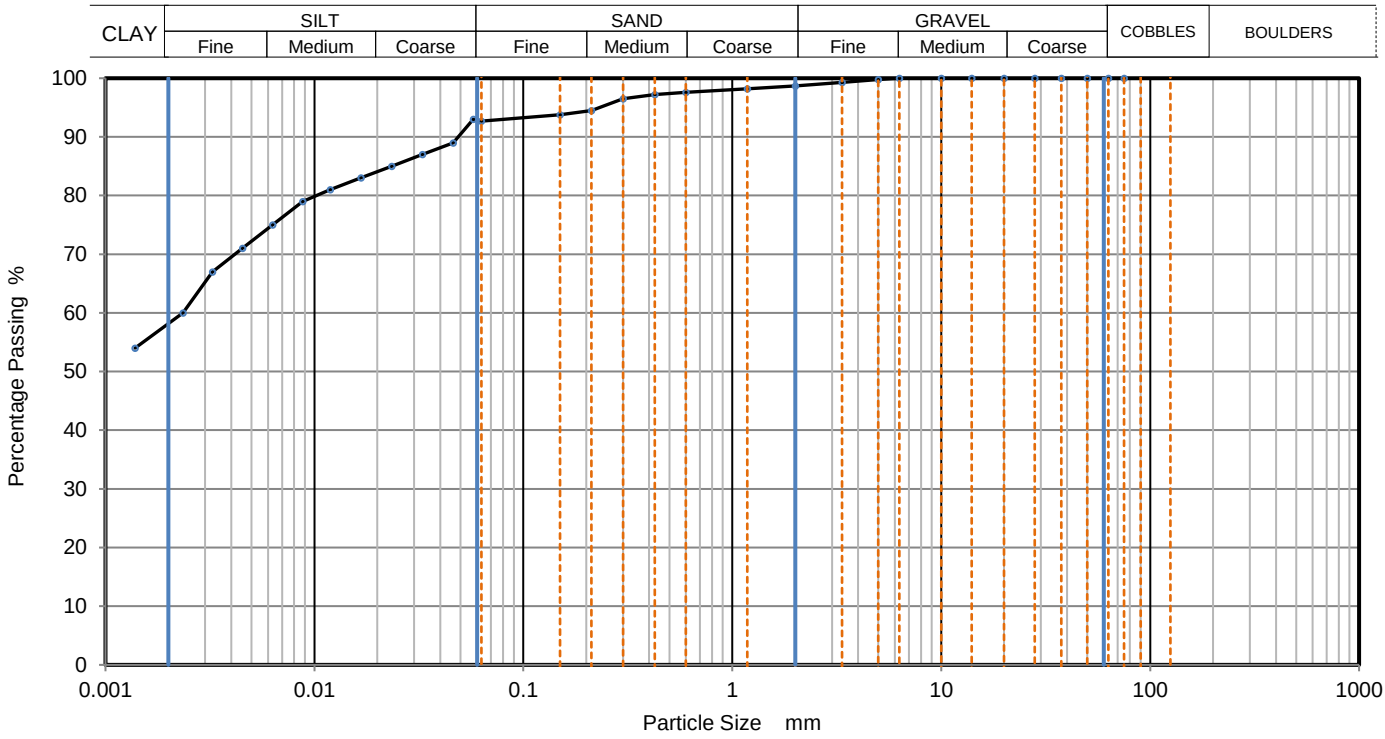
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP02
Site Name	Arklow Bank Windpark			Sample No.	4
Soil Description	Dark brown slightly sandy SILT.			Depth, m	1.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102911



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0575	93
		0.0461	89
75	100	0.0329	87
63	100	0.0234	85
50	100	0.0167	83
37.5	100	0.0119	81
28	100	0.0088	79
20	100	0.0063	75
14	100	0.0045	71
10	100	0.0033	67
6.3	100	0.0023	60
5	100	0.0014	54
3.35	99		
2	99		
1.18	98		
0.6	98	Particle density (assumed)	
0.425	97	2.65 Mg/m3	
0.3	97		
0.212	95		
0.15	94		
0.063	93		

Dry Mass of sample, g	373

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	6
Silt	34
Clay	59

Grading Analysis		
D100	mm	
D60	mm	0.00226
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

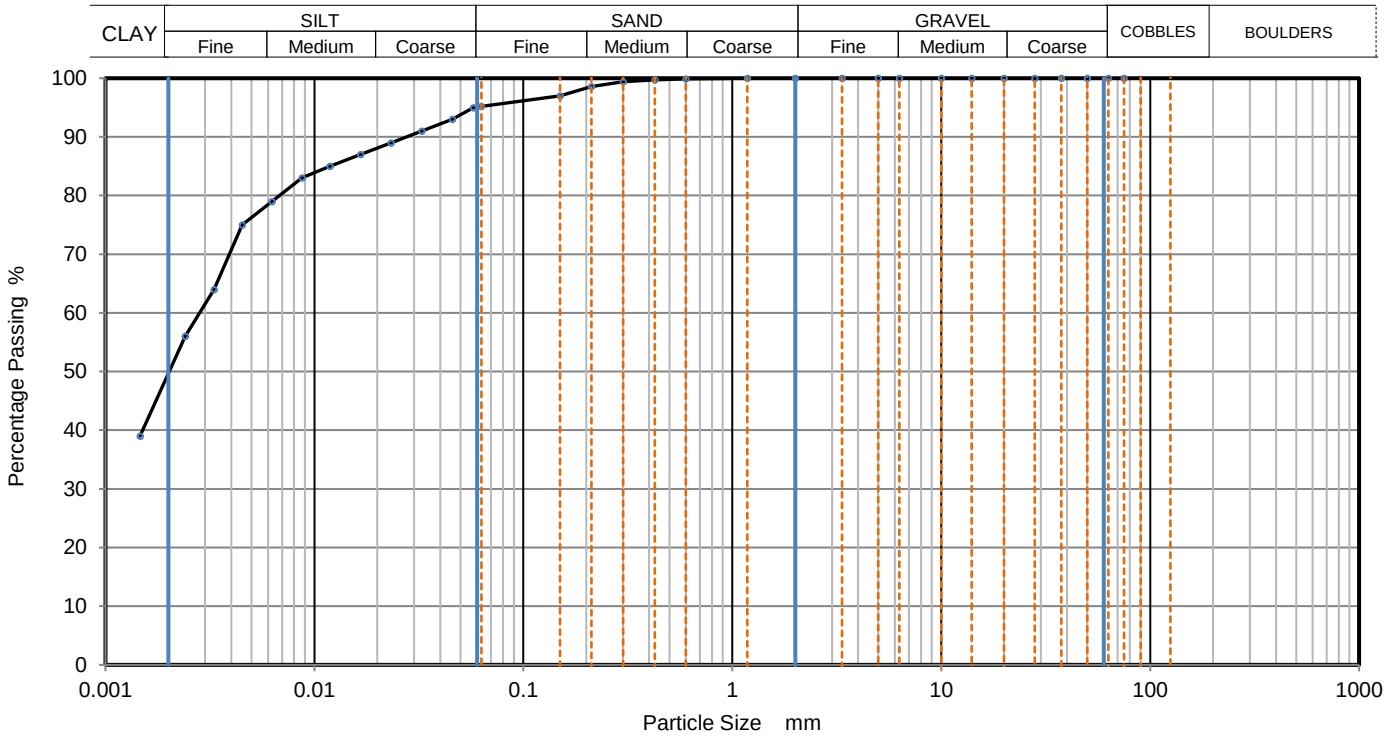
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP02
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Dark brown slightly sandy SILT.			Depth, m	3.30
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102913



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0575	95
		0.0458	93
75	100	0.0327	91
63	100	0.0233	89
50	100	0.0166	87
37.5	100	0.0119	85
28	100	0.0087	83
20	100	0.0063	79
14	100	0.0045	75
10	100	0.0033	64
6.3	100	0.0024	56
5	100	0.0015	39
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	100	2.65	Mg/m3
0.3	99		
0.212	99		
0.15	97		
0.063	95		

Dry Mass of sample, g	471

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	5
Silt	46
Clay	50

Grading Analysis		
D100	mm	
D60	mm	0.00282
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

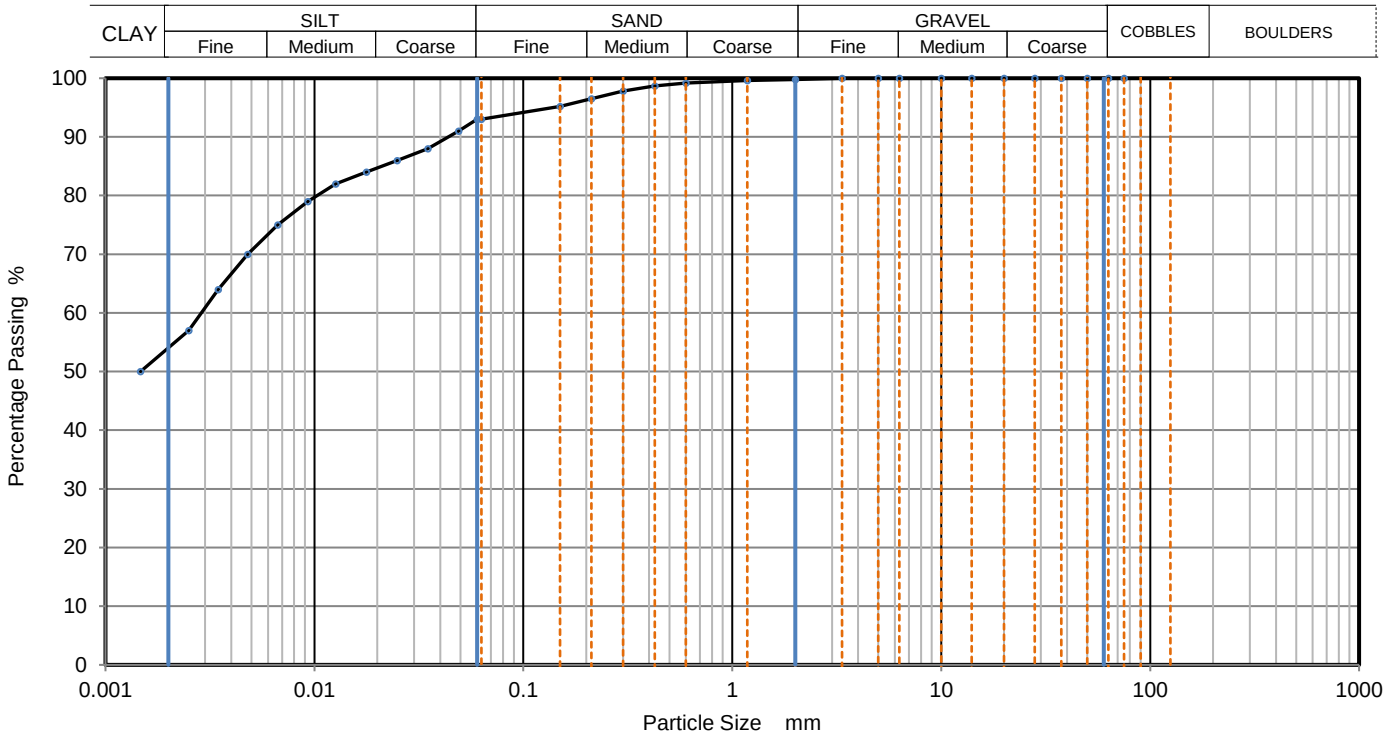
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP03
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Light brown slightly sandy SILT.			Depth, m	0.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102916



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0601	93
		0.0490	91
75	100	0.0349	88
63	100	0.0249	86
50	100	0.0177	84
37.5	100	0.0126	82
28	100	0.0093	79
20	100	0.0067	75
14	100	0.0048	70
10	100	0.0035	64
6.3	100	0.0025	57
5	100	0.0015	50
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density (assumed)	
0.425	99	2.65	Mg/m3
0.3	98		
0.212	97		
0.15	95		
0.063	93		

Dry Mass of sample, g	380

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	7
Silt	39
Clay	54

Grading Analysis		
D100	mm	
D60	mm	0.00292
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

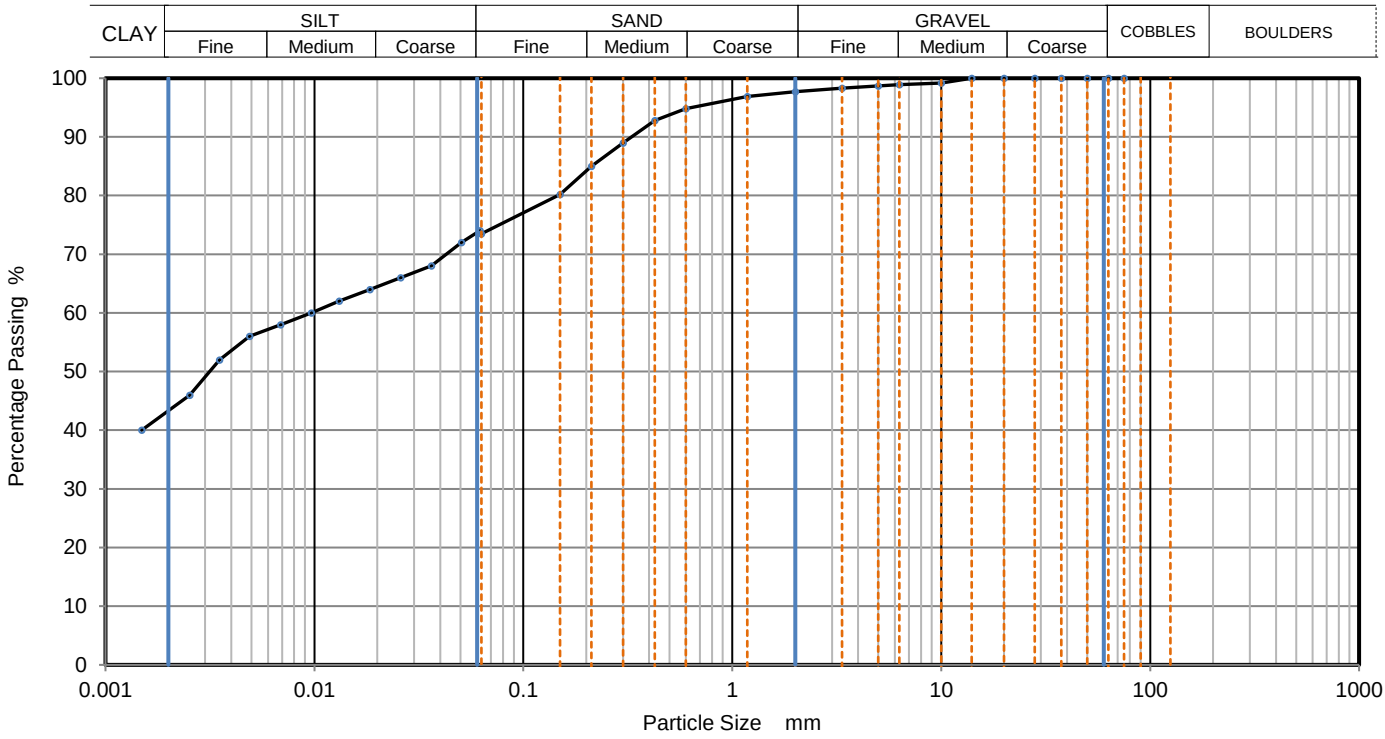
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP03
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Dark brown slightly gravelly slightly sandy SILT.			Depth, m	1.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102920



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0621	74
		0.0506	72
75	100	0.0363	68
63	100	0.0259	66
50	100	0.0184	64
37.5	100	0.0131	62
28	100	0.0097	60
20	100	0.0069	58
14	100	0.0049	56
10	99	0.0035	52
6.3	99	0.0025	46
5	99	0.0015	40
3.35	98		
2	98		
1.18	97		
0.6	95	Particle density (assumed)	
0.425	93	2.65 Mg/m3	
0.3	89		
0.212	85		
0.15	80		
0.063	74		

Dry Mass of sample, g	538

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	24
Silt	31
Clay	43

Grading Analysis		
D100	mm	
D60	mm	0.0103
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

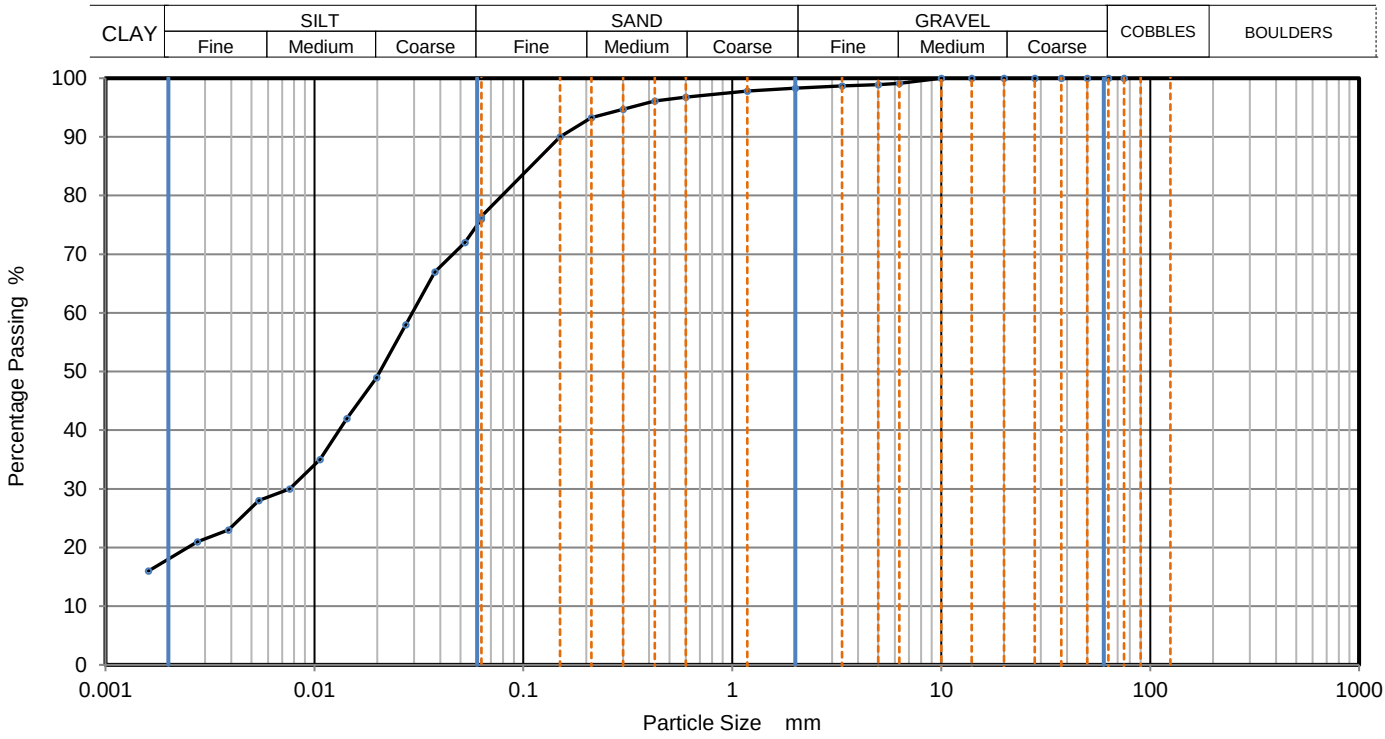
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP03
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth, m	2.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102921



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	76
		0.0525	72
75	100	0.0377	67
63	100	0.0274	58
50	100	0.0199	49
37.5	100	0.0143	42
28	100	0.0106	35
20	100	0.0076	30
14	100	0.0054	28
10	100	0.0039	23
6.3	99	0.0028	21
5	99	0.0016	16
3.35	99		
2	98		
1.18	98		
0.6	97	Particle density (assumed)	
0.425	96	2.65	Mg/m3
0.3	95		
0.212	93		
0.15	90		
0.063	76		

Dry Mass of sample, g	662

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	22
Silt	58
Clay	18

Grading Analysis		
D100	mm	
D60	mm	0.0295
D30	mm	0.0075
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

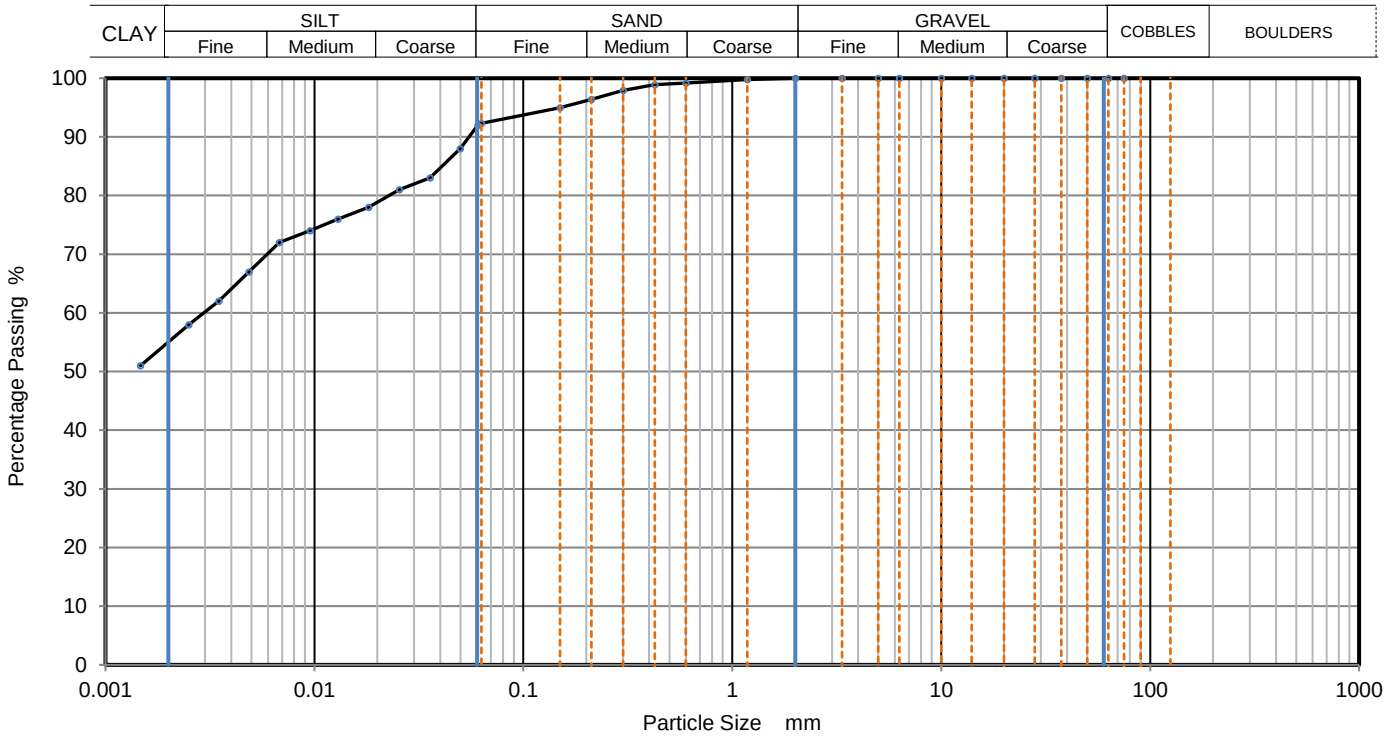
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly sandy silty CLAY.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102923



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0606	92
		0.0498	88
75	100	0.0358	83
63	100	0.0255	81
50	100	0.0182	78
37.5	100	0.0129	76
28	100	0.0095	74
20	100	0.0068	72
14	100	0.0049	67
10	100	0.0035	62
6.3	100	0.0025	58
5	100	0.0015	51
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	98		
0.212	96		
0.15	95		
0.063	92		

Dry Mass of sample, g	484

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	8
Silt	38
Clay	55

Grading Analysis		
D100	mm	
D60	mm	0.00295
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

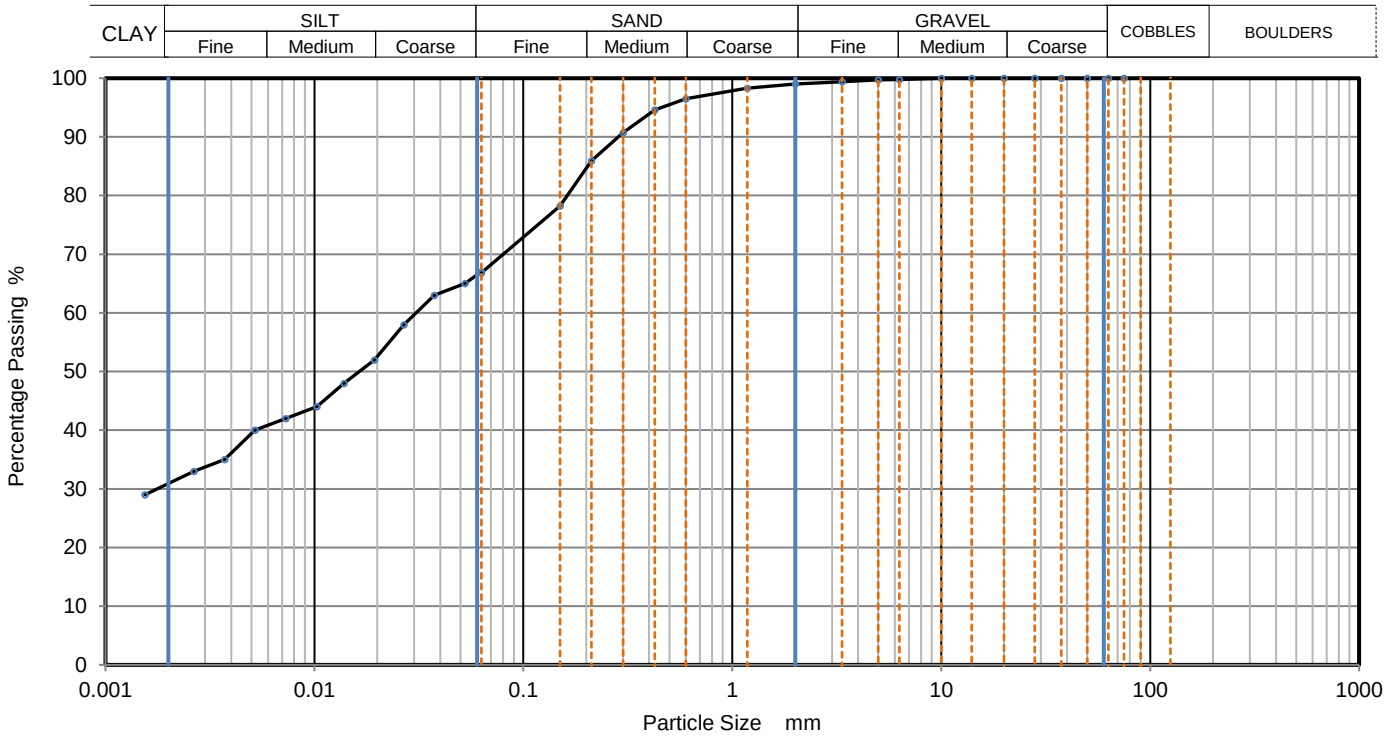
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth, m	1.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102929



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	67
		0.0525	65
75	100	0.0374	63
63	100	0.0268	58
50	100	0.0194	52
37.5	100	0.0139	48
28	100	0.0103	44
20	100	0.0073	42
14	100	0.0052	40
10	100	0.0037	35
6.3	100	0.0026	33
5	100	0.0015	29
3.35	99		
2	99		
1.18	98		
0.6	97	Particle density	(assumed)
0.425	95	2.65	Mg/m3
0.3	91		
0.212	86		
0.15	78		
0.063	67		

Dry Mass of sample, g	608

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	32
Silt	36
Clay	31

Grading Analysis		
D100	mm	
D60	mm	0.0303
D30	mm	0.00171
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

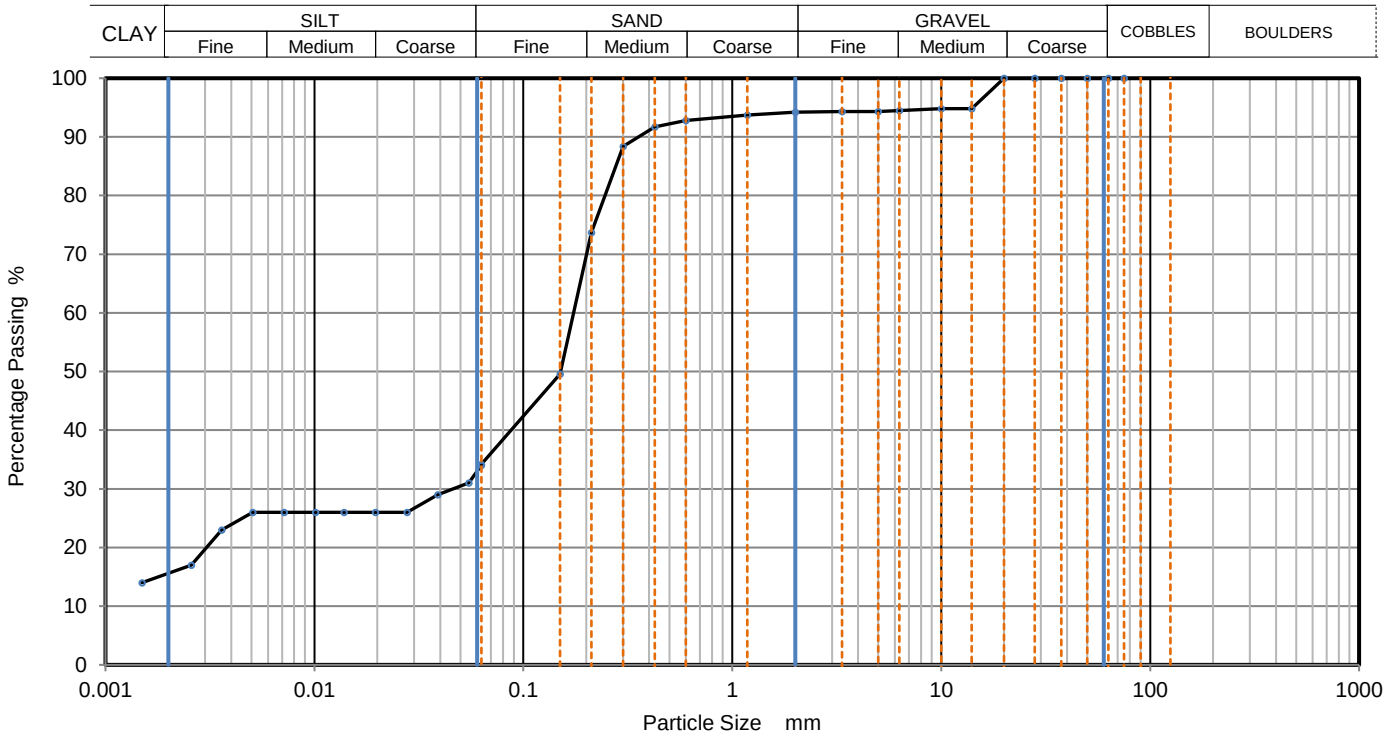
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown gravelly very silty fine SAND.			Depth, m	1.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102928



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	34
		0.0548	31
75	100	0.0390	29
63	100	0.0277	26
50	100	0.0196	26
37.5	100	0.0139	26
28	100	0.0101	26
20	100	0.0072	26
14	95	0.0051	26
10	95	0.0036	23
6.3	95	0.0026	17
5	94	0.0015	14
3.35	94		
2	94		
1.18	94		
0.6	93	Particle density (assumed)	
0.425	92	2.65	Mg/m3
0.3	88		
0.212	74		
0.15	50		
0.063	34		

Dry Mass of sample, g	462

Sample Proportions	% dry mass
Very coarse	0
Gravel	6
Sand	60
Silt	18
Clay	16

Grading Analysis		
D100	mm	
D60	mm	0.174
D30	mm	0.0467
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

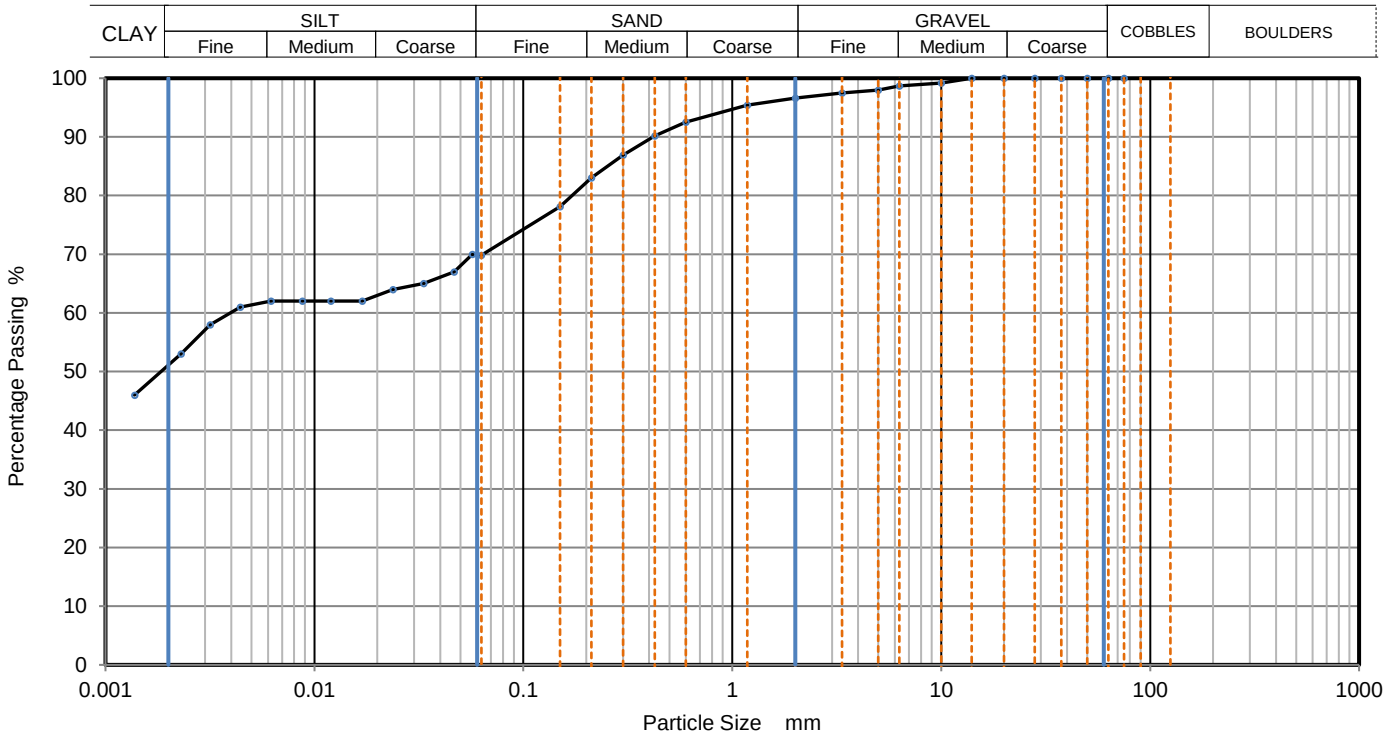
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	8
Soil Description	Mottled brown-grey slightly gravelly slightly sandy SILT.			Depth, m	3.70
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102931



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0570	70
		0.0467	67
75	100	0.0333	65
63	100	0.0238	64
50	100	0.0169	62
37.5	100	0.0120	62
28	100	0.0088	62
20	100	0.0062	62
14	100	0.0044	61
10	99	0.0032	58
6.3	99	0.0023	53
5	98	0.0014	46
3.35	98		
2	97		
1.18	95		
0.6	93	Particle density (assumed)	
0.425	90	2.65 Mg/m3	
0.3	87		
0.212	83		
0.15	78		
0.063	70		

Dry Mass of sample, g	741

Sample Proportions	% dry mass
Very coarse	0
Gravel	3
Sand	27
Silt	18
Clay	52

Grading Analysis		
D100	mm	
D60	mm	0.004
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

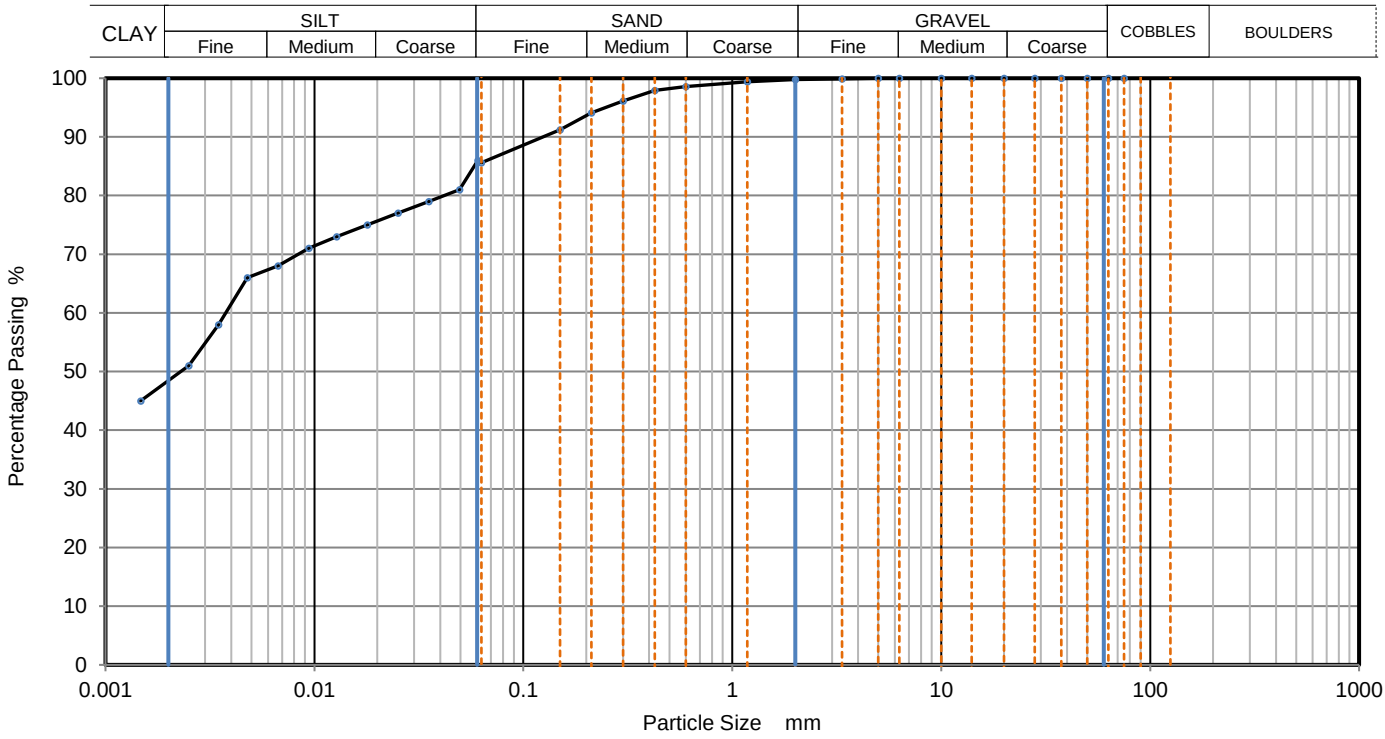
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Operator	Checked	Approved	Sheet printed	
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Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP05
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Orange-brown slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102933



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0606	86
		0.0496	81
75	100	0.0353	79
63	100	0.0252	77
50	100	0.0179	75
37.5	100	0.0128	73
28	100	0.0094	71
20	100	0.0067	68
14	100	0.0048	66
10	100	0.0035	58
6.3	100	0.0025	51
5	100	0.0015	45
3.35	100		
2	100		
1.18	99		
0.6	99	Particle density	(assumed)
0.425	98	2.65	Mg/m3
0.3	96		
0.212	94		
0.15	91		
0.063	86		

Dry Mass of sample, g	433

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	14
Silt	37
Clay	49

Grading Analysis		
D100	mm	
D60	mm	0.00377
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

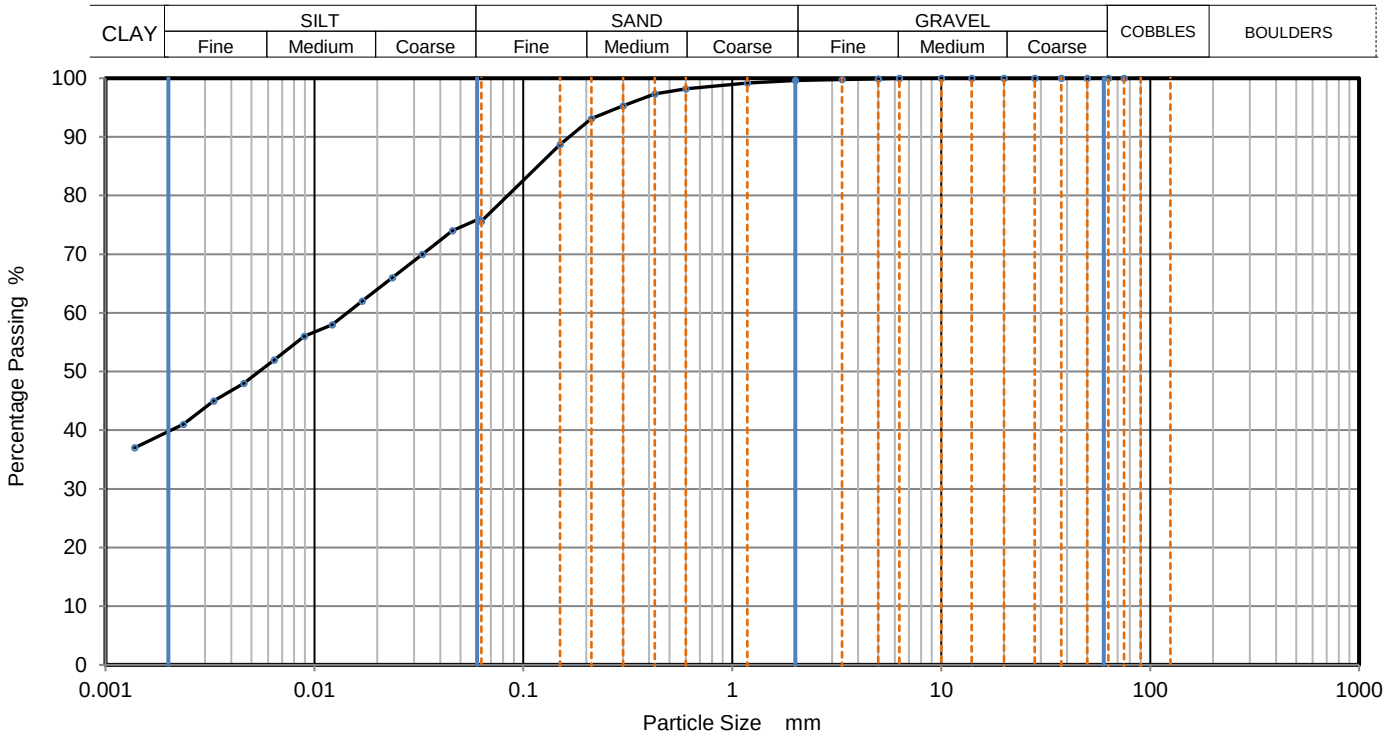
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP05
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly sandy SILT.			Depth, m	1.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102937



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0611	76
		0.0458	74
75	100	0.0329	70
63	100	0.0236	66
50	100	0.0170	62
37.5	100	0.0122	58
28	100	0.0089	56
20	100	0.0064	52
14	100	0.0046	48
10	100	0.0033	45
6.3	100	0.0024	41
5	100	0.0014	37
3.35	100		
2	100		
1.18	99		
0.6	98	Particle density (assumed)	
0.425	97	2.65 Mg/m3	
0.3	95		
0.212	93		
0.15	89		
0.063	76		

Dry Mass of sample, g	528

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	24
Silt	36
Clay	40

Grading Analysis		
D100	mm	
D60	mm	0.0142
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

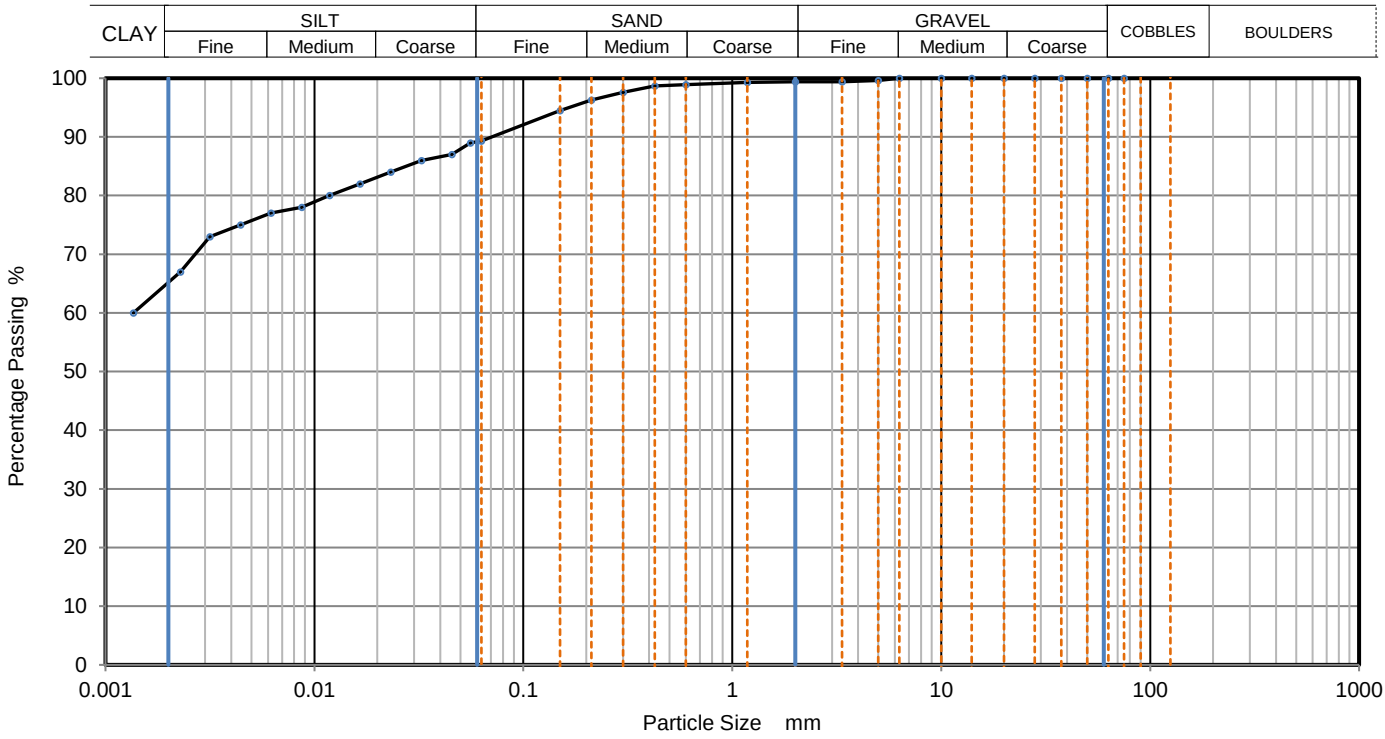
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP05
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown slightly sandy SILT.			Depth, m	2.60
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102938



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0559	89
		0.0455	87
75	100	0.0325	86
63	100	0.0232	84
50	100	0.0165	82
37.5	100	0.0118	80
28	100	0.0087	78
20	100	0.0062	77
14	100	0.0044	75
10	100	0.0032	73
6.3	100	0.0023	67
5	100	0.0014	60
3.35	99		
2	99		
1.18	99		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	98		
0.212	96		
0.15	95		
0.063	89		

Dry Mass of sample, g	369

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	10
Silt	24
Clay	66

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

Remarks

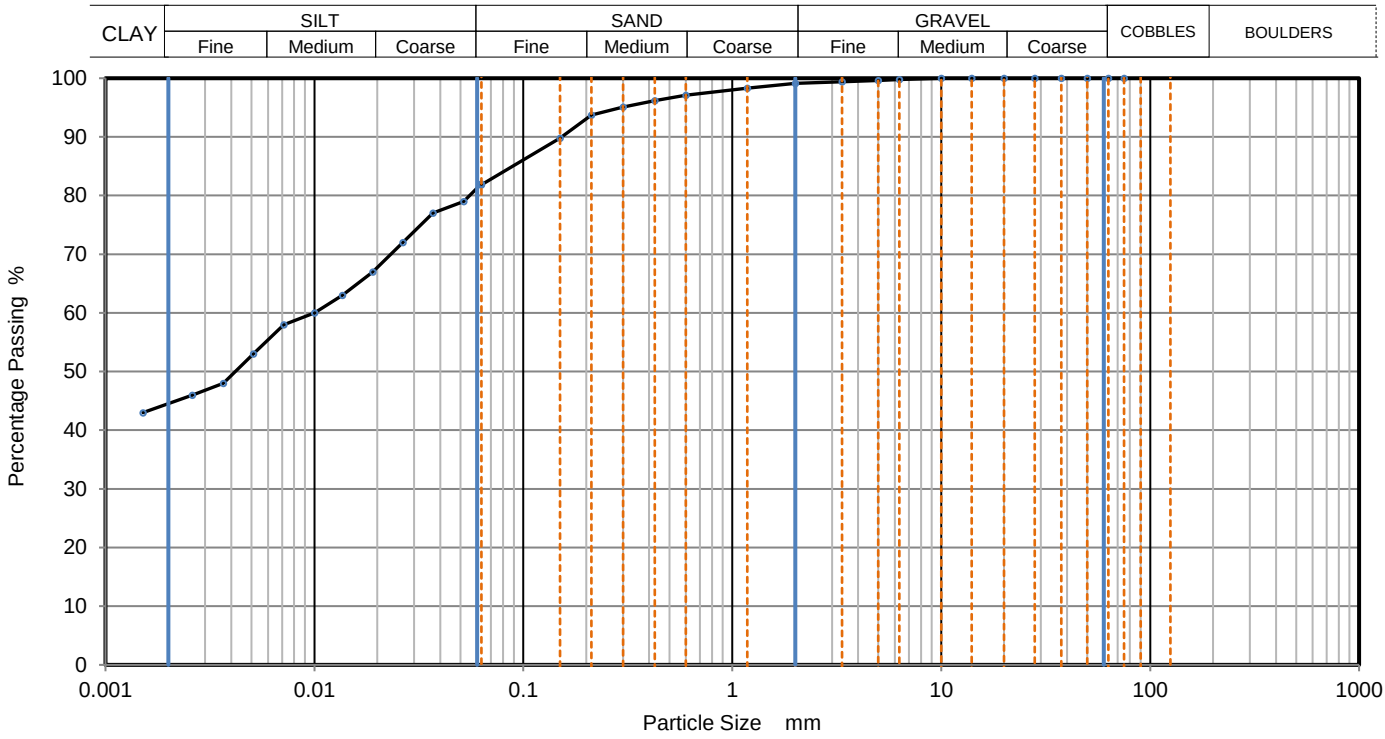
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP06
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Orange-brown slightly gravelly slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202010301



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	82
		0.0519	79
75	100	0.0370	77
63	100	0.0265	72
50	100	0.0190	67
37.5	100	0.0136	63
28	100	0.0100	60
20	100	0.0071	58
14	100	0.0051	53
10	100	0.0037	48
6.3	100	0.0026	46
5	100	0.0015	43
3.35	99		
2	99		
1.18	98		
0.6	97	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	95		
0.212	94		
0.15	90		
0.063	82		

Dry Mass of sample, g	395

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	17
Silt	37
Clay	45

Grading Analysis		
D100	mm	
D60	mm	0.00981
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

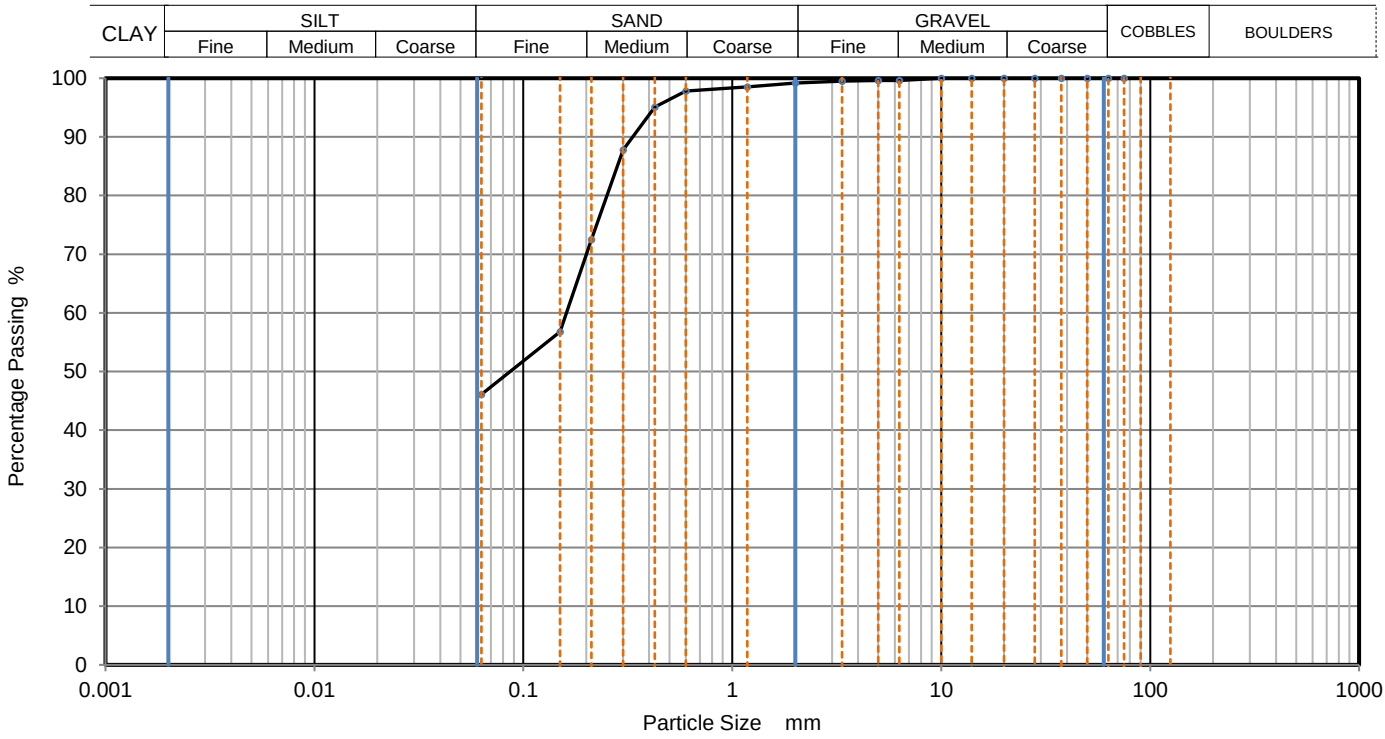
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP06
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Orange-brown sandy SILT. Sand is medium and fine.			Depth, m	2.10
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL1202010307



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98		
0.425	95		
0.3	88		
0.212	73		
0.15	57		
0.063	46		

Dry Mass of sample, g	603

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	53
Fines <0.063mm	46

Grading Analysis		
D100	mm	
D60	mm	0.161
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

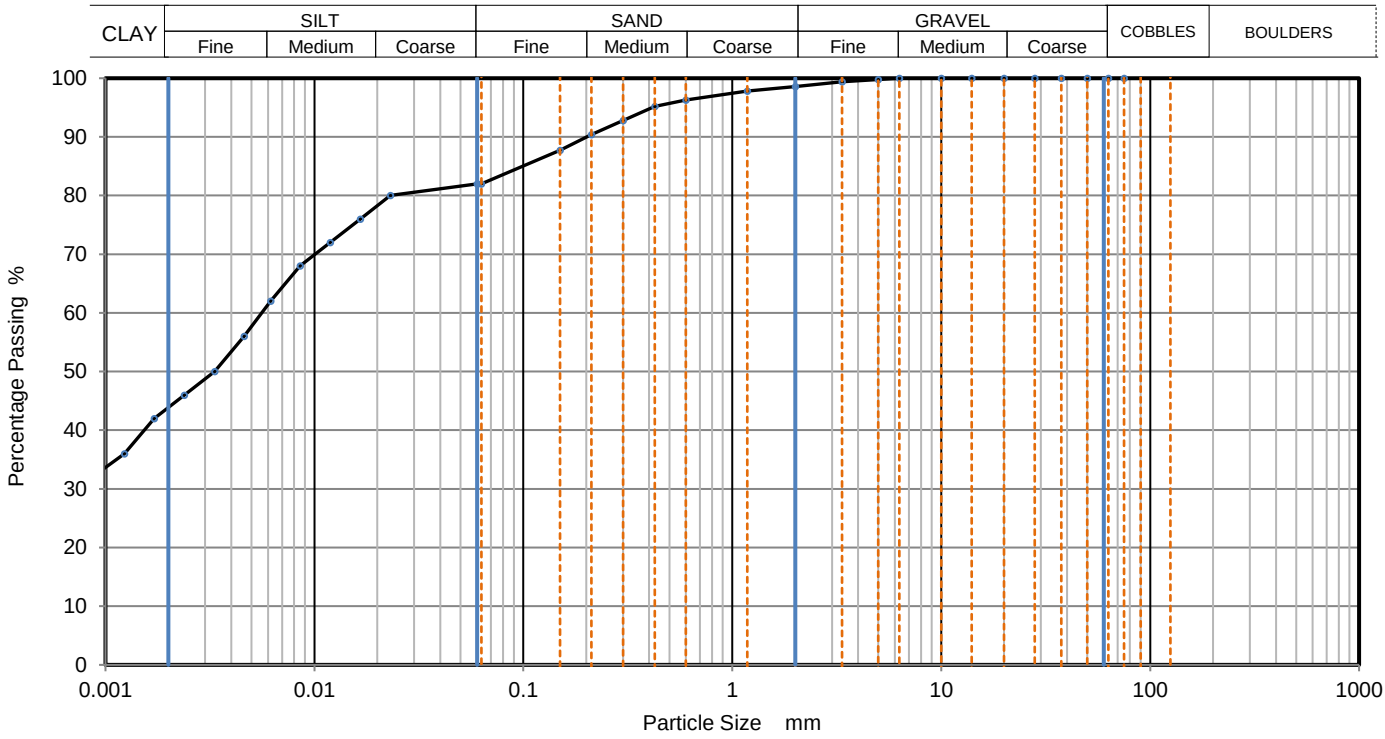
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP07
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly sandy SILT.			Depth, m	1.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103014



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0601	82
		0.0231	80
75	100	0.0166	76
63	100	0.0119	72
50	100	0.0085	68
37.5	100	0.0062	62
28	100	0.0046	56
20	100	0.0033	50
14	100	0.0024	46
10	100	0.0017	42
6.3	100	0.0012	36
5	100	0.0007	30
3.35	99		
2	99		
1.18	98		
0.6	96	Particle density (assumed)	
0.425	95	2.65 Mg/m3	
0.3	93		
0.212	90		
0.15	88		
0.063	82		

Dry Mass of sample, g	397

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	17
Silt	38
Clay	44

Grading Analysis		
D100	mm	
D60	mm	0.0056
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

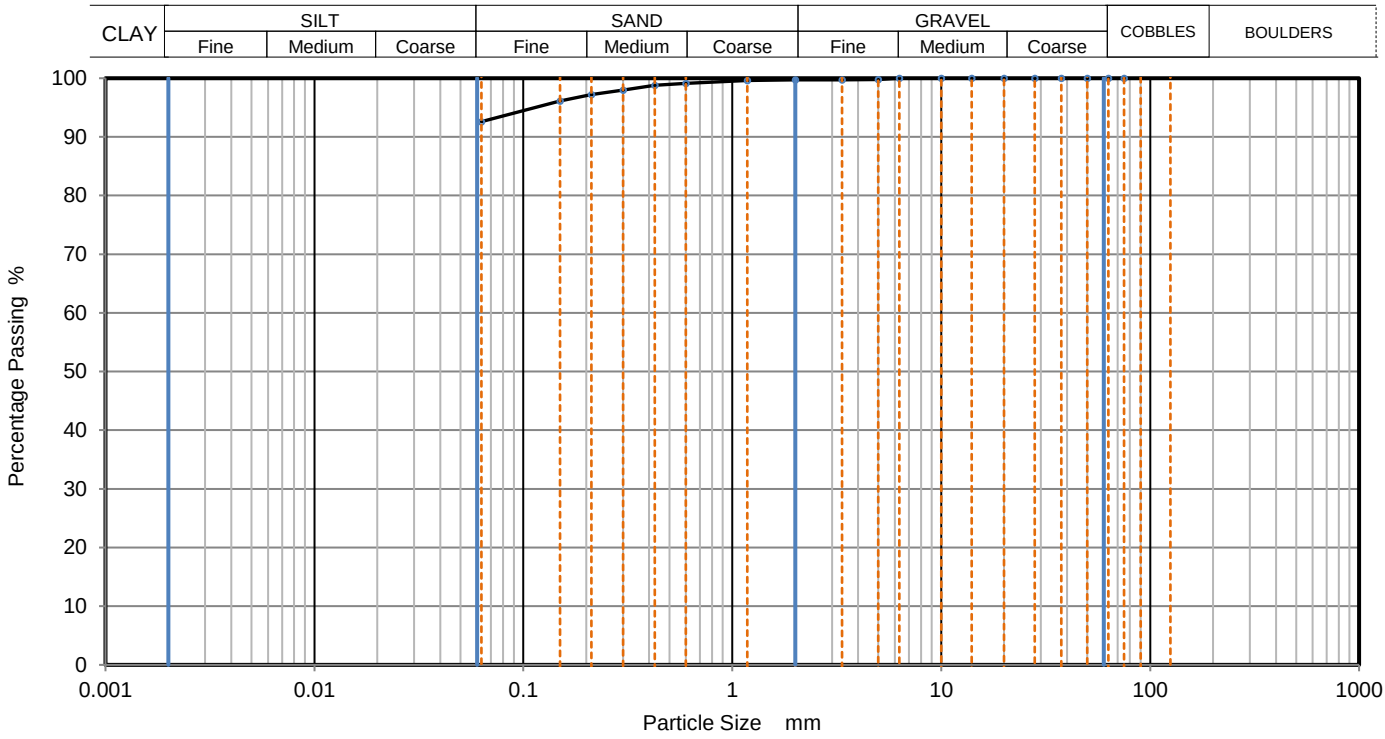
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP07
Site Name	Arklow Bank Windpark			Sample No.	8
Soil Description	Dark brown slightly sandy SILT.			Depth, m	4.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12020103017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	99		
0.3	98		
0.212	97		
0.15	96		
0.063	93		

Dry Mass of sample, g	494

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	7
Fines <0.063mm	93

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

Remarks

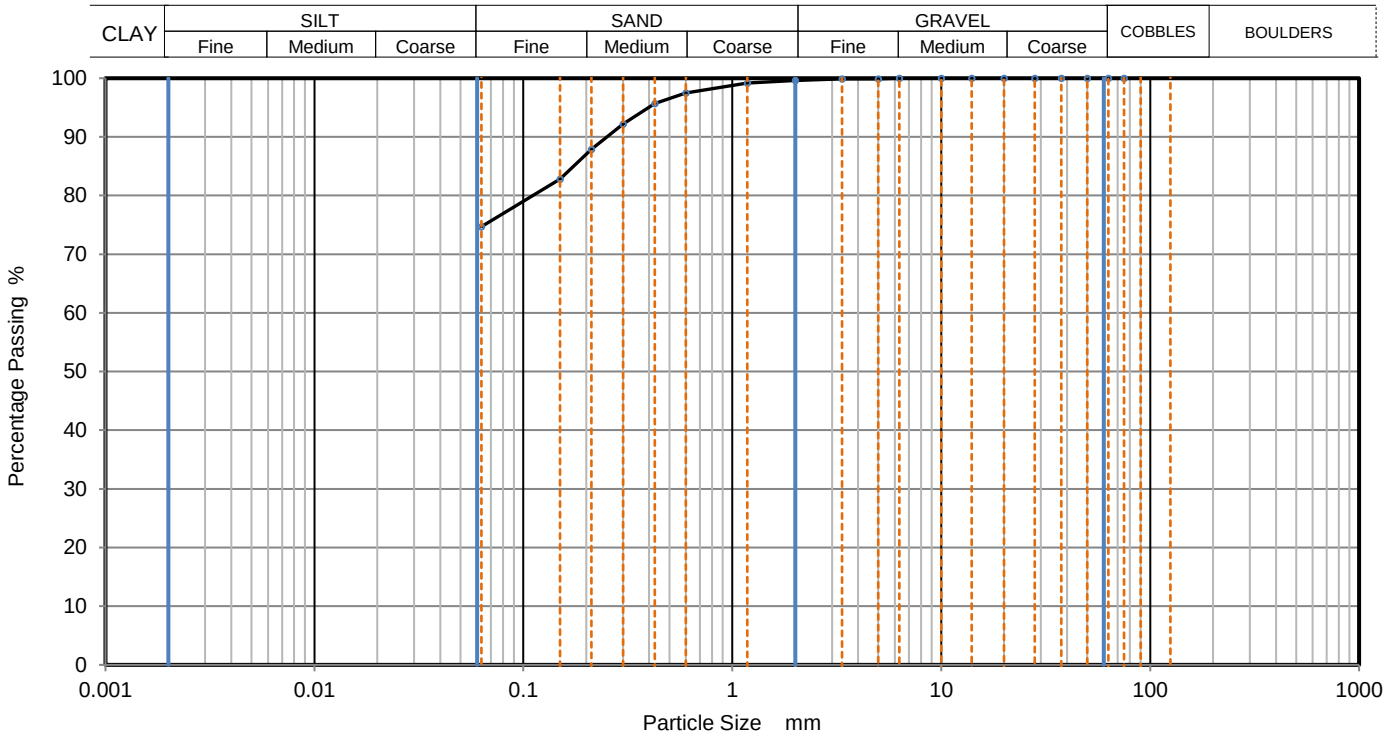
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP08
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12020103019



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	98		
0.425	96		
0.3	92		
0.212	88		
0.15	83		
0.063	75		

Dry Mass of sample, g	387

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	25
Fines <0.063mm	75

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

Remarks

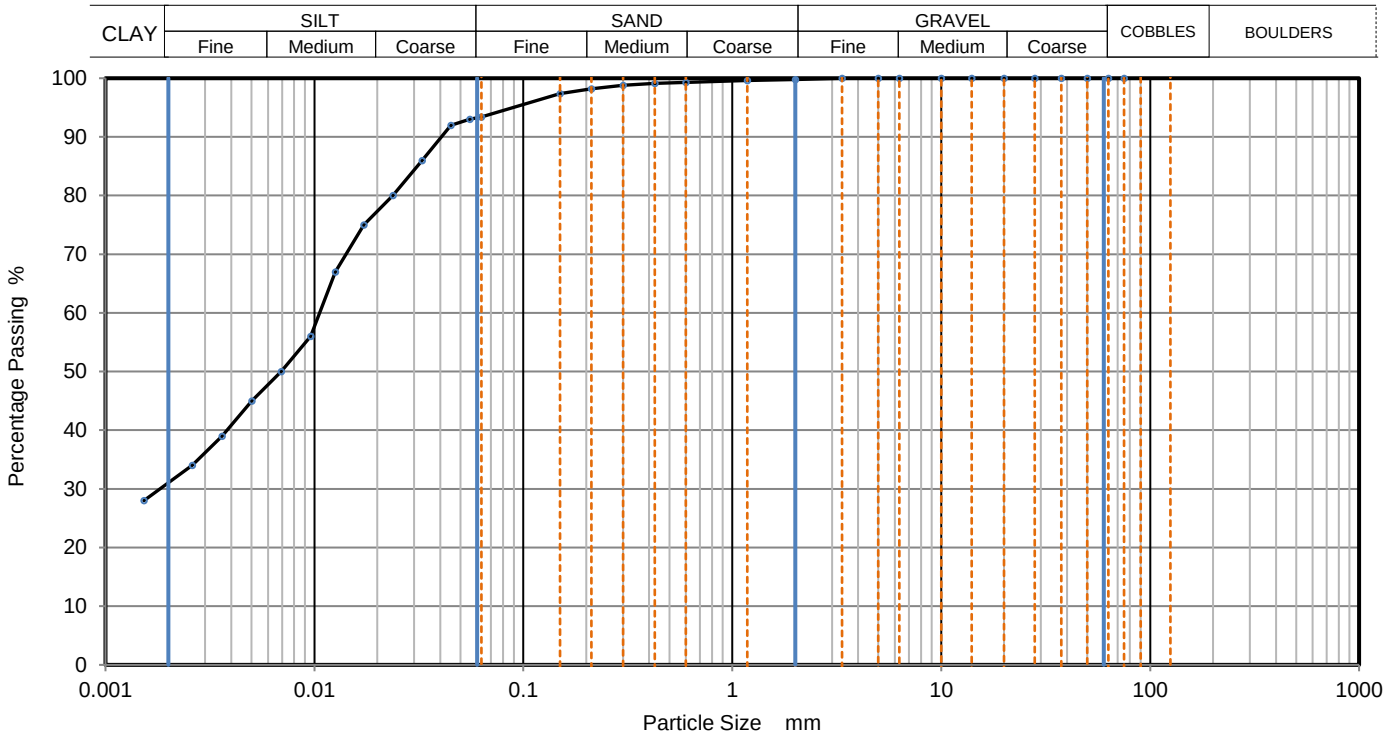
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP08
Site Name	Arklow Bank Windpark			Sample No.	8
Soil Description	Dark brown slightly sandy SILT.			Depth, m	4.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103025



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0553	93
		0.0450	92
75	100	0.0327	86
63	100	0.0238	80
50	100	0.0172	75
37.5	100	0.0126	67
28	100	0.0096	56
20	100	0.0069	50
14	100	0.0050	45
10	100	0.0036	39
6.3	100	0.0026	34
5	100	0.0015	28
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	99		
0.212	98		
0.15	97		
0.063	93		

Dry Mass of sample, g	444

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	6
Silt	63
Clay	31

Grading Analysis		
D100	mm	
D60	mm	0.0106
D30	mm	0.00184
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

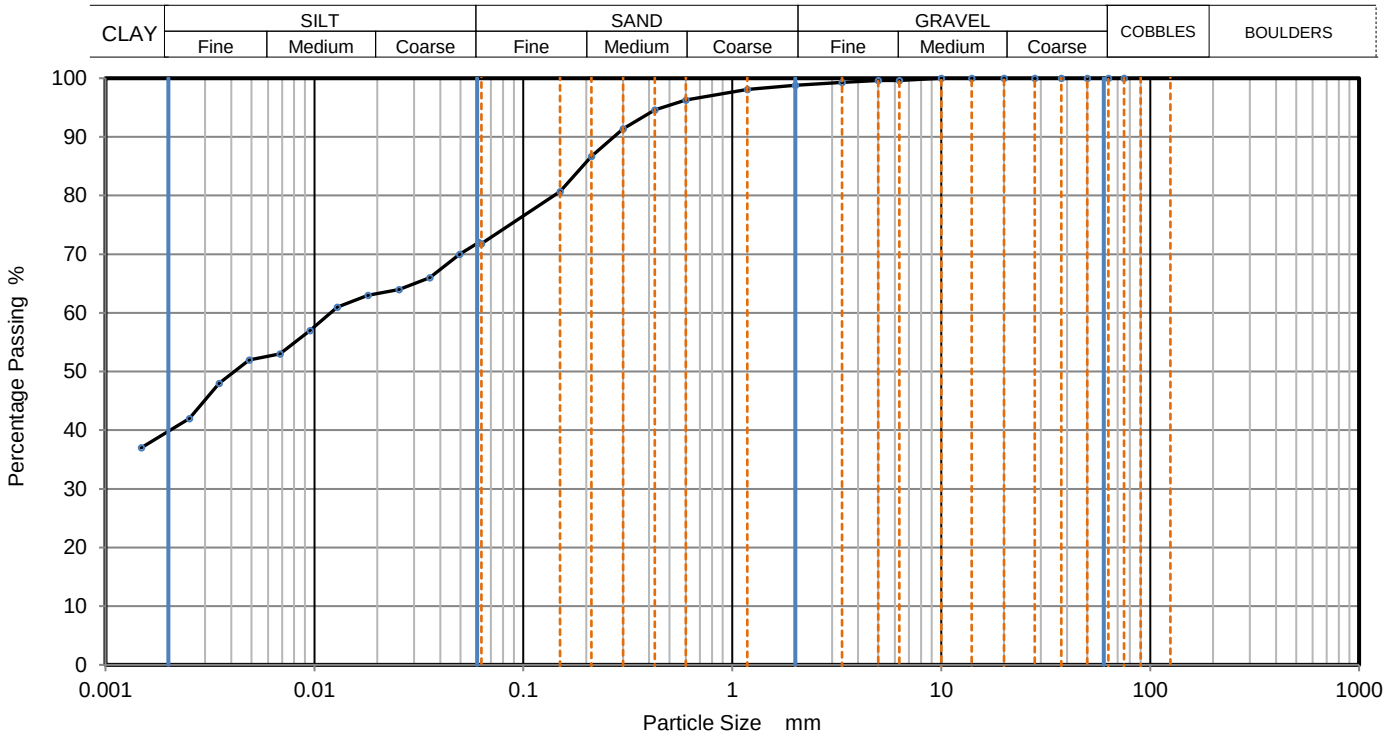
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP09
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly sandy SILT.			Depth, m	1.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103032



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0611	72
		0.0496	70
75	100	0.0356	66
63	100	0.0254	64
50	100	0.0181	63
37.5	100	0.0129	61
28	100	0.0095	57
20	100	0.0068	53
14	100	0.0049	52
10	100	0.0035	48
6.3	100	0.0025	42
5	100	0.0015	37
3.35	99		
2	99		
1.18	98		
0.6	96	Particle density (assumed)	
0.425	95	2.65 Mg/m3	
0.3	91		
0.212	87		
0.15	81		
0.063	72		

Dry Mass of sample, g	492

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	27
Silt	32
Clay	40

Grading Analysis		
D100	mm	
D60	mm	0.0121
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

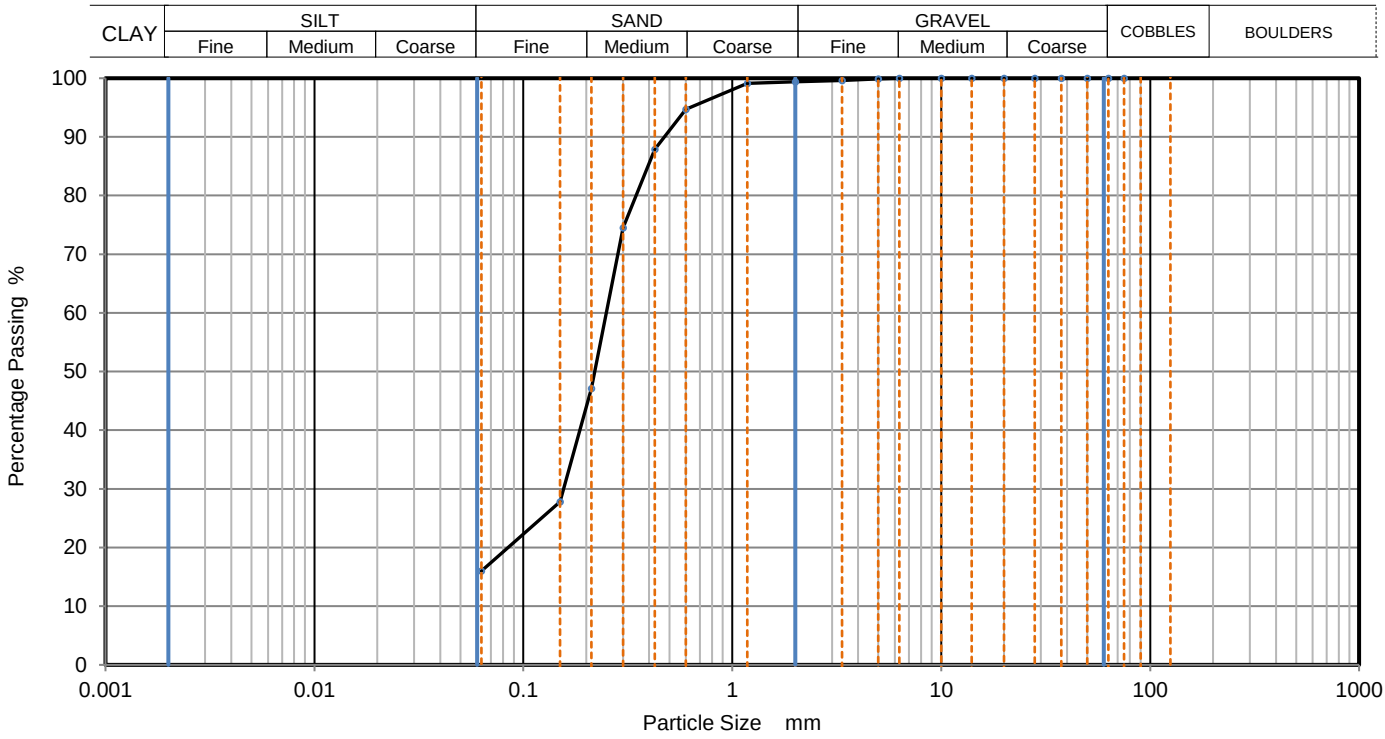
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Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP10
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown silty medium and fine SAND.			Depth, m	2.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12020103040



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	95		
0.425	88		
0.3	75		
0.212	47		
0.15	28		
0.063	16		

Dry Mass of sample, g	741

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	84
Fines <0.063mm	16

Grading Analysis		
D100	mm	
D60	mm	0.25
D30	mm	0.156
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

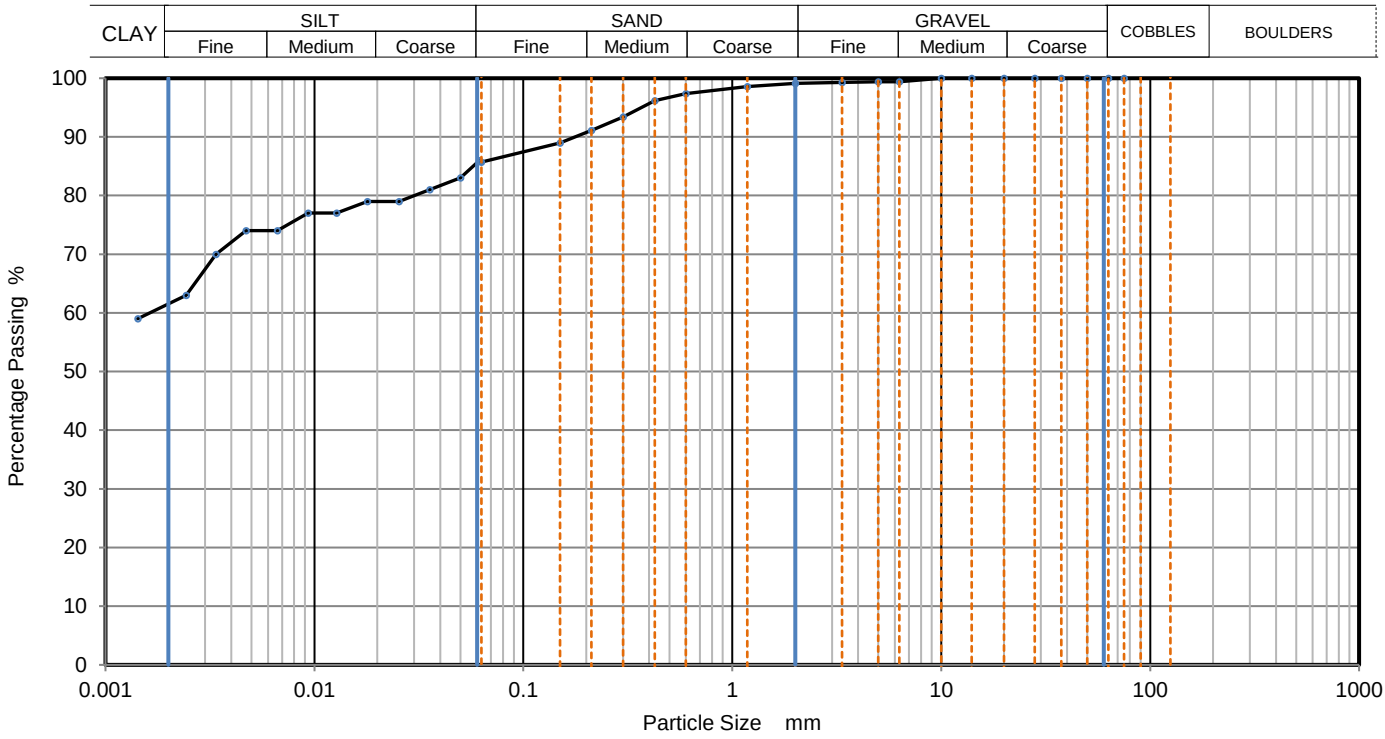
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP11
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103043



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0616	86
		0.0499	83
75	100	0.0356	81
63	100	0.0254	79
50	100	0.0179	79
37.5	100	0.0128	77
28	100	0.0093	77
20	100	0.0066	74
14	100	0.0047	74
10	100	0.0034	70
6.3	99	0.0024	63
5	99	0.0014	59
3.35	99		
2	99		
1.18	99		
0.6	97	Particle density (assumed)	
0.425	96	2.65 Mg/m3	
0.3	93		
0.212	91		
0.15	89		
0.063	86		

Dry Mass of sample, g	463

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	13
Silt	24
Clay	62

Grading Analysis		
D100	mm	
D60	mm	0.00168
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

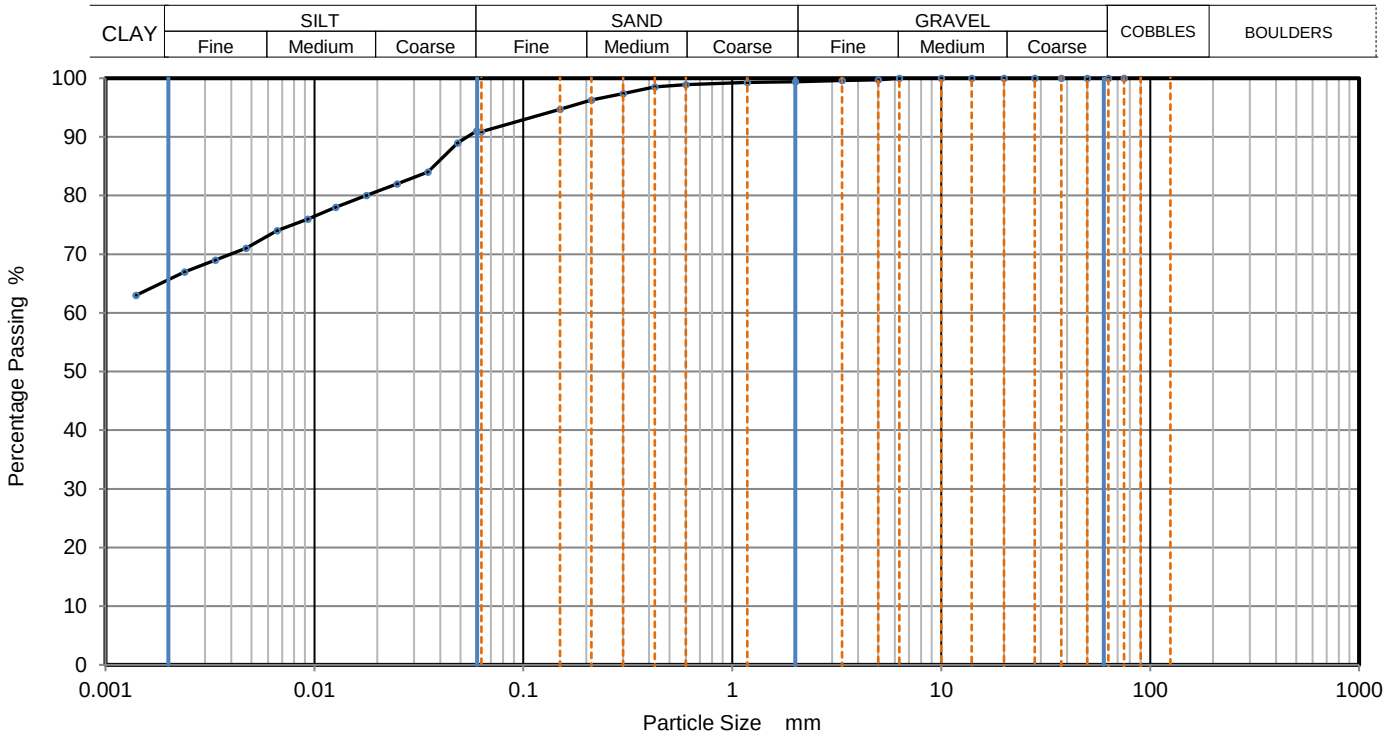
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP11
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Dark brown slightly sandy SILT.			Depth, m	2.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103049



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0596	91
		0.0485	89
75	100	0.0348	84
63	100	0.0248	82
50	100	0.0177	80
37.5	100	0.0126	78
28	100	0.0093	76
20	100	0.0066	74
14	100	0.0047	71
10	100	0.0034	69
6.3	100	0.0024	67
5	100	0.0014	63
3.35	100		
2	99		
1.18	99		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	97		
0.212	96		
0.15	95		
0.063	91		

Dry Mass of sample, g	605

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	9
Silt	25
Clay	66

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

Remarks

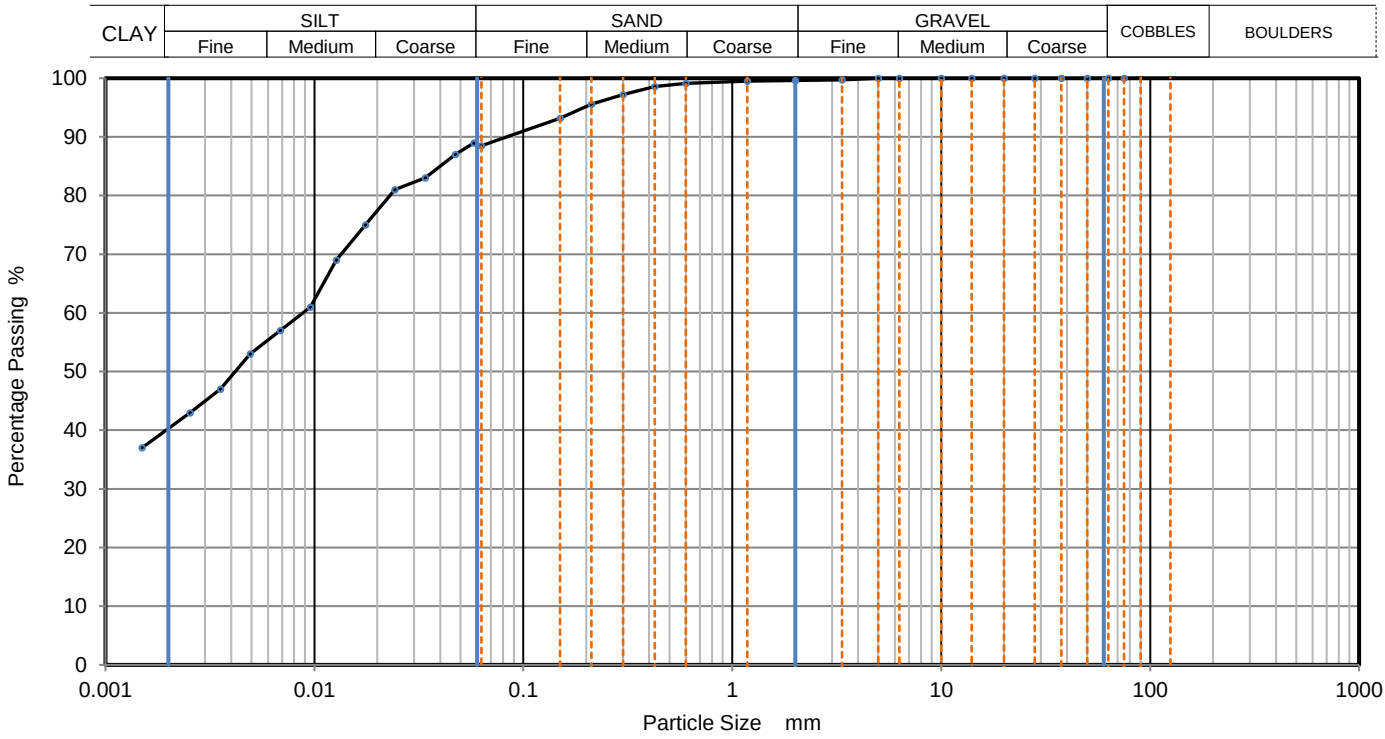
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	1
				QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP11
Site Name	Arklow Bank Windpark			Sample No.	7
Soil Description	Dark brown slightly sandy SILT.			Depth, m	3.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103050



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0580	89
		0.0472	87
75	100	0.0340	83
63	100	0.0242	81
50	100	0.0176	75
37.5	100	0.0127	69
28	100	0.0096	61
20	100	0.0069	57
14	100	0.0049	53
10	100	0.0035	47
6.3	100	0.0025	43
5	100	0.0015	37
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	97		
0.212	96		
0.15	93		
0.063	89		

Dry Mass of sample, g	545

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	11
Silt	48
Clay	41

Grading Analysis		
D100	mm	
D60	mm	0.00882
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

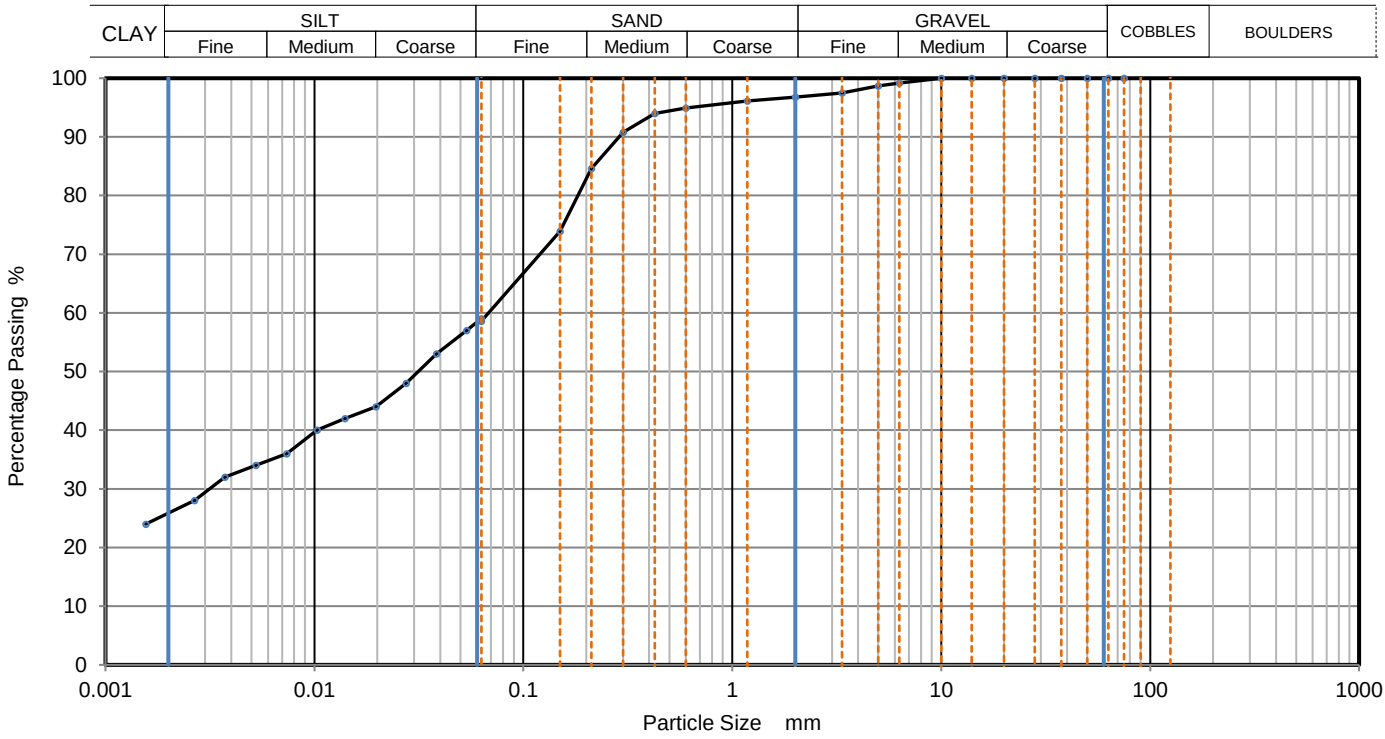
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP12
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown slightly gravelly sandy SILT. Sand is fine.			Depth, m	2.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103058



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	59
		0.0535	57
75	100	0.0384	53
63	100	0.0275	48
50	100	0.0197	44
37.5	100	0.0140	42
28	100	0.0103	40
20	100	0.0074	36
14	100	0.0052	34
10	100	0.0037	32
6.3	99	0.0027	28
5	99	0.0016	24
3.35	98		
2	97		
1.18	96		
0.6	95	Particle density (assumed)	
0.425	94	2.65	Mg/m3
0.3	91		
0.212	85		
0.15	74		
0.063	59		

Dry Mass of sample, g	549

Sample Proportions	% dry mass
Very coarse	0
Gravel	3
Sand	38
Silt	33
Clay	26

Grading Analysis		
D100	mm	
D60	mm	0.0681
D30	mm	0.00307
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

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Deeside
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Website: www.alsenvironmental.co.uk

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway

Attention: Dympna Darcy

CERTIFICATE OF ANALYSIS

Date of report Generation:	23 December 2020
Customer:	Irish Drilling Limited
Sample Delivery Group (SDG):	201216-121
Your Reference:	2020WW102
Location:	Arklow Bank
Report No:	581370

We received 12 samples on Wednesday December 16, 2020 and 12 of these samples were scheduled for analysis which was completed on Wednesday December 23, 2020. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
23446025	TP01	B4	1.40 - 1.50	15/10/2020
23446038	TP02	B2	0.50 - 0.60	15/10/2020
23446040	TP03	D3	1.10 - 1.20	15/10/2020
23446042	TP04	B7	2.40 - 2.50	15/10/2020
23446046	TP05	D3	1.10 - 1.20	15/10/2020
23446049	TP06	B5	1.40 - 1.50	14/10/2020
23446053	TP07	B6	2.40 - 2.50	13/10/2020
23446056	TP08	B2	0.40 - 0.50	13/10/2020
23446060	TP09	B5	1.50 - 1.60	13/10/2020
23446027	TP10	B2	0.40 - 0.50	14/10/2020
23446030	TP11	B2	0.40 - 0.50	14/10/2020
23446032	TP12	B7	3.50 - 3.60	14/10/2020

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X **Test**

N **No Determination Possible**

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)	23446025	23446038	23446040	23446042	23446046	23446049	23446053	23446056	23446060	23446027	23446030	23446032
Customer Sample Reference	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10	TP11	TP12
AGS Reference	B4	B2	D3	B7	D3	B5	B6	B2	B5	B2	B2	B7
Depth (m)	1.40 - 1.50	0.50 - 0.60	1.10 - 1.20	2.40 - 2.50	1.10 - 1.20	1.40 - 1.50	2.40 - 2.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	0.40 - 0.50	3.50 - 3.60
Container	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)
Sample Type	S	S	S	S	S	S	S	S	S	S	S	S
Anions by Kone (soil) — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X
pH — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X
Sample description — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X
Total Sulphate — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X
Total Sulphur — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
23446025	TP01	1.40 - 1.50	Light Brown	Sandy Loam	None	Stones
23446038	TP02	0.50 - 0.60	Light Brown	Silty Clay	Vegetation	N/A
23446040	TP03	1.10 - 1.20	Dark Brown	Sandy Silt Loam	None	Stones
23446042	TP04	2.40 - 2.50	Light Brown	Silty Clay Loam	None	Stones
23446046	TP05	1.10 - 1.20	Light Brown	Clay	Stones	None
23446049	TP06	1.40 - 1.50	Light Brown	Sandy Silt Loam	None	None
23446053	TP07	2.40 - 2.50	Light Brown	Clay	Stones	None
23446056	TP08	0.40 - 0.50	Light Brown	Clay	Vegetation	None
23446060	TP09	1.50 - 1.60	Dark Brown	Sandy Clay Loam	None	Stones
23446027	TP10	0.40 - 0.50	Dark Brown	Loamy Sand	None	Stones
23446030	TP11	0.40 - 0.50	Light Brown	Clay	Vegetation	None
23446032	TP12	3.50 - 3.60	Light Brown	Clay	None	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Validated

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP01	TP02	TP03	TP04	TP05	TP06
			Depth (m)	1.40 - 1.50	0.50 - 0.60	1.10 - 1.20	2.40 - 2.50	1.10 - 1.20	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020
			Sample Time	.	.	.	.	.	.
			Date Received	16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020
			SDG Ref	201216-121	201216-121	201216-121	201216-121	201216-121	201216-121
			Lab Sample No.(s)	23446025	23446038	23446040	23446042	23446046	23446049
			AGS Reference	B4	B2	D3	B7	D3	B5
Moisture Content Ratio (% of as received sample)	%	PM024		18	22	16	14	17	20
Sulphur, Total	<0.02 %	TM132		<0.02 @	<0.02 @	<0.02 @	<0.02 @	<0.02 @	<0.02 @
Sulphate, Total potential	<0.06 %	TM132		0.06	0.06	0.06	0.06	0.06	0.06
pH	1 pH Units	TM133		8.59 @ M	7.24 @ M	8.73 @ M	8.82 @ M	7.9 @ M	8.2 @ M
Sulphate, Total	<48 mg/kg	TM221		82.8 M	<48 M	<48 M	<48 M	<48 M	<48 M
Water Soluble Sulphate as SO4 2:1 Extract	<0.004 g/l	TM243		0.0226 @ M	0.0279 @ M	0.0227 @ M	0.0099 @ M	0.0204 @ M	0.0184 @ M

Validated

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	TP07	TP08	TP09	TP10	TP11	TP12
Customer Sample Ref.								
Depth (m)			2.40 - 2.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	0.40 - 0.50	3.50 - 3.60
Sample Type			Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Date Sampled			13/10/2020	13/10/2020	13/10/2020	14/10/2020	14/10/2020	14/10/2020
Sample Time			.	.	.	.	.	.
Date Received			16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020
SDG Ref			201216-121	201216-121	201216-121	201216-121	201216-121	201216-121
Lab Sample No.(s)			23446053	23446056	23446060	23446027	23446030	23446032
AGS Reference			B6	B2	B5	B2	B2	B7
Moisture Content Ratio (% of as received sample)	%	PM024	16	19	17	19	22	19
Sulphur, Total	<0.02 %	TM132	<0.02 @	<0.02 @	<0.02 @	<0.02 @	<0.02 @	<0.02 @
Sulphate, Total potential	<0.06 %	TM132	0.06	0.06	0.06	0.06	0.06	0.06
pH	1 pH Units	TM133	8.8 @ M	7.77 @ M	8.45 @ M	7.61 @ M	8.06 @ M	8.55 @ M
Sulphate, Total	<48 mg/kg	TM221	68.2 M	<48 M	<48 M	<48 M	<48 M	<48 M
Water Soluble Sulphate as SO4 2:1 Extract	<0.004 g/l	TM243	0.0212 @ M	0.0183 @ M	0.0111 @ M	0.0272 @ M	0.0193 @ M	0.009 @ M

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM132	In - house Method	ELTRA CS800 Operators Guide
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter
TM221	Inductively Coupled Plasma - Atomic Emission Spectroscopy. An Atlas of Spectral Information: Winge, Fassel, Peterson and Floyd	Determination of Acid extractable Sulphate in Soils by IRIS Emission Spectrometer
TM243		Mixed Anions In Soils By Kone

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Validated

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	23446025	23446038	23446040	23446042	23446046	23446049	23446053	23446056	23446060	23446027
Customer Sample Ref.	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10
AGS Ref.	B4	B2	D3	B7	D3	B5	B6	B2	B5	B2
Depth	1.40 - 1.50	0.50 - 0.60	1.10 - 1.20	2.40 - 2.50	1.10 - 1.20	1.40 - 1.50	2.40 - 2.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (soil)	23-Dec-2020	23-Dec-2020	22-Dec-2020	23-Dec-2020	23-Dec-2020	23-Dec-2020	22-Dec-2020	22-Dec-2020	23-Dec-2020	23-Dec-2020
pH	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020
Sample description	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020
Total Sulphate	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	22-Dec-2020	22-Dec-2020
Total Sulphur	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020

Lab Sample No(s)	23446030	23446032
Customer Sample Ref.	TP11	TP12
AGS Ref.	B2	B7
Depth	0.40 - 0.50	3.50 - 3.60
Type	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (soil)	23-Dec-2020	23-Dec-2020
pH	18-Dec-2020	18-Dec-2020
Sample description	17-Dec-2020	17-Dec-2020
Total Sulphate	21-Dec-2020	21-Dec-2020
Total Sulphur	21-Dec-2020	21-Dec-2020

Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

18. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

19. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

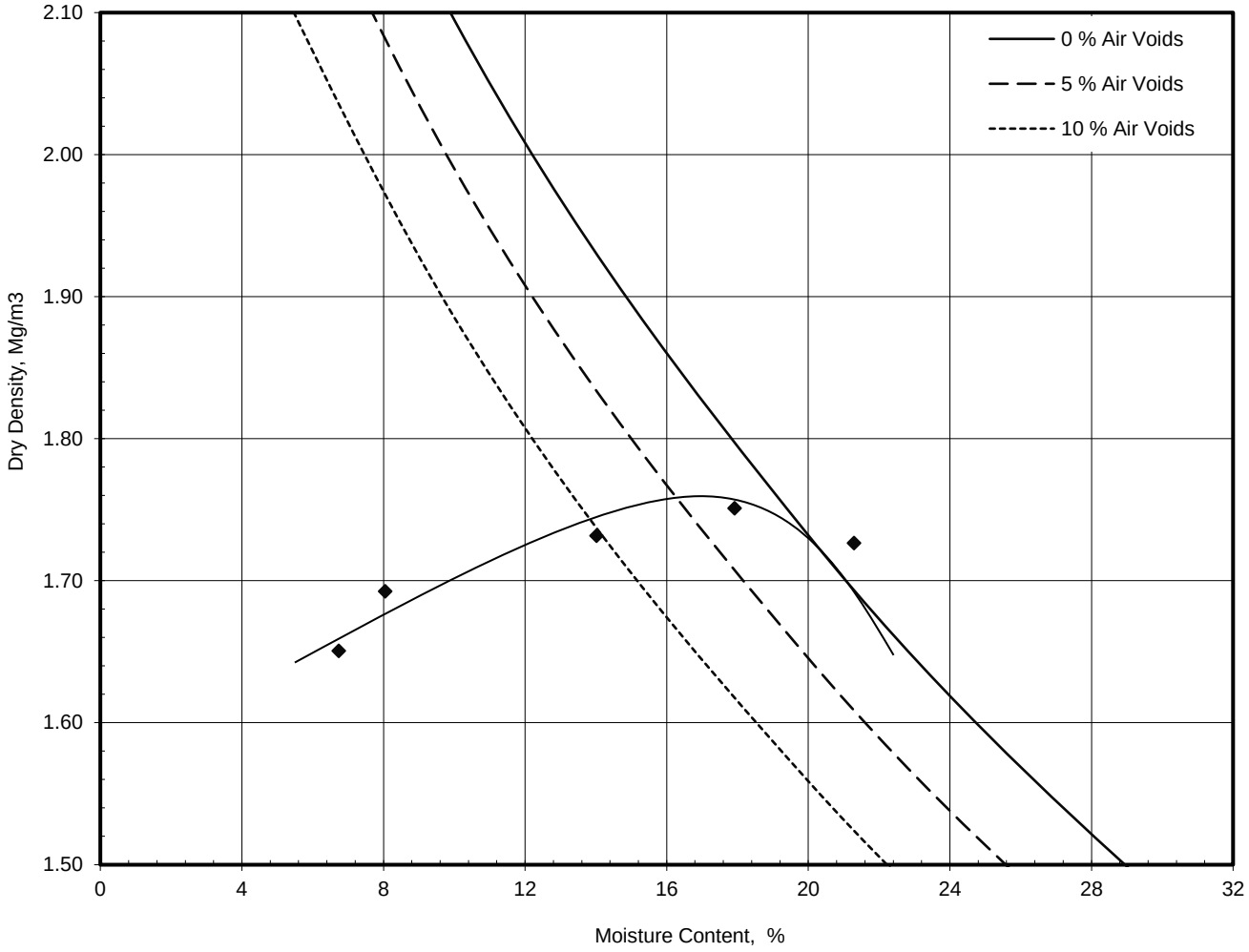
Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2017).*

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP04
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Brown gravelly very silty fine SAND.			Depth	1.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020102928
				Compaction Test Reference/No.	



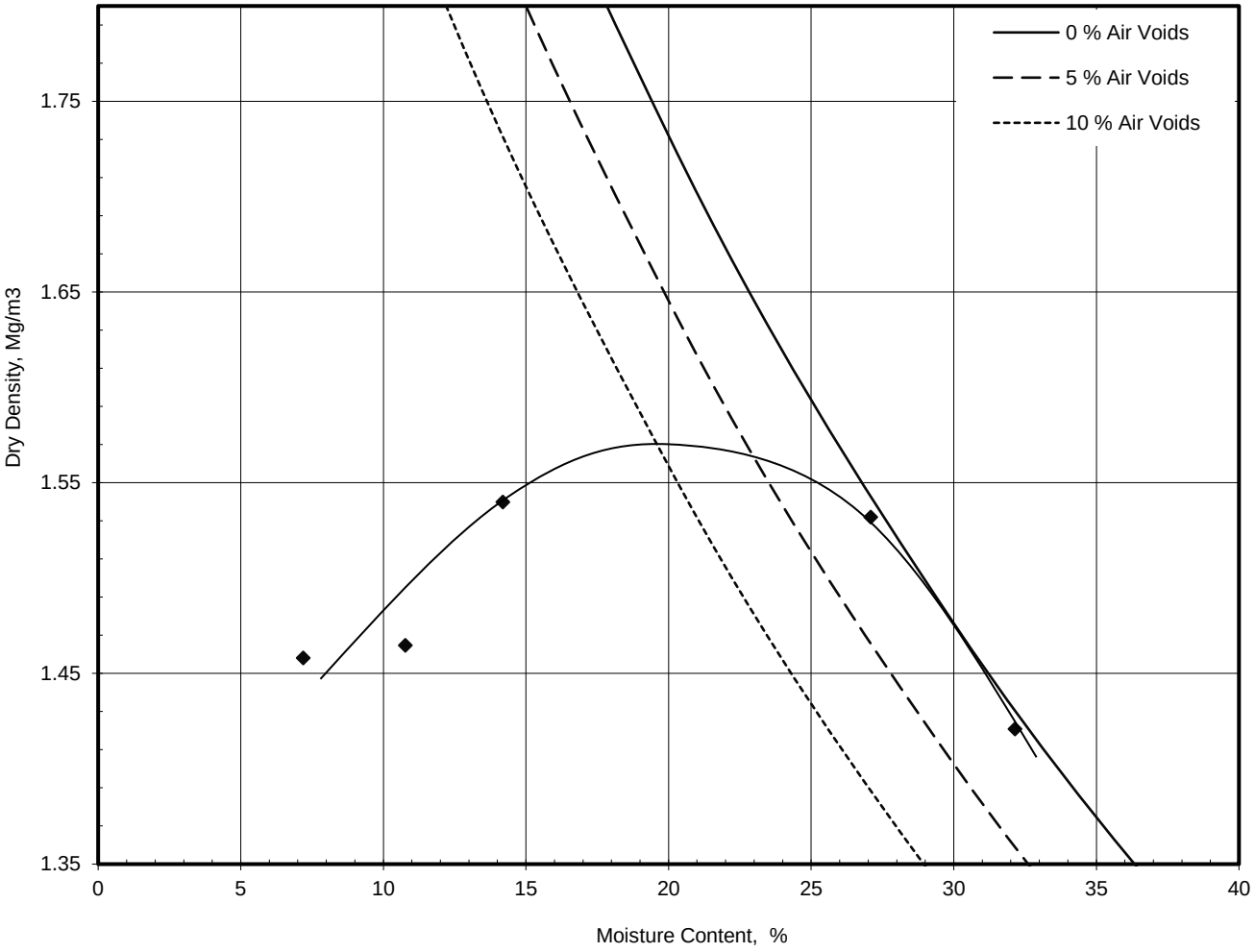
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density -	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.75**
Optimum Moisture Content	%	**18**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP06
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Orange-brown slightly gravelly slightly sandy SILT.			Depth	1.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL1202010306
				Compaction Test Reference/No.	



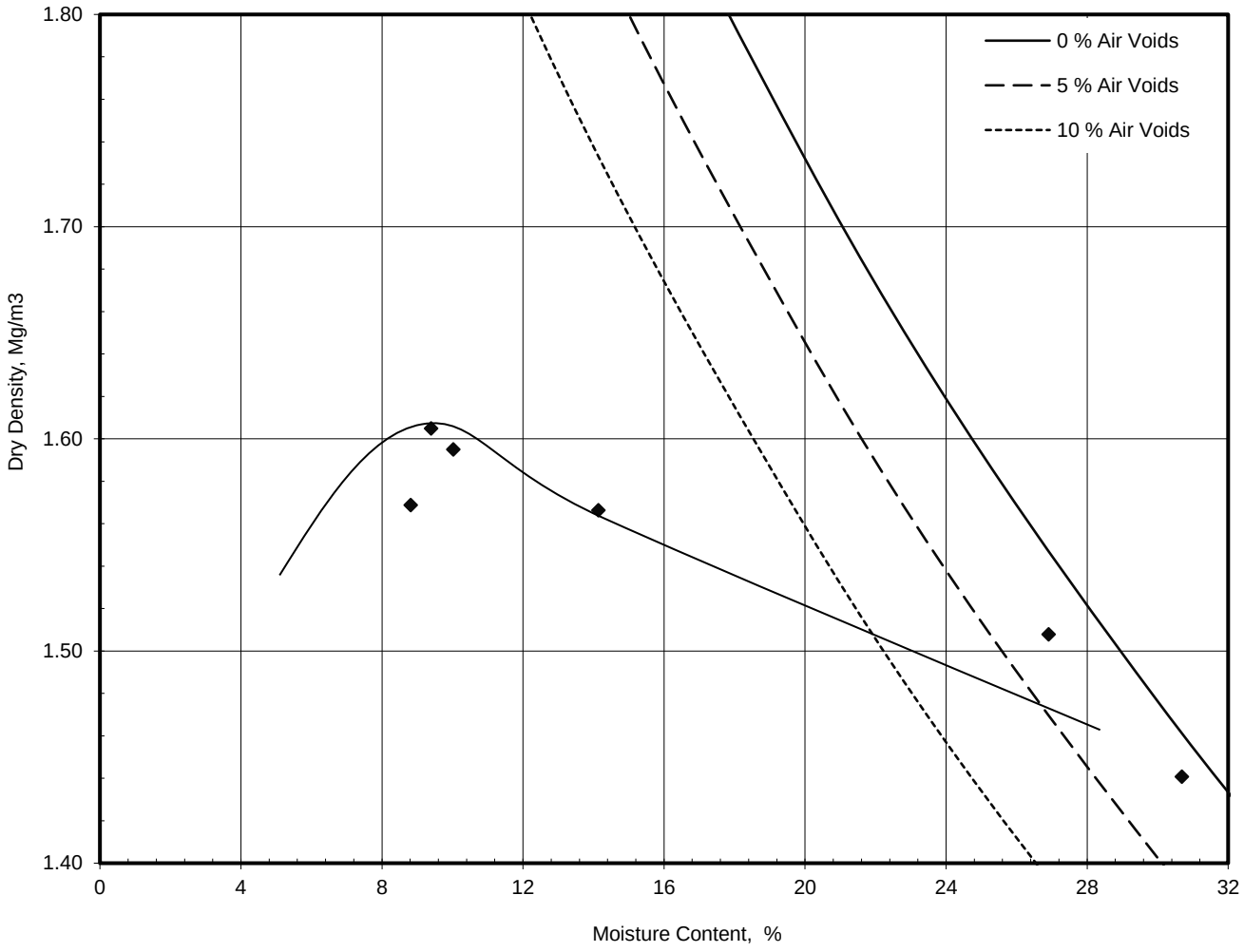
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.56**
Optimum Moisture Content	%	**20**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP07
Site Name	**Arklow Bank Windpark**			Sample No	2
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth	0.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103010
				Compaction Test Reference/No.	



Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

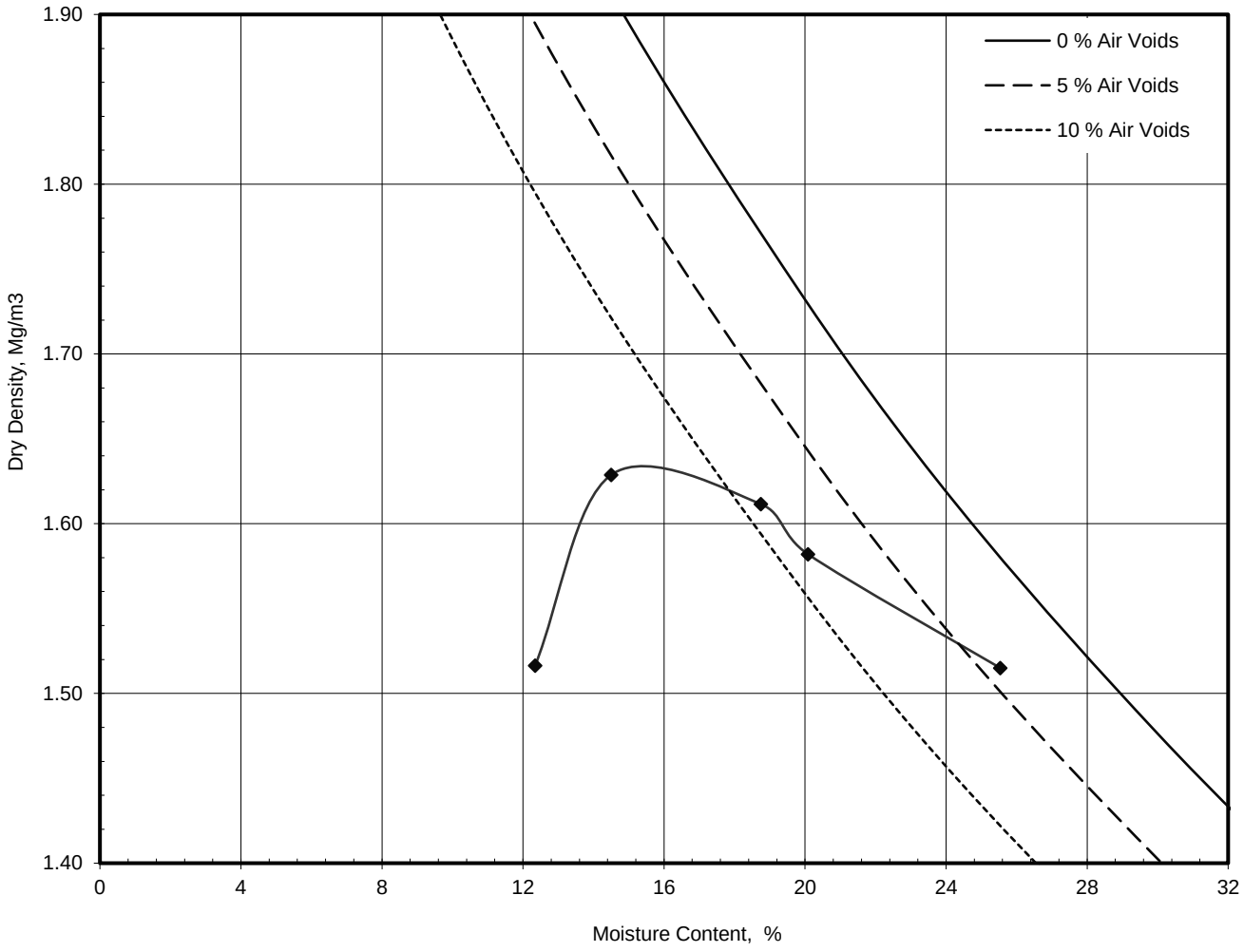
Maximum Dry Density	Mg/m³	**1.60**

Optimum Moisture Content	%	**9.1**

Operator	Checked	Approved	Remarks	**QC Form R4**
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP08
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Greyish-brown slightly gravelly sandy SILT.			Depth	1.50 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103022
				Compaction Test Reference/No.	



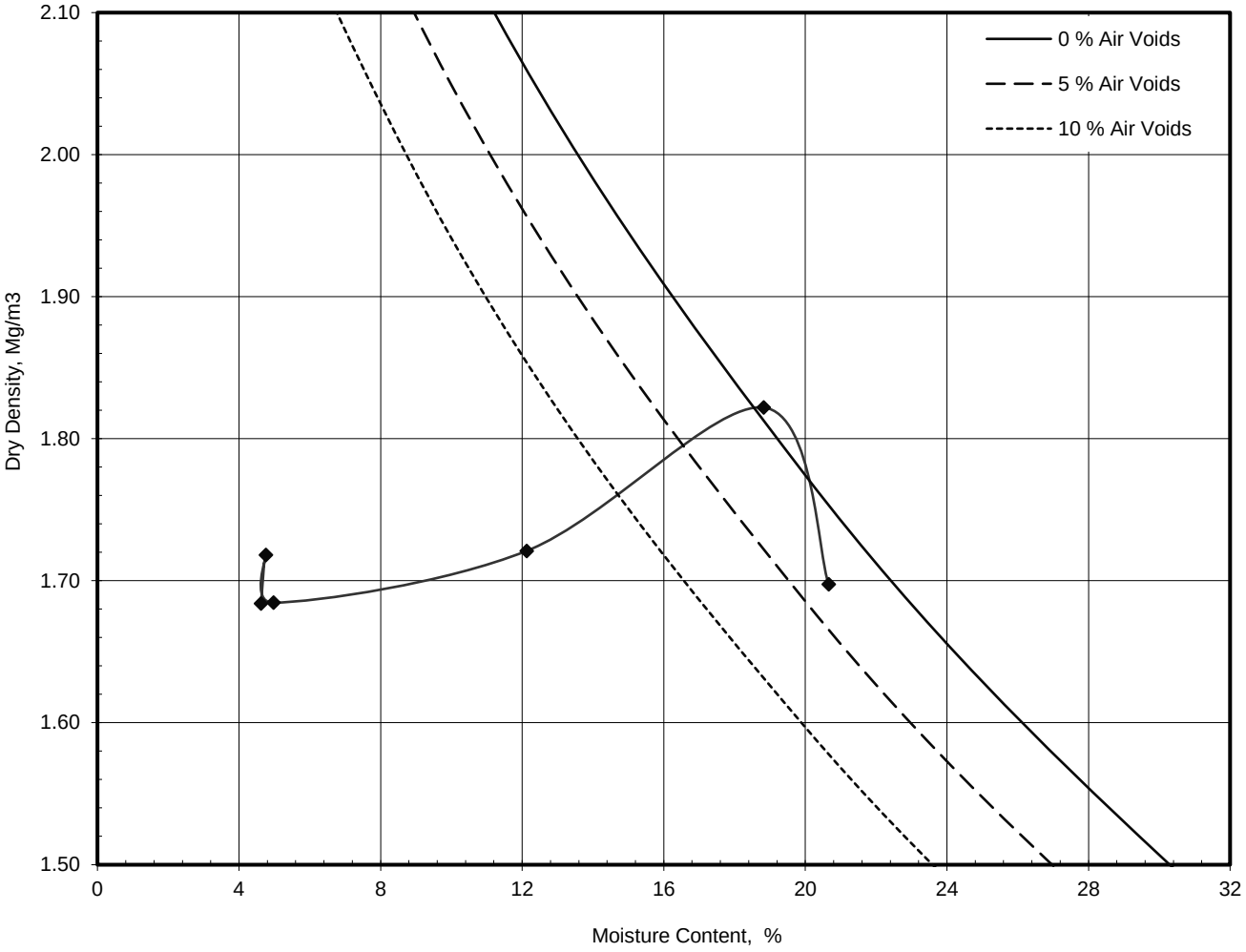
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.64**
Optimum Moisture Content	%	**16**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP09
Site Name	**Arklow Bank Windpark**			Sample No	2
Soil Description	Grey-brown slightly sandy SILT.			Depth	0.50 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103028
				Compaction Test Reference/No.	



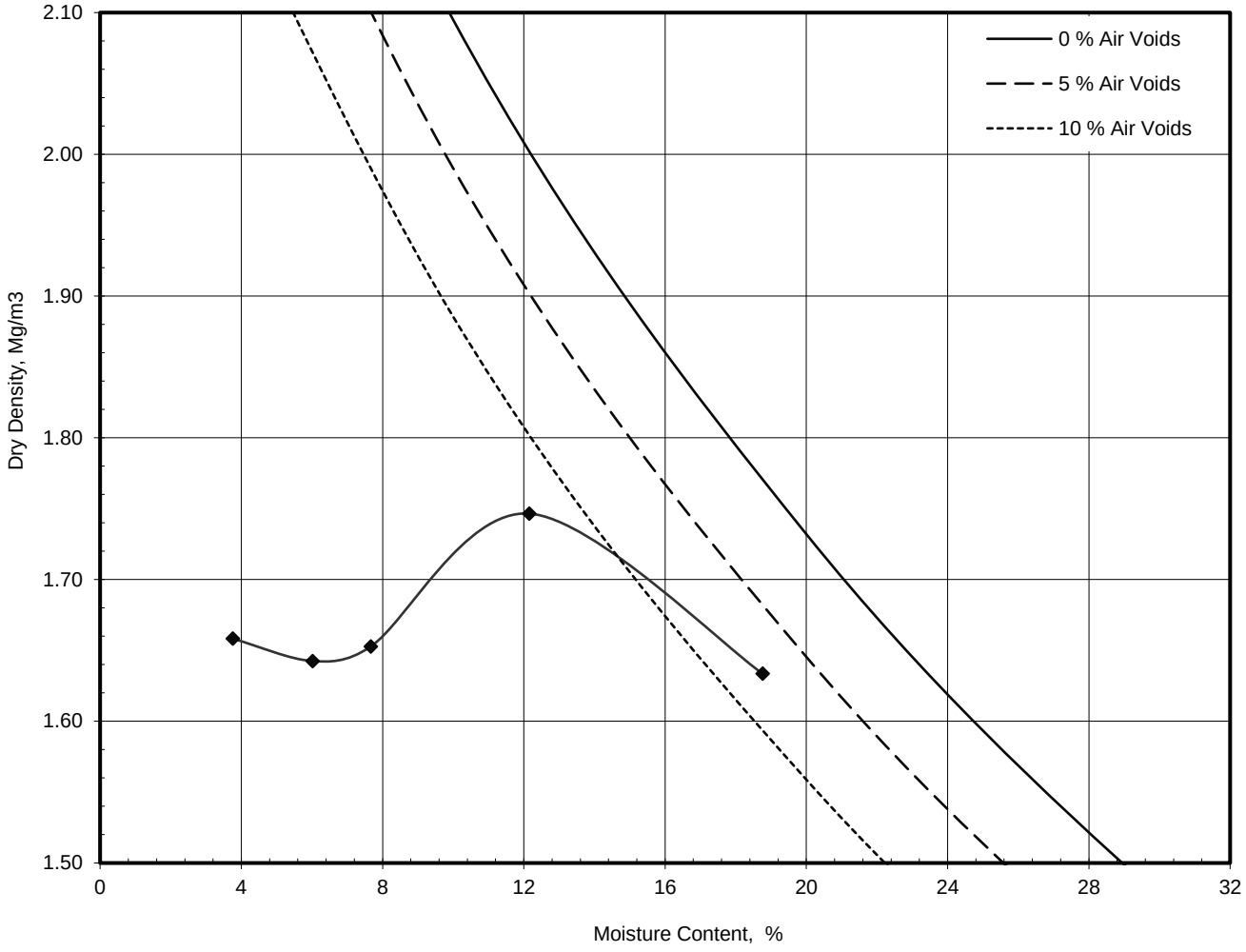
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.75

Maximum Dry Density	Mg/m³	**1.82**
Optimum Moisture Content	%	**19**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP10
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Brown slightly sandy SILT.			Depth	1.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103039
				Compaction Test Reference/No.	



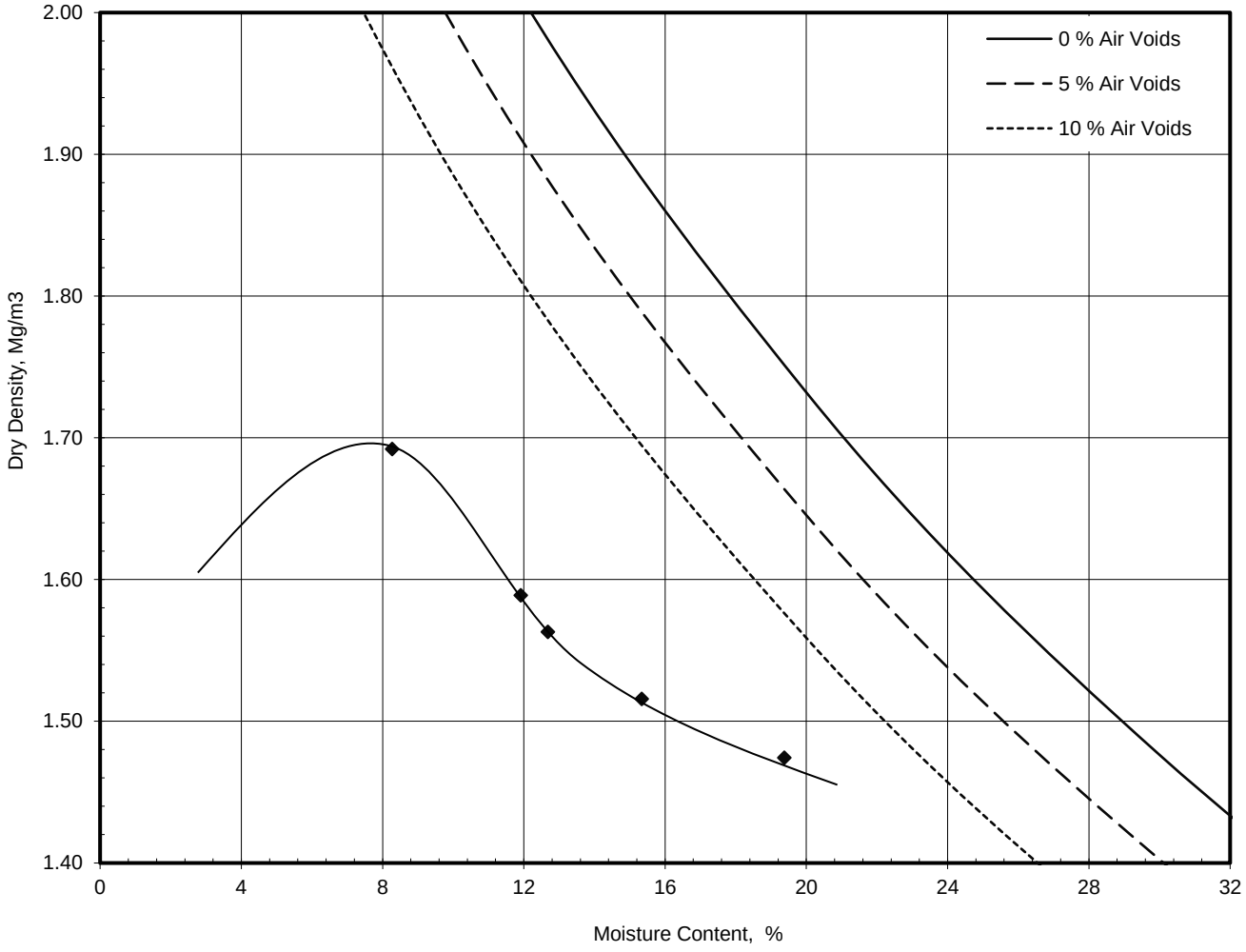
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.75**
Optimum Moisture Content	%	**12**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP11
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth	1.40 m
Specimen Ref.		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103048
				Compaction Test Reference/No.	



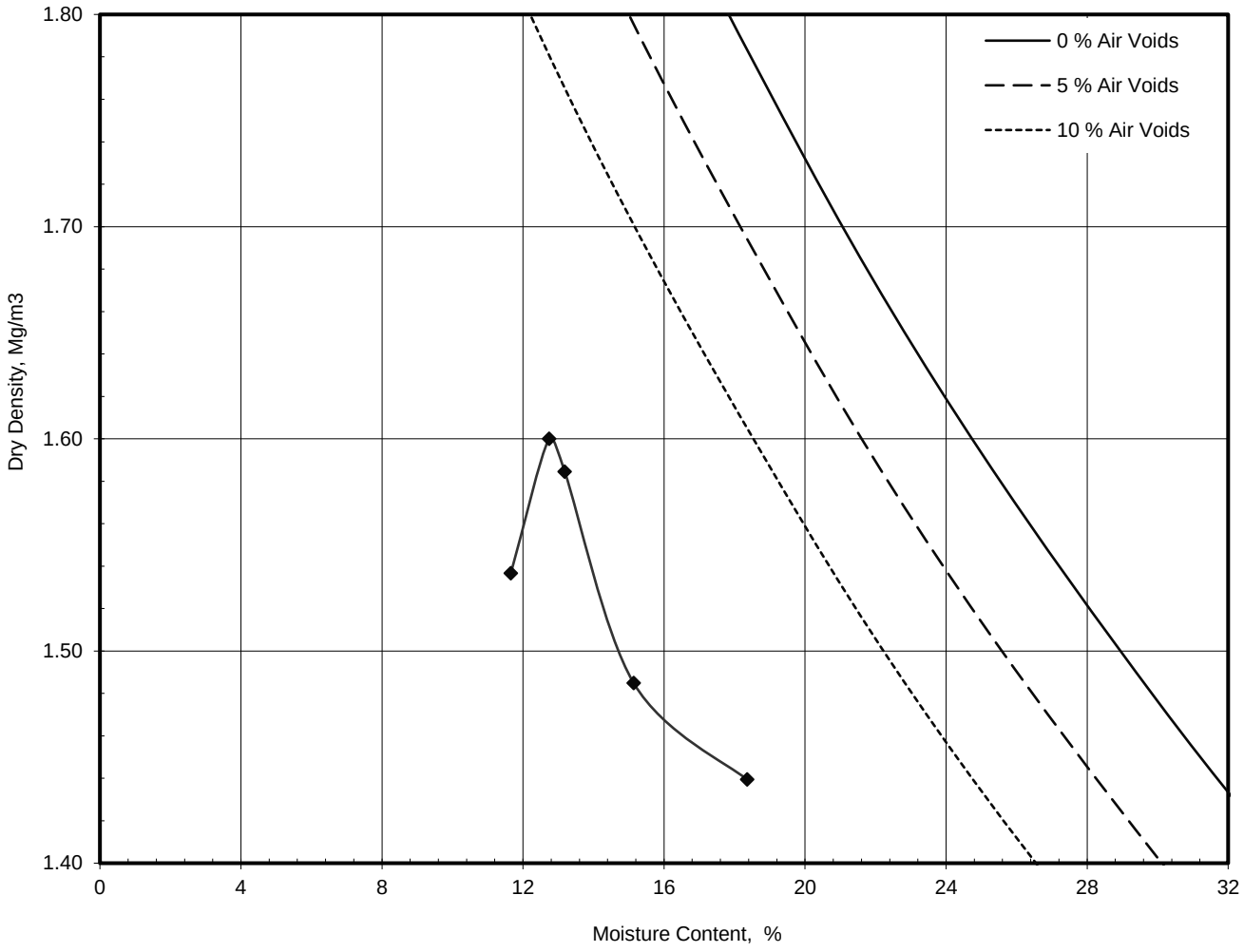
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.69**
Optimum Moisture Content	%	**8.7**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP12
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Brown slightly gravelly sandy SILT. Sand is fine.			Depth	1.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103057
				Compaction Test Reference/No.	



Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.60**

Optimum Moisture Content	%	**13**

Operator	Checked	Approved	Remarks	**QC Form R4**
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown gravelly very silty fine SAND.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020102928
Test Method	BS1377:Part4:1990:clause 5.5			Date started	25/11/2020

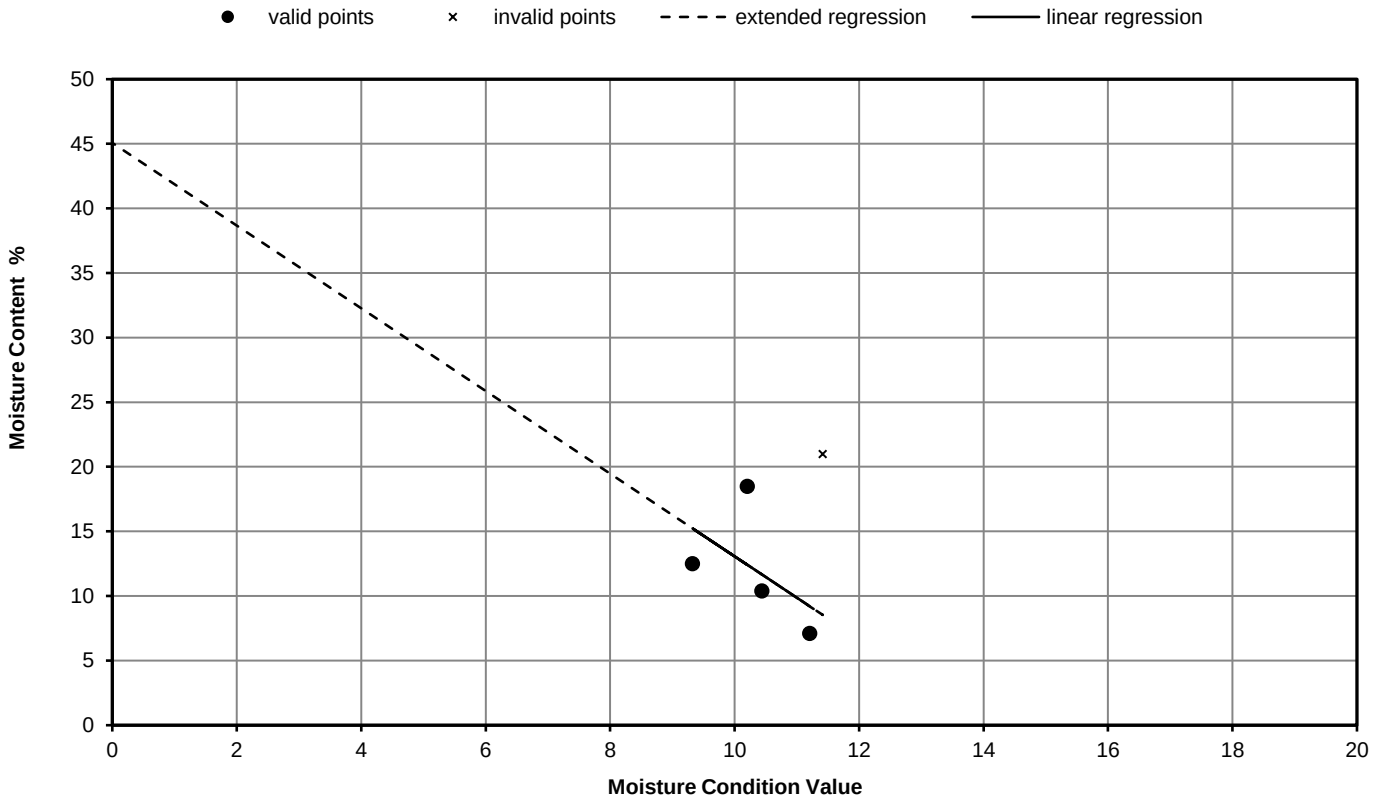
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	13.1	%
Initial Moisture Content of test sample below 20mm	18.5	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	18.5	12.5	10.4	7.1	21.0
Moisture Condition Value	10.2	9.3	10.4	11.2	11.4
MCV report	10.2	9.3	10.4	11.2	11.4
Effective / Valid data point	YES	YES	YES	YES	NO
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP06
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Orange-brown slightly gravelly slightly sandy SILT.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL1202010306
Test Method	BS1377:Part4:1990:clause 5.5			Date started	07/12/2020

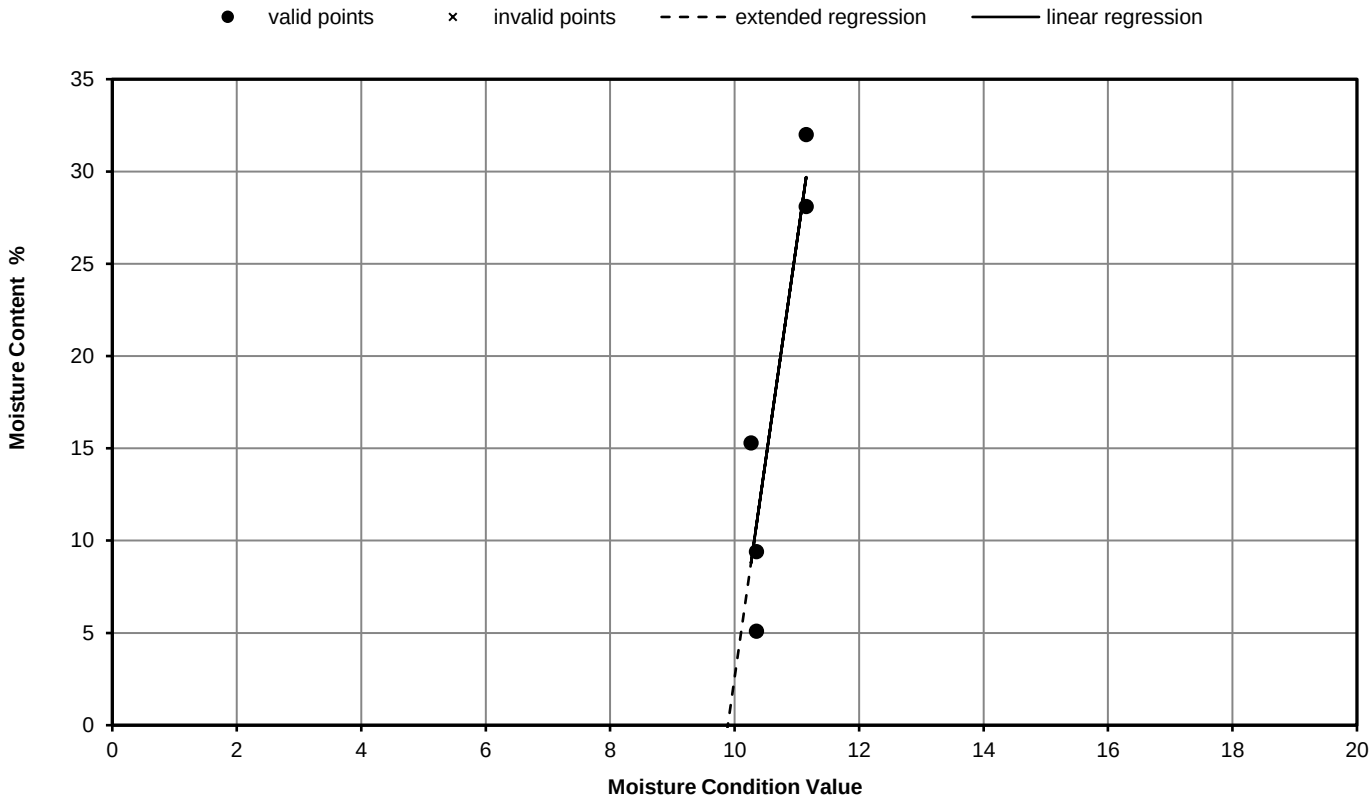
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	23	%
Initial Moisture Content of test sample below 20mm	32	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	32.0	9.4	15.3	28.1	5.1
Moisture Condition Value	11.1	10.4	10.3	11.1	10.4
MCV report	11.1	10.4	10.3	11.1	10.4
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP07
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth	0.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103010
Test Method	BS1377:Part4:1990:clause 5.5			Date started	02/12/2020

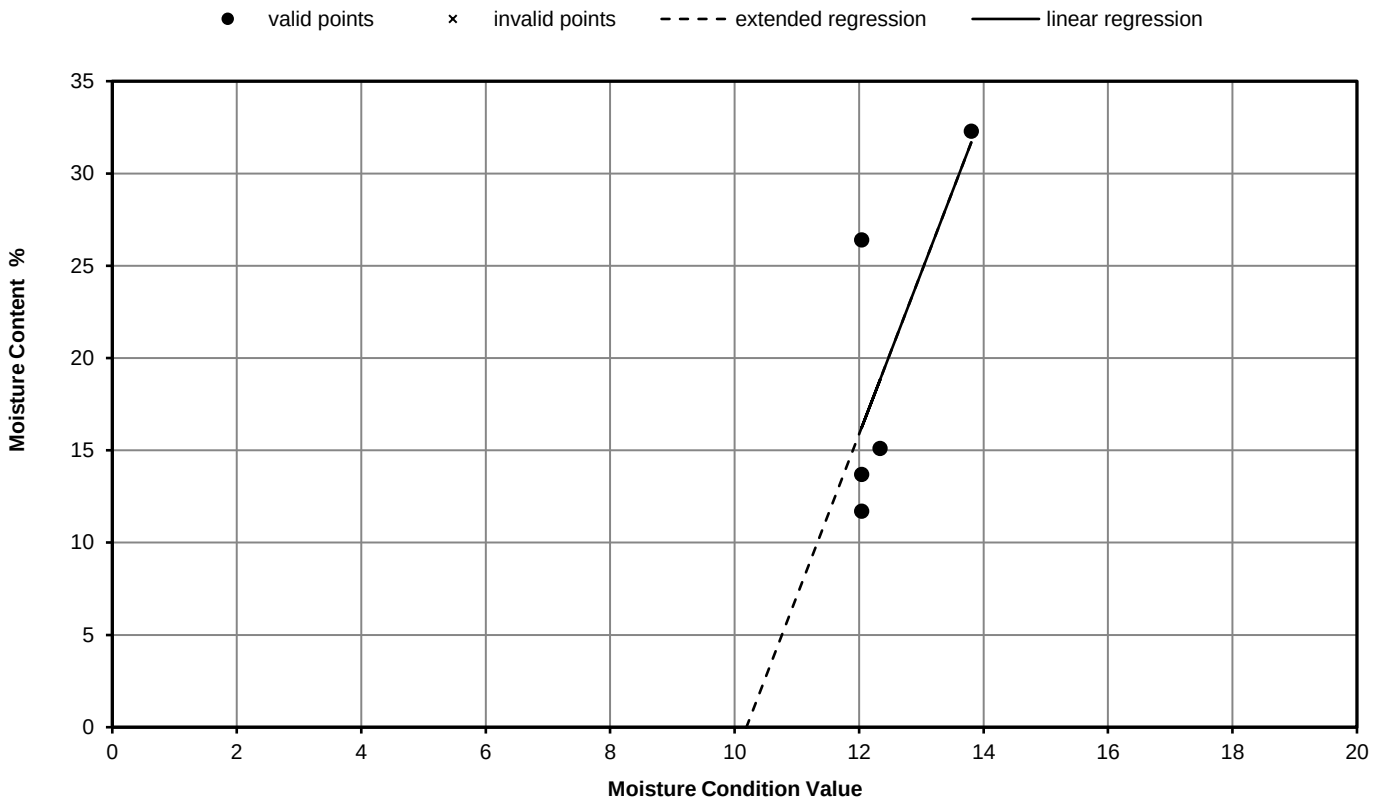
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	27	%
Initial Moisture Content of test sample below 20mm	32.3	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	32.3	11.7	15.1	13.7	26.4
Moisture Condition Value	13.8	12.0	12.3	12.0	12.0
MCV report	13.8	12	12.3	12	12
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP08
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Greyish-brown slightly gravelly sandy SILT.			Depth	1.5
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103022
Test Method	BS1377:Part4:1990:clause 5.5			Date started	26/11/2020

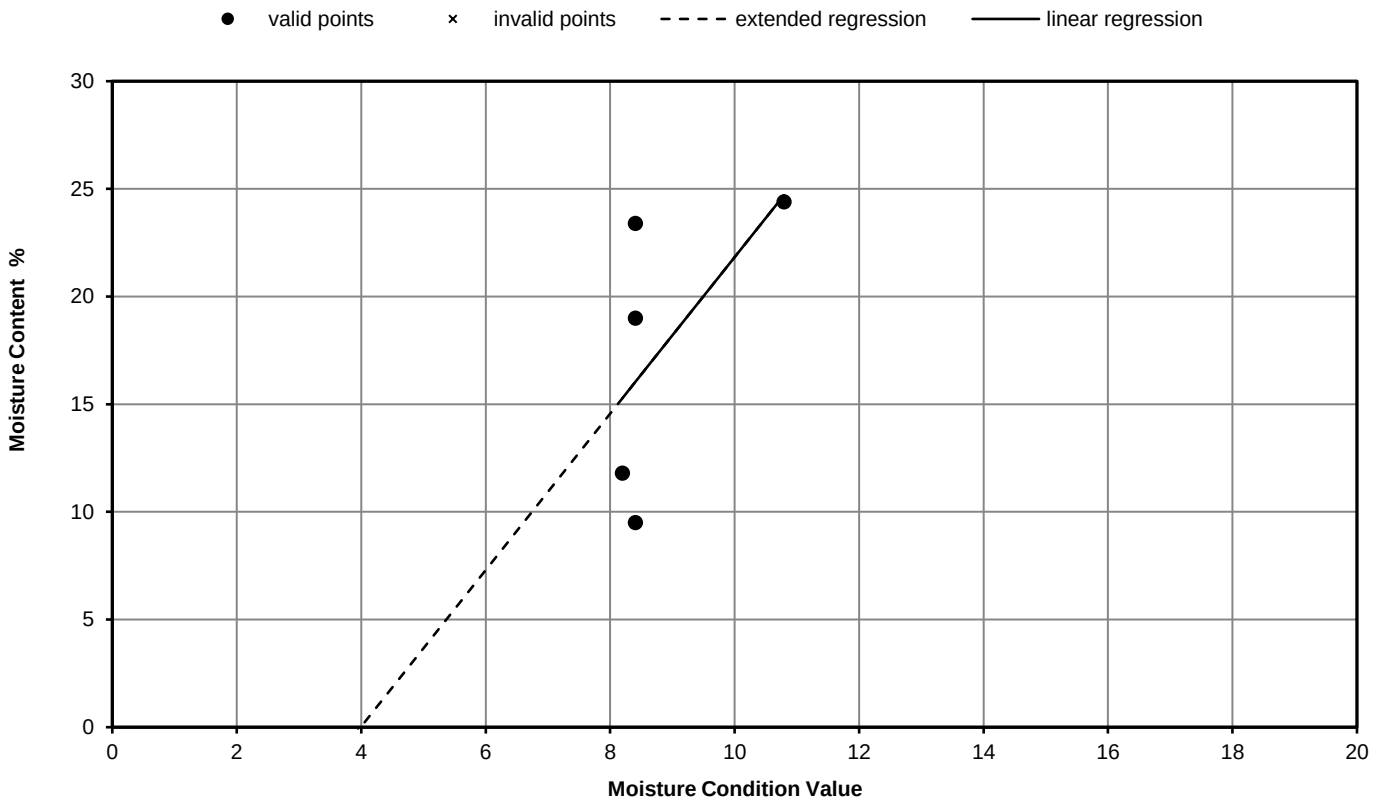
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	27	%
Initial Moisture Content of test sample below 20mm	24.4	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	24.4	23.4	19.0	9.5	11.8
Moisture Condition Value	10.8	8.4	8.4	8.4	8.2
MCV report	10.8	8.4	8.4	8.4	8.2
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP09
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Grey-brown slightly sandy SILT.			Depth	0.5
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103028
Test Method	BS1377:Part4:1990:clause 5.5			Date started	27/11/2020

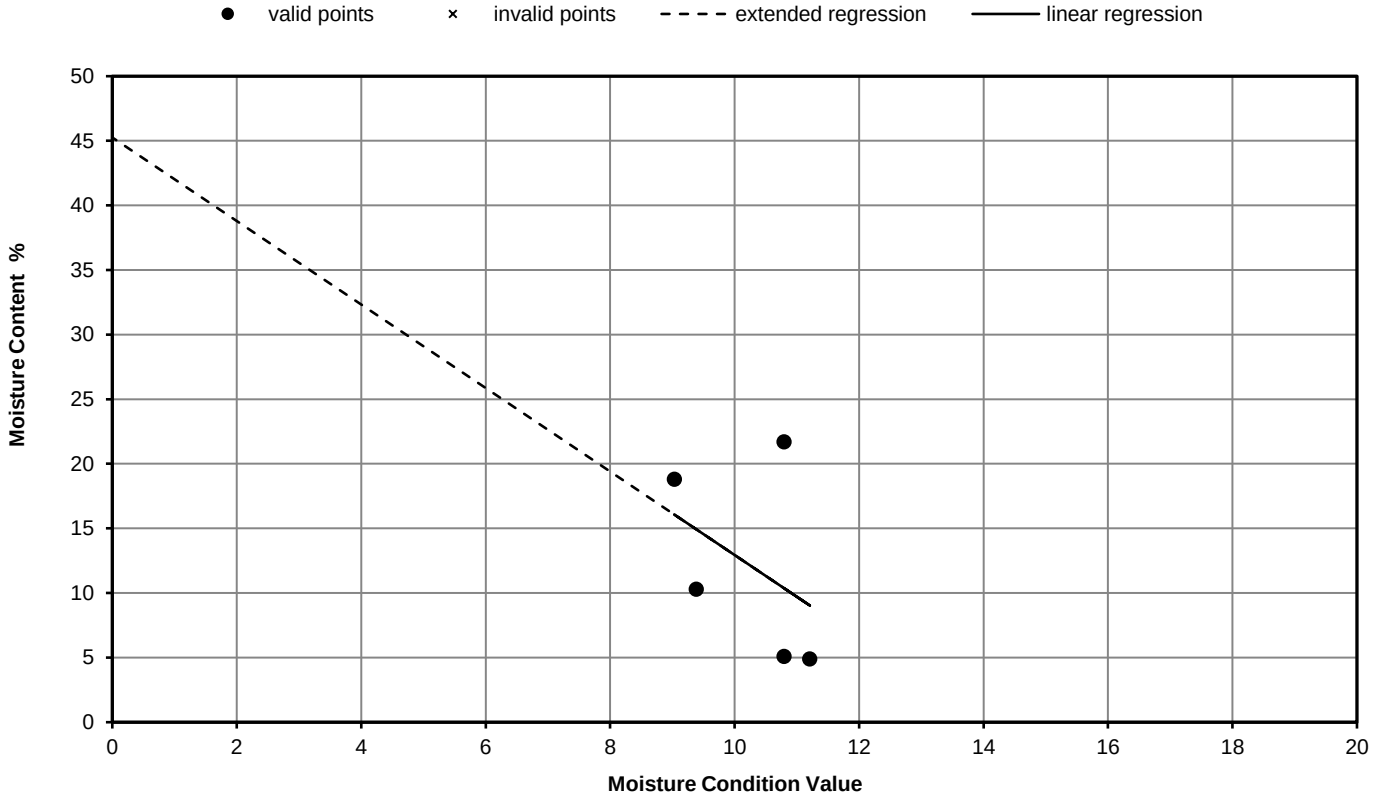
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	18.8	%
Initial Moisture Content of test sample below 20mm	18.8	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	18.8	10.3	5.1	4.9	21.7
Moisture Condition Value	9.0	9.4	10.8	11.2	10.8
MCV report	9	9.4	10.8	11.2	10.8
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP10
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly sandy SILT.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103039
Test Method	BS1377:Part4:1990:clause 5.5			Date started	30/11/2020

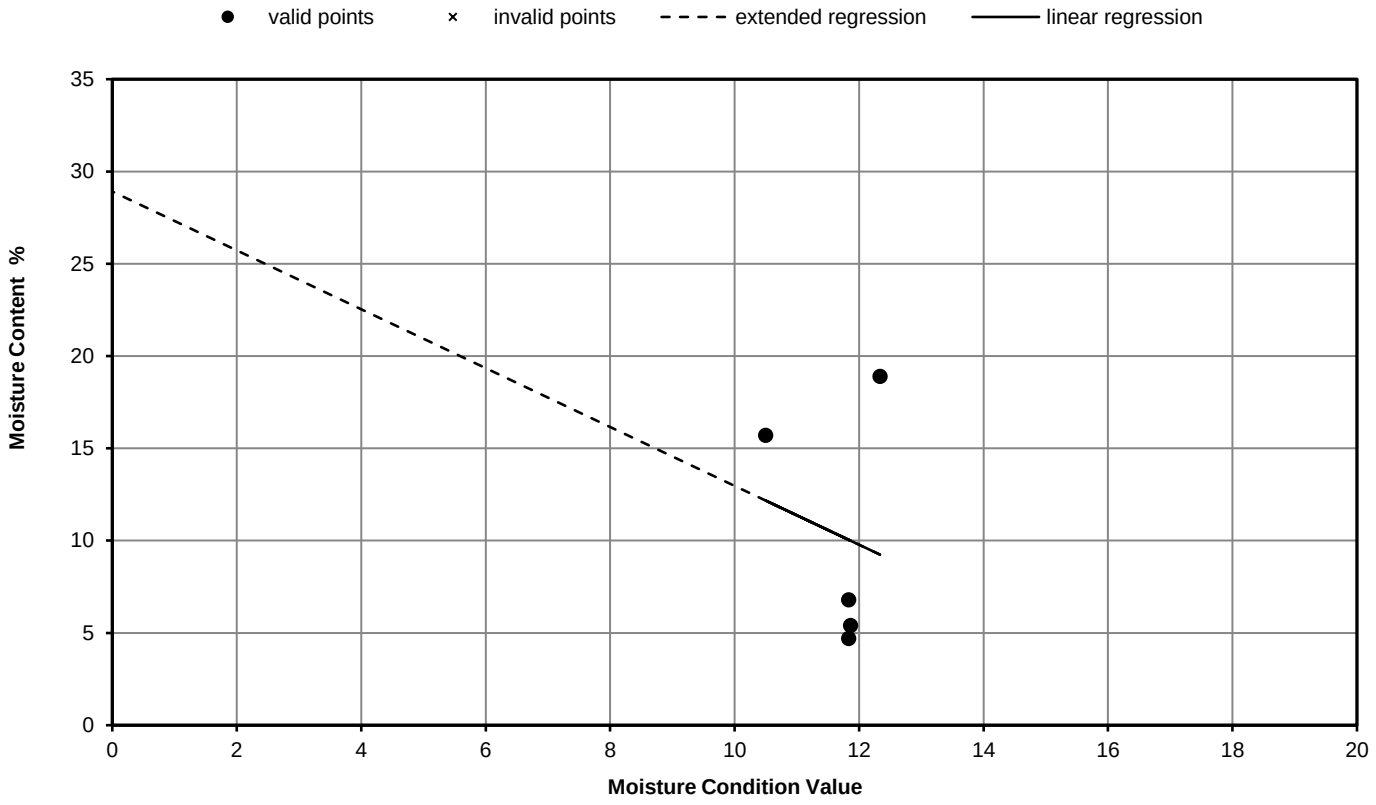
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	20	%
Initial Moisture Content of test sample below 20mm	19	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	18.9	15.7	6.8	5.4	4.7
Moisture Condition Value	12.3	10.5	11.8	11.9	11.8
MCV report	12.3	10.5	11.8	11.9	11.8
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP11
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103048
Test Method	BS1377:Part4:1990:clause 5.5			Date started	27/11/2020

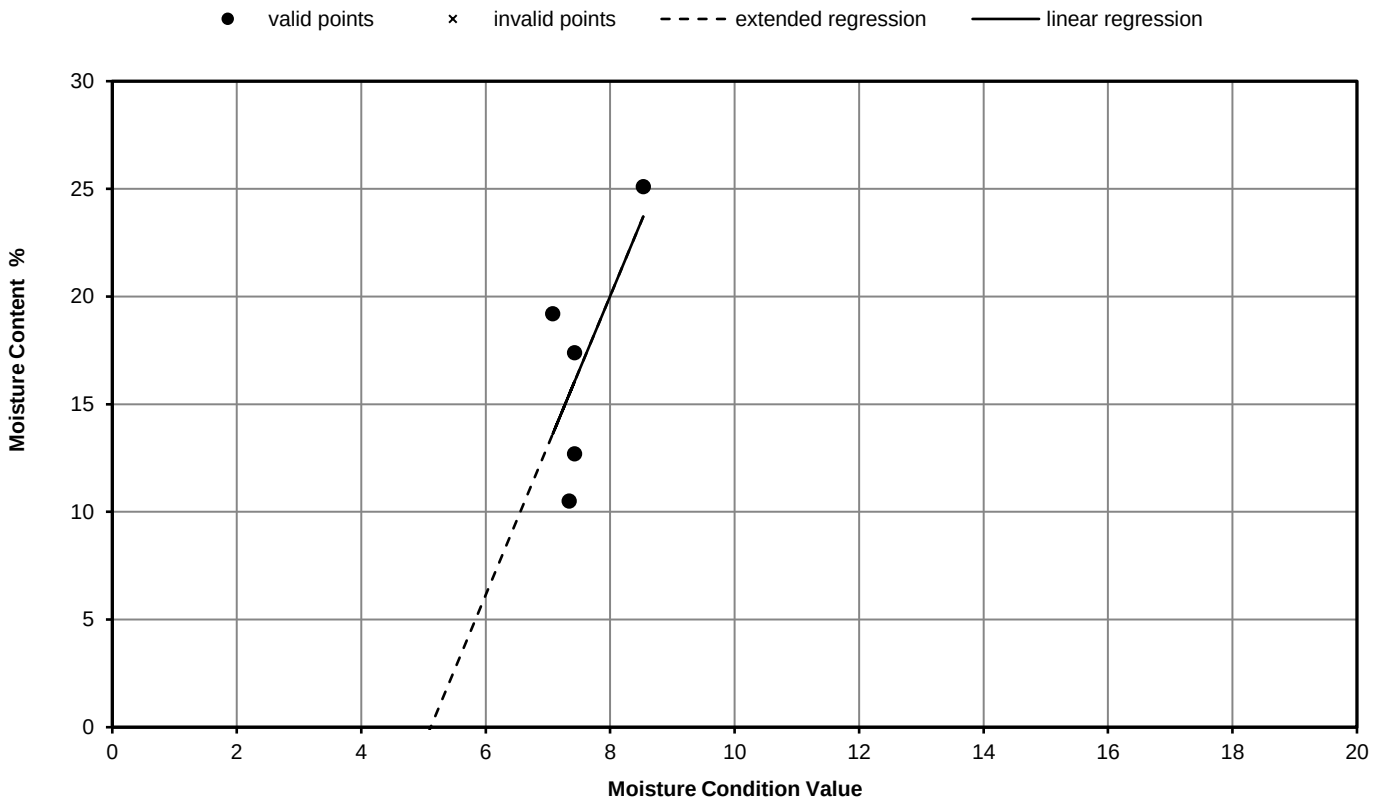
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	26	%
Initial Moisture Content of test sample below 20mm	25	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	25.1	19.2	17.4	12.7	10.5
Moisture Condition Value	8.5	7.1	7.4	7.4	7.3
MCV report	8.5	7.1	7.4	7.4	7.3
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP12
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly gravelly sandy SILT. Sand is fine.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103057
Test Method	BS1377:Part4:1990:clause 5.5			Date started	08/12/2020

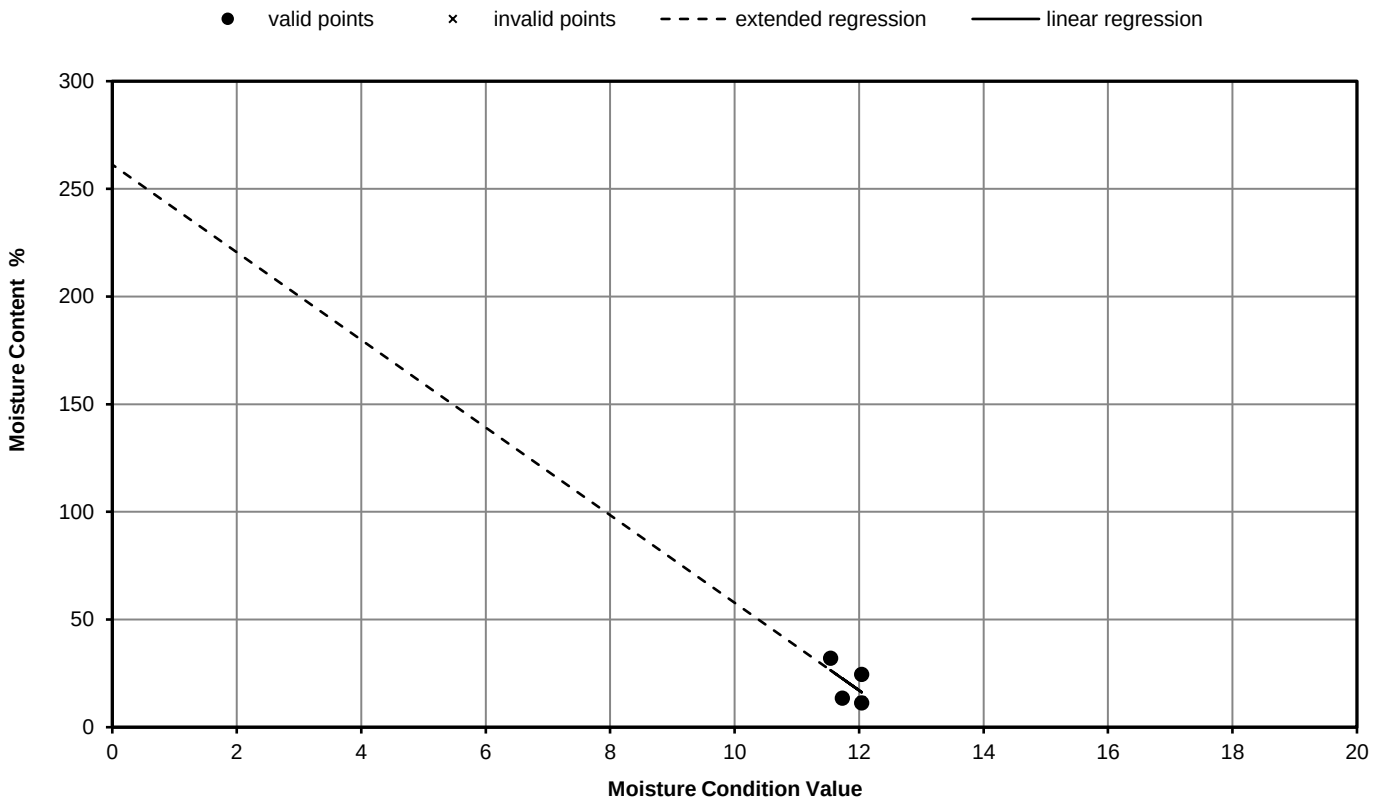
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	32	%
Initial Moisture Content of test sample below 20mm	32	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	32.1	24.6	12.7	13.5	11.3
Moisture Condition Value	11.5	12.0	12.0	11.7	12.0
MCV report	11.5	12	12	11.7	12
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

IDL

Point Load Strength Index Tests
Summary of Results

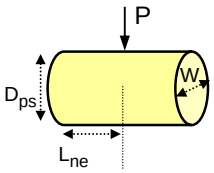
Project No.: 2020WW102

Project Name: Arklow Bank Windpark

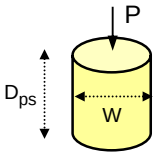
Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Top Depth	Base Depth	Type	Top	Base		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m	m		m	m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH01	3.50	4.7	C	4.2	4.34		A	U	YES		101.5		88.0	7.3	106.6	0.6	0.9	Weak
BH01	5.20	6.7	C	5.7	5.80		D	U	YES		101.5		101.5	3.2	101.5	0.3	0.4	Weak
BH01	6.70	8.2	C	7	7.20		A	U	YES		101.5		101.5	1.3	114.5	0.1	0.1	Very Weak
BH01	6.70	8.2	C	7.8	7.90		D	U	YES		101.5		101.5	2.1	101.5	0.2	0.3	Weak
BH01	8.20	9.7	C	8.52	8.66		D	U	YES		101.5		101.5	4.3	101.5	0.4	0.6	Weak
BH01	9.70	10.2	C	9.9	10.04		D	U	YES		101.5		101.5	3.2	101.5	0.3	0.4	Weak
BH02	9.40	10.1	C	9.68	9.75		D	U	YES		84.5		84.5	2.7	84.5	0.4	0.5	Weak
BH03	1.70	3.2	C	3	3.20		D	U	YES		101.5		101.5	1.2	101.5	0.1	0.2	Weak
BH03	3.20	3.8	C	3.5	3.65		A	U	YES		84.7		73.0	1.1	88.7	0.1	0.2	Weak
BH03	3.80	5.3	C	4.8	4.93		D	U	YES		84.7		84.7	2.2	84.7	0.3	0.4	Weak
BH03	5.30	6.8	C	6.46	6.60		A	U	YES		84.7		80.0	5.0	92.9	0.6	0.8	Weak
BH03	11.20	12.7	C	11.8	12.00		D	U	YES		84.7		84.7	5.6	84.7	0.8	1.0	Weak
BH03	12.70	14.2	C	12.8	13.00		D	U	YES		84.7		84.7	2.9	84.7	0.4	0.5	Weak
BH03	14.20	15.7	C	14.8	15.00		D	U	YES		84.7		84.7	0.8	84.7	0.1	0.1	Very Weak
BH03	15.70	17.2	C	15.8	15.94		D	U	YES		84.7		84.7	4.1	84.7	0.6	0.7	Weak
BH03	17.20	18.7	C	17.95	18.30		D	U	YES		84.7		84.7	8.3	84.7	1.2	1.5	Medium Strong
BH03	18.70	20.2	C	18.7	18.90		D	U	YES		84.7		84.7	3.3	84.7	0.5	0.6	Weak
BH05	4.70	5.3	C	4.5	4.66		D	U	YES		84.7		84.7	5.1	84.7	0.7	0.9	Weak
BH05	5.30	6.8	C	5.5	5.67		D	U	YES		84.7		84.7	3.5	84.7	0.5	0.6	Weak
BH05	6.80	8.3	C	7.5	7.74		D	U	YES		84.7		84.7	3.9	84.7	0.5	0.7	Weak

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P

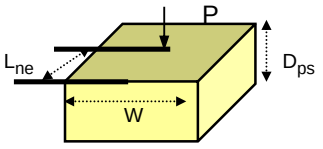
Diametral



Axial



Block/irregular lump



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Date Printed: 13/01/2021

Approved By: APPROVED By DCD at Administrator

Table 1 sheet 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IDL

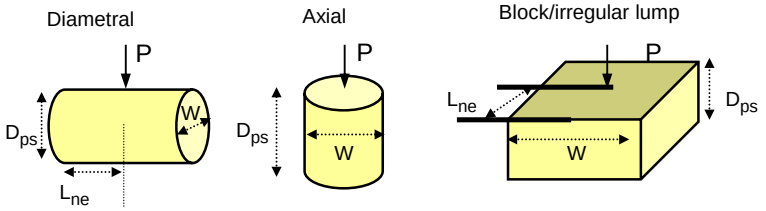
Point Load Strength Index Tests
Summary of Results

Project No.: 2020WW102

Project Name: Arklow Bank Windpark

Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Top Depth	Base Depth	Type	Top	Base		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m	m		m	m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH05	9.70	10.4	C	9.8	10.06		D	U	YES		84.7		84.7	3.8	84.7	0.5	0.7	Weak

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Date Printed: 13/01/2021

Approved By: APPROVED By DCD at Administrator

Table 1 sheet 2

IDL

UNIAXIAL COMPRESSION TEST ON ROCK - SUMMARY OF RESULTS

Project No.: 2020WW102

Project Name: Arklow Bank Windpark

Hole No.	Sample				Specimen Depth (m)	Specimen Dimensions2			Bulk Density2	Water Content 1	Uniaxial Compression3				Remarks
	Ref	Top	Base	Type		Dia. mm	Length mm	H/D	Mg/m3	%	Condition	Stress Rate MPa/s	Mode of failure	UCS MPa	
BH03		12.70	14.20	C	13.0-13.4	84.5	224.7	2.7	2.73		as received	0.0383	MS	6.5	Weak

Notes

1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as tested for UCS

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

Test Specification: International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

Date Printed: 13/01/2021

Approved By: APPROVED By DCD at Administrator

Table 1 sheet 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LTD.
Loughrea Co. Galway
Lab@IrishDrilling.ie
Tel: (091) 841274

Contract:	**Arklow Bank**	2020WW102
Client:	SSE	
Engineer:	**Arup**	
Date:	13.01.2021	
Tested by:	**DCD / RG**	

Thermal Conductivity / Resistivity Test

Using ThermTest TLS-100 Thermal Conductivity / Thermal Resistivity Meter

BS1377:Part 2:1990 and ASTM D5334-08

Location	Depth (m.bgl)	Date	Soil Temperature Before Test °C	Thermal Conductivity W/m.K	Thermal Resistivity K.m/W	Moisture Content Tested %	Bulk Density Mg.m3	Sample Description / preparation
TP03	1.1-1.2	24.11.20	17.28	0.177	5.635	33.6		mct from Tub
TP04	1.1-1.2	24.11.20	17.16	1.41	0.709	13.1		mct from Tub
TP04	1.4-1.5	25.11.20	13.118	2.02	0.495	17.9	2.065	mct from compaction point 1
TP04	1.4-1.5	26.11.20	18.225	1	1	14	1.974	mct from compaction point 2
TP04	1.4-1.5	27.11.20	11.619	1.298	0.77	8	1.829	mct from compaction point 3
TP04	1.4-1.5	30.11.20	12.303	0.945	1.058	6.7	1.762	mct from compaction point 4
TP04	1.4-1.5	01.12.20	12.662	1.783	0.561	21.3	2.094	mct from compaction point 5
TP05	1.1-1.2	24.11.20	10.39	1.145	0.873	21		mct from Tub
TP06	1.1-1.2	27.11.20	15.22	1.203	0.831	22		mct from Tub
TP06	1.4-1.5	7.12.20	13.201	1.322	0.756	32.1	1.878	mct from compaction point 1
TP06	1.4-1.5	8.12.20	18.897	1.115	0.897	11.2	1.846	mct from compaction point 2
TP06	1.4-1.5	9.12.20	16.785	0.783	1.278	14.2	1.758	mct from compaction point 3

Location	Depth (m.bgl)	Date	Soil Temperature Before Test °C	Thermal Conductivity W/m.K	Thermal Resistivity K.m/W	Moisture Content Tested %	Bulk Density Mg.m3	Sample Description / preparation
TP06	1.4-1.5	10.12.20	13.414	1.32	0.758	27.1	1.947	mct from compaction point 4
TP06	1.4-1.5	14.12.20	11.082	0.902	1.108	3.4	1.767	mct from compaction point 5
TP07	1.1-1.2	27.11.20	15.421	1.062	0.942	24		mct from Tub
TP07	0.4-0.5	02.12.20	13.062	1.566	0.638	30.7	1.883	mct from compaction point 1
TP07	0.4-0.5	03.12.20	10.17	1.116	0.896	9.4	1.756	mct from compaction point 2
TP07	0.4-0.5	07.12.20	14.282	1.153	0.867	14.1	1.788	mct from compaction point 3
TP07	0.4-0.5	08.12.20	12.961	1.206	0.829	10	1.755	mct from compaction point 4
TP07	0.4-0.5	09.12.20	13.291	1.527	0.655	26.9	1.914	mct from compaction point 5
TP08	1.1-1.2	27.11.20	15.318	0.702	1.424	26		mct from Tub
TP08	1.5-1.6	26.11.20	13.502	1.353	0.739	25.5	1.902	mct from compaction point 1
TP08	1.5-1.6	27.11.20	17.714	1.201	0.833	20.1	1.9	mct from compaction point 2
TP08	1.5-1.6	30.11.20	15.261	0.836	1.196	17.6	1.831	mct from compaction point 3
TP08	1.5-1.6	02.12.20	11.081	1.092	0.916	14.5	1.865	mct from compaction point 4
TP08	1.5-1.6	03.12.20	18.48	0.727	1.376	12.3	1.704	mct from compaction point 5
TP09	0.5-0.6	27.11.20	12.48	2.155	0.464	18.8	2.165	mct from compaction point 1
TP09	0.5-0.6	30.11.20	13.04	2.099	0.476	12.1	1.843	mct from compaction point 2
TP09	0.5-0.6	01.12.20	15.572	1.125	0.889	4.8	1.8	mct from compaction point 3
TP09	0.5-0.6	02.12.20	16.156	0.801	1.249	5	1.768	mct from compaction point 4
TP09	0.5-0.6	03.12.20	14.117	0.538	1.859	4.6	1.762	mct from compaction point 5
TP09	1.1-1.2	30.11.20	13.354	1.144	0.874	12.1		mct from tub
TP10	1.1-1.2	30.11.20	13.071	0.475	2.107	14		mct from Tub
TP10	1.4-1.5	30.11.20	13.488	1.35	0.741	20.4	2.047	mct from compaction point 1
TP10	1.4-1.5	01.12.20	22.601	0.664	1..507	7.7	1.78	mct from compaction point 2
TP10	1.4-1.5	02.12.20	16.615	0.757	1.321	6	1.741	mct from compaction point 3
TP10	1.4-1.5	03.12.20	19.022	0.347	2.883	3.8	1.721	mct from compaction point 4
TP10	1.4-1.5	04.12.20	21.917	0.501	1.995	4.7	1.762	mct from compaction point 5
TP11	1.1-1.2	30.11.20	13.684	1.37	0.73	25.1		mct from Tub

Location	Depth (m.bgl)	Date	Soil Temperature Before Test °C	Thermal Conductivity W/m.K	Thermal Resistivity K.m/W	Moisture Content Tested %	Bulk Density Mg.m3	Sample Description / preparation
TP11	1.4-1.5	27.11.20	12.022	1.655	0.604	25.6	2.009	mct from compaction point 1
TP11	1.4-1.5	30.11.20	14.687	1.572	0.636	19.4	1.76	mct from compaction point 2
TP11	1.4-1.5	01.12.20	17.155	1.178	0.849	15.3	1.748	mct from compaction point 3
TP11	1.4-1.5	02.12.20	16.934	1.111	0.9	12.7	1.761	mct from compaction point 4
TP11	1.4-1.5	03.12.20	17.57	0.584	1.712	11.9	1.778	mct from compaction point 5
TP12	1.1-1.2	30.11.20	13.413	0.877	1.141			mct from Tub
TP12	1.4-1.5	04.12.20	6.436	1.445	0.692	18.4	2.051	mct from compaction point 1
TP12	1.4-1.5	07.12.20	14.122	1.312	0.762	13.2	1.793	mct from compaction point 2
TP12	1.4-1.5	08.12.20	19.583	1.113	0.898	12.7	1.804	mct from compaction point 3
TP12	1.4-1.5	09.12.20	14.651	0.512	1.955	15.1	1.71	mct from compaction point 4
TP12	1.4-1.5	10.12.20	16.887	0.619	1.614	11.7	1.716	mct from compaction point 5

Appendix 6A Laboratory Tests Results (Environment)

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway

Attention: Dympna Darcy

CERTIFICATE OF ANALYSIS

Date of report Generation:	14 December 2020
Customer:	Irish Drilling Limited
Sample Delivery Group (SDG):	201015-115
Your Reference:	2020WW102
Location:	Arklow Bank
Report No:	579794

We received 18 samples on Thursday October 15, 2020 and 18 of these samples were scheduled for analysis which was completed on Monday December 14, 2020. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
23039439	TP007	ES1	0.40 - 0.50	13/10/2020
23039335	TP007	ES4	1.50 - 1.60	13/10/2020
23039368	TP008	ES1	0.40 - 0.50	13/10/2020
23039374	TP008	ES4	1.50 - 1.60	13/10/2020
23039379	TP009	ES1	0.50 - 0.60	13/10/2020
23039387	TP009	ES4	1.50 - 1.60	13/10/2020
23039330	TP202	ES1	0.50 - 0.60	12/10/2020
23039392	TP202	ES4	1.40 - 1.50	12/10/2020
23039401	TP203	ES1	0.50 - 0.60	12/10/2020
23039408	TP203	ES4	1.60 - 1.70	12/10/2020
23039414	TP311	ES1	0.40 - 0.50	12/10/2020
23039421	TP311	ES2	1.10 - 1.20	12/10/2020
23039427	TP311	ES4	2.10 - 2.20	12/10/2020
23039434	TP311	ES4	3.10 - 3.20	12/10/2020
23039342	TP319	ES1	0.40 - 0.50	12/10/2020
23039350	TP319	ES2	1.20 - 1.30	12/10/2020
23039356	TP319	ES3	2.30 - 2.40	12/10/2020
23039363	TP319	ES5	3.50 - 3.60	12/10/2020

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

Validated

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			23039439			23039335			23039368			23039374			23039379			23039387			23039330		
Customer Sample Reference			TP007			TP007			TP008			TP008			TP009			TP009			TP202		
AGS Reference			ES1			ES4			ES1			ES4			ES1			ES4			ES1		
Depth (m)			0.40 - 0.50			1.50 - 1.60			0.40 - 0.50			1.50 - 1.60			0.50 - 0.60			1.50 - 1.60			0.50 - 0.60		
Container			1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	
Sample Type			S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Anions by Kone (w)	All	NDPs: 0 Tests: 18	X			X			X			X			X			X			X		
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 18	X			X			X			X			X			X			X		
CEN Readings	All	NDPs: 0 Tests: 18	X			X			X			X			X			X			X		
Chromium III	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
Coronene	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 18	X			X			X			X			X			X			X		
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 18	X			X			X			X			X			X			X		
Easily Liberated Sulphide	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
EPH by GCxGC-FID	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
EPH CWG GC (S)	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
Fluoride	All	NDPs: 0 Tests: 18	X			X			X			X			X			X			X		
GRO by GC-FID (S)	All	NDPs: 0 Tests: 18			X			X			X			X			X			X			
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
Loss on Ignition in soils	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	

23039434	TP311	ES4	3.10 - 3.20	1kg TUB with Handle (ALE260)	S		X		X		X					X	X				X			
23039427	TP311	ES4	2.10 - 2.20	60g VOC (ALE215)	S																	X		
				250g Amber Jar (ALE210)	S					X		X		X				X		X		X		X		X
				1kg TUB with Handle (ALE260)	S		X		X		X					X	X				X			
23039421	TP311	ES2	1.10 - 1.20	60g VOC (ALE215)	S																	X		
				250g Amber Jar (ALE210)	S					X		X		X				X		X		X		X		X
				1kg TUB with Handle (ALE260)	S		X		X		X					X	X				X			
23039414	TP311	ES1	0.40 - 0.50	60g VOC (ALE215)	S																	X		
				250g Amber Jar (ALE210)	S					X		X		X				X		X		X		X		X
				1kg TUB with Handle (ALE260)	S		X		X		X					X	X				X			
23039408	TP203	ES4	1.60 - 1.70	60g VOC (ALE215)	S																	X		
				250g Amber Jar (ALE210)	S					X		X		X				X		X		X		X		X
				1kg TUB with Handle (ALE260)	S		X		X		X					X	X				X			
23039401	TP203	ES1	0.50 - 0.60	60g VOC (ALE215)	S																	X		
				250g Amber Jar (ALE210)	S					X		X		X				X		X		X		X		X
				1kg TUB with Handle (ALE260)	S		X		X		X					X	X				X			
23039392	TP202	ES4	1.40 - 1.50	60g VOC (ALE215)	S																	X		
				250g Amber Jar (ALE210)	S					X		X		X				X		X		X		X		X
				1kg TUB with Handle (ALE260)	S		X		X		X					X	X				X			
23039330	TP202	ES1	0.50 - 0.60	60g VOC (ALE215)	S																	X		

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
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Lab Sample No(s)			23039439			23039335			23039368			23039374			23039379			23039387			23039330		
Customer Sample Reference			TP007			TP007			TP008			TP008			TP009			TP009			TP202		
AGS Reference			ES1			ES4			ES1			ES4			ES1			ES4			ES1		
Depth (m)			0.40 - 0.50			1.50 - 1.60			0.40 - 0.50			1.50 - 1.60			0.50 - 0.60			1.50 - 1.60			0.50 - 0.60		
Container			1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	
Sample Type			S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Mercury Dissolved	All	NDPs: 0 Tests: 18	X			X			X			X			X			X			X		
Metals in solid samples by OES	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
PAH 16 & 17 Calc	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
PAH by GCMS	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
PCBs by GCMS	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
pH	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
Phenols by HPLC (W)	All	NDPs: 0 Tests: 18	X			X			X			X			X			X			X		
Sample description	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
Semi Volatile Organic Compounds	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
Total Dissolved Solids	All	NDPs: 0 Tests: 18	X			X			X			X			X			X			X		
Total Organic Carbon	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
TPH CWG GC (S)	All	NDPs: 0 Tests: 18		X			X			X			X			X			X			X	
VOC MS (S)	All	NDPs: 0 Tests: 18			X			X			X			X			X			X			

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
23039335	TP007	1.50 - 1.60	Dark Brown	Sandy Clay	Stones	Vegetation
23039439	TP007	0.40 - 0.50	Dark Brown	Clay Loam	Stones	None
23039368	TP008	0.40 - 0.50	Dark Brown	Clay Loam	Stones	None
23039374	TP008	1.50 - 1.60	Dark Brown	Clay Loam	Stones	None
23039379	TP009	0.50 - 0.60	Dark Brown	Clay Loam	Stones	None
23039387	TP009	1.50 - 1.60	Dark Brown	Sandy Loam	Stones	Vegetation
23039330	TP202	0.50 - 0.60	Dark Brown	Loamy Sand	Stones	None
23039392	TP202	1.40 - 1.50	Light Brown	Silty Clay	None	None
23039401	TP203	0.50 - 0.60	Light Brown	Sand	Stones	None
23039408	TP203	1.60 - 1.70	Dark Brown	Sandy Loam	Stones	None
23039414	TP311	0.40 - 0.50	Dark Brown	Sandy Loam	Vegetation	Stones
23039421	TP311	1.10 - 1.20	Dark Brown	Loamy Sand	Stones	Vegetation
23039427	TP311	2.10 - 2.20	Light Brown	Silty Clay	None	None
23039434	TP311	3.10 - 3.20	Grey	Silty Clay	None	None
23039342	TP319	0.40 - 0.50	Red	Loamy Sand	None	None
23039350	TP319	1.20 - 1.30	Cream	Silt Loam	Vegetation	Stones
23039356	TP319	2.30 - 2.40	Dark Brown	Silt Loam	Stones	None
23039363	TP319	3.50 - 3.60	Grey	Silt Loam	None	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009
			Depth (m)	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039439	23039335	23039368	23039374	23039379	23039387
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
Moisture Content Ratio (% of as received sample)	%	PM024		20	14	23	17	17	14
Loss on ignition	<0.7 % M	TM018		4.84	3.06	6.13	4.16	3.92	4.61
Organic Carbon, Total	<0.2 % M	TM132		0.309	<0.2	0.396	0.233	<0.2	<0.2
pH	1 pH Units M	TM133		7.29	8.46	7.43	8.48	7.41	8.25
Chromium, Hexavalent	<0.6 mg/kg #	TM151		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Cyanide, Total	<1 mg/kg M	TM153		<1	<1	<1	<1	<1	<1
Cyanide, Free	<1 mg/kg M	TM153		<1	<1	<1	<1	<1	<1
Cyanide, Complex	<1 mg/kg	TM153		<1	<1	<1	<1	<1	<1
PCB congener 28	<3 µg/kg M	TM168		<3	<3	<3	<3	<3	<3
PCB congener 52	<3 µg/kg M	TM168		<3	<3	<3	<3	<3	<3
PCB congener 101	<3 µg/kg M	TM168		<3	<3	<3	<3	<3	<3
PCB congener 118	<3 µg/kg M	TM168		<3	<3	<3	<3	<3	<3
PCB congener 138	<3 µg/kg M	TM168		<3	<3	<3	<3	<3	<3
PCB congener 153	<3 µg/kg M	TM168		<3	<3	<3	<3	<3	<3
PCB congener 180	<3 µg/kg M	TM168		<3	<3	<3	<3	<3	<3
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168		<21	<21	<21	<21	<21	<21
Sulphide, Easily liberated	<15 mg/kg ♦ M	TM180		<15	<15	<15	<15	<15	<15
Chromium, Trivalent	<0.9 mg/kg	TM181		37.2	26.9	43.3	30	36.5	27
Antimony	<0.6 mg/kg #	TM181		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Arsenic	<0.6 mg/kg M	TM181		18.5	10.6	19.9	14.7	17.1	13
Barium	<0.6 mg/kg #	TM181		58.3	63.7	74.9	76	51.6	76.7
Cadmium	<0.02 mg/kg M	TM181		<0.02	0.0955	0.0347	0.126	<0.02	0.0545
Chromium	<0.9 mg/kg M	TM181		37.2	26.9	43.3	30	36.5	27
Copper	<1.4 mg/kg M	TM181		17.9	18.3	15.7	23.2	25.8	19.9
Lead	<0.7 mg/kg M	TM181		18.8	13.8	22.3	18.4	17.1	15.2
Mercury	<0.14 mg/kg M	TM181		<0.14	<0.14	<0.14	<0.14	0.15	<0.14
Molybdenum	<0.1 mg/kg #	TM181		0.489	0.337	0.451	0.43	0.511	0.364
Nickel	<0.2 mg/kg M	TM181		28.8	33	29.7	40.2	28.5	36.3
Selenium	<1 mg/kg #	TM181		<1	<1	<1	<1	<1	<1
Zinc	<1.9 mg/kg M	TM181		62.4	56.6	57.1	69.9	70	56
PAH, Total Detected USEPA 16 + Coronene	<318 µg/kg	TM410		<318	<318	<318	<318	<318	<318
Coronene	<200 µg/kg	TM410		<200	<200	<200	<200	<200	<200

Validated

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009
			Depth (m)	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039439	23039335	23039368	23039374	23039379	23039387
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
EPH >C8-C40	<35 mg/kg	TM415		<35	<35	<35	<35	<35	<35

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP202	TP202	TP203	TP203	TP311	TP311
			Depth (m)	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70	0.40 - 0.50	1.10 - 1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039330	23039392	23039401	23039408	23039414	23039421
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES2
Moisture Content Ratio (% of as received sample)	%	PM024		9	14	12	16	6.2	12
Loss on ignition	<0.7 % M	TM018		1.99 M	2.29 M	1.48 M	2.87 M	1.62 M	4.57 M
Organic Carbon, Total	<0.2 % M	TM132		0.248 M	<0.2 M	0.303 M	<0.2 M	0.397 M	0.355 M
pH	1 pH Units M	TM133		7.45 M	7.32 M	7.05 M	6.7 M	8.4 M	6.84 M
Chromium, Hexavalent	<0.6 mg/kg #	TM151		<3 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Cyanide, Total	<1 mg/kg M	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Free	<1 mg/kg M	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Complex	<1 mg/kg	TM153		<1	<1	<1	<1	<1	<1
PCB congener 28	<3 µg/kg M	TM168		<3 M	<3 M	<3 M	<3 M	<15 M	<3 M
PCB congener 52	<3 µg/kg M	TM168		<3 M	<3 M	<3 M	<3 M	<15 M	<3 M
PCB congener 101	<3 µg/kg M	TM168		<3 M	<3 M	<3 M	<3 M	<15 M	<3 M
PCB congener 118	<3 µg/kg M	TM168		<3 M	<3 M	<3 M	<3 M	<15 M	<3 M
PCB congener 138	<3 µg/kg M	TM168		<3 M	<3 M	<3 M	<3 M	<15 M	<3 M
PCB congener 153	<3 µg/kg M	TM168		<3 M	<3 M	<3 M	<3 M	<15 M	<3 M
PCB congener 180	<3 µg/kg M	TM168		<3 M	<3 M	<3 M	<3 M	<15 M	<3 M
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168		<21	<21	<21	<21	<105	<21
Sulphide, Easily liberated	<15 mg/kg @ M	TM180		<15 @ M	<15 @ M	<15 @ M	<15 @ M	<15 @ M	55.7 @ M
Chromium, Trivalent	<0.9 mg/kg	TM181		20.2	23	10.2	26.3	3.96	12.2
Antimony	<0.6 mg/kg #	TM181		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Arsenic	<0.6 mg/kg M	TM181		12.6 M	11.1 M	5.06 M	9.19 M	23.8 M	30.6 M
Barium	<0.6 mg/kg #	TM181		29.6 #	43.3 #	17 #	64.5 #	43.4 #	42.1 #
Cadmium	<0.02 mg/kg M	TM181		0.141 M	0.0676 M	0.0496 M	0.071 M	0.426 M	0.246 M
Chromium	<0.9 mg/kg M	TM181		20.2 M	23 M	10.2 M	26.3 M	3.96 M	12.2 M
Copper	<1.4 mg/kg M	TM181		12.9 M	16.3 M	3.11 M	16 M	72.1 M	58 M
Lead	<0.7 mg/kg M	TM181		12 M	12.5 M	8.12 M	19.3 M	31.8 M	37.5 M
Mercury	<0.14 mg/kg M	TM181		<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg #	TM181		0.439 #	0.315 #	0.177 #	0.489 #	1.77 #	0.345 #
Nickel	<0.2 mg/kg M	TM181		27.8 M	24.6 M	6.52 M	21.6 M	19.4 M	39.4 M
Selenium	<1 mg/kg #	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg M	TM181		66.9 M	44.8 M	16.5 M	34.7 M	263 M	128 M
PAH, Total Detected USEPA 16 + Coronene	<318 µg/kg	TM410		<318	<318	<318	<318	<318	<318
Coronene	<200 µg/kg	TM410		<200	<200	<200	<200	<200	<200

Validated

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP202	TP202	TP203	TP203	TP311	TP311
			Depth (m)	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70	0.40 - 0.50	1.10 - 1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039330	23039392	23039401	23039408	23039414	23039421
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES2
EPH >C8-C40	<35 mg/kg	TM415		<35	<35	<35	<35	195	<35

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP311	TP311	TP319	TP319	TP319	TP319
			Depth (m)	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039427	23039434	23039342	23039350	23039356	23039363
			AGS Reference	ES4	ES4	ES1	ES2	ES3	ES5
Moisture Content Ratio (% of as received sample)	%	PM024		32	37	28	31	31	26
Loss on ignition	<0.7 %	TM018		3.7 M	11.1 M	<0.7 M	5.56 M	7.55 M	14.3 M
Organic Carbon, Total	<0.2 %	TM132		0.361 M	1.6 M	<0.2 M	0.493 M	0.376 M	0.608 M
pH	1 pH Units	TM133		6.83 M	6.3 M	6.84 M	6.37 M	5.16 M	5.33 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<3 #	<3 #	<0.6 #
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Free	<1 mg/kg	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Complex	<1 mg/kg	TM153		<1	<1	<1	<1	<1	<1
PCB congener 28	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 52	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 101	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 118	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 138	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 153	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 180	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168		<21	<21	<21	<21	<21	<21
Sulphide, Easily liberated	<15 mg/kg	TM180		<15 @ M	<15 @ M	<15 @ M	<15 @ M	<15 @ M	63.5 @ M
Chromium, Trivalent	<0.9 mg/kg	TM181		12.7	30.4	<0.9	9.45	7.57	<0.9
Antimony	<0.6 mg/kg	TM181		<0.6 #	<0.6 #	36.5 #	<0.6 #	<0.6 #	<0.6 #
Arsenic	<0.6 mg/kg	TM181		50.4 M	30.5 M	2910 M	85.1 M	74 M	97.3 M
Barium	<0.6 mg/kg	TM181		50.5 #	86.4 #	20.7 #	42.6 #	87.6 #	40.1 #
Cadmium	<0.02 mg/kg	TM181		0.133 M	0.0858 M	13.7 M	2.25 M	1.67 M	<0.02 M
Chromium	<0.9 mg/kg	TM181		12.7 M	30.4 M	<0.9 M	9.45 M	7.57 M	<0.9 M
Copper	<1.4 mg/kg	TM181		25.9 M	28.8 M	6240 M	803 M	648 M	22.9 M
Lead	<0.7 mg/kg	TM181		43.8 M	55.9 M	4760 M	100 M	56.2 M	62.7 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	2.51 M	<0.14 M	0.283 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		1.04 #	0.261 #	99.1 #	1.68 #	0.946 #	1.55 #
Nickel	<0.2 mg/kg	TM181		20.9 M	32.2 M	<0.2 M	19.8 M	23.8 M	18.2 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		95.7 M	128 M	5890 M	1500 M	1290 M	87 M
PAH, Total Detected USEPA 16 + Coronene	<318 µg/kg	TM410		<318	<318	<318	<318	<318	<318
Coronene	<200 µg/kg	TM410		<200	<200	<200	<200	<200	<200

Validated

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP311	TP311	TP319	TP319	TP319	TP319
			Depth (m)	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039427	23039434	23039342	23039350	23039356	23039363
			AGS Reference	ES4	ES4	ES1	ES2	ES3	ES5
EPH >C8-C40	<35 mg/kg	TM415		<35	43	<35	<35	<35	<35

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009
			Depth (m)	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039439	23039335	23039368	23039374	23039379	23039387
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
Naphthalene-d8 % recovery**	%	TM218		70.3	92.7	70.7	70.9	72.4	96.6
Acenaphthene-d10 % recovery**	%	TM218		70.6	83	70.2	71.2	71	86.7
Phenanthrene-d10 % recovery**	%	TM218		71.7	90.1	75.5	71.9	71.2	92.4
Chrysene-d12 % recovery**	%	TM218		82.6	90.7	92.6	81.7	83.7	92.4
Perylene-d12 % recovery**	%	TM218		81.3	85.9	87.6	78.7	80.3	83.9
Naphthalene	<9 µg/kg	TM218		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Acenaphthylene	<12 µg/kg	TM218		<12 M	<12 M	<12 M	<12 M	<12 M	<12 M
Acenaphthene	<8 µg/kg	TM218		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
Fluorene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Phenanthrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Anthracene	<16 µg/kg	TM218		<16 M	<16 M	<16 M	<16 M	<16 M	<16 M
Fluoranthene	<17 µg/kg	TM218		<17 M	<17 M	<17 M	<17 M	<17 M	<17 M
Pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benz(a)anthracene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Chrysene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Benzo(a)pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		<18 M	<18 M	<18 M	<18 M	<18 M	<18 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	<23 M	<23 M	<23 M	<23 M	<23 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		<24 M	<24 M	<24 M	<24 M	<24 M	<24 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		<118	<118	<118	<118	<118	<118

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP202	TP202	TP203	TP203	TP311	TP311
			Depth (m)	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70	0.40 - 0.50	1.10 - 1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039330	23039392	23039401	23039408	23039414	23039421
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES2
Naphthalene-d8 % recovery**	%	TM218		71.7	95.1	72.8	72.4	93.2	72.2
Acenaphthene-d10 % recovery**	%	TM218		70.2	85.9	71.2	70.8	84.7	70.4
Phenanthrene-d10 % recovery**	%	TM218		73.3	93.2	73.8	77.5	92.8	77.1
Chrysene-d12 % recovery**	%	TM218		85.5	95.3	84.3	95.7	102	93.6
Perylene-d12 % recovery**	%	TM218		86.6	87	84	91.1	93.3	89.5
Naphthalene	<9 µg/kg	TM218		<9 M	<9 M	<9 M	<9 M	<45 M	<9 M
Acenaphthylene	<12 µg/kg	TM218		<12 M	<12 M	<12 M	<12 M	<60 M	<12 M
Acenaphthene	<8 µg/kg	TM218		<8 M	<8 M	<8 M	<8 M	<40 M	<8 M
Fluorene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<50 M	<10 M
Phenanthrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<75 M	<15 M
Anthracene	<16 µg/kg	TM218		<16 M	<16 M	<16 M	<16 M	<80 M	<16 M
Fluoranthene	<17 µg/kg	TM218		<17 M	<17 M	<17 M	<17 M	<85 M	<17 M
Pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<75 M	<15 M
Benz(a)anthracene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<70 M	<14 M
Chrysene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<50 M	<10 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<75 M	<15 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<70 M	<14 M
Benzo(a)pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<75 M	<15 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		<18 M	<18 M	<18 M	<18 M	<90 M	<18 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	<23 M	<23 M	<23 M	<115 M	<23 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		<24 M	<24 M	<24 M	<24 M	<120 M	<24 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		<118	<118	<118	<118	<590	<118

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP311	TP311	TP319	TP319	TP319	TP319
			Depth (m)	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039427	23039434	23039342	23039350	23039356	23039363
			AGS Reference	ES4	ES4	ES1	ES2	ES3	ES5
Naphthalene-d8 % recovery**	%	TM218		96.2	94.8	71.7	72.7	72.5	72.1
Acenaphthene-d10 % recovery**	%	TM218		88.3	88.3	70.5	71.9	71.2	70.3
Phenanthrene-d10 % recovery**	%	TM218		94.1	95.8	75.7	79	74.7	81.7
Chrysene-d12 % recovery**	%	TM218		98.1	97.4	90.8	97.3	88.2	92.7
Perylene-d12 % recovery**	%	TM218		86.8	86.8	85.1	95.7	88.8	89.3
Naphthalene	<9 µg/kg	TM218		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Acenaphthylene	<12 µg/kg	TM218		<12 M	<12 M	<12 M	<12 M	<12 M	<12 M
Acenaphthene	<8 µg/kg	TM218		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
Fluorene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Phenanthrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Anthracene	<16 µg/kg	TM218		<16 M	<16 M	<16 M	<16 M	<16 M	<16 M
Fluoranthene	<17 µg/kg	TM218		<17 M	<17 M	<17 M	<17 M	<17 M	<17 M
Pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benz(a)anthracene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Chrysene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Benzo(a)pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		<18 M	<18 M	<18 M	<18 M	<18 M	<18 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	<23 M	<23 M	<23 M	<23 M	<23 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		<24 M	<24 M	<24 M	<24 M	<24 M	<24 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		<118	<118	<118	<118	<118	<118

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009
			Depth (m)	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039439	23039335	23039368	23039374	23039379	23039387
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
Phenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pentachlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Nitrobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Isophorone	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachloroethane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorocyclopentadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorobutadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dioctyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dimethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Diethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dibutyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzofuran	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Carbazole	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Butylbenzyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethyl)ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Azobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitrophenol	<100 µg/kg	TM157		<500	<100	<500	<500	<500	<100
4-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chlorophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Bromophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
3-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2,4-Trichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009
			Depth (m)	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039439	23039335	23039368	23039374	23039379	23039387
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
2-Chlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylnaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(b)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(k)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(g,h,i)perylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Chrysene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluorene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Phenanthrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Naphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
TIC report		TM157		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Total SVOC TIC	<100 µg/kg	TM157		<1000	<1000	<1000	<1000	<1000	<1000

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP202	TP202	TP203	TP203	TP311	TP311
			Depth (m)	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70	0.40 - 0.50	1.10 - 1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039330	23039392	23039401	23039408	23039414	23039421
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES2
Phenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Pentachlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Nitrobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Isophorone	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Hexachloroethane	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Hexachlorocyclopentadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Hexachlorobutadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Hexachlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
n-Dioctyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Dimethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Diethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
n-Dibutyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Dibenzofuran	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Carbazole	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Butylbenzyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
bis(2-Chloroethyl)ether	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Azobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
4-Nitrophenol	<100 µg/kg	TM157		<500	<100	<100	<500	<200	<500
4-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
4-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
4-Chlorophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
4-Chloroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
4-Chloro-3-methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
4-Bromophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
3-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
1,2,4-Trichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP202	TP202	TP203	TP203	TP311	TP311
			Depth (m)	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70	0.40 - 0.50	1.10 - 1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039330	23039392	23039401	23039408	23039414	23039421
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES2
2-Chlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
2-Methylnaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Acenaphthylene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Acenaphthene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Benzo(a)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Benzo(b)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Benzo(k)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Benzo(a)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Benzo(g,h,i)perylene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Chrysene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Fluoranthene	<100 µg/kg	TM157		<100	123	<100	<100	<200	<100
Fluorene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Phenanthrene	<100 µg/kg	TM157		<100	185	<100	<100	<200	<100
Pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Naphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157		<100	<100	<100	<100	<200	<100
TIC report		TM157		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Total SVOC TIC	<100 µg/kg	TM157		<1000	<1000	<1000	<1000	<2000	<1000

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP311	TP311	TP319	TP319	TP319	TP319
			Depth (m)	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039427	23039434	23039342	23039350	23039356	23039363
			AGS Reference	ES4	ES4	ES1	ES2	ES3	ES5
Phenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pentachlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Nitrobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Isophorone	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachloroethane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorocyclopentadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorobutadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dioctyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dimethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Diethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dibutyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzofuran	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Carbazole	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Butylbenzyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethyl)ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Azobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitrophenol	<100 µg/kg	TM157		<100	<100	<500	<500	<500	<500
4-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chlorophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Bromophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
3-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2,4-Trichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP311	TP311	TP319	TP319	TP319	TP319
			Depth (m)	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039427	23039434	23039342	23039350	23039356	23039363
			AGS Reference	ES4	ES4	ES1	ES2	ES3	ES5
2-Chlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylnaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(b)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(k)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(g,h,i)perylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Chrysene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluorene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Phenanthrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Naphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
TIC report		TM157		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Total SVOC TIC	<100 µg/kg	TM157		<1000	<1000	<1000	<1000	<1000	<1000

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009
			Depth (m)	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039439	23039335	23039368	23039374	23039379	23039387
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
GRO Surrogate % recovery**	%	TM089		89.3	92.1	104	98.1	104	91.8
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C10-C12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C12-C16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C16-C21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C21-C35	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C35-C44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Total Aliphatics >C10-C44	<5000 µg/kg	TM414		<5000	<5000	<5000	<5000	<5000	<5000
Total Aliphatics & Aromatics >C10-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	<10000	<10000	<10000
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics > EC10-EC12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC12-EC16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC16-EC21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC21-EC35	<1000 µg/kg	TM414		<1000	1280	<1000	<1000	<1000	3390
Aromatics >EC35-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC40-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Total Aromatics > EC10-EC44	<5000 µg/kg	TM414		<5000	<5000	<5000	<5000	<5000	<5000
Total Aliphatics & Aromatics >C5-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	<10000	<10000	<10000
Total Aliphatics >C5-C10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
Total Aromatics >EC5-EC10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
GRO >C5-C10	<20 µg/kg	TM089		<20	<20	<20	<20	<20	<20

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP202	TP202	TP203	TP203	TP311	TP311
			Depth (m)	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70	0.40 - 0.50	1.10 - 1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039330	23039392	23039401	23039408	23039414	23039421
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES2
GRO Surrogate % recovery**	%	TM089		93.6	93.2	90	105	91.1	105
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C10-C12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C12-C16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	2270	<1000
Aliphatics >C16-C21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	26800	1840
Aliphatics >C21-C35	<1000 µg/kg	TM414		<1000	<1000	2340	<1000	101000	2540
Aliphatics >C35-C44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	26500	<1000
Total Aliphatics >C10-C44	<5000 µg/kg	TM414		<5000	<5000	<5000	<5000	156000	<5000
Total Aliphatics & Aromatics >C10-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	<10000	211000	13900
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics > EC10-EC12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC12-EC16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC16-EC21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC21-EC35	<1000 µg/kg	TM414		<1000	<1000	5230	<1000	50200	8240
Aromatics >EC35-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	3700	<1000
Aromatics > EC40-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	2270	<1000
Total Aromatics > EC10-EC44	<5000 µg/kg	TM414		<5000	<5000	6570	<5000	54100	9400
Total Aliphatics & Aromatics >C5-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	<10000	211000	<10000
Total Aliphatics >C5-C10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
Total Aromatics >EC5-EC10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
GRO >C5-C10	<20 µg/kg	TM089		<20	<20	<20	<20	<20	<20

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP311	TP311	TP319	TP319	TP319	TP319
			Depth (m)	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039427	23039434	23039342	23039350	23039356	23039363
			AGS Reference	ES4	ES4	ES1	ES2	ES3	ES5
GRO Surrogate % recovery**	%	TM089		95.4	80.6	80.4	90.2	74.2	91.8
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	13.9	<10	<10	<10
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	26.4	<10	<10	<10
Aliphatics >C10-C12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C12-C16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C16-C21	<1000 µg/kg	TM414		<1000	1020	<1000	<1000	<1000	<1000
Aliphatics >C21-C35	<1000 µg/kg	TM414		<1000	34000	<1000	<1000	<1000	5530
Aliphatics >C35-C44	<1000 µg/kg	TM414		<1000	3580	<1000	<1000	<1000	<1000
Total Aliphatics >C10-C44	<5000 µg/kg	TM414		<5000	39200	<5000	<5000	<5000	6070
Total Aliphatics & Aromatics >C10-C44	<10000 µg/kg	TM414		<10000	68400	<10000	<10000	<10000	15000
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	16.7	<10	<10	<10
Aromatics > EC10-EC12	<1000 µg/kg	TM414		<1000	1380	<1000	<1000	<1000	<1000
Aromatics > EC12-EC16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC16-EC21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC21-EC35	<1000 µg/kg	TM414		<1000	17400	<1000	2560	<1000	7670
Aromatics >EC35-EC44	<1000 µg/kg	TM414		<1000	9850	<1000	<1000	<1000	1110
Aromatics > EC40-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Total Aromatics > EC10-EC44	<5000 µg/kg	TM414		<5000	29200	<5000	<5000	<5000	8890
Total Aliphatics & Aromatics >C5-C44	<10000 µg/kg	TM414		<10000	68400	<10000	<10000	<10000	15000
Total Aliphatics >C5-C10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
Total Aromatics >EC5-EC10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
GRO >C5-C10	<20 µg/kg	TM089		<20	<20	<20	<20	<20	<20

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009
			Depth (m)	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039439	23039335	23039368	23039374	23039379	23039387
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
Dibromofluoromethane**	%	TM116		109	111	106	102	116	107
Toluene-d8**	%	TM116		98.9	101	100	97	98.7	99.6
4-Bromofluorobenzene**	%	TM116		86.6	86	93.1	82.3	97.6	86.4
Dichlorodifluoromethane	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
Chloromethane	<7 µg/kg	TM116		<7 #	<7 #	<7 #	<7 #	<7 #	<7 #
Vinyl Chloride	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
Bromomethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Chloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Trichlorofluorormethane	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
1,1-Dichloroethene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Carbon Disulphide	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
Dichloromethane	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
trans-1,2-Dichloroethene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,1-Dichloroethane	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
cis-1,2-Dichloroethene	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
2,2-Dichloropropane	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<10
Bromochloromethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Chloroform	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
1,1,1-Trichloroethane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
1,1-Dichloropropene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Carbontetrachloride	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,2-Dichloroethane	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
Benzene	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Trichloroethene	<9 µg/kg	TM116		<9 #	<9 #	<9 #	<9 #	<9 #	<9 #
1,2-Dichloropropane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Dibromomethane	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Bromodichloromethane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
cis-1,3-Dichloropropene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Toluene	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
trans-1,3-Dichloropropene	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<10
1,1,2-Trichloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009
			Depth (m)	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039439	23039335	23039368	23039374	23039379	23039387
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
1,3-Dichloropropane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
Tetrachloroethene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
Dibromochloromethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,2-Dibromoethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Chlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Ethylbenzene	<4 µg/kg	TM116		<4 M	<4 M	<4 M	<4 M	<4 M	<4 M
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
o-Xylene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Styrene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Bromoform	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Isopropylbenzene	<5 µg/kg	TM116		<5 #	<5 #	<5 #	<5 #	<5 #	<5 #
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
1,2,3-Trichloropropane	<16 µg/kg	TM116		<16 M	<16 M	<16 M	<16 M	<16 M	<16 M
Bromobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Propylbenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
2-Chlorotoluene	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
1,3,5-Trimethylbenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
4-Chlorotoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
tert-Butylbenzene	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
1,2,4-Trimethylbenzene	<9 µg/kg	TM116		<9 #	<9 #	<9 #	<9 #	<9 #	<9 #
sec-Butylbenzene	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<10
4-Isopropyltoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,3-Dichlorobenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
1,4-Dichlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
n-Butylbenzene	<11 µg/kg	TM116		<11	<11	<11	<11	<11	<11
1,2-Dichlorobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Tert-amyl methyl ether	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
1,2,4-Trichlorobenzene	<20 µg/kg	TM116		<20	<20	<20	<20	<20	<20
Hexachlorobutadiene	<20 µg/kg	TM116		<20	<20	<20	<20	<20	<20
Naphthalene	<13 µg/kg	TM116		<13 M	<13 M	<13 M	<13 M	<13 M	<13 M

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009
			Depth (m)	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039439	23039335	23039368	23039374	23039379	23039387
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
1,2,3-Trichlorobenzene	<20 µg/kg	TM116		<20 #	<20 #	<20 #	<20 #	<20 #	<20 #
VOC TIC		TM116		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Sum of Detected Xylenes	<0.02 mg/kg	TM116		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Sum of BTEX	<40 µg/kg	TM116		<40	<40	<40	<40	<40	<40
Total VOC TIC	<50 µg/kg	TM116		<50	<50	<50	<50	<50	<50

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP202	TP202	TP203	TP203	TP311	TP311
			Depth (m)	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70	0.40 - 0.50	1.10 - 1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039330	23039392	23039401	23039408	23039414	23039421
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES2
Dibromofluoromethane**	%	TM116		106	117	101	112	106	125
Toluene-d8**	%	TM116		99.8	101	97.4	99.4	94	100
4-Bromofluorobenzene**	%	TM116		93.6	95.2	80.2	90.6	76.9	89.1
Dichlorodifluoromethane	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
Chloromethane	<7 µg/kg	TM116		<7 #	<7 #	<7 #	<7 #	<7 #	<7 #
Vinyl Chloride	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
Bromomethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Chloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Trichlorofluorormethane	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
1,1-Dichloroethene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Carbon Disulphide	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
Dichloromethane	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
trans-1,2-Dichloroethene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,1-Dichloroethane	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
cis-1,2-Dichloroethene	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
2,2-Dichloropropane	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<10
Bromochloromethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Chloroform	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
1,1,1-Trichloroethane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
1,1-Dichloropropene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Carbontetrachloride	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,2-Dichloroethane	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
Benzene	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Trichloroethene	<9 µg/kg	TM116		<9 #	<9 #	<9 #	<9 #	<9 #	<9 #
1,2-Dichloropropane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Dibromomethane	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Bromodichloromethane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
cis-1,3-Dichloropropene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Toluene	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
trans-1,3-Dichloropropene	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<10
1,1,2-Trichloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP202	TP202	TP203	TP203	TP311	TP311
			Depth (m)	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70	0.40 - 0.50	1.10 - 1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039330	23039392	23039401	23039408	23039414	23039421
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES2
1,3-Dichloropropane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
Tetrachloroethene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
Dibromochloromethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,2-Dibromoethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Chlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Ethylbenzene	<4 µg/kg	TM116		<4 M	<4 M	<4 M	<4 M	<4 M	<4 M
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
o-Xylene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Styrene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Bromoform	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Isopropylbenzene	<5 µg/kg	TM116		<5 #	<5 #	<5 #	<5 #	<5 #	<5 #
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
1,2,3-Trichloropropane	<16 µg/kg	TM116		<16 M	<16 M	<16 M	<16 M	<16 M	<16 M
Bromobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Propylbenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
2-Chlorotoluene	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
1,3,5-Trimethylbenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
4-Chlorotoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
tert-Butylbenzene	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
1,2,4-Trimethylbenzene	<9 µg/kg	TM116		<9 #	<9 #	<9 #	<9 #	<9 #	<9 #
sec-Butylbenzene	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<10
4-Isopropyltoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,3-Dichlorobenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
1,4-Dichlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
n-Butylbenzene	<11 µg/kg	TM116		<11	<11	<11	<11	<11	<11
1,2-Dichlorobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Tert-amyl methyl ether	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
1,2,4-Trichlorobenzene	<20 µg/kg	TM116		<20	<20	<20	<20	<20	<20
Hexachlorobutadiene	<20 µg/kg	TM116		<20	<20	<20	<20	<20	<20
Naphthalene	<13 µg/kg	TM116		<13 M	<13 M	<13 M	<13 M	<13 M	<13 M

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP202	TP202	TP203	TP203	TP311	TP311
			Depth (m)	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70	0.40 - 0.50	1.10 - 1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039330	23039392	23039401	23039408	23039414	23039421
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES2
1,2,3-Trichlorobenzene	<20 µg/kg	TM116		<20 #	<20 #	<20 #	<20 #	<20 #	<20 #
VOC TIC		TM116		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Sum of Detected Xylenes	<0.02 mg/kg	TM116		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Sum of BTEX	<40 µg/kg	TM116		<40	<40	<40	<40	<40	<40
Total VOC TIC	<50 µg/kg	TM116		<50	<50	<50	<50	<50	<50

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP311	TP311	TP319	TP319	TP319	TP319
			Depth (m)	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039427	23039434	23039342	23039350	23039356	23039363
			AGS Reference	ES4	ES4	ES1	ES2	ES3	ES5
Dibromofluoromethane**	%	TM116		117	115	108	113	105	109
Toluene-d8**	%	TM116		102	101	101	101	99.9	97.6
4-Bromofluorobenzene**	%	TM116		97.6	92.6	91.9	90.2	90.6	80.4
Dichlorodifluoromethane	<6 µg/kg	TM116		<6 M	<60 M	<6 M	<6 M	<6 M	<6 M
Chloromethane	<7 µg/kg	TM116		<7 #	<70 #	<7 #	<7 #	<7 #	<7 #
Vinyl Chloride	<6 µg/kg	TM116		<6 M	<60 M	<6 M	<6 M	<6 M	<6 M
Bromomethane	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Chloroethane	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Trichlorofluorormethane	<6 µg/kg	TM116		<6 M	<60 M	<6 M	<6 M	<6 M	<6 M
1,1-Dichloroethene	<10 µg/kg	TM116		<10 #	<100 #	<10 #	<10 #	<10 #	<10 #
Carbon Disulphide	<7 µg/kg	TM116		<7 M	<70 M	<7 M	<7 M	<7 M	<7 M
Dichloromethane	<10 µg/kg	TM116		<10 #	<100 #	<10 #	<10 #	<10 #	<10 #
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
trans-1,2-Dichloroethene	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
1,1-Dichloroethane	<8 µg/kg	TM116		<8 M	<80 M	<8 M	<8 M	<8 M	<8 M
cis-1,2-Dichloroethene	<6 µg/kg	TM116		<6 M	<60 M	<6 M	<6 M	<6 M	<6 M
2,2-Dichloropropane	<10 µg/kg	TM116		<10	<100	<10	<10	<10	<10
Bromochloromethane	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Chloroform	<8 µg/kg	TM116		<8 M	<80 M	<8 M	<8 M	<8 M	<8 M
1,1,1-Trichloroethane	<7 µg/kg	TM116		<7 M	<70 M	<7 M	<7 M	<7 M	<7 M
1,1-Dichloropropene	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Carbontetrachloride	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
1,2-Dichloroethane	<5 µg/kg	TM116		<5 M	<50 M	<5 M	<5 M	<5 M	<5 M
Benzene	<9 µg/kg	TM116		<9 M	<90 M	<9 M	<9 M	<9 M	<9 M
Trichloroethene	<9 µg/kg	TM116		<9 #	<90 #	<9 #	<9 #	<9 #	<9 #
1,2-Dichloropropane	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Dibromomethane	<9 µg/kg	TM116		<9 M	<90 M	<9 M	<9 M	<9 M	<9 M
Bromodichloromethane	<7 µg/kg	TM116		<7 M	<70 M	<7 M	<7 M	<7 M	<7 M
cis-1,3-Dichloropropene	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Toluene	<7 µg/kg	TM116		<7 M	<70 M	<7 M	<7 M	<7 M	<7 M
trans-1,3-Dichloropropene	<10 µg/kg	TM116		<10	<100	<10	<10	<10	<10
1,1,2-Trichloroethane	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP311	TP311	TP319	TP319	TP319	TP319
			Depth (m)	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039427	23039434	23039342	23039350	23039356	23039363
			AGS Reference	ES4	ES4	ES1	ES2	ES3	ES5
1,3-Dichloropropane	<7 µg/kg	TM116		<7 M	<70 M	<7 M	<7 M	<7 M	<7 M
Tetrachloroethene	<5 µg/kg	TM116		<5 M	<50 M	<5 M	<5 M	<5 M	<5 M
Dibromochloromethane	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
1,2-Dibromoethane	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Chlorobenzene	<5 µg/kg	TM116		<5 M	<50 M	<5 M	<5 M	<5 M	<5 M
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Ethylbenzene	<4 µg/kg	TM116		<4 M	<40 M	<4 M	<4 M	<4 M	<4 M
p/m-Xylene	<10 µg/kg	TM116		<10 #	<100 #	<10 #	<10 #	<10 #	<10 #
o-Xylene	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Styrene	<10 µg/kg	TM116		<10 #	<100 #	<10 #	<10 #	<10 #	<10 #
Bromoform	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Isopropylbenzene	<5 µg/kg	TM116		<5 #	<50 #	<5 #	<5 #	<5 #	<5 #
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116		<10 #	<100 #	<10 #	<10 #	<10 #	<10 #
1,2,3-Trichloropropane	<16 µg/kg	TM116		<16 M	<160 M	<16 M	<16 M	<16 M	<16 M
Bromobenzene	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
Propylbenzene	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
2-Chlorotoluene	<9 µg/kg	TM116		<9 M	<90 M	<9 M	<9 M	<9 M	<9 M
1,3,5-Trimethylbenzene	<8 µg/kg	TM116		<8 M	<80 M	<8 M	<8 M	<8 M	<8 M
4-Chlorotoluene	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
tert-Butylbenzene	<14 µg/kg	TM116		<14 M	<140 M	<14 M	<14 M	<14 M	<14 M
1,2,4-Trimethylbenzene	<9 µg/kg	TM116		<9 #	<90 #	<9 #	<9 #	<9 #	<9 #
sec-Butylbenzene	<10 µg/kg	TM116		<10	<100	<10	<10	<10	<10
4-Isopropyltoluene	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
1,3-Dichlorobenzene	<8 µg/kg	TM116		<8 M	<80 M	<8 M	<8 M	<8 M	<8 M
1,4-Dichlorobenzene	<5 µg/kg	TM116		<5 M	<50 M	<5 M	<5 M	<5 M	<5 M
n-Butylbenzene	<11 µg/kg	TM116		<11	<110	<11	<11	<11	<11
1,2-Dichlorobenzene	<10 µg/kg	TM116		<10 M	<100 M	<10 M	<10 M	<10 M	<10 M
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116		<14 M	<140 M	<14 M	<14 M	<14 M	<14 M
Tert-amyl methyl ether	<10 µg/kg	TM116		<10 #	<100 #	<10 #	<10 #	<10 #	<10 #
1,2,4-Trichlorobenzene	<20 µg/kg	TM116		<20	<200	<20	<20	<20	<20
Hexachlorobutadiene	<20 µg/kg	TM116		<20	<200	<20	<20	<20	<20
Naphthalene	<13 µg/kg	TM116		<13 M	<130 M	<13 M	<13 M	<13 M	<13 M

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP311	TP311	TP319	TP319	TP319	TP319
			Depth (m)	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020	12/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			SDG Ref	201015-115	201015-115	201015-115	201015-115	201015-115	201015-115
			Lab Sample No.(s)	23039427	23039434	23039342	23039350	23039356	23039363
			AGS Reference	ES4	ES4	ES1	ES2	ES3	ES5
1,2,3-Trichlorobenzene	<20 µg/kg	TM116		<20 #	<200 #	<20 #	<20 #	<20 #	<20 #
VOC TIC		TM116		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Sum of Detected Xylenes	<0.02 mg/kg	TM116		<0.02	<0.2	<0.02	<0.02	<0.02	<0.02
Sum of BTEX	<40 µg/kg	TM116		<40	<400	<40	<40	<40	<40
Total VOC TIC	<50 µg/kg	TM116		<50	<500	<50	<50	<50	<50

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Asbestos Identification - Solid Samples

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
*	Subcontracted test.
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP007ES1 0.40 - 0.50 SOLID 13/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039439 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP007ES4 1.50 - 1.60 SOLID 13/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039335 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP008ES1 0.40 - 0.50 SOLID 13/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039368 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP008ES4 1.50 - 1.60 SOLID 13/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039374 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP009ES1 0.50 - 0.60 SOLID 13/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039379 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP009ES4 1.50 - 1.60 SOLID 13/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039387 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP202ES1 0.50 - 0.60 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039330 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP202ES4 1.40 - 1.50 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039392 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP203ES1 0.50 - 0.60 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039401 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP203ES4 1.60 - 1.70 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039408 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP311ES1 0.40 - 0.50 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039414 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP311ES2 1.10 - 1.20 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039421 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP311ES4 2.10 - 2.20 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039427 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP311ES4 3.10 - 3.20 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039434 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP319ES1 0.40 - 0.50 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039342 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP319ES2 1.20 - 1.30 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039350 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP319ES3 2.30 - 2.40 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039356 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

Validated

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP319ES5 3.50 - 3.60 SOLID 12/10/2020 00:00:00 15/10/2020 09:00:00 201015-115 23039363 TM048	25/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.101	**Natural Moisture Content (%)**	11.9
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	89.3
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039330
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP202 ES1
Depth (m)	0.50 - 0.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	4.43	<3	44.3	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	0.0000491	<0.00001	0.000491	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00432	<0.0005	0.0432	<0.005	-	-	-
Barium	0.0132	<0.0002	0.132	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00786	<0.001	0.0786	<0.01	-	-	-
Copper	0.0071	<0.0003	0.071	<0.003	-	-	-
Lead	0.00463	<0.0002	0.0463	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.00434	<0.0004	0.0434	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0158	<0.001	0.158	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	18.2	<5	182	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	8.65
Conductivity (µS/cm)	18.90
Temperature (°C)	19.20
Volume Leachant (Litres)	0.889

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.105	**Natural Moisture Content (%)**	16.3
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	86
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039335
Sampled Date	13-Oct-2020
Customer Sample Ref.	TP007 ES4
Depth (m)	1.50 - 1.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	0.724	<0.5	7.24	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.000516	<0.0005	0.00516	<0.005	-	-	-
Barium	0.368	<0.0002	3.68	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00163	<0.001	0.0163	<0.01	-	-	-
Copper	0.00159	<0.0003	0.0159	<0.003	-	-	-
Lead	0.000248	<0.0002	0.00248	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.000542	<0.0004	0.00542	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0191	<0.001	0.191	<0.01	-	-	-
Chloride	3.4	<2	34	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	87.9	<5	879	<50	-	-	-

Leach Test Information

Date Prepared	24-Oct-2020
pH (pH Units)	8.70
Conductivity (µS/cm)	109.00
Temperature (°C)	15.10
Volume Leachant (Litres)	0.885

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.122	**Natural Moisture Content (%)**	35.8
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	73.6
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039342
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP319 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	0.0000322	<0.00001	0.000322	<0.0001	-	-	-
Antimony	0.00214	<0.001	0.0214	<0.01	-	-	-
Arsenic	0.323	<0.00253	3.23	<0.0253	-	-	-
Barium	0.00215	<0.0002	0.0215	<0.002	-	-	-
Cadmium	0.000922	<0.00008	0.00922	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.00509	<0.0003	0.0509	<0.003	-	-	-
Lead	0.000977	<0.0002	0.00977	<0.002	-	-	-
Molybdenum	0.18	<0.003	1.8	<0.03	-	-	-
Nickel	0.000948	<0.0004	0.00948	<0.004	-	-	-
Selenium	0.00198	<0.001	0.0198	<0.01	-	-	-
Zinc	0.168	<0.001	1.68	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	39	<2	390	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	82.9	<5	829	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	8.53
Conductivity (µS/cm)	104.00
Temperature (°C)	20.00
Volume Leachant (Litres)	0.868

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.125	**Natural Moisture Content (%)**	39.2
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	71.8
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039350
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP319 ES2
Depth (m)	1.20 - 1.30

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	7.04	<3	70.4	<30	-	-	-
Fluoride	0.733	<0.5	7.33	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00498	<0.0005	0.0498	<0.005	-	-	-
Barium	0.0264	<0.0002	0.264	<0.002	-	-	-
Cadmium	0.0021	<0.00008	0.021	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.0181	<0.0003	0.181	<0.003	-	-	-
Lead	0.000269	<0.0002	0.00269	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.000997	<0.0004	0.00997	<0.004	-	-	-
Selenium	0.00278	<0.001	0.0278	<0.01	-	-	-
Zinc	0.43	<0.001	4.3	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	66.5	<2	665	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	137	<5	1370	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	7.75
Conductivity (µS/cm)	178.00
Temperature (°C)	19.30
Volume Leachant (Litres)	0.865

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.137	**Natural Moisture Content (%)**	50.8
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	66.3
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039356
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP319 ES3
Depth (m)	2.30 - 2.40

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	2.3	<0.5	23	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.0246	<0.0002	0.246	<0.002	-	-	-
Cadmium	0.0327	<0.00008	0.327	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.284	<0.0003	2.84	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.0137	<0.0004	0.137	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	12.6	<0.00394	126	<0.0394	-	-	-
Chloride	2.2	<2	22	<20	-	-	-
Sulphate (soluble)	150	<2	1500	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	247	<5	2470	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	7.42
Conductivity (µS/cm)	307.00
Temperature (°C)	17.80
Volume Leachant (Litres)	0.854

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.131	**Natural Moisture Content (%)**	45.5
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	68.7
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039363
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP319 ES5
Depth (m)	3.50 - 3.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	7.11	<3	71.1	<30	-	-	-
Fluoride	8.47	<2.5	84.7	<25	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.133	<0.00154	1.33	<0.0154	-	-	-
Barium	0.383	<0.0002	3.83	<0.002	-	-	-
Cadmium	0.0000856	<0.00008	0.000856	<0.0008	-	-	-
Chromium	0.00457	<0.001	0.0457	<0.01	-	-	-
Copper	0.00708	<0.0003	0.0708	<0.003	-	-	-
Lead	0.0112	<0.0002	0.112	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.00244	<0.0004	0.0244	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.306	<0.001	3.06	<0.01	-	-	-
Chloride	4.5	<2	45	<20	-	-	-
Sulphate (soluble)	95.8	<2	958	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	164	<5	1640	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	5.61
Conductivity (µS/cm)	223.00
Temperature (°C)	20.50
Volume Leachant (Litres)	0.860

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.122	**Natural Moisture Content (%)**	35.7
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	73.7
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039368
Sampled Date	13-Oct-2020
Customer Sample Ref.	TP008 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	3.1	<3	31	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	0.000012	<0.00001	0.00012	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.000967	<0.0005	0.00967	<0.005	-	-	-
Barium	0.367	<0.0002	3.67	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00429	<0.001	0.0429	<0.01	-	-	-
Copper	0.00194	<0.0003	0.0194	<0.003	-	-	-
Lead	0.00407	<0.0002	0.0407	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.000564	<0.0004	0.00564	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.135	<0.001	1.35	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	2.9	<2	29	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	27.9	<5	279	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	7.84
Conductivity (µS/cm)	34.10
Temperature (°C)	16.70
Volume Leachant (Litres)	0.868

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.111	**Natural Moisture Content (%)**	23.7
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	80.8
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039374
Sampled Date	13-Oct-2020
Customer Sample Ref.	TP008 ES4
Depth (m)	1.50 - 1.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	0.608	<0.5	6.08	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.00377	<0.0002	0.0377	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.00087	<0.0003	0.0087	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00297	<0.001	0.0297	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	80.9	<5	809	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	8.52
Conductivity (µS/cm)	99.50
Temperature (°C)	18.30
Volume Leachant (Litres)	0.879

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.110	**Natural Moisture Content (%)**	21.3
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	82.5
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039379
Sampled Date	13-Oct-2020
Customer Sample Ref.	TP009 ES1
Depth (m)	0.50 - 0.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00104	<0.0005	0.0104	<0.005	-	-	-
Barium	0.379	<0.0002	3.79	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00339	<0.001	0.0339	<0.01	-	-	-
Copper	0.00196	<0.0003	0.0196	<0.003	-	-	-
Lead	0.00351	<0.0002	0.0351	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.000712	<0.0004	0.00712	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.114	<0.001	1.14	<0.01	-	-	-
Chloride	2.6	<2	26	<20	-	-	-
Sulphate (soluble)	2.6	<2	26	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	49.7	<5	497	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	8.21
Conductivity (µS/cm)	33.10
Temperature (°C)	2.80
Volume Leachant (Litres)	0.880

Mcerts Certification does not apply to leachates

14/12/2020 15:31:58

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.108	**Natural Moisture Content (%)**	20.9
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	82.7
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039387
Sampled Date	13-Oct-2020
Customer Sample Ref.	TP009 ES4
Depth (m)	1.50 - 1.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	0.678	<0.5	6.78	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.00618	<0.0002	0.0618	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000907	<0.0003	0.00907	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00678	<0.001	0.0678	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	75.6	<5	756	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	8.59
Conductivity (µS/cm)	94.20
Temperature (°C)	17.70
Volume Leachant (Litres)	0.882

Mcerts Certification does not apply to leachates

14/12/2020 15:31:58

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.106	**Natural Moisture Content (%)**	17.3
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	85.2
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039392
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP202 ES4
Depth (m)	1.40 - 1.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.000909	<0.0005	0.00909	<0.005	-	-	-
Barium	0.063	<0.0002	0.63	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000395	<0.0003	0.00395	<0.003	-	-	-
Lead	0.000395	<0.0002	0.00395	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.00043	<0.0004	0.0043	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00564	<0.001	0.0564	<0.01	-	-	-
Chloride	2.4	<2	24	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	20	<5	200	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	9.13
Conductivity (µS/cm)	19.00
Temperature (°C)	19.50
Volume Leachant (Litres)	0.884

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.102	**Natural Moisture Content (%)**	14
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	87.7
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039401
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP203 ES1
Depth (m)	0.50 - 0.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	4.31	<3	43.1	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	0.0000125	<0.00001	0.000125	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00158	<0.0005	0.0158	<0.005	-	-	-
Barium	0.00375	<0.0002	0.0375	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00144	<0.001	0.0144	<0.01	-	-	-
Copper	0.0023	<0.0003	0.023	<0.003	-	-	-
Lead	0.00105	<0.0002	0.0105	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.000959	<0.0004	0.00959	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00398	<0.001	0.0398	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	14.5	<5	145	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	7.65
Conductivity (µS/cm)	13.60
Temperature (°C)	20.30
Volume Leachant (Litres)	0.888

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.110	**Natural Moisture Content (%)**	21.3
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	82.5
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039408
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP203 ES4
Depth (m)	1.60 - 1.70

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.003	<0.0005	0.03	<0.005	-	-	-
Barium	0.018	<0.0002	0.18	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000606	<0.0003	0.00606	<0.003	-	-	-
Lead	0.00335	<0.0002	0.0335	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0116	<0.001	0.116	<0.01	-	-	-
Chloride	2.2	<2	22	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	20.5	<5	205	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	8.41
Conductivity (µS/cm)	12.50
Temperature (°C)	19.90
Volume Leachant (Litres)	0.880

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.109	**Natural Moisture Content (%)**	21.1
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	82.5
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039414
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP311 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	3.69	<3	36.9	<30	-	-	-
Fluoride	0.657	<0.5	6.57	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00691	<0.0005	0.0691	<0.005	-	-	-
Barium	0.00827	<0.0002	0.0827	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.00571	<0.0003	0.0571	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	0.0101	<0.003	0.101	<0.03	-	-	-
Nickel	0.000433	<0.0004	0.00433	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	<0.001	<0.001	<0.01	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	139	<2	1390	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	266	<5	2660	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	8.50
Conductivity (µS/cm)	348.00
Temperature (°C)	19.10
Volume Leachant (Litres)	0.882

Mcerts Certification does not apply to leachates

14/12/2020 15:31:58

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.103	**Natural Moisture Content (%)**	15.4
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	86.6
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039421
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP311 ES2
Depth (m)	1.10 - 1.20

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	3.02	<3	30.2	<30	-	-	-
Fluoride	1.09	<0.5	10.9	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00112	<0.001	0.0112	<0.01	-	-	-
Arsenic	0.00135	<0.0005	0.0135	<0.005	-	-	-
Barium	0.0407	<0.0002	0.407	<0.002	-	-	-
Cadmium	0.000402	<0.00008	0.00402	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.00227	<0.0003	0.0227	<0.003	-	-	-
Lead	0.000519	<0.0002	0.00519	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.0215	<0.0004	0.215	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0178	<0.001	0.178	<0.01	-	-	-
Chloride	2	<2	20	<20	-	-	-
Sulphate (soluble)	1490	<10	14900	<100	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	1550	<5	15500	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	6.37
Conductivity (µS/cm)	2,060.00
Temperature (°C)	18.60
Volume Leachant (Litres)	0.887

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.133	**Natural Moisture Content (%)**	47.7
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	67.7
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039427
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP311 ES4
Depth (m)	2.10 - 2.20

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	3.38	<3	33.8	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.00874	<0.0002	0.0874	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.00144	<0.0003	0.0144	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00285	<0.001	0.0285	<0.01	-	-	-
Chloride	2.4	<2	24	<20	-	-	-
Sulphate (soluble)	49.7	<2	497	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	131	<5	1310	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	7.97
Conductivity (µS/cm)	170.00
Temperature (°C)	18.10
Volume Leachant (Litres)	0.858

Mcerts Certification does not apply to leachates

14/12/2020 15:31:58

CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.164	**Natural Moisture Content (%)**	81.7
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	55
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039434
Sampled Date	12-Oct-2020
Customer Sample Ref.	TP311 ES4
Depth (m)	3.10 - 3.20

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	4.22	<3	42.2	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00109	<0.001	0.0109	<0.01	-	-	-
Arsenic	0.0807	<0.0005	0.807	<0.005	-	-	-
Barium	0.228	<0.0002	2.28	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00135	<0.001	0.0135	<0.01	-	-	-
Copper	0.00323	<0.0003	0.0323	<0.003	-	-	-
Lead	0.00282	<0.0002	0.0282	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.00158	<0.0004	0.0158	<0.004	-	-	-
Selenium	0.00105	<0.001	0.0105	<0.01	-	-	-
Zinc	0.138	<0.001	1.38	<0.01	-	-	-
Chloride	5.9	<2	59	<20	-	-	-
Sulphate (soluble)	9	<2	90	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	48.2	<5	482	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	8.72
Conductivity (µS/cm)	42.70
Temperature (°C)	18.30
Volume Leachant (Litres)	0.826

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.117	**Natural Moisture Content (%)**	29.1
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	77.5
Particle Size <4mm	>95%		

Case	
SDG	201015-115
Lab Sample Number(s)	23039439
Sampled Date	13-Oct-2020
Customer Sample Ref.	TP007 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	4.38	<3	43.8	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00129	<0.0005	0.0129	<0.005	-	-	-
Barium	0.0223	<0.0002	0.223	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.0037	<0.001	0.037	<0.01	-	-	-
Copper	0.00322	<0.0003	0.0322	<0.003	-	-	-
Lead	0.00296	<0.0002	0.0296	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.00159	<0.0004	0.0159	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00561	<0.001	0.0561	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	5.3	<2	53	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	41.3	<5	413	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	8.53
Conductivity (µS/cm)	58.60
Temperature (°C)	19.80
Volume Leachant (Litres)	0.873

Mcerts Certification does not apply to leachates

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Table of Results - Appendix

Method No	Reference	Description
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step
TM018	BS 1377: Part 3 1990	Determination of Loss on Ignition
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) by Headspace GC-FID (C4-C12)
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water
TM132	In - house Method	ELTRA CS800 Operators Guide
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser
TM157	HP 6890 Gas Chromatograph (GC) system and HP 5973 Mass Selective Detector (MSD).	Determination of SVOC in Soils by GC-MS extracted by sonication in DCM/Acetone
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)'	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM218	Shaker extraction - EPA method 3546.	The determination of PAH in soil samples by GC-MS
TM259	by HPLC	Determination of Phenols in Waters and Leachates by HPLC
TM410	Shaker extraction-In house coronene method	Determination of Coronene in soils by GCMS
TM414	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID
TM415	Analysis of Petroleum Hydrocarbons in Environmental Media.	Determination of Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

Test Completion Dates

Lab Sample No(s)	23039335	23039439	23039368	23039374	23039379	23039387	23039330	23039392	23039401	23039408
Customer Sample Ref.	TP007	TP007	TP008	TP008	TP009	TP009	TP202	TP202	TP203	TP203
AGS Ref.	ES4	ES1	ES1	ES4	ES1	ES4	ES1	ES4	ES1	ES4
Depth	1.50 - 1.60	0.40 - 0.50	0.40 - 0.50	1.50 - 1.60	0.50 - 0.60	1.50 - 1.60	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.60 - 1.70
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (w)	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020
Asbestos ID in Solid Samples	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020
CEN 10:1 Leachate (1 Stage)	24-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020
CEN Readings	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020
Chromium III	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	24-Oct-2020	26-Oct-2020
Coronene	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Cyanide Comp/Free/Total/Thiocyanate	27-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	26-Oct-2020	23-Oct-2020	26-Oct-2020	26-Oct-2020	23-Oct-2020
Dissolved Metals by ICP-MS	27-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020
Dissolved Organic/Inorganic Carbon	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Easily Liberated Sulphide	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020	26-Oct-2020
EPH by GCxGC-FID	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020
EPH CWG GC (S)	27-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	27-Oct-2020	23-Oct-2020	27-Oct-2020	27-Oct-2020	23-Oct-2020
Fluoride	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
GRO by GC-FID (S)	24-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Hexavalent Chromium (s)	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	23-Oct-2020	26-Oct-2020
Loss on Ignition in soils	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Mercury Dissolved	26-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Metals in solid samples by OES	26-Oct-2020	26-Oct-2020	24-Oct-2020	24-Oct-2020	26-Oct-2020	24-Oct-2020	24-Oct-2020	24-Oct-2020	24-Oct-2020	24-Oct-2020
Moisture at 105C	24-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020
PAH 16 & 17 Calc	26-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	24-Oct-2020	23-Oct-2020	24-Oct-2020	23-Oct-2020	23-Oct-2020
PAH by GCMS	26-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	24-Oct-2020	23-Oct-2020	24-Oct-2020	23-Oct-2020	23-Oct-2020
PCBs by GCMS	26-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
pH	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Phenols by HPLC (W)	26-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020
Sample description	23-Oct-2020	21-Oct-2020	21-Oct-2020	21-Oct-2020	21-Oct-2020	22-Oct-2020	21-Oct-2020	22-Oct-2020	22-Oct-2020	21-Oct-2020
Semi Volatile Organic Compounds	26-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	26-Oct-2020	23-Oct-2020	26-Oct-2020	26-Oct-2020	23-Oct-2020
Total Dissolved Solids	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Total Organic Carbon	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
TPH CWG GC (S)	27-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	27-Oct-2020	23-Oct-2020	27-Oct-2020	27-Oct-2020	23-Oct-2020
VOC MS (S)	24-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020

Lab Sample No(s)	23039414	23039421	23039427	23039434	23039342	23039350	23039356	23039363
Customer Sample Ref.	TP311	TP311	TP311	TP311	TP319	TP319	TP319	TP319
AGS Ref.	ES1	ES2	ES4	ES4	ES1	ES2	ES3	ES5
Depth	0.40 - 0.50	1.10 - 1.20	2.10 - 2.20	3.10 - 3.20	0.40 - 0.50	1.20 - 1.30	2.30 - 2.40	3.50 - 3.60
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (w)	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020
Asbestos ID in Solid Samples	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020
CEN 10:1 Leachate (1 Stage)	24-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
CEN Readings	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020
Chromium III	26-Oct-2020	26-Oct-2020	26-Oct-2020	24-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Coronene	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Cyanide Comp/Free/Total/Thiocyanate	26-Oct-2020	23-Oct-2020	26-Oct-2020	26-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Dissolved Metals by ICP-MS	27-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020
Dissolved Organic/Inorganic Carbon	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Easily Liberated Sulphide	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020	26-Oct-2020
EPH by GCxGC-FID	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020
EPH CWG GC (S)	27-Oct-2020	23-Oct-2020	27-Oct-2020	27-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Fluoride	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
GRO by GC-FID (S)	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Hexavalent Chromium (s)	26-Oct-2020	26-Oct-2020	26-Oct-2020	23-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Loss on Ignition in soils	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Mercury Dissolved	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Metals in solid samples by OES	24-Oct-2020	24-Oct-2020	24-Oct-2020	24-Oct-2020	27-Oct-2020	27-Oct-2020	26-Oct-2020	24-Oct-2020
Moisture at 105C	23-Oct-2020	22-Oct-2020	26-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020	22-Oct-2020
PAH 16 & 17 Calc	24-Oct-2020	23-Oct-2020	24-Oct-2020	24-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
PAH by GCMS	24-Oct-2020	23-Oct-2020	24-Oct-2020	24-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
PCBs by GCMS	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
pH	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Phenols by HPLC (W)	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020
Sample description	22-Oct-2020	21-Oct-2020	22-Oct-2020	22-Oct-2020	21-Oct-2020	21-Oct-2020	21-Oct-2020	21-Oct-2020
Semi Volatile Organic Compounds	26-Oct-2020	23-Oct-2020	26-Oct-2020	26-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Total Dissolved Solids	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Total Organic Carbon	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
TPH CWG GC (S)	27-Oct-2020	23-Oct-2020	27-Oct-2020	27-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
VOC MS (S)	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020

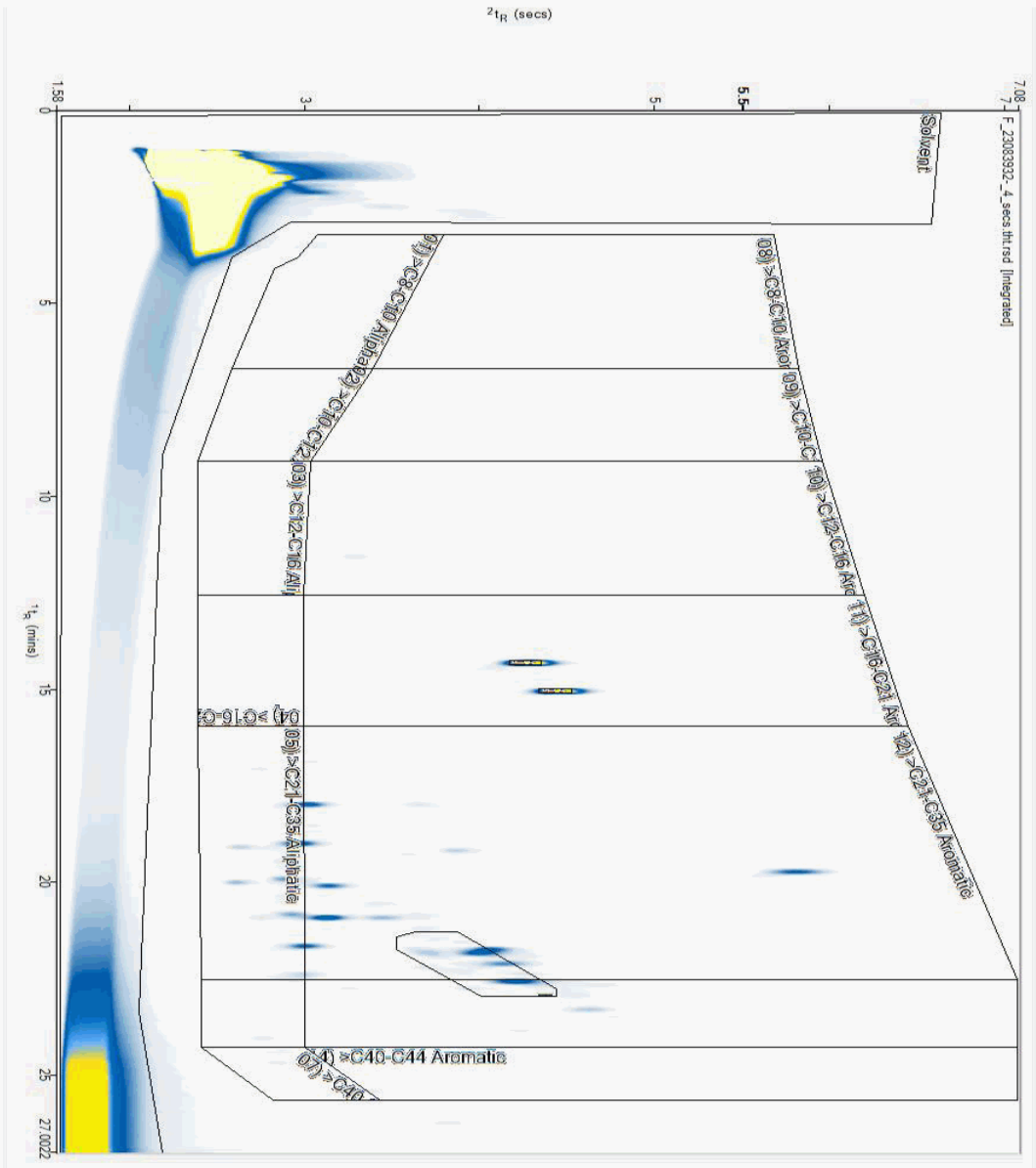
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23083932 **Depth :** 3.50 - 3.60
Sample ID : TP319

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23083932-_4_secs.tht
Date Acquired   :  22/10/20 05:26:50
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



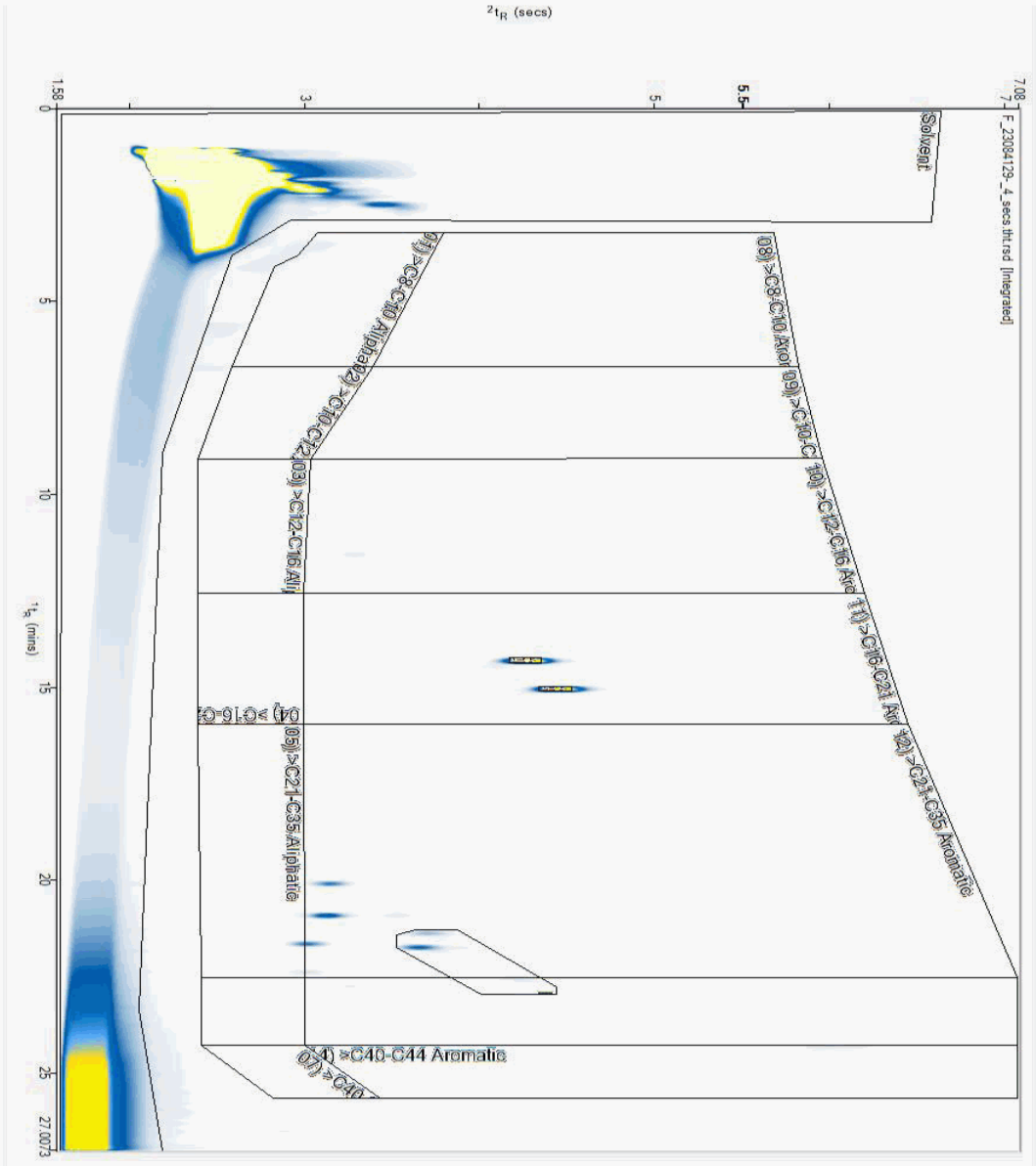
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23084129 **Depth :** 1.20 - 1.30
Sample ID : TP319

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23084129-_4_secs.tht
Date Acquired   :  22/10/20 04:55:16
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```

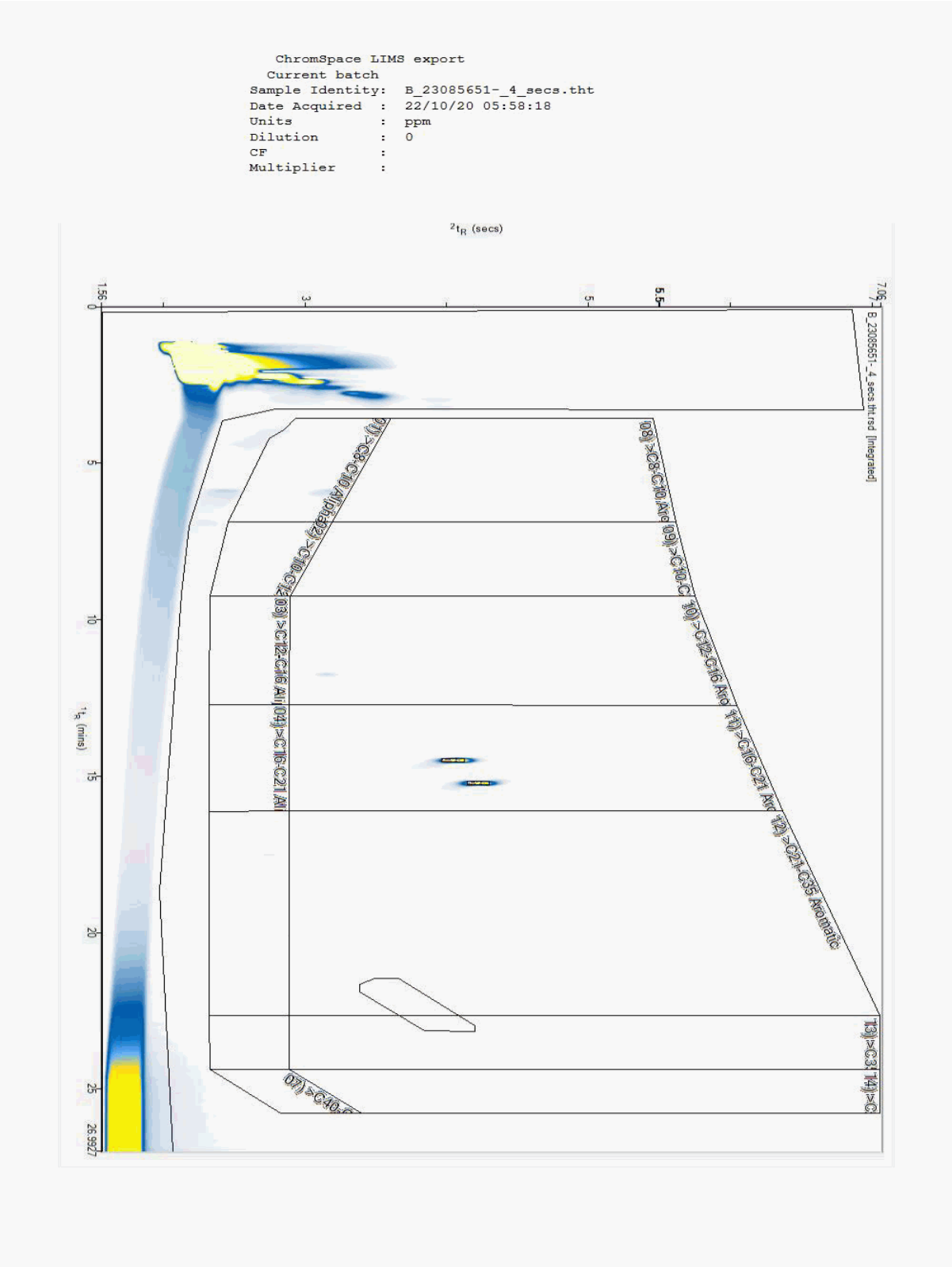


CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23085651 **Depth :** 0.40 - 0.50
Sample ID : TP008



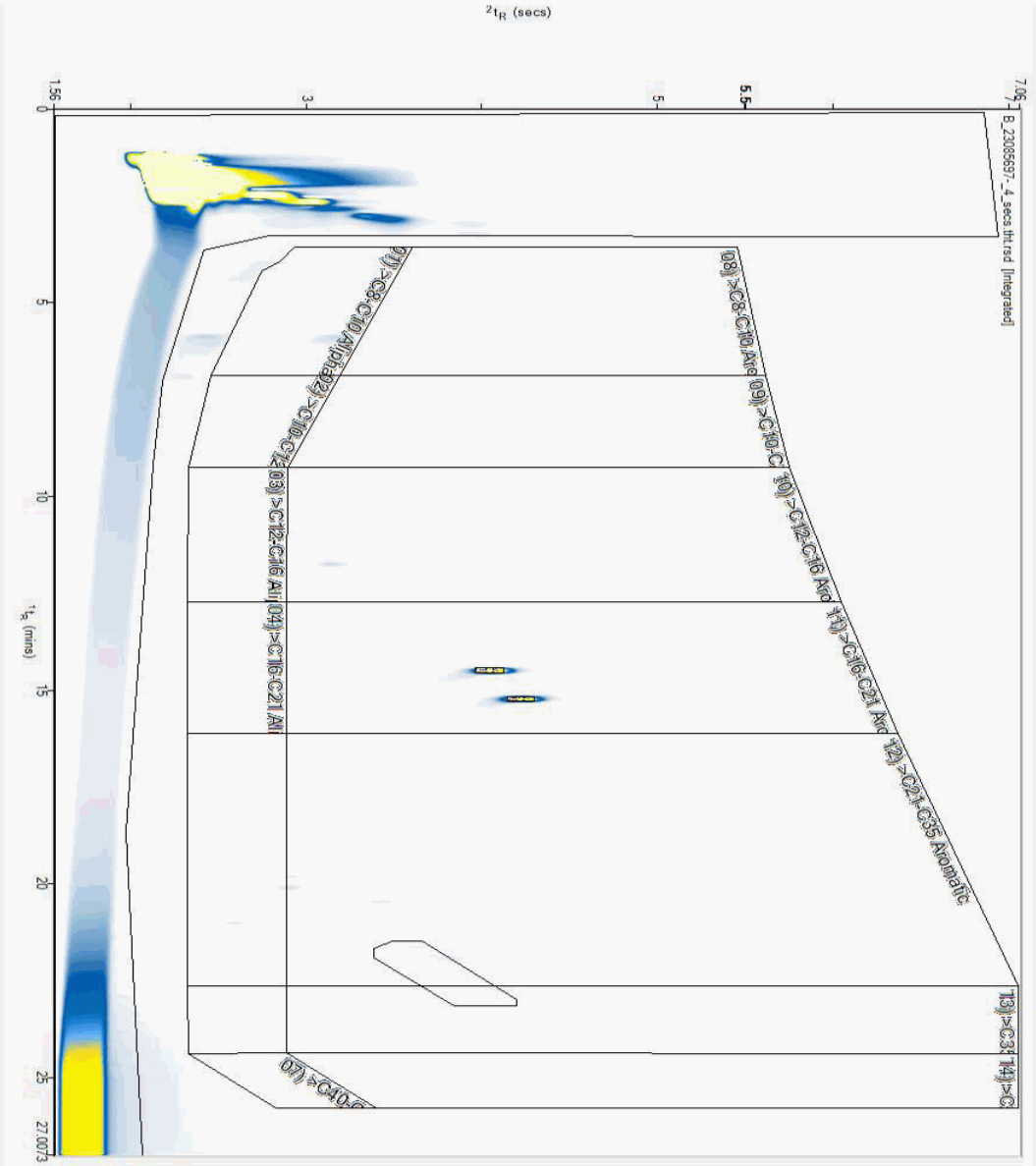
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23085697 **Depth :** 0.40 - 0.50
Sample ID : TP007

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23085697-_4_secs.tht
Date Acquired   :  22/10/20 04:55:15
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



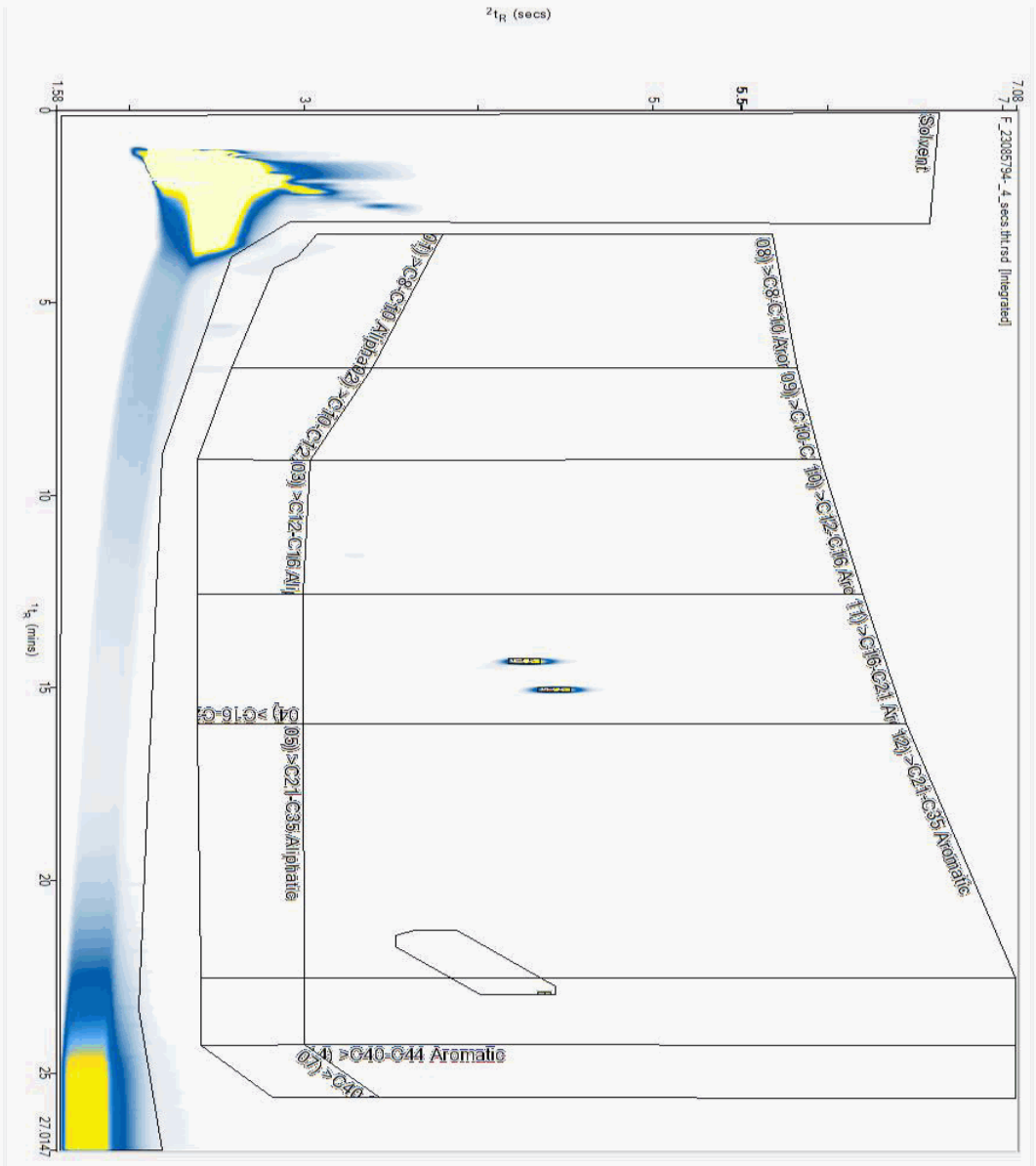
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23085794 **Depth :** 0.40 - 0.50
Sample ID : TP319

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23085794-_4_secs.tht
Date Acquired   :  22/10/20 07:33:01
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



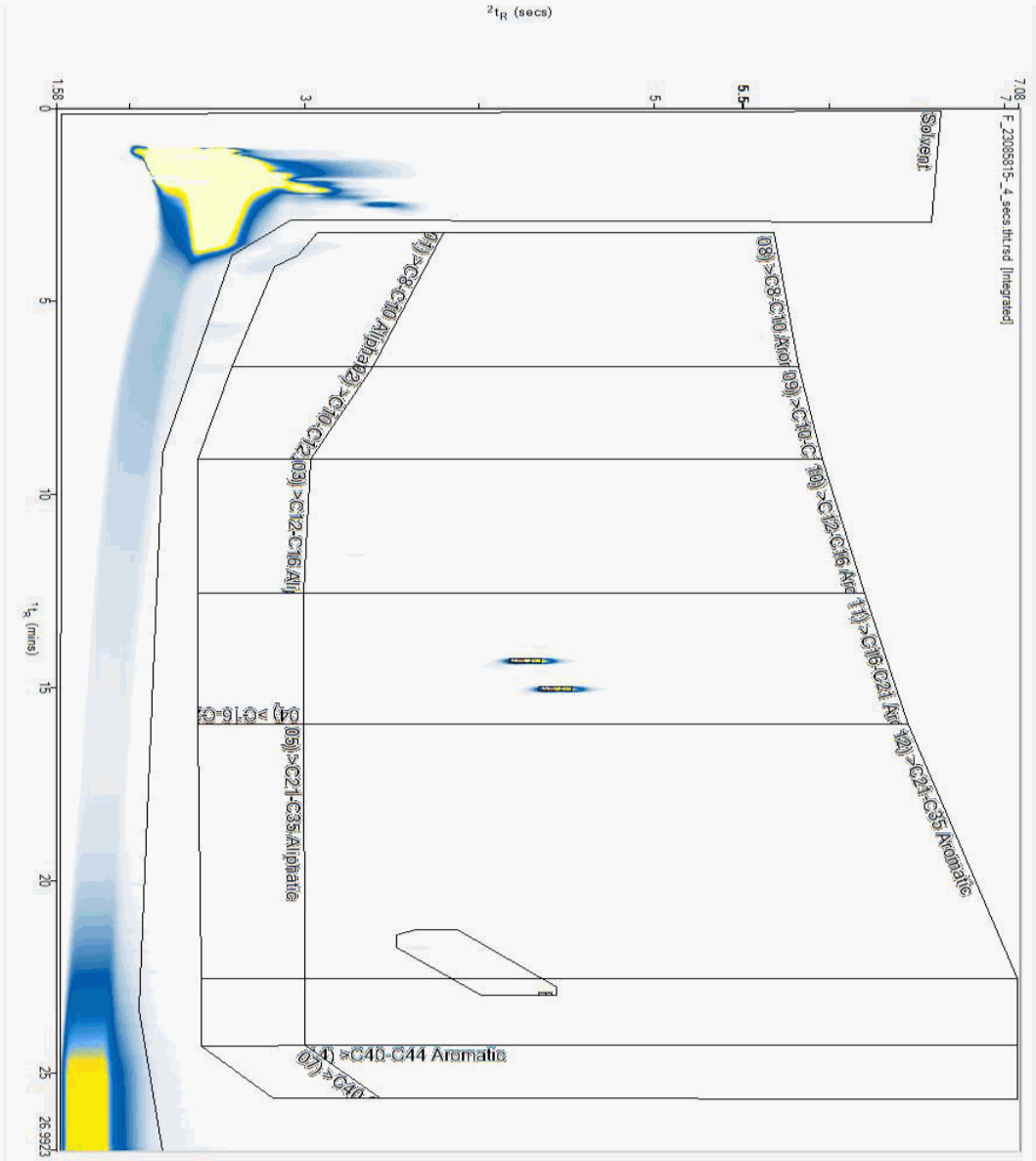
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23085815 **Depth :** 2.30 - 2.40
Sample ID : TP319

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23085815-_4_secs.tht
Date Acquired   :  22/10/20 08:36:06
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



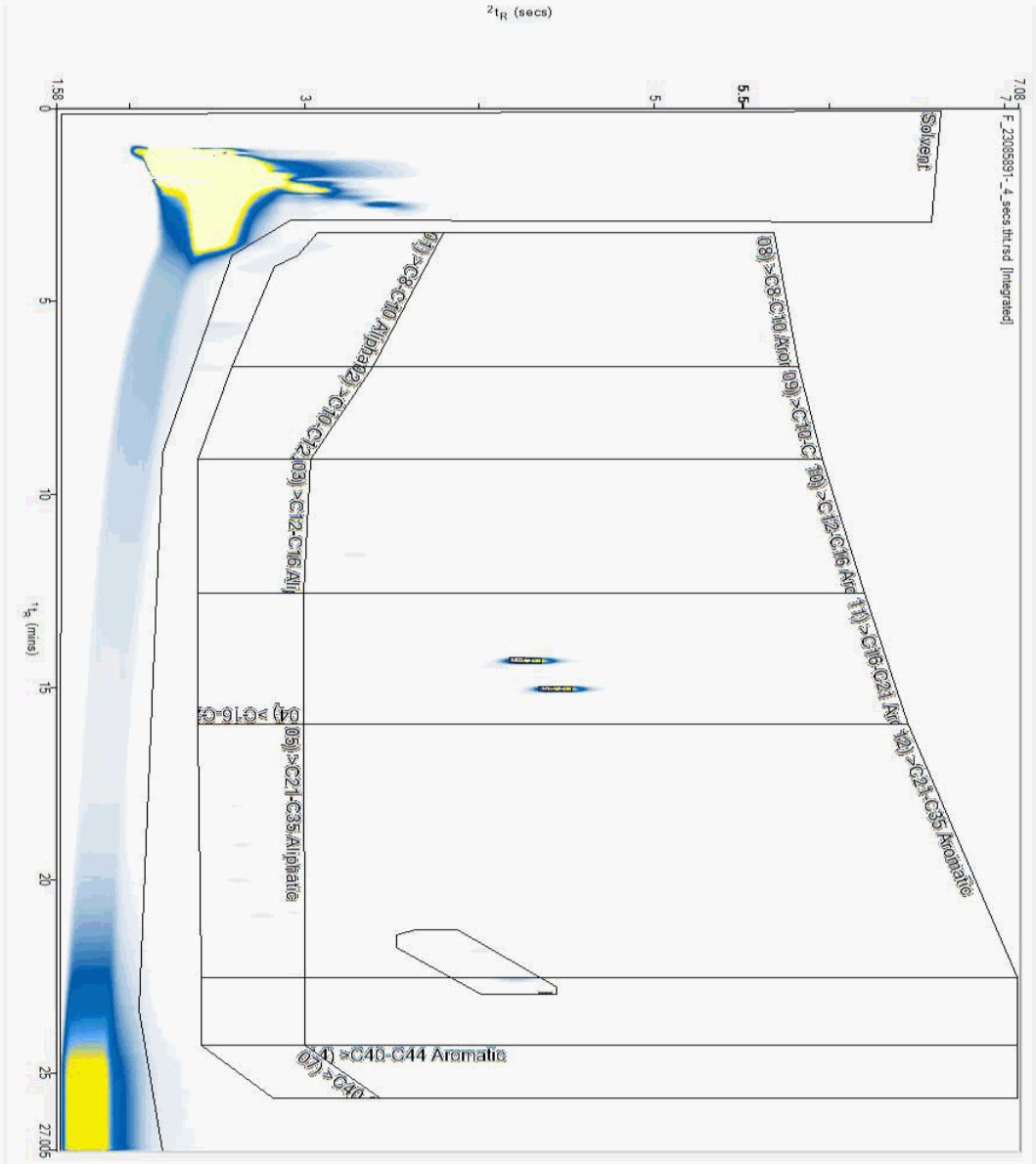
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23085891 **Depth :** 1.50 - 1.60
Sample ID : TP008

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23085891-_4_secs.tht
Date Acquired   :  22/10/20 06:29:53
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



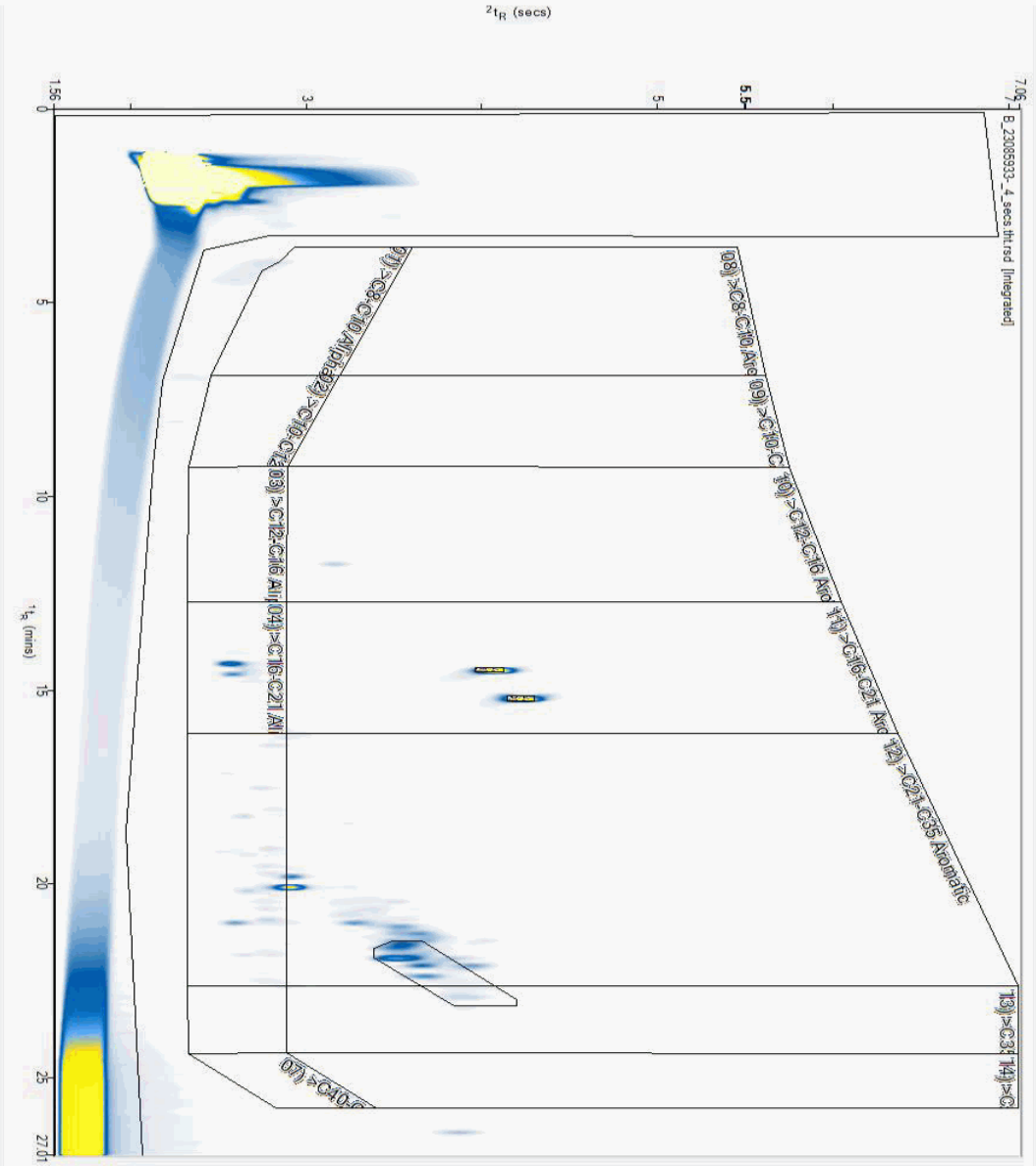
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23085933 **Depth :** 1.10 - 1.20
Sample ID : TP311

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23085933-_4_secs.tht
Date Acquired   :  22/10/20 11:23:17
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



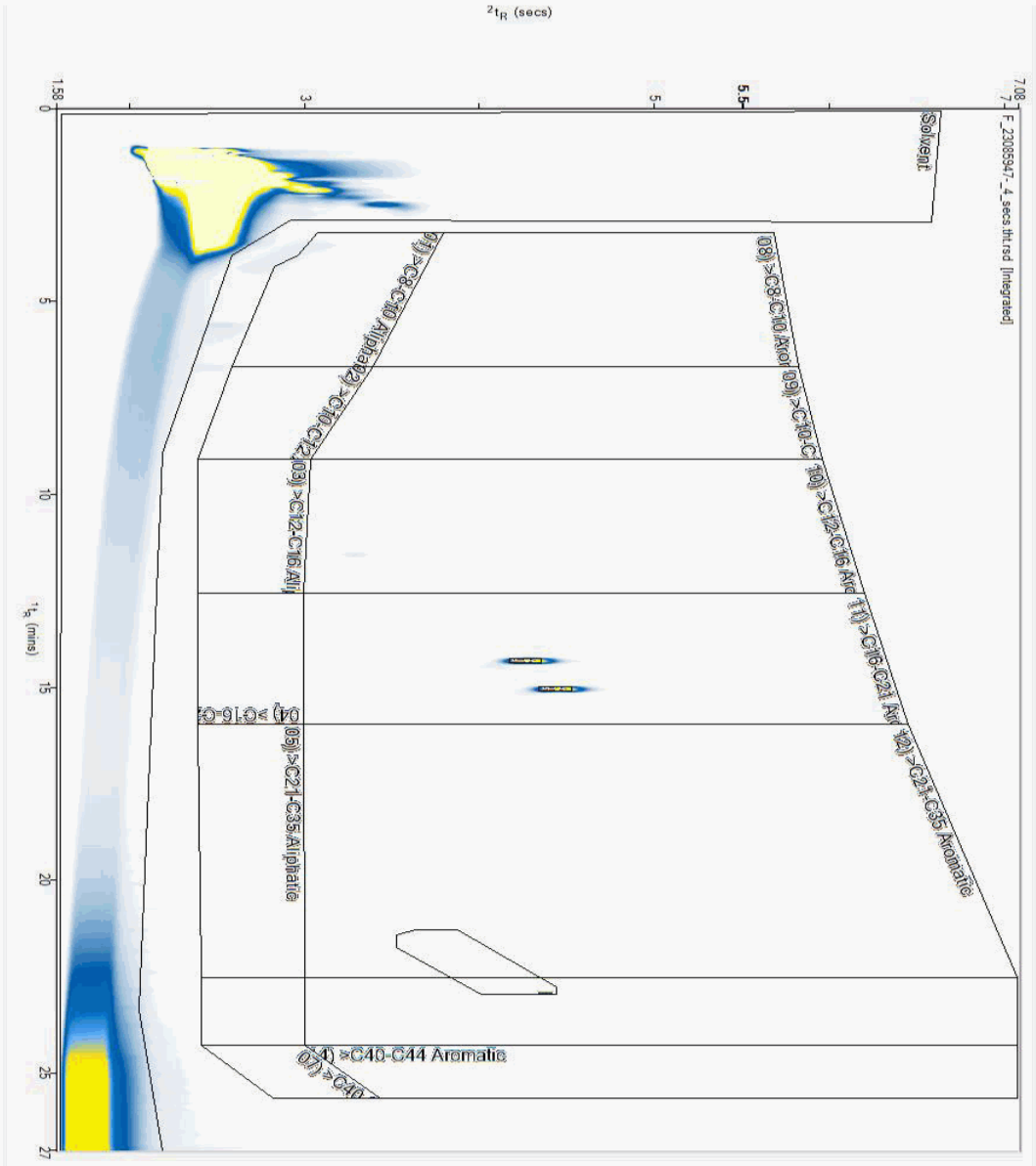
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23085947 **Depth :** 0.50 - 0.60
Sample ID : TP009

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23085947-_4_secs.tht
Date Acquired   :  22/10/20 07:01:31
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



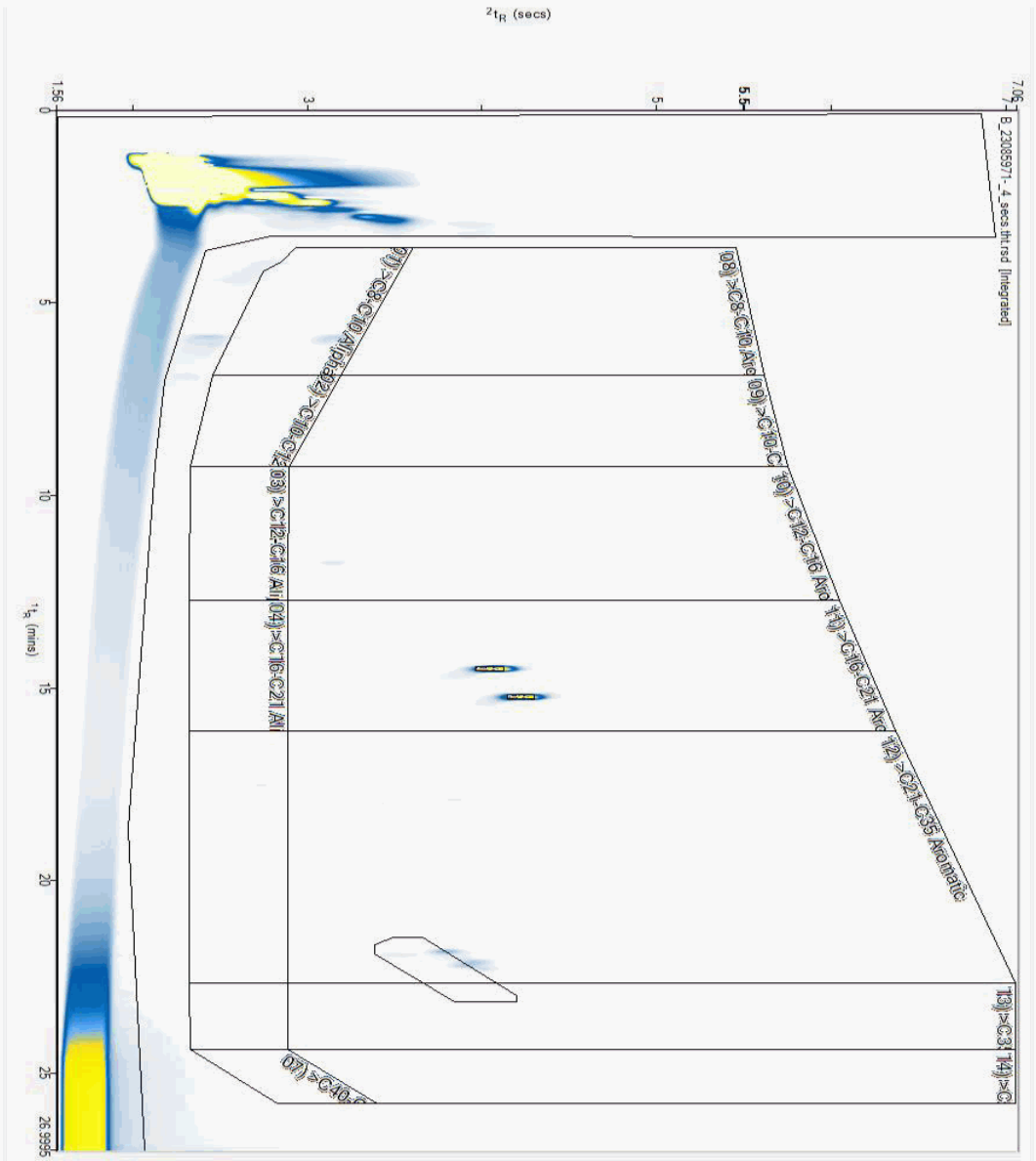
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23085971 **Depth :** 1.60 - 1.70
Sample ID : TP203

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23085971-_4_secs.tht
Date Acquired   :  22/10/20 03:52:04
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



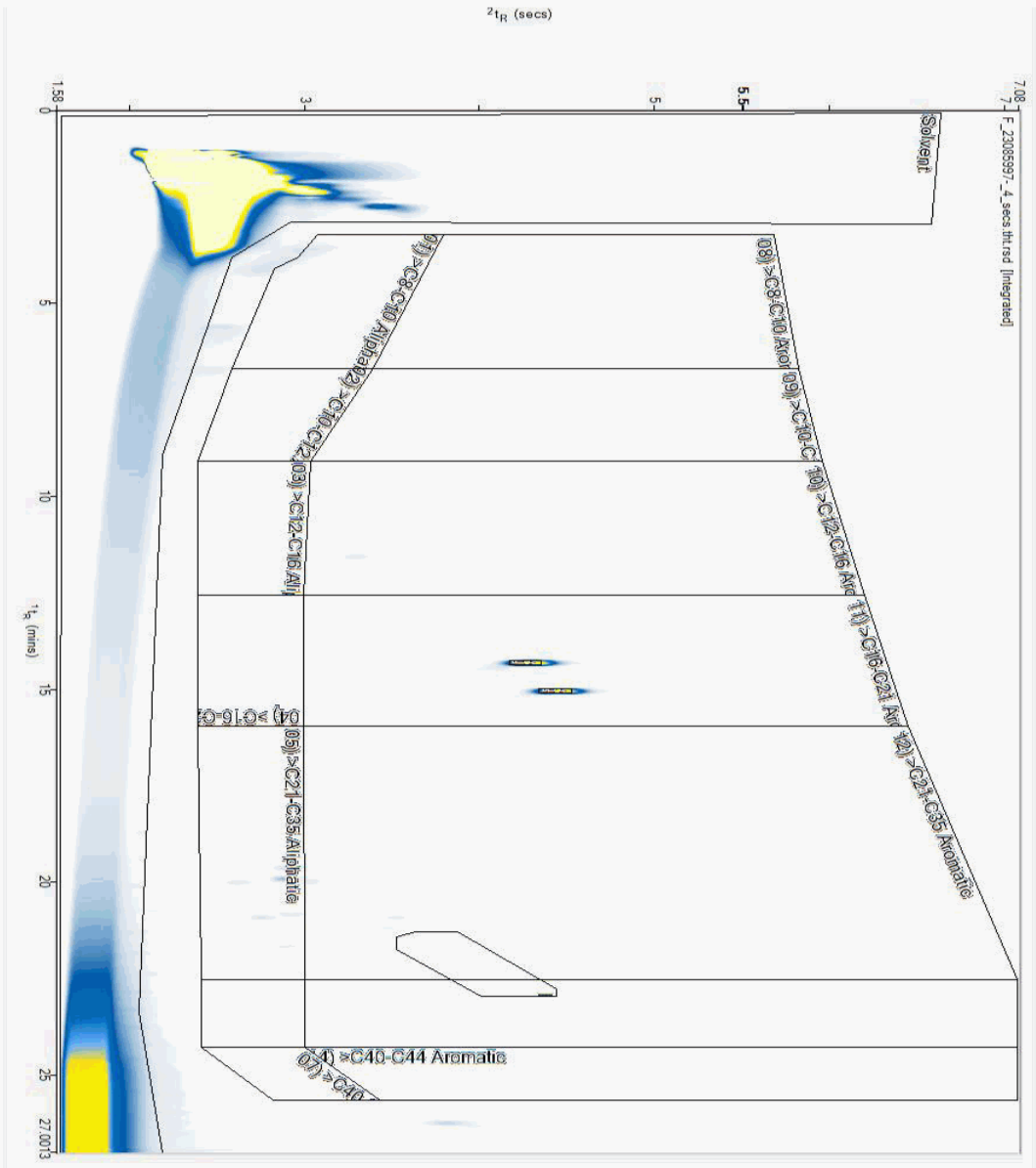
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23085997 **Depth :** 0.50 - 0.60
Sample ID : TP202

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23085997-_4_secs.tht
Date Acquired   :  22/10/20 08:04:32
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```

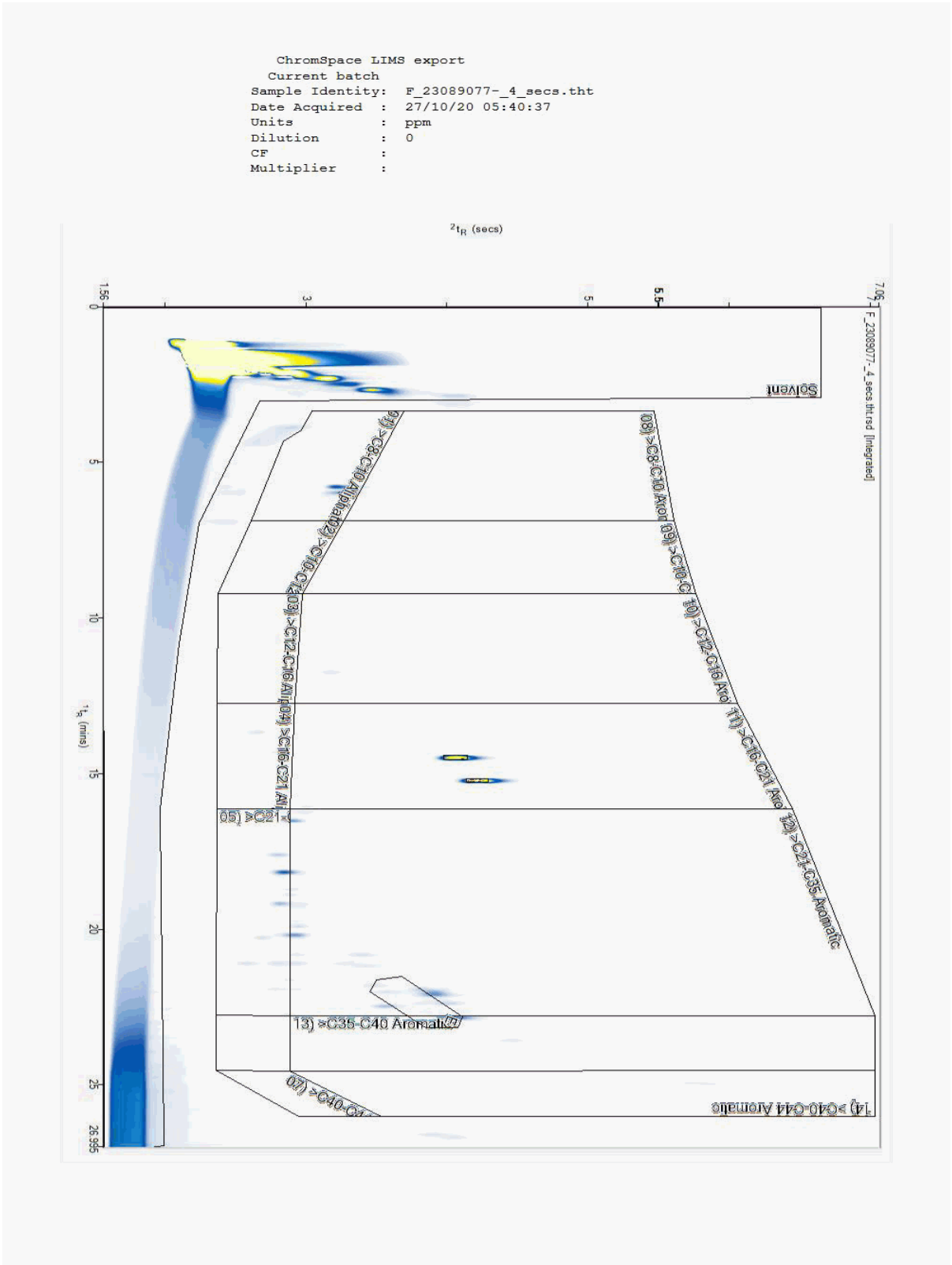


CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23089077 **Depth :** 0.50 - 0.60
Sample ID : TP203



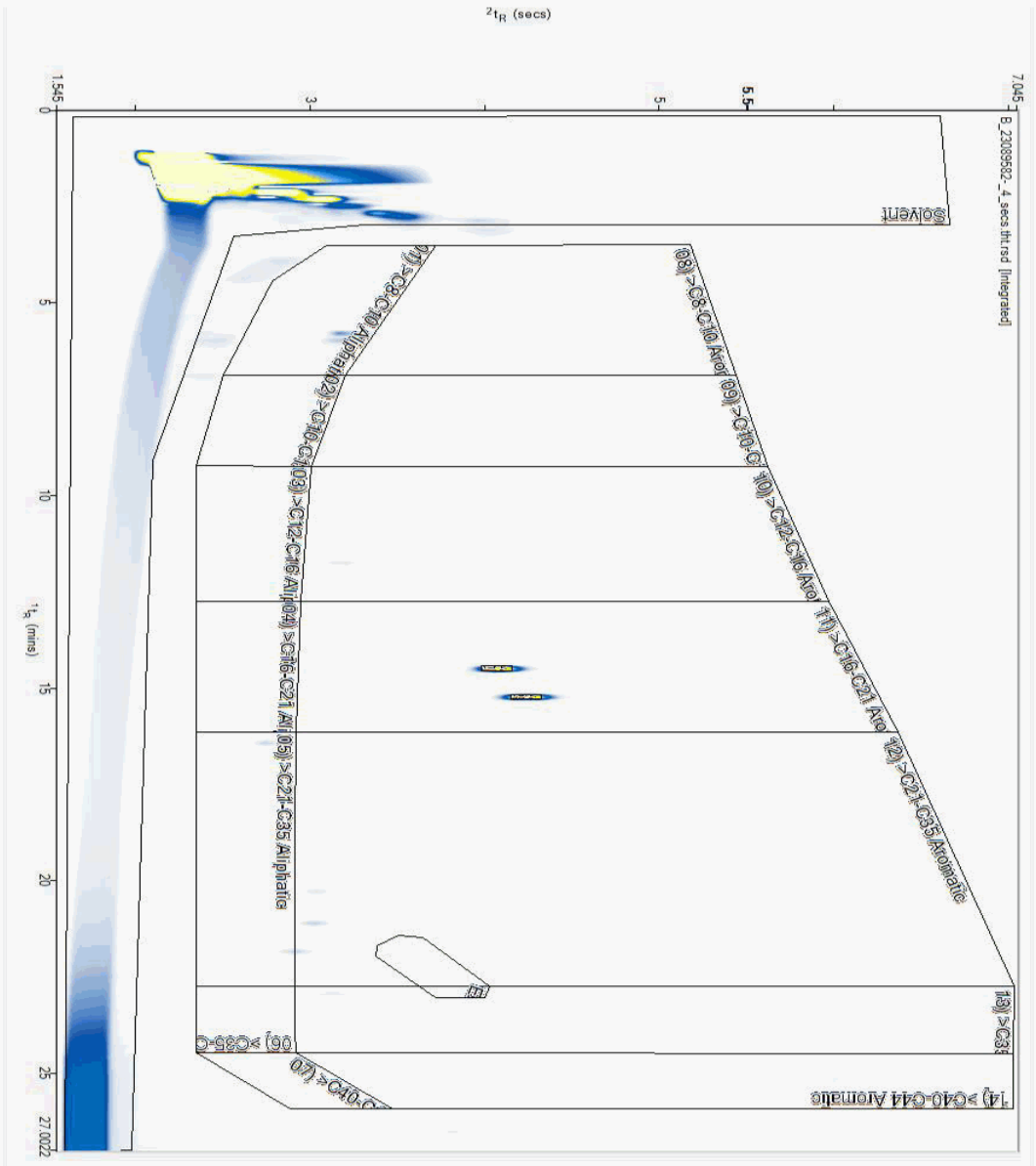
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23089582 **Depth :** 2.10 - 2.20
Sample ID : TP311

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23089582-_4_secs.tht
Date Acquired   :  27/10/20 04:06:29
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



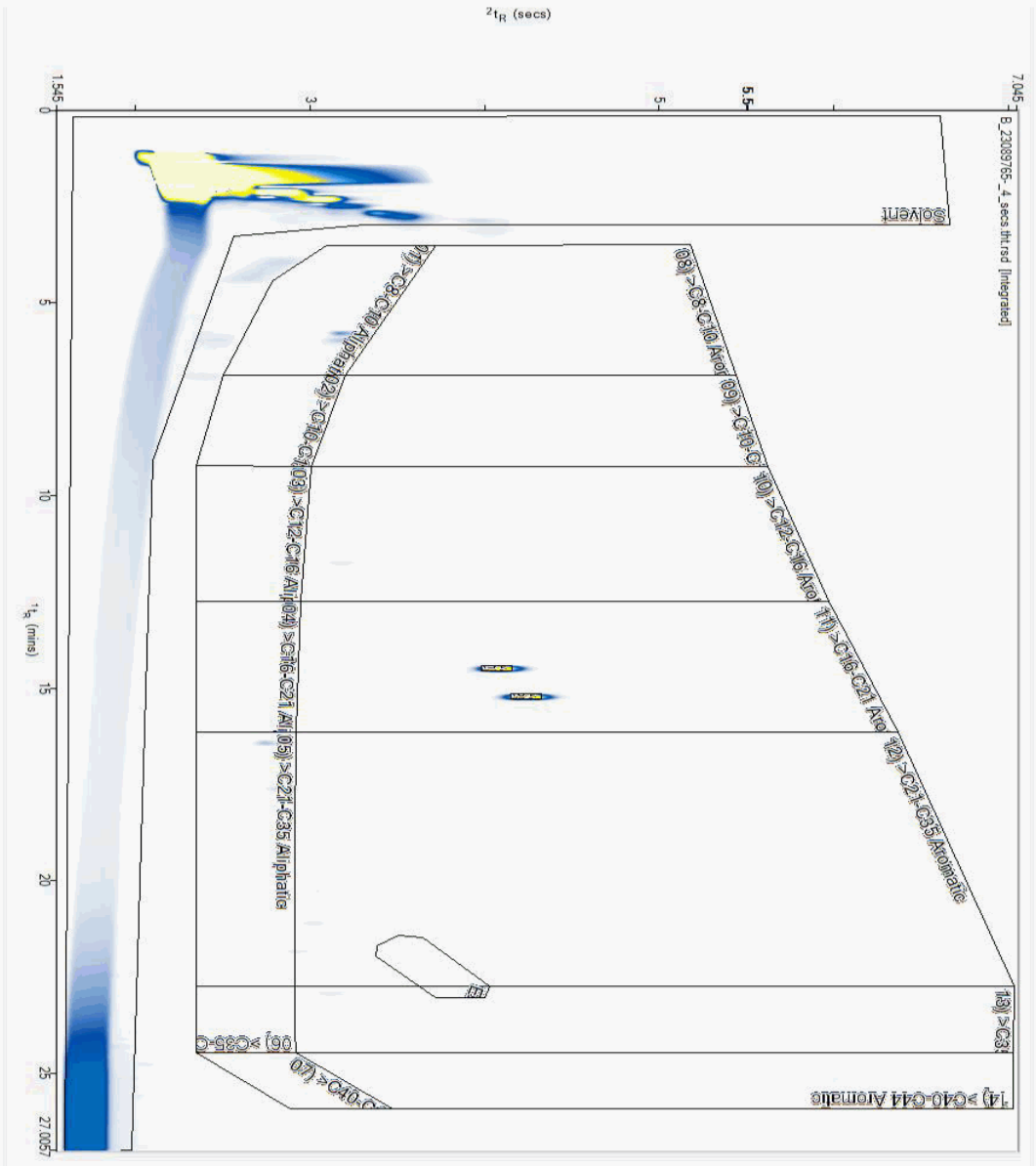
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23089765 **Depth :** 1.40 - 1.50
Sample ID : TP202

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23089765-_4_secs.tht
Date Acquired   :  27/10/20 04:37:51
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



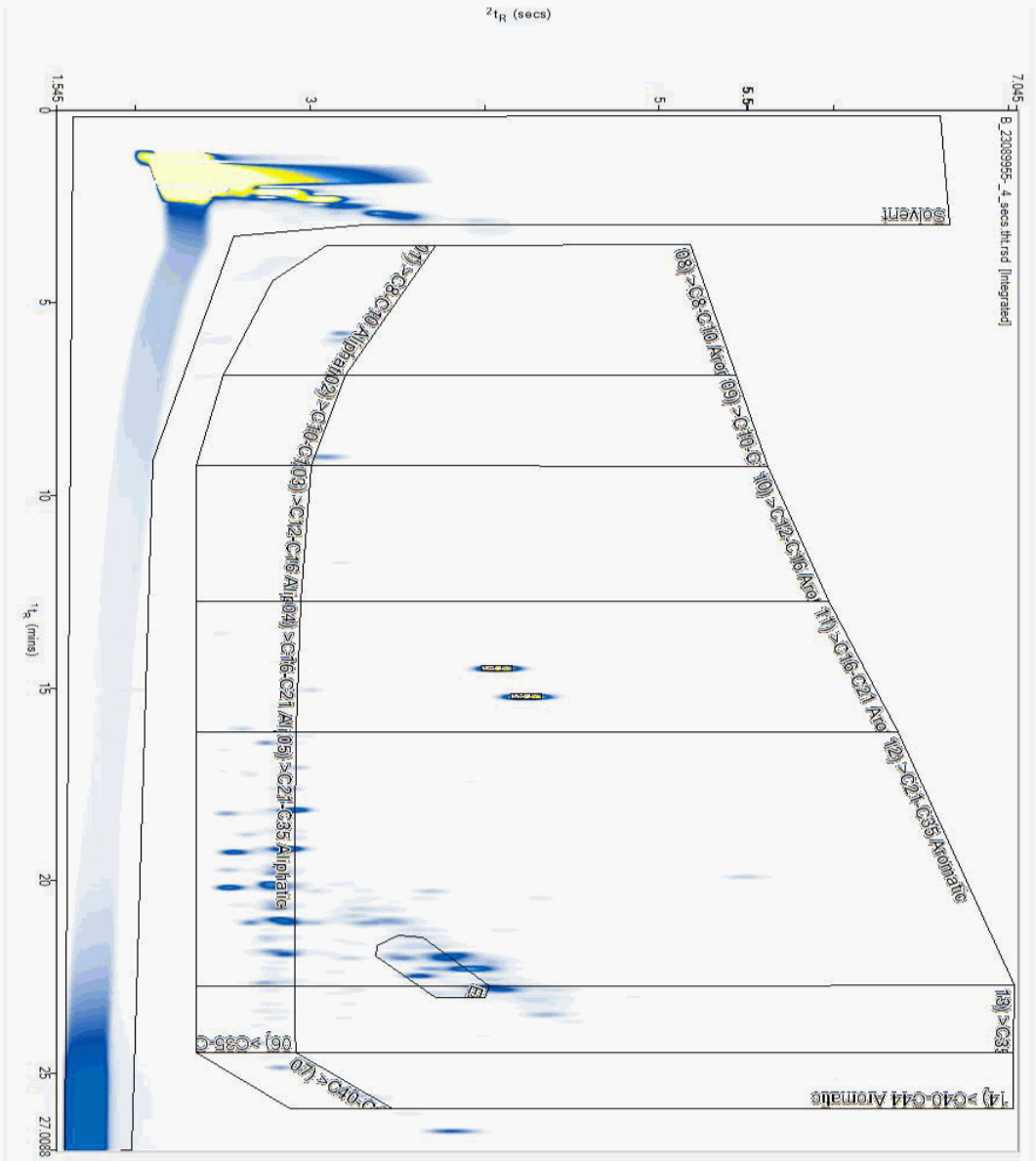
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23089955 **Depth :** 3.10 - 3.20
Sample ID : TP311

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  B_23089955-_4_secs.tht
Date Acquired   :  27/10/20 05:09:14
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```

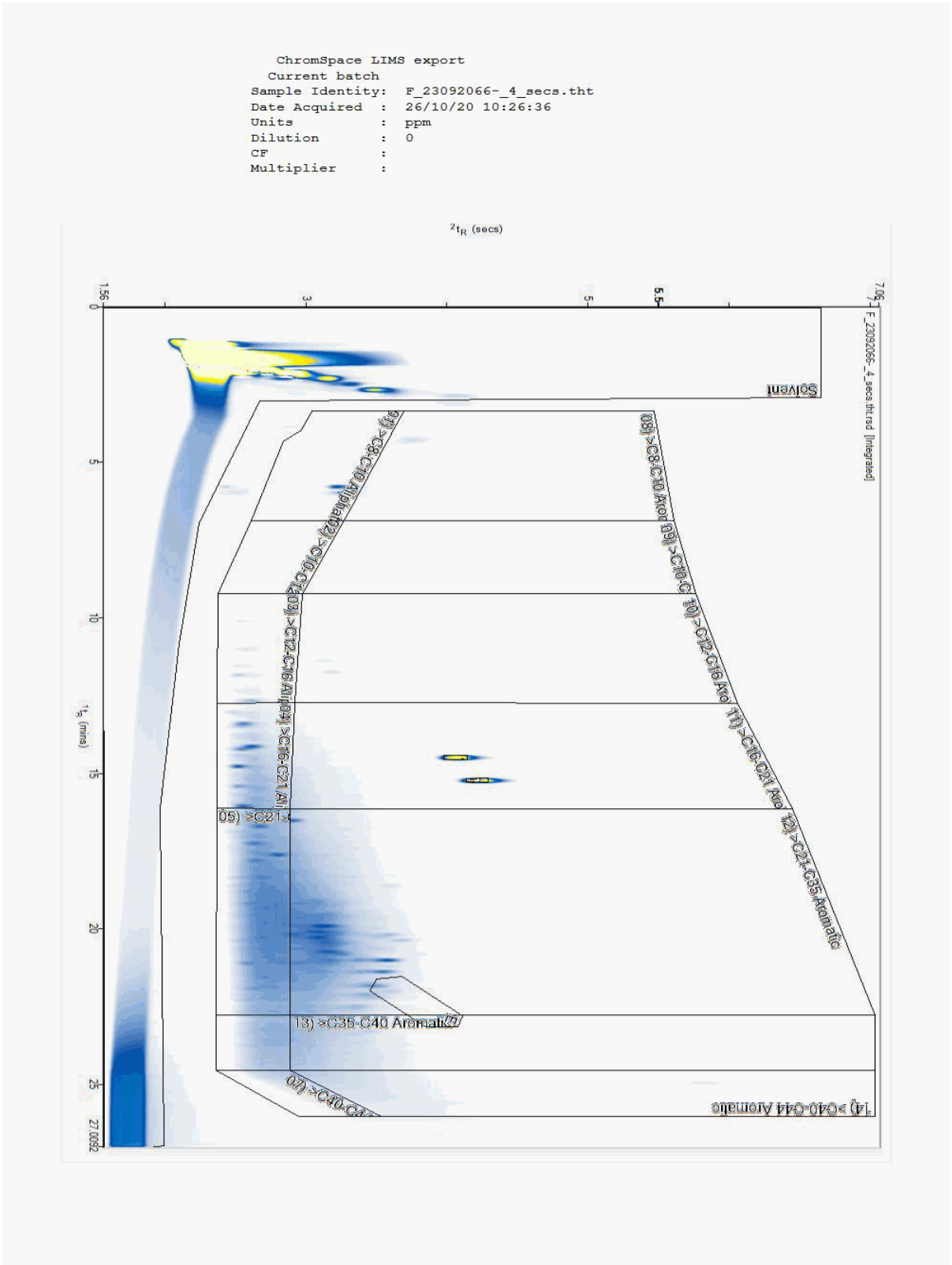


CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23092066 **Depth :** 0.40 - 0.50
Sample ID : TP311



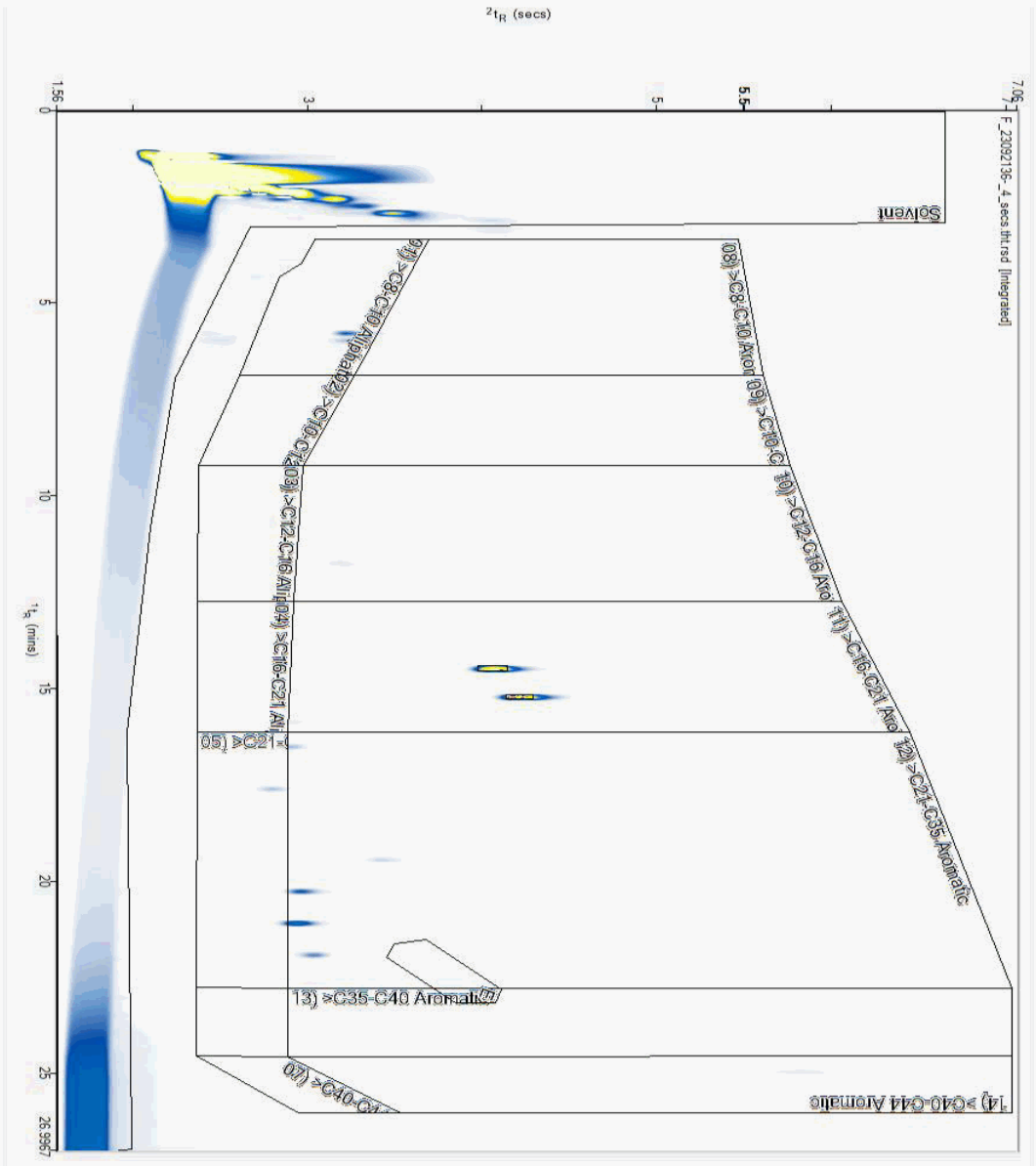
CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23092136 **Depth :** 1.50 - 1.60
Sample ID : TP009

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23092136-_4_secs.tht
Date Acquired   :  26/10/20 04:41:02
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```

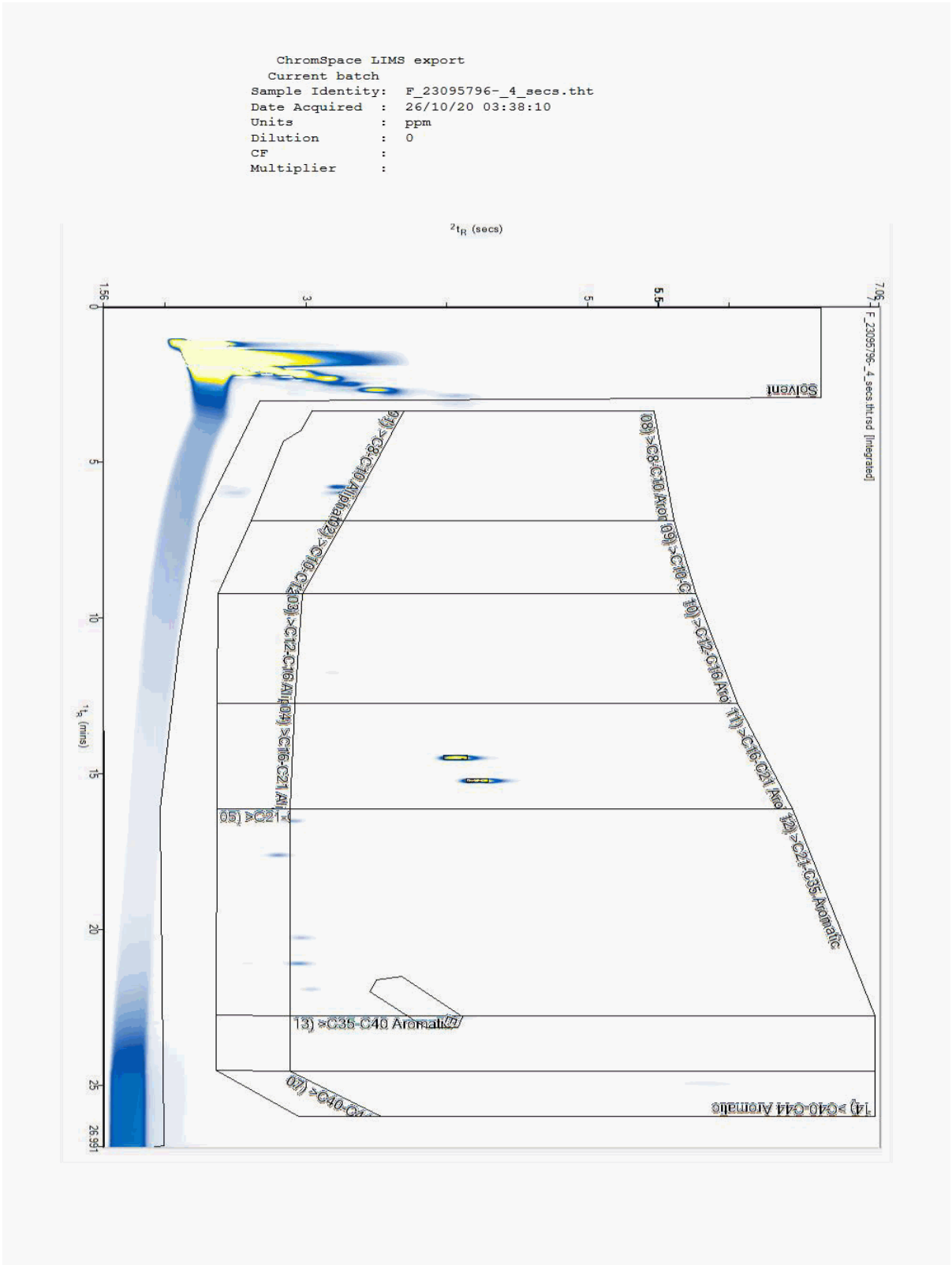


CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23095796 **Depth :** 1.50 - 1.60
Sample ID : TP007



CERTIFICATE OF ANALYSIS

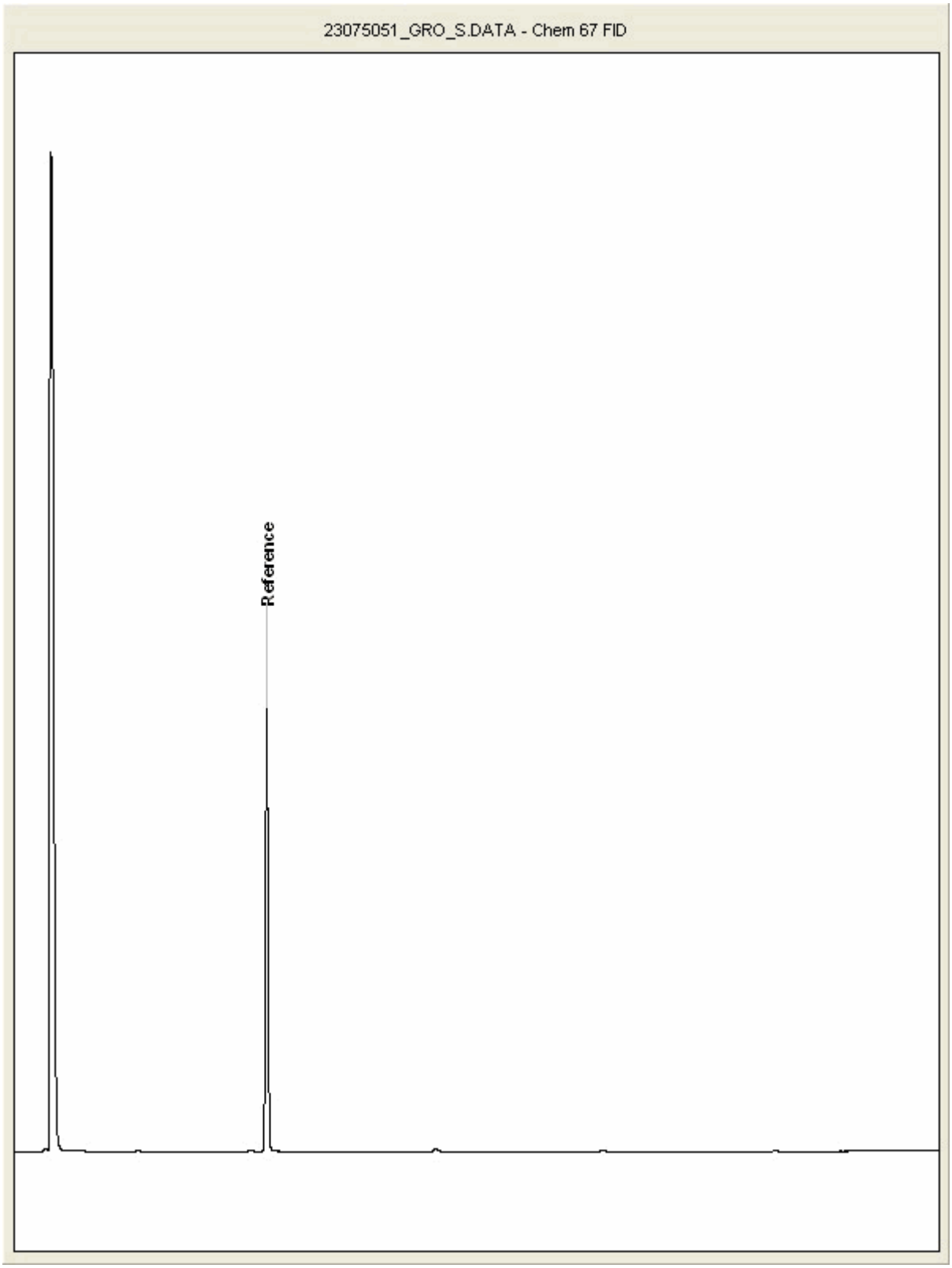
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075051
Sample ID : TP311

Depth : 2.10 - 2.20

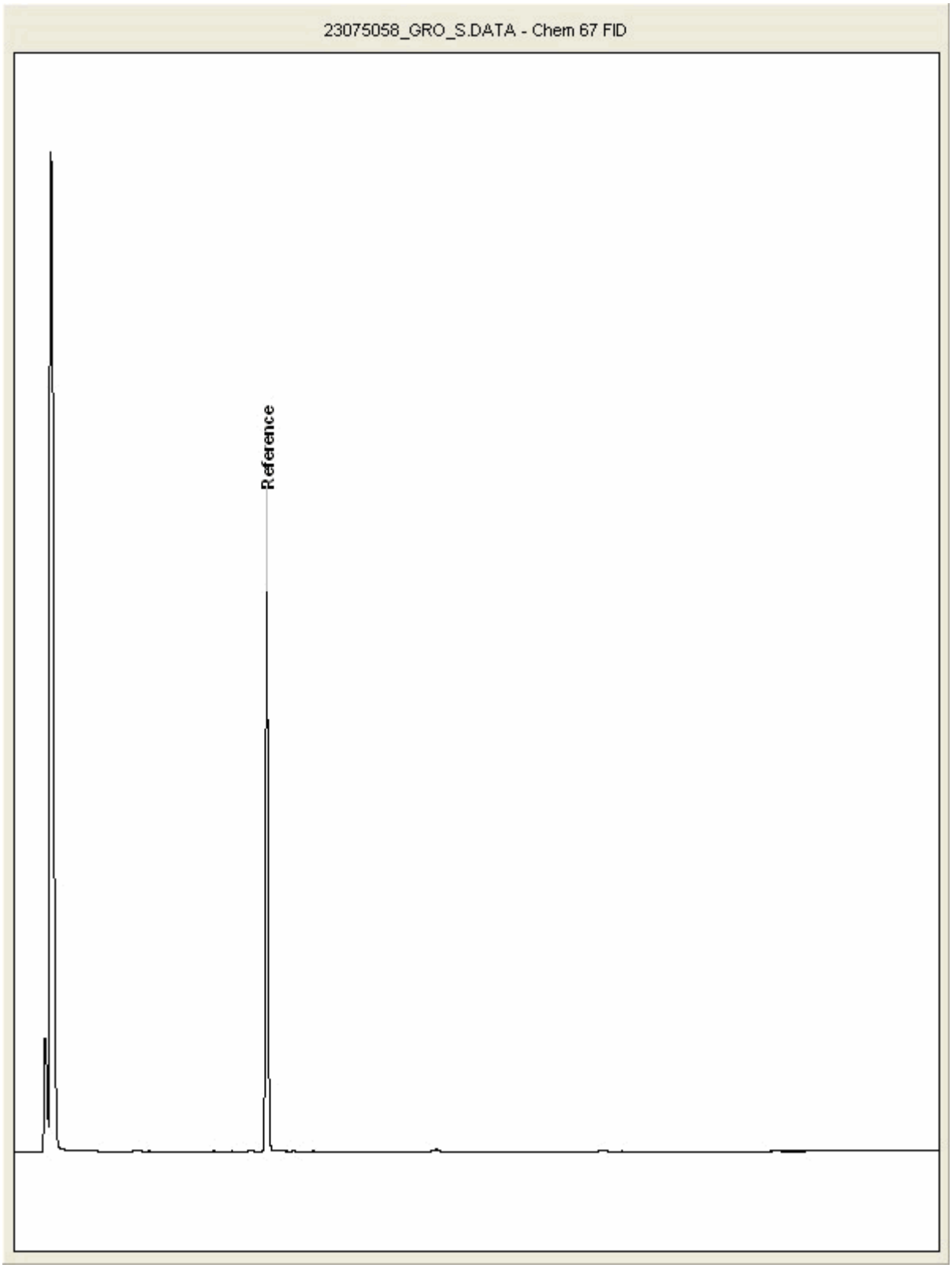


CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S) **Sample No :** 23075058 **Sample ID :** TP311 **Depth :** 3.10 - 3.20



CERTIFICATE OF ANALYSIS

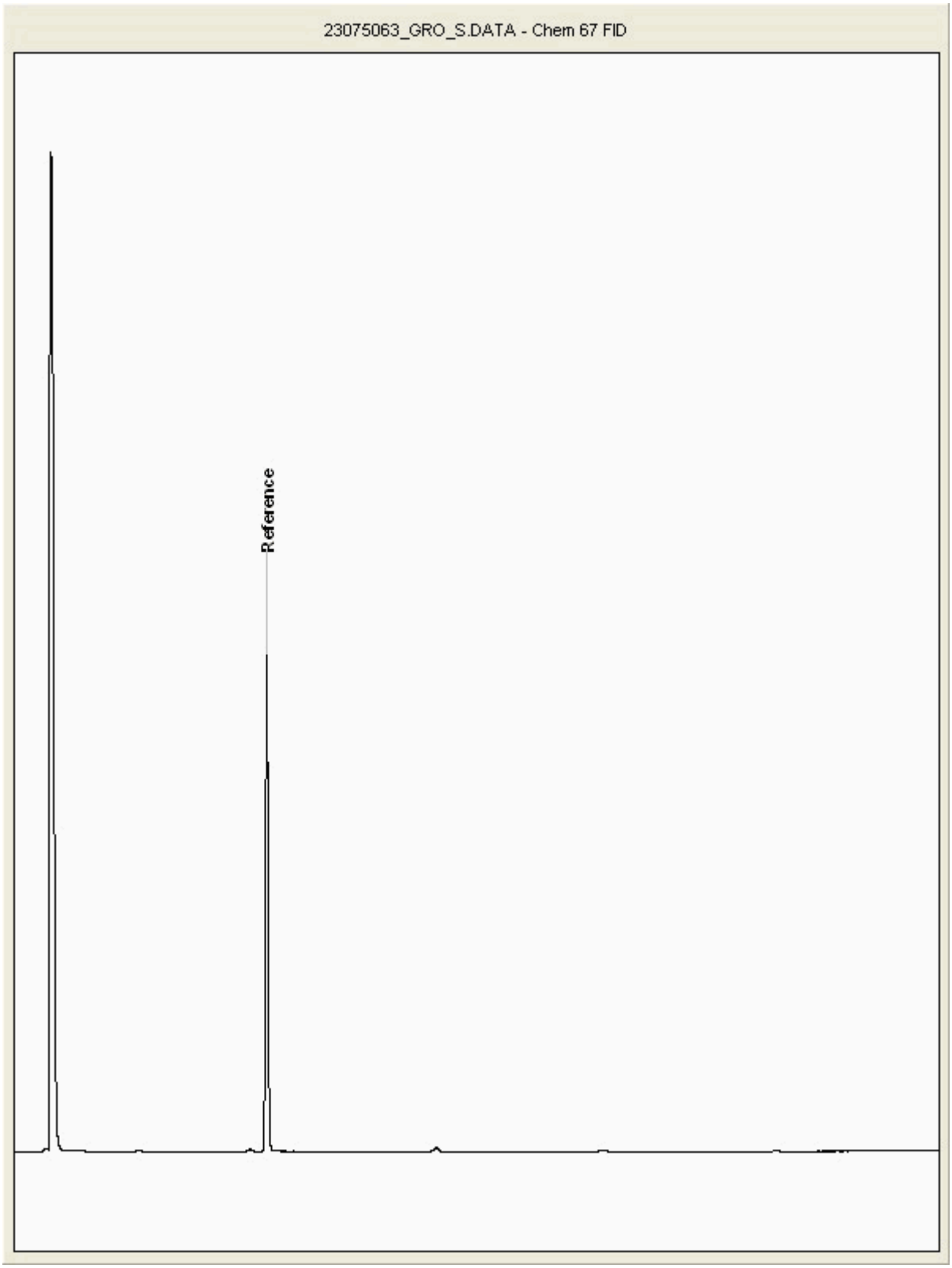
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075063
Sample ID : TP009

Depth : 0.50 - 0.60



CERTIFICATE OF ANALYSIS

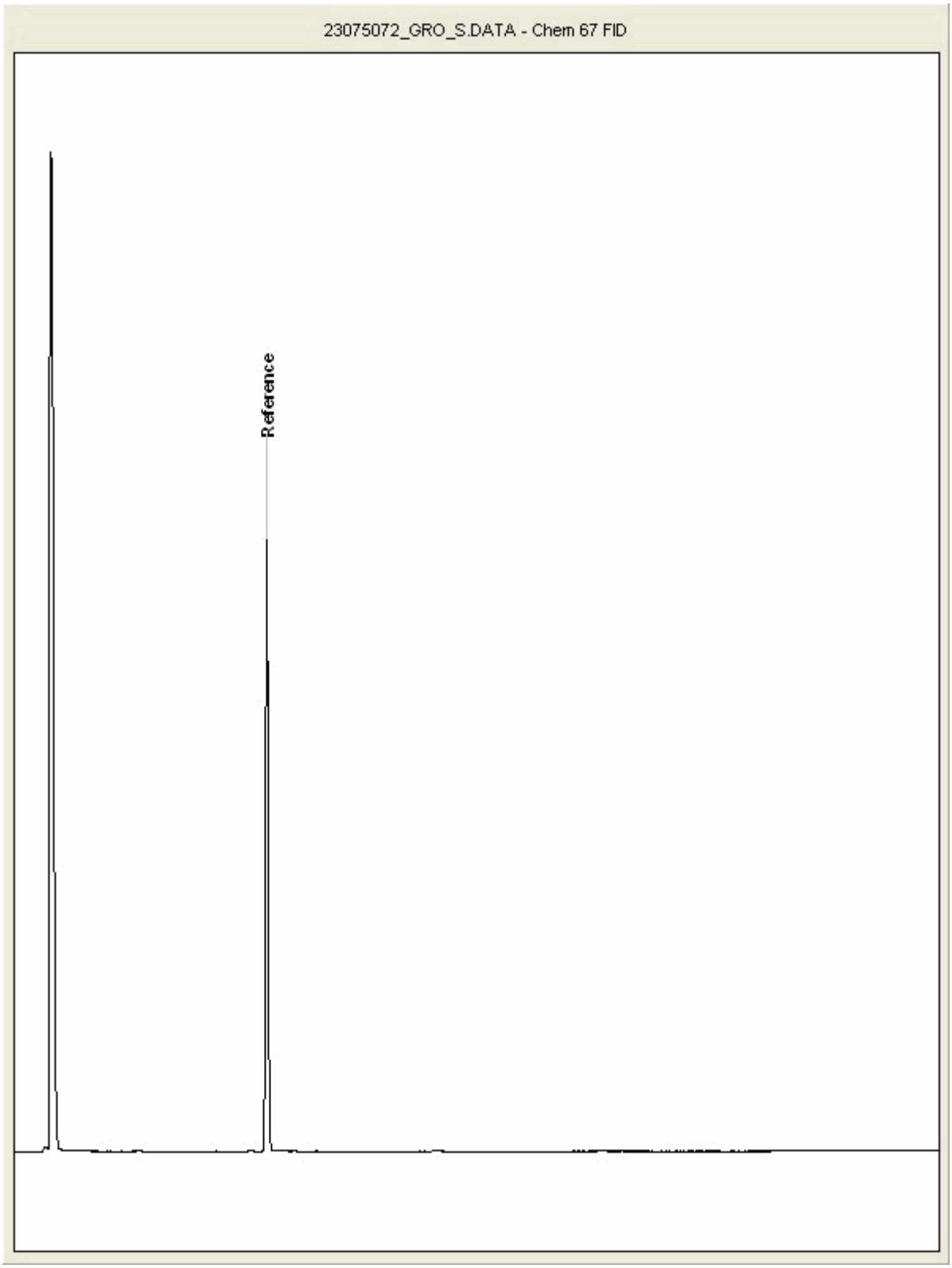
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075072
Sample ID : TP202

Depth : 0.50 - 0.60



CERTIFICATE OF ANALYSIS

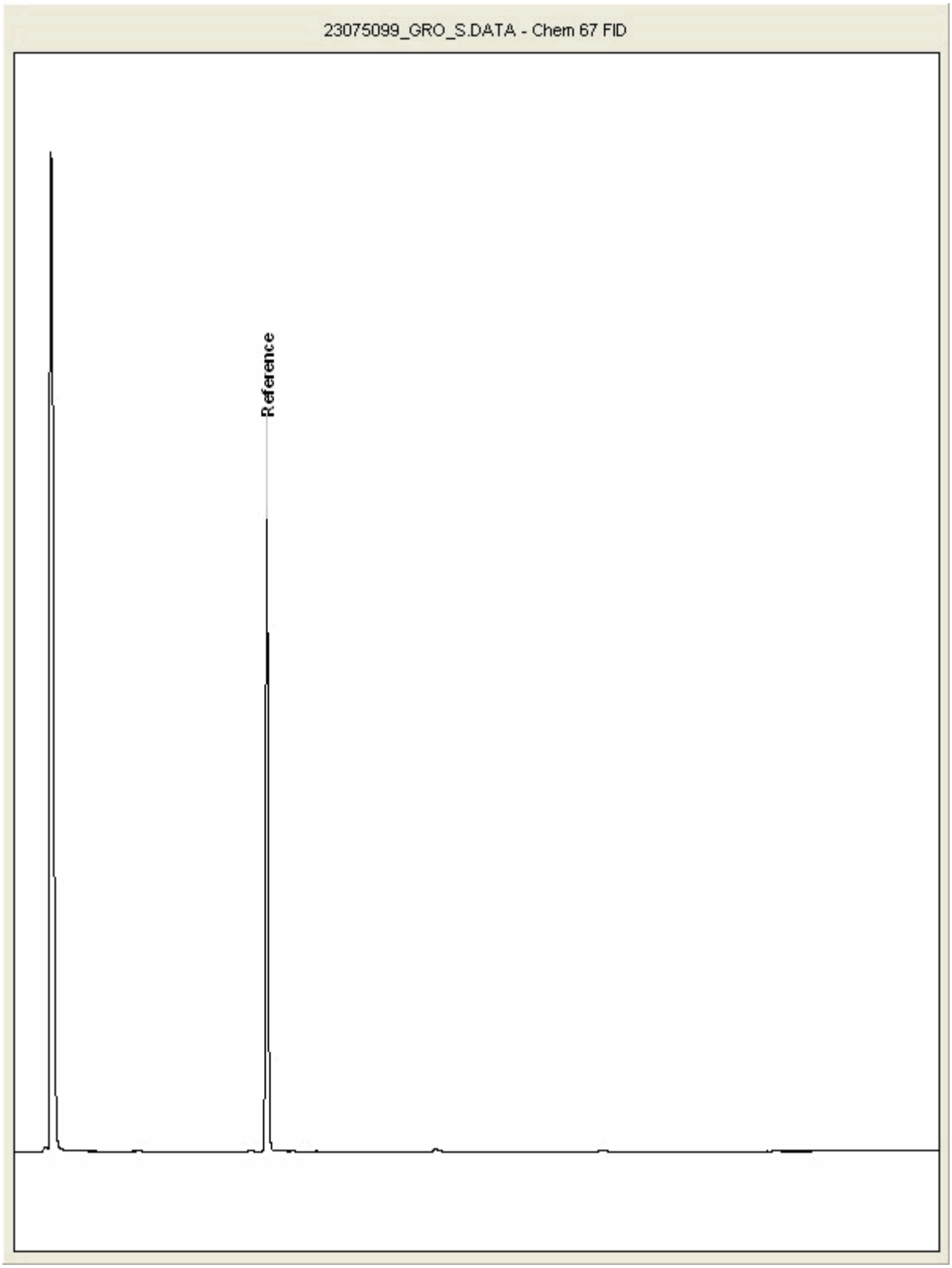
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075099
Sample ID : TP202

Depth : 1.40 - 1.50



CERTIFICATE OF ANALYSIS

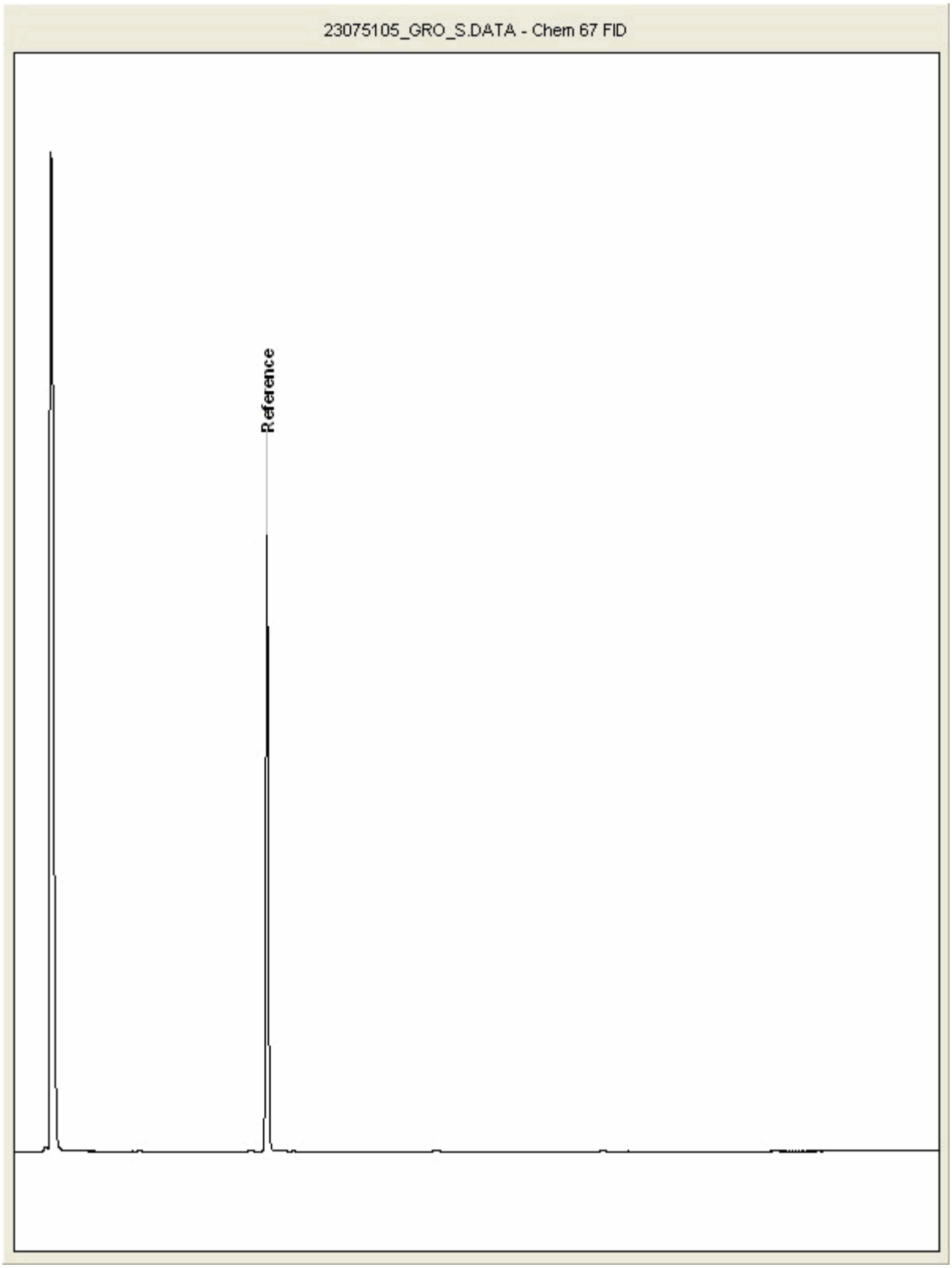
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075105
Sample ID : TP203

Depth : 0.50 - 0.60



CERTIFICATE OF ANALYSIS

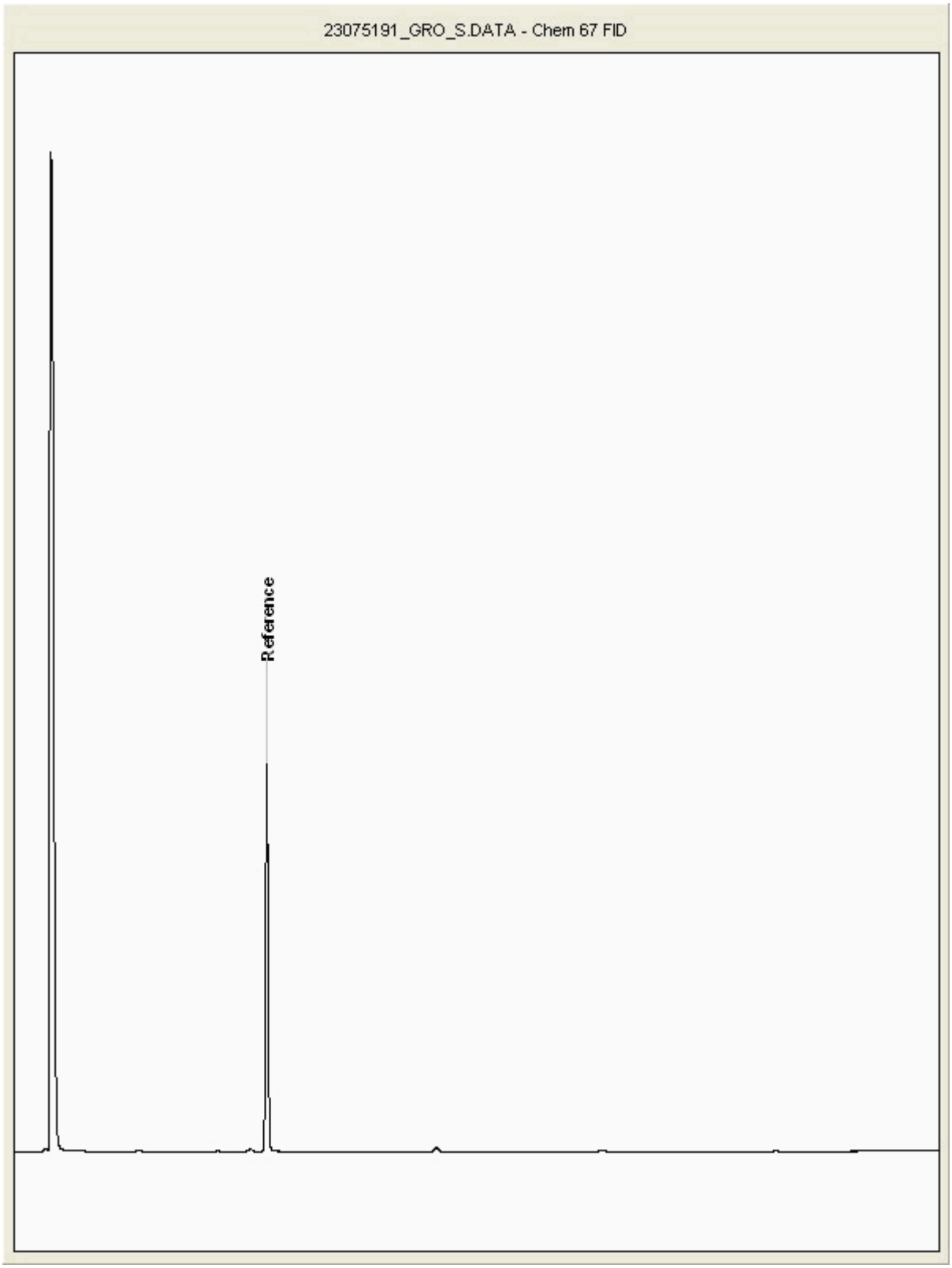
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075191
Sample ID : TP009

Depth : 1.50 - 1.60



CERTIFICATE OF ANALYSIS

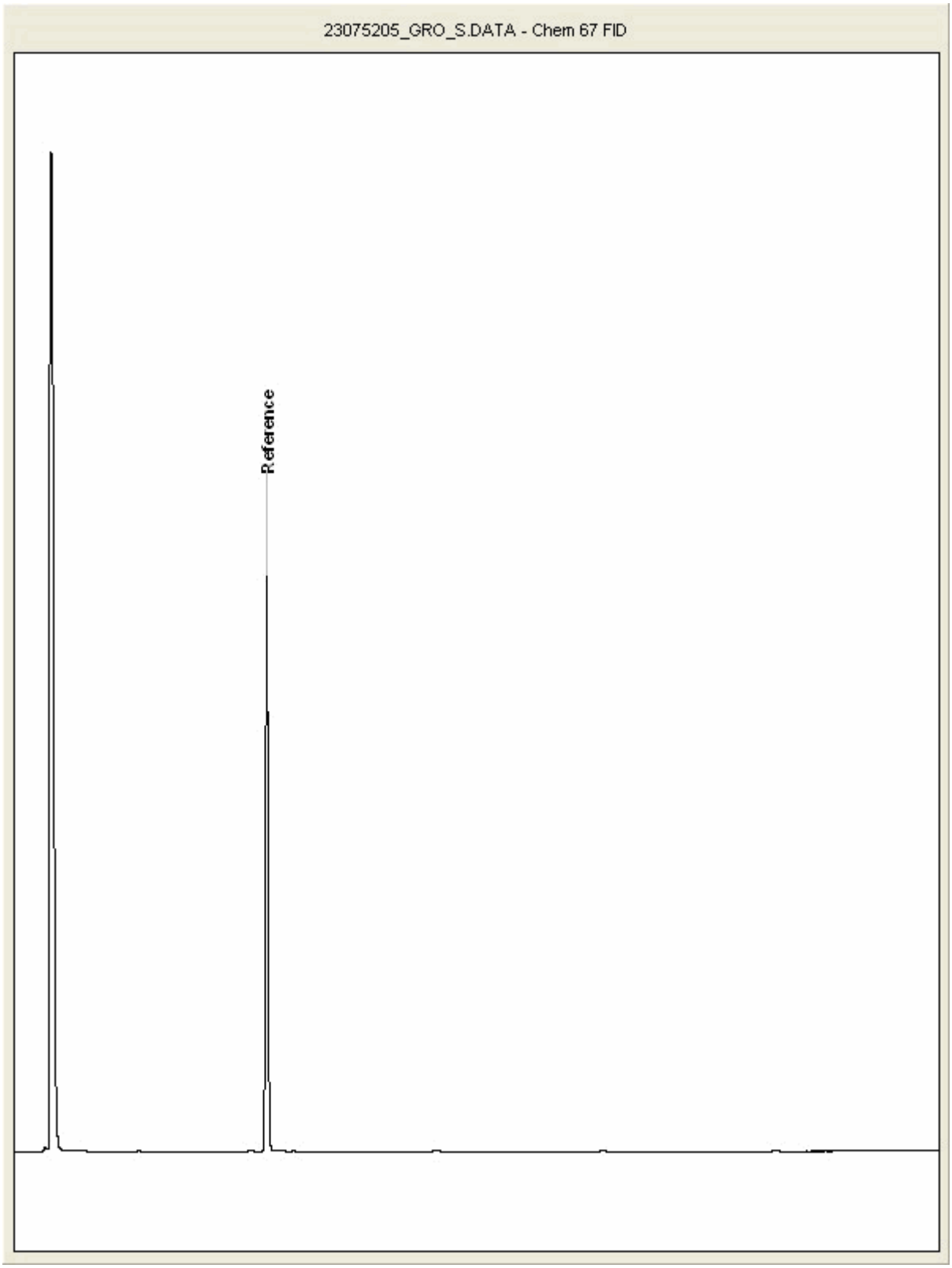
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075205
Sample ID : TP203

Depth : 1.60 - 1.70



CERTIFICATE OF ANALYSIS

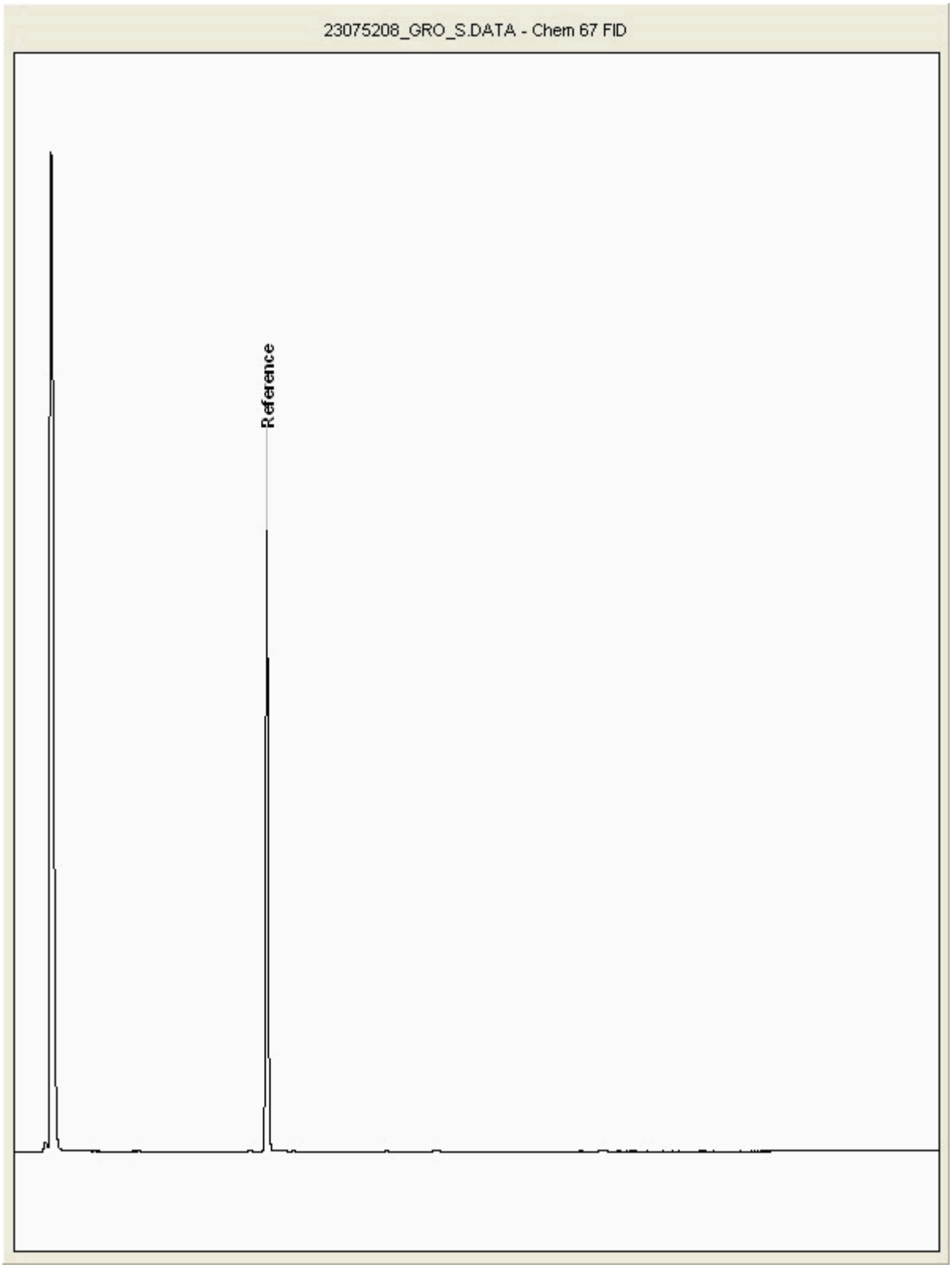
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075208
Sample ID : TP311

Depth : 0.40 - 0.50



CERTIFICATE OF ANALYSIS

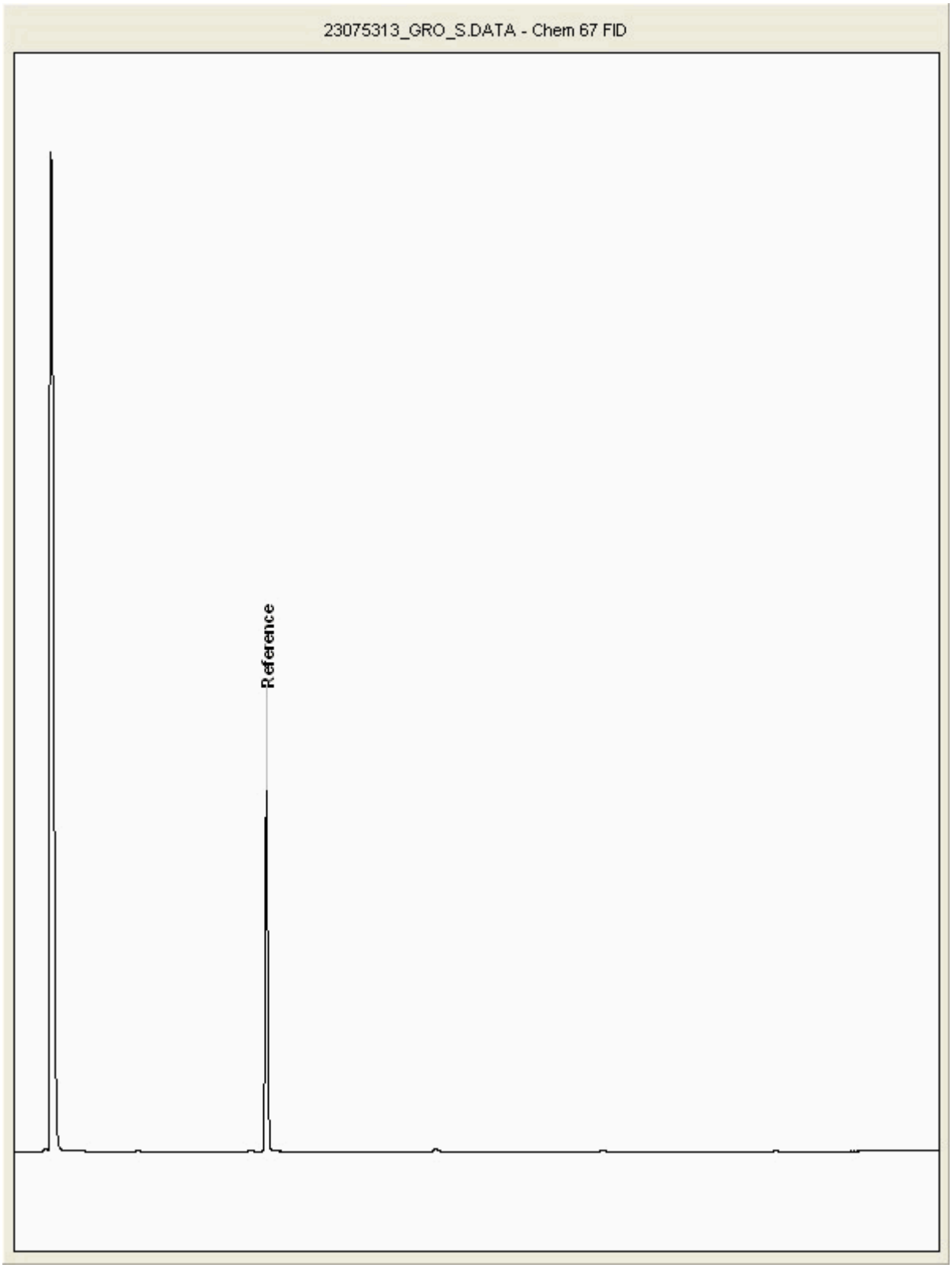
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075313
Sample ID : TP007

Depth : 0.40 - 0.50



CERTIFICATE OF ANALYSIS

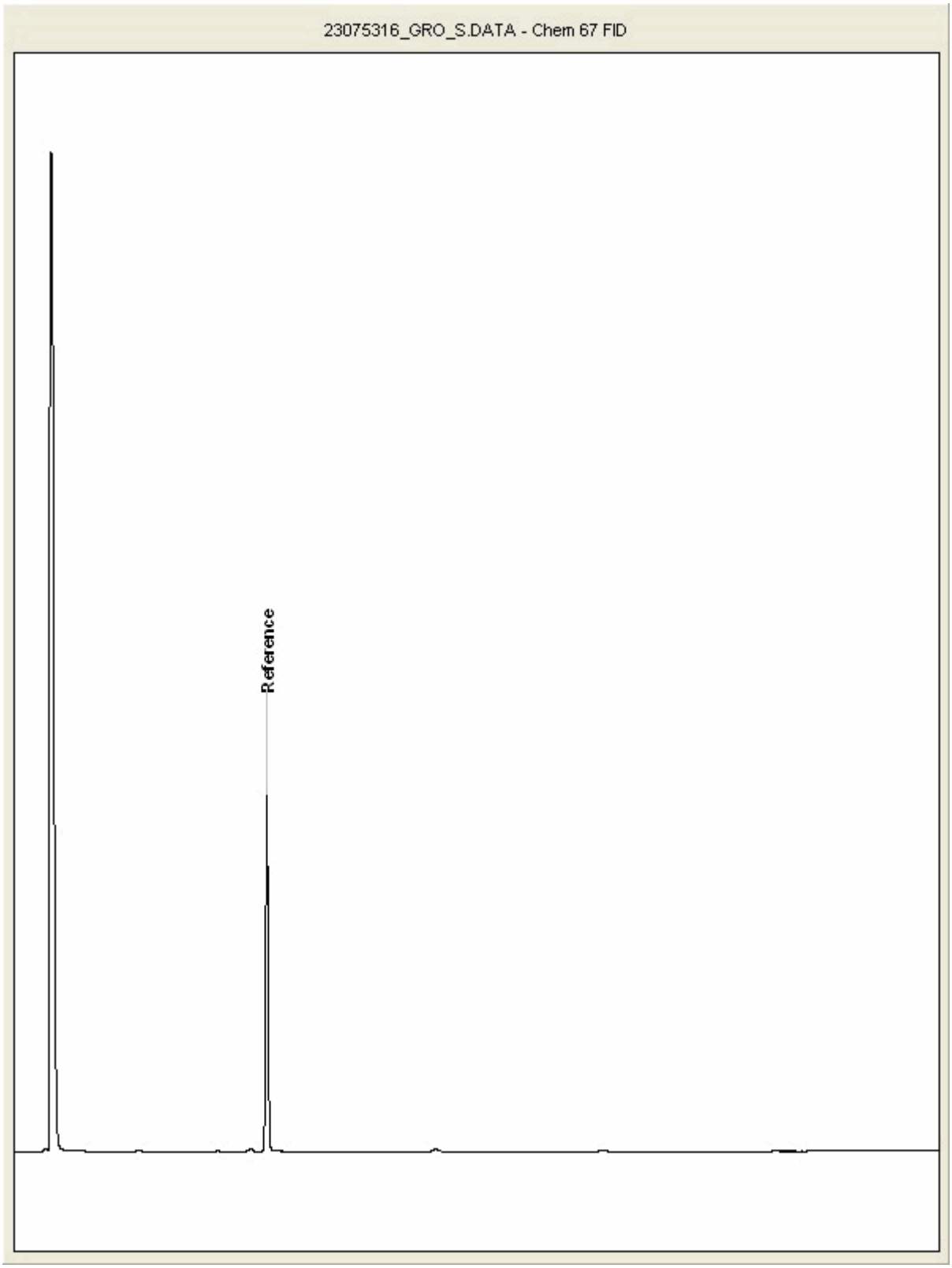
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075316
Sample ID : TP319

Depth : 0.40 - 0.50



CERTIFICATE OF ANALYSIS

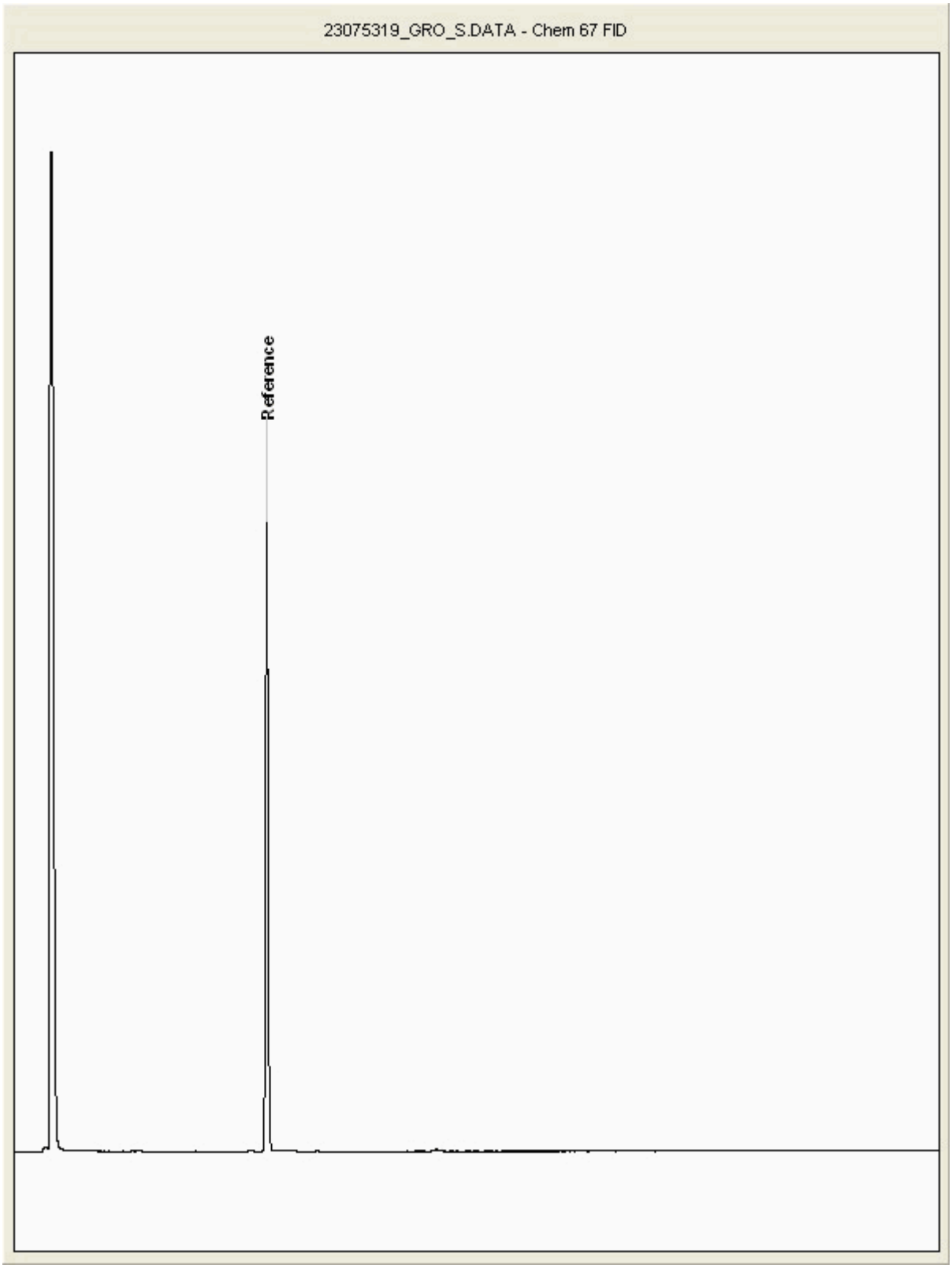
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075319
Sample ID : TP007

Depth : 1.50 - 1.60



CERTIFICATE OF ANALYSIS

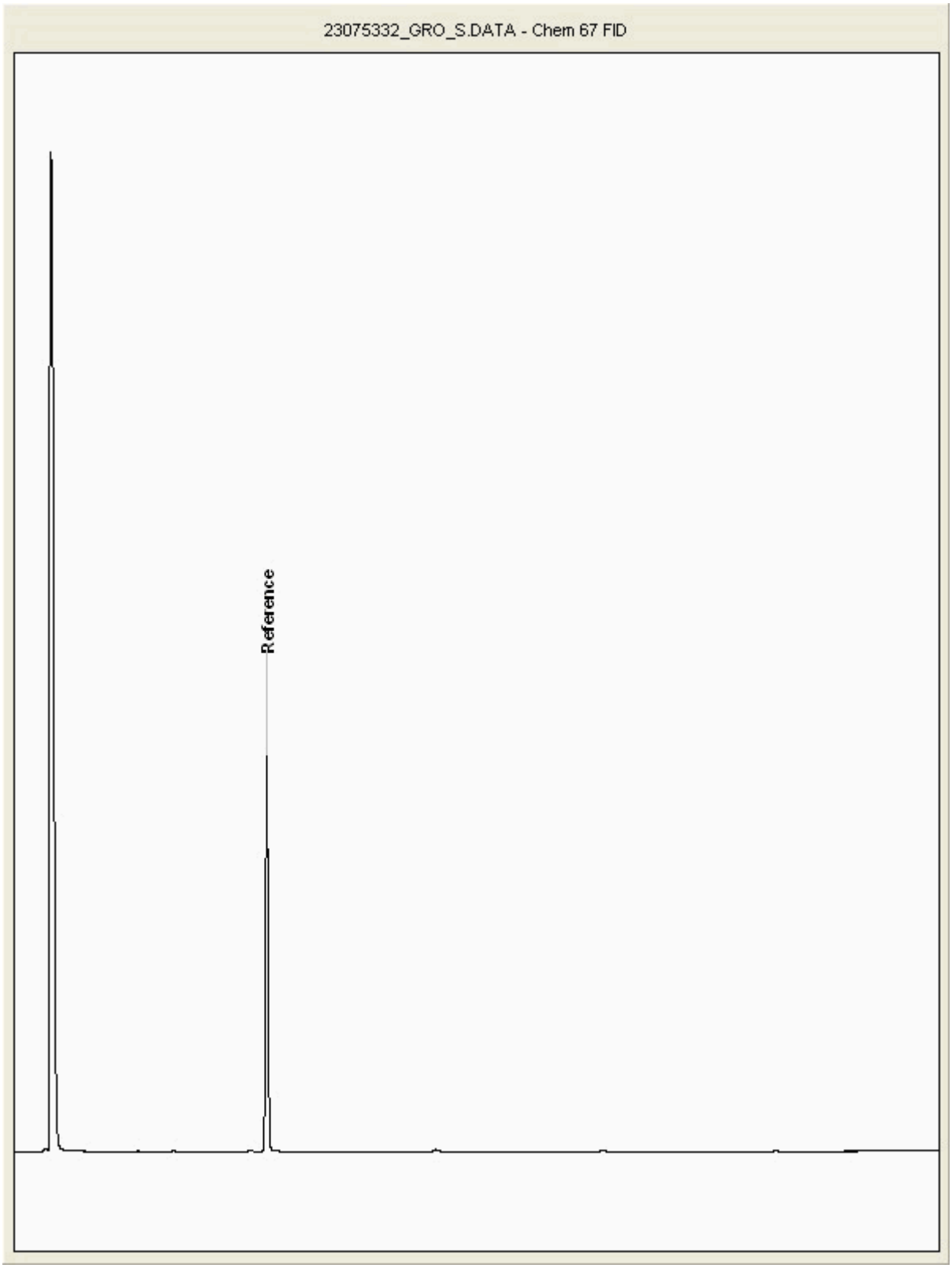
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075332
Sample ID : TP319

Depth : 1.20 - 1.30



CERTIFICATE OF ANALYSIS

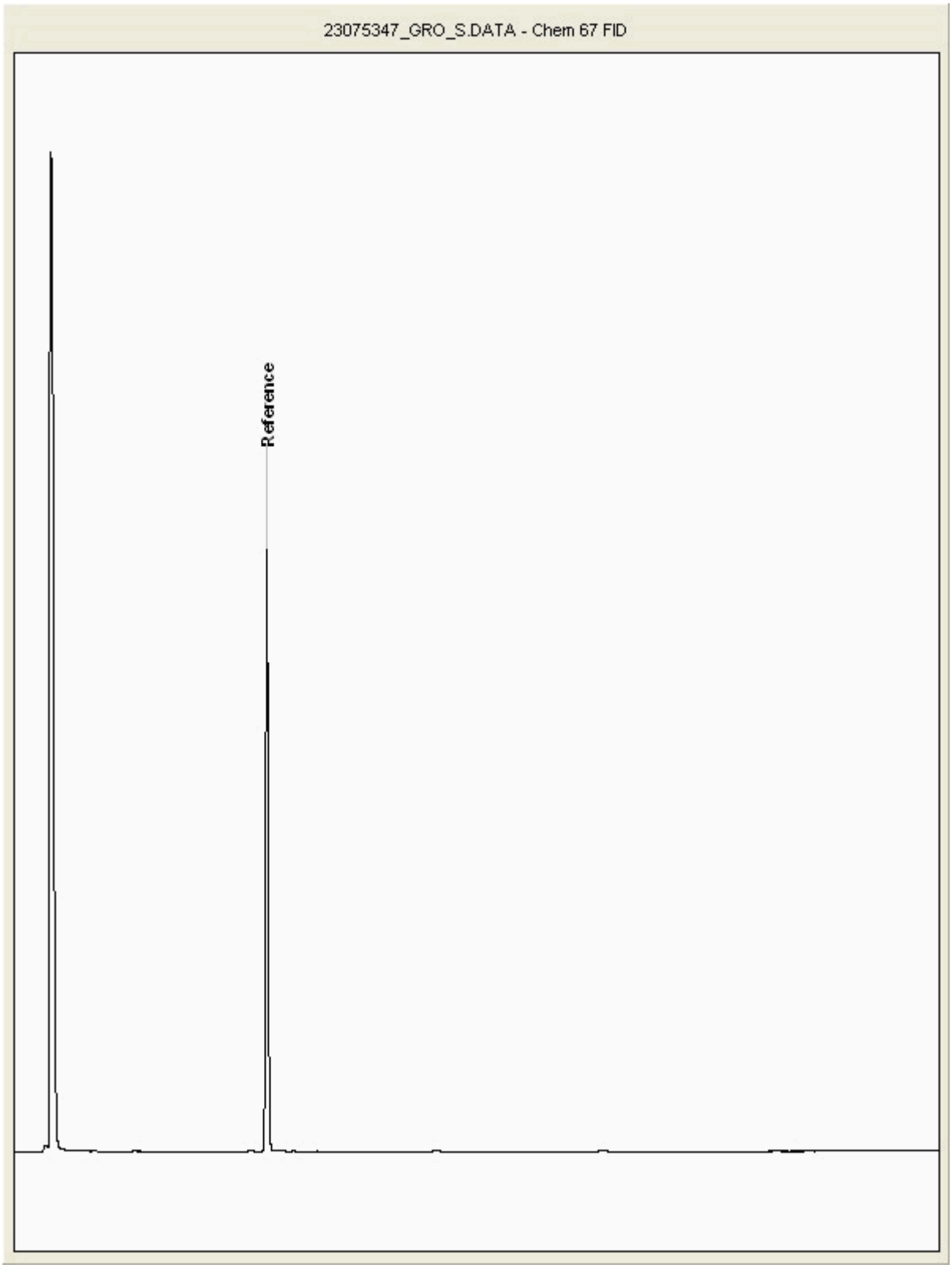
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075347
Sample ID : TP319

Depth : 3.50 - 3.60



CERTIFICATE OF ANALYSIS

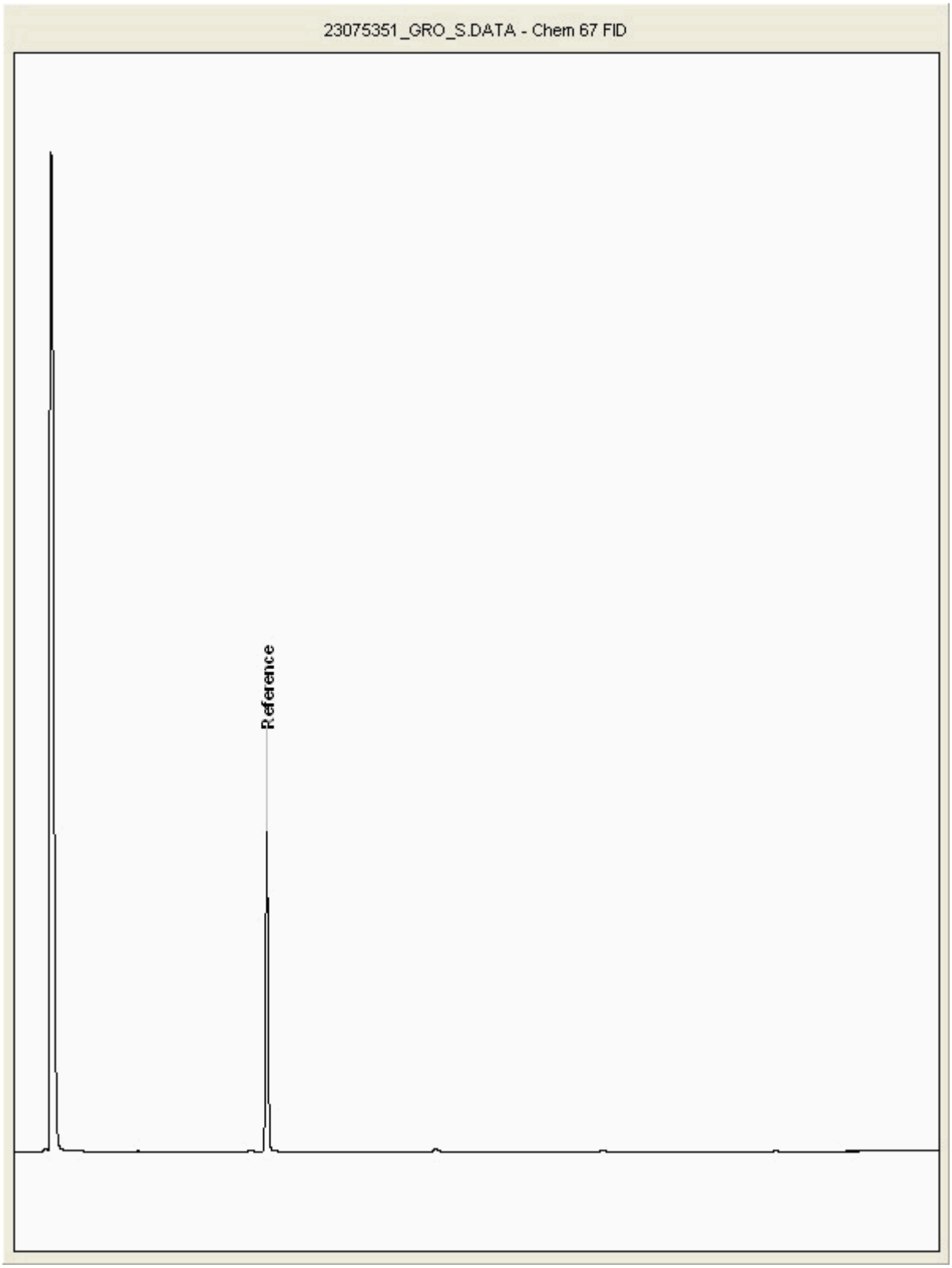
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075351
Sample ID : TP319

Depth : 2.30 - 2.40



CERTIFICATE OF ANALYSIS

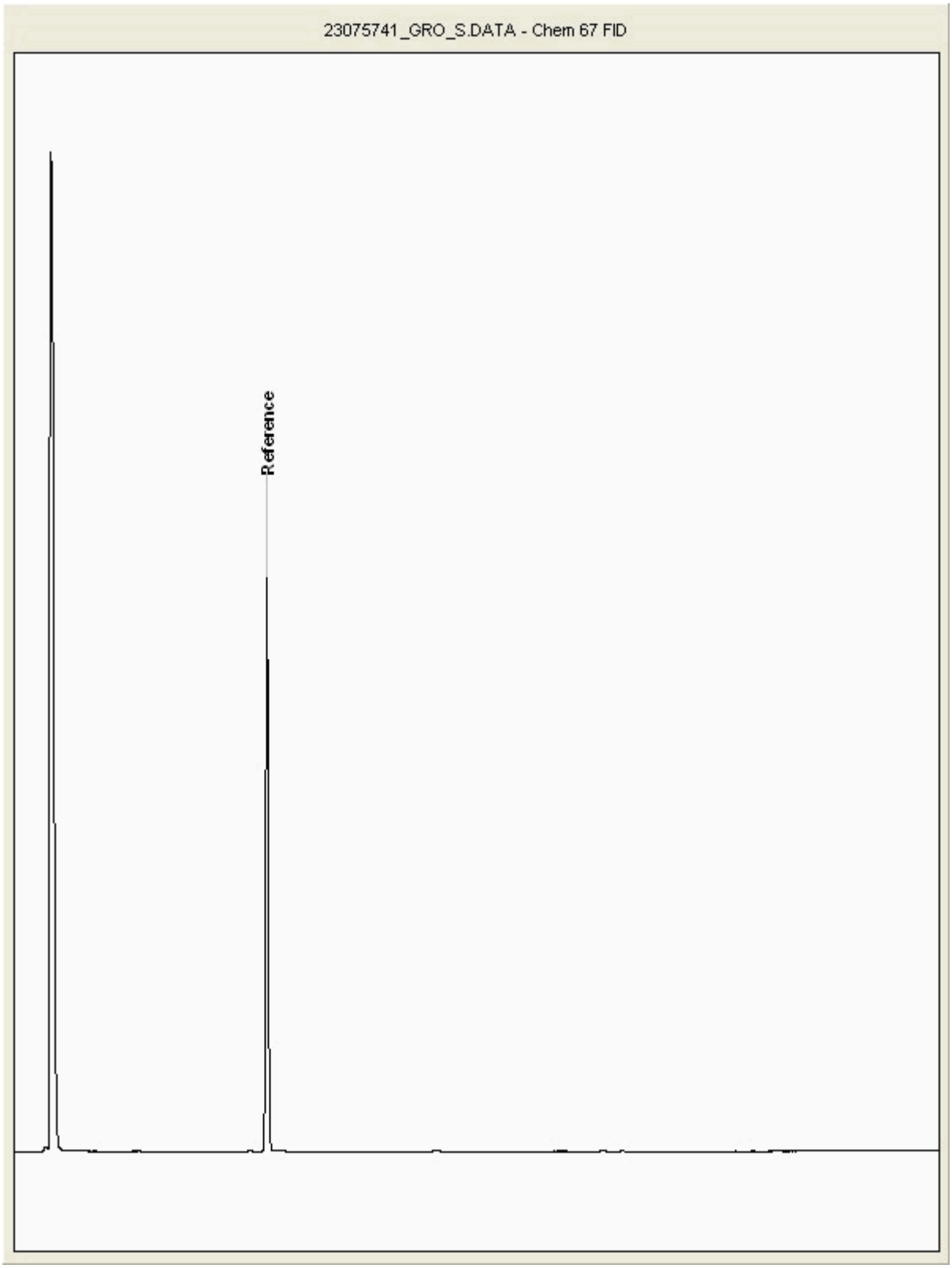
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075741
Sample ID : TP008

Depth : 1.50 - 1.60



CERTIFICATE OF ANALYSIS

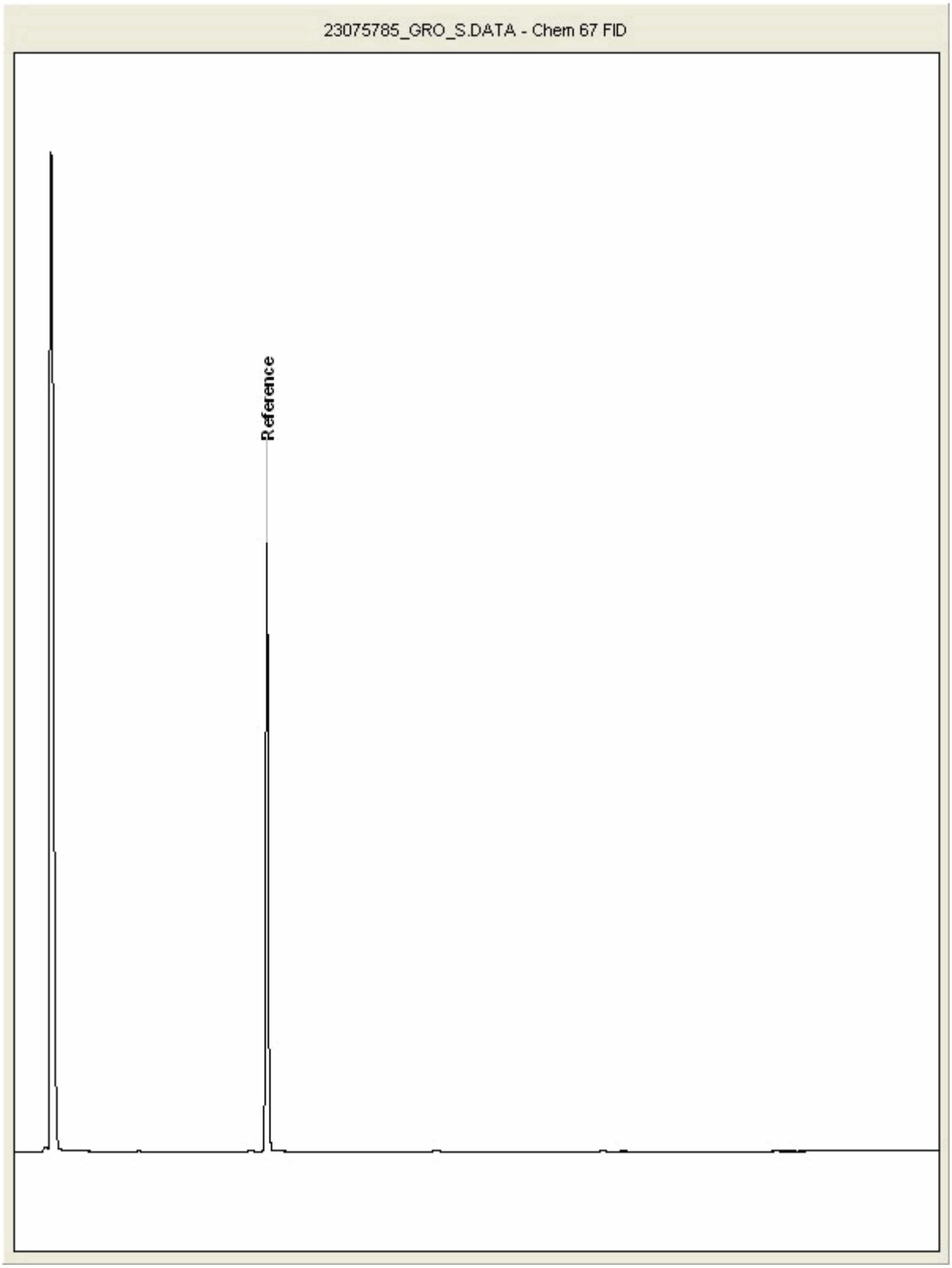
SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23075785
Sample ID : TP008

Depth : 0.40 - 0.50

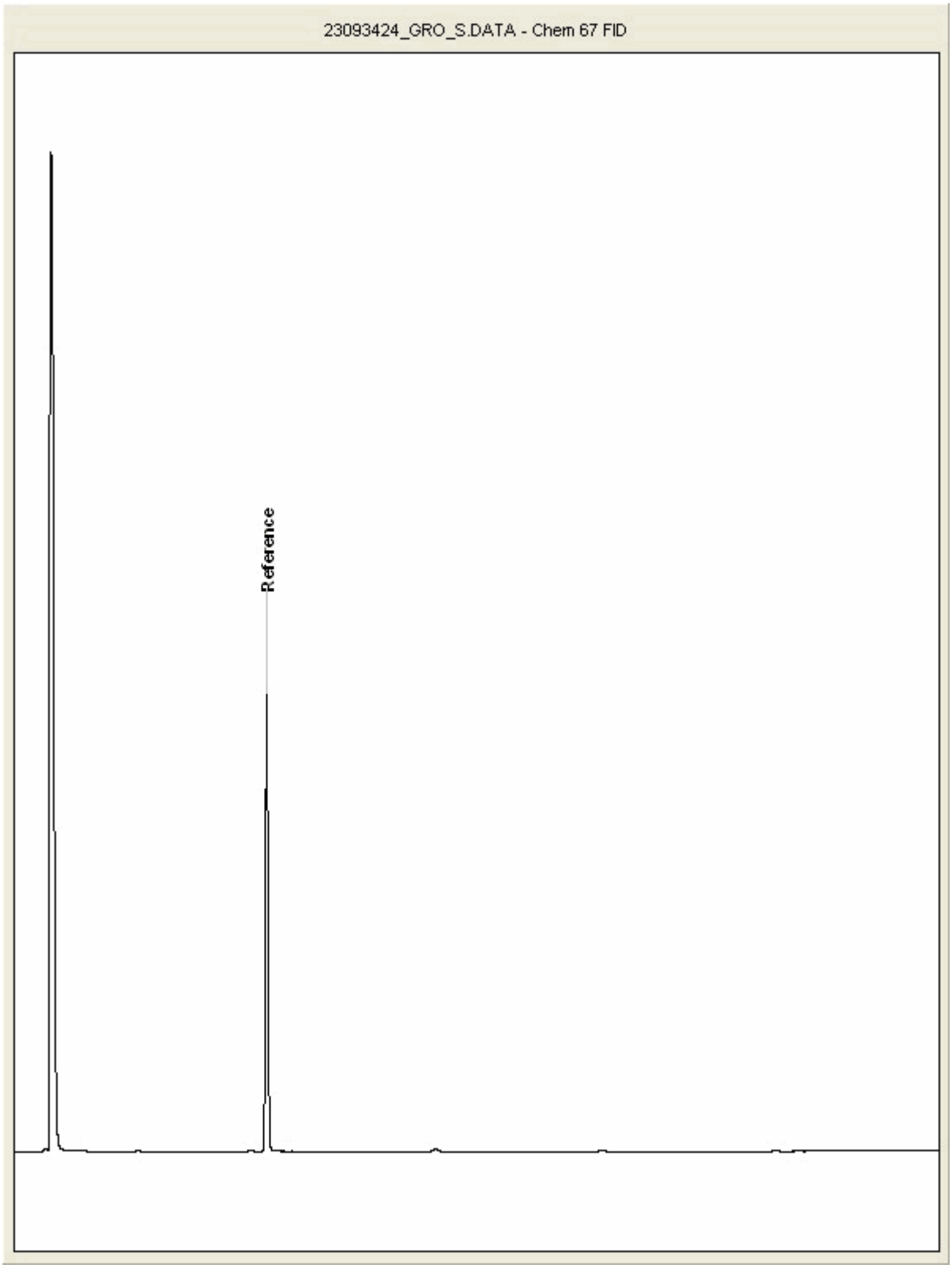


CERTIFICATE OF ANALYSIS

SDG:	201015-115	**Client Reference:**	2020WW102	**Report Number:**	579794
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S) **Sample No :** 23093424 **Sample ID :** TP311 **Depth :** 1.10 - 1.20



Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

18. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

19. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2017).*

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway

Attention: Dympna Darcy

CERTIFICATE OF ANALYSIS

Date of report Generation:	14 December 2020
Customer:	Irish Drilling Limited
Sample Delivery Group (SDG):	201021-100
Your Reference:	2020WW102
Location:	Arklow Bank
Report No:	579754

We received 20 samples on Wednesday October 21, 2020 and 20 of these samples were scheduled for analysis which was completed on Monday December 14, 2020. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
23081642	TP001	ES1	0.40 - 0.50	15/10/2020
23081508	TP001	ES3	1.40 - 1.50	15/10/2020
23081514	TP002	ES1	0.50 - 0.60	15/10/2020
23081519	TP002	ES3	1.40 - 1.50	15/10/2020
23081502	TP003	ES1	0.50 - 0.60	15/10/2020
23081580	TP003	ES4	1.50 - 1.60	15/10/2020
23081629	TP004	ES1	0.40 - 0.50	15/10/2020
23081636	TP004	ES2	1.40 - 1.50	15/10/2020
23081593	TP005	ES1	0.40 - 0.50	15/10/2020
23081599	TP005	ES4	1.50 - 1.60	15/10/2020
23081526	TP006	ES1	0.40 - 0.50	14/10/2020
23081533	TP006	ES4	1.40 - 1.50	14/10/2020
23081538	TP010	ES1	0.40 - 0.50	14/10/2020
23081550	TP010	ES4	1.40 - 1.50	14/10/2020
23081573	TP011	ES1	0.40 - 0.50	14/10/2020
23081587	TP011	ES4	1.40 - 1.50	14/10/2020
23081559	TP012	ES1	0.50 - 0.60	14/10/2020
23081567	TP012	ES4	1.40 - 1.50	14/10/2020
23081608	TP201	ES1	0.50 - 0.60	15/10/2020
23081621	TP201	ES4	1.50 - 1.60	15/10/2020

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

Validated

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container	Sample Type
			23081642	TP001	ES1	0.40 - 0.50	1kg TUB with Handle (ALE260)	S
							250g Amber Jar (ALE210)	S
							60g VOC (ALE215)	S
			23081508	TP001	ES3	1.40 - 1.50	1kg TUB with Handle (ALE260)	S
							250g Amber Jar (ALE210)	S
							60g VOC (ALE215)	S
			23081514	TP002	ES1	0.50 - 0.60	1kg TUB with Handle (ALE260)	S
							250g Amber Jar (ALE210)	S
							60g VOC (ALE215)	S
			23081519	TP002	ES3	1.40 - 1.50	1kg TUB with Handle (ALE260)	S
							250g Amber Jar (ALE210)	S
							60g VOC (ALE215)	S
			23081502	TP003	ES1	0.50 - 0.60	1kg TUB with Handle (ALE260)	S
							250g Amber Jar (ALE210)	S
							60g VOC (ALE215)	S
			23081580	TP003	ES4	1.50 - 1.60	1kg TUB with Handle (ALE260)	S
							250g Amber Jar (ALE210)	S
							60g VOC (ALE215)	S
			23081629	TP004	ES1	0.40 - 0.50	1kg TUB with Handle (ALE260)	S
							250g Amber Jar (ALE210)	S
Anions by Kone (w)	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
CEN Readings	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
Chromium III	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
Coronene	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
Easily Liberated Sulphide	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
EPH by GCxGC-FID	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
EPH CWG GC (S)	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
Fluoride	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 20			X			X			X			X			X			X		
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
Loss on Ignition in soils	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	

23081550	TP010	ES4	1.40 - 1.50	1kg TUB with Handle (ALE260)	S		X		X		X						X		X				X			
23081538	TP010	ES1	0.40 - 0.50	60g VOC (ALE215)	S																			X		
				250g Amber Jar (ALE210)	S						X		X		X				X		X				X		X
				1kg TUB with Handle (ALE260)	S		X		X		X						X		X				X			
23081533	TP006	ES4	1.40 - 1.50	60g VOC (ALE215)	S																			X		
				250g Amber Jar (ALE210)	S						X		X		X				X		X				X		X
				1kg TUB with Handle (ALE260)	S		X		X		X						X		X				X			
23081526	TP006	ES1	0.40 - 0.50	60g VOC (ALE215)	S																			X		
				250g Amber Jar (ALE210)	S						X		X		X				X		X				X		X
				1kg TUB with Handle (ALE260)	S		X		X		X						X		X				X			
23081599	TP005	ES4	1.50 - 1.60	60g VOC (ALE215)	S																			X		
				250g Amber Jar (ALE210)	S						X		X		X				X		X				X		X
				1kg TUB with Handle (ALE260)	S		X		X		X						X		X				X			
23081593	TP005	ES1	0.40 - 0.50	60g VOC (ALE215)	S																			X		
				250g Amber Jar (ALE210)	S						X		X		X				X		X				X		X
				1kg TUB with Handle (ALE260)	S		X		X		X						X		X				X			
23081636	TP004	ES2	1.40 - 1.50	60g VOC (ALE215)	S																			X		
				250g Amber Jar (ALE210)	S						X		X		X				X		X				X		X
				1kg TUB with Handle (ALE260)	S		X		X		X						X		X				X			
23081629	TP004	ES1	0.40 - 0.50	60g VOC (ALE215)	S																			X		

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			23081642			23081508			23081514			23081519			23081502			23081580			23081629		
Customer Sample Reference			TP001			TP001			TP002			TP002			TP003			TP003			TP004		
AGS Reference			ES1			ES3			ES1			ES3			ES1			ES4			ES1		
Depth (m)			0.40 - 0.50			1.40 - 1.50			0.50 - 0.60			1.40 - 1.50			0.50 - 0.60			1.50 - 1.60			0.40 - 0.50		
Container			1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	
Sample Type			S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Mercury Dissolved	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X		
Metals in solid samples by OES	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
PAH 16 & 17 Calc	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
PAH by GCMS	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
PCBs by GCMS	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
pH	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
Phenols by HPLC (W)	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X		
Sample description	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
Semi Volatile Organic Compounds	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
Total Dissolved Solids	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X		
Total Organic Carbon	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
TPH CWG GC (S)	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X	
VOC MS (S)	All	NDPs: 0 Tests: 20			X			X			X			X			X			X			

| | | |

CERTIFICATE OF ANALYSIS

Validated

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
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LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	23081550	23081573	23081587	23081559	23081567	23081608	23081621
			Customer Sample Reference	TP010	TP011	TP011	TP012	TP012	TP201	TP201
			AGS Reference	ES4	ES1	ES4	ES1	ES4	ES1	ES4
			Depth (m)	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Container	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)
			Sample Type	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Anions by Kone (w)	All	NDPs: 0 Tests: 20			X		X		X			X			X			X		
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 20			X		X		X			X			X			X		
CEN Readings	All	NDPs: 0 Tests: 20			X		X		X			X			X			X		
Chromium III	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
Coronene	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 20			X			X			X			X			X			X	
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 20			X			X			X			X			X			X	
Easily Liberated Sulphide	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
EPH by GCxGC-FID	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
EPH CWG GC (S)	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
Fluoride	All	NDPs: 0 Tests: 20			X			X			X			X			X			X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	
Loss on Ignition in soils	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X	

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			23081550		23081573		23081587		23081559		23081567		23081608		23081621								
Customer Sample Reference			TP010		TP011		TP011		TP012		TP012		TP201		TP201								
AGS Reference			ES4		ES1		ES4		ES1		ES4		ES1		ES4								
Depth (m)			1.40 - 1.50		0.40 - 0.50		1.40 - 1.50		0.50 - 0.60		1.40 - 1.50		0.50 - 0.60		1.50 - 1.60								
Container			250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)
Sample Type			S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Mercury Dissolved	All	NDPs: 0 Tests: 20			X			X			X			X			X			X					
Metals in solid samples by OES	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X			X	
PAH 16 & 17 Calc	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X			X	
PAH by GCMS	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X			X	
PCBs by GCMS	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X			X	
pH	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X			X	
Phenols by HPLC (W)	All	NDPs: 0 Tests: 20			X			X			X			X			X			X					
Sample description	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X			X	
Semi Volatile Organic Compounds	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X			X	
Total Dissolved Solids	All	NDPs: 0 Tests: 20			X			X			X			X			X			X					
Total Organic Carbon	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X			X	
TPH CWG GC (S)	All	NDPs: 0 Tests: 20	X			X			X			X			X			X			X			X	
VOC MS (S)	All	NDPs: 0 Tests: 20		X			X			X			X			X			X			X			X	X

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
23081508	TP001	1.40 - 1.50	Dark Brown	Sand	None	Stones
23081642	TP001	0.40 - 0.50	Light Brown	Silt Loam	Vegetation	Stones
23081514	TP002	0.50 - 0.60	Light Brown	Sand	None	Stones
23081519	TP002	1.40 - 1.50	Dark Brown	Sand	None	Stones
23081502	TP003	0.50 - 0.60	Light Brown	Sandy Silt Loam	None	Stones
23081580	TP003	1.50 - 1.60	Light Brown	Sand	None	Stones
23081629	TP004	0.40 - 0.50	Light Brown	Silt Loam	Stones	Vegetation
23081636	TP004	1.40 - 1.50	Light Brown	Loamy Sand	Stones	Vegetation
23081593	TP005	0.40 - 0.50	Dark Brown	Clay	Stones	Vegetation
23081599	TP005	1.50 - 1.60	Light Brown	Sandy Clay Loam	Vegetation	None
23081526	TP006	0.40 - 0.50	Light Brown	Silt Loam	Stones	Vegetation
23081533	TP006	1.40 - 1.50	Dark Brown	Silt Loam	None	None
23081538	TP010	0.40 - 0.50	Light Brown	Clay	Vegetation	None
23081550	TP010	1.40 - 1.50	Light Brown	Clay	Stones	None
23081573	TP011	0.40 - 0.50	Light Brown	Sand	None	Stones
23081587	TP011	1.40 - 1.50	Light Brown	Clay	Stones	None
23081559	TP012	0.50 - 0.60	Light Brown	Clay	Vegetation	None
23081567	TP012	1.40 - 1.50	Light Brown	Clay	Stones	None
23081608	TP201	0.50 - 0.60	Dark Brown	Sandy Clay Loam	Stones	Vegetation
23081621	TP201	1.50 - 1.60	Light Brown	Loamy Sand	Vegetation	Stones

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081642	23081508	23081514	23081519	23081502	23081580
			AGS Reference	ES1	ES3	ES1	ES3	ES1	ES4
Moisture Content Ratio (% of as received sample)	%	PM024		19	17	23	18	18	13
Loss on ignition	<0.7 %	TM018		7.88 M	3.5 M	6.99 M	3.43 M	8.95 M	5.08 M
Organic Carbon, Total	<0.2 %	TM132		0.344 M	0.273 M	0.407 M	0.312 M	0.339 M	<0.2 M
pH	1 pH Units	TM133		7.15 M	8.41 M	7.72 M	8.44 M	7.56 M	8.72 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Free	<1 mg/kg	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Complex	<1 mg/kg	TM153		<1	<1	<1	<1	<1	<1
PCB congener 28	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 52	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 101	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 118	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 138	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 153	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 180	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168		<21	<21	<21	<21	<21	<21
Sulphide, Easily liberated	<15 mg/kg	TM180		<15 @ M	<15 @ M	<15 @ M	<15 @ M	<15 @ M	<15 @ M
Chromium, Trivalent	<0.9 mg/kg	TM181		42.6	36.9	47.5	35.9	48.6	30.7
Antimony	<0.6 mg/kg	TM181		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Arsenic	<0.6 mg/kg	TM181		17.9 M	15.4 M	19.9 M	16.4 M	17.9 M	14.1 M
Barium	<0.6 mg/kg	TM181		86.1 #	88.7 #	114 #	83.8 #	110 #	73 #
Cadmium	<0.02 mg/kg	TM181		<0.02 M	<0.02 M	<0.02 M	<0.02 M	<0.02 M	<0.02 M
Chromium	<0.9 mg/kg	TM181		42.6 M	36.9 M	47.5 M	35.9 M	48.6 M	30.7 M
Copper	<1.4 mg/kg	TM181		15.6 M	24.3 M	32.3 M	24.7 M	27.5 M	21.2 M
Lead	<0.7 mg/kg	TM181		21.7 M	17.5 M	27.1 M	17.4 M	23.8 M	15.7 M
Mercury	<0.14 mg/kg	TM181		0.163 M	<0.14 M	0.194 M	<0.14 M	0.153 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		0.373 #	0.232 #	1.72 #	0.188 #	0.232 #	0.339 #
Nickel	<0.2 mg/kg	TM181		34.2 M	44.2 M	62.9 M	43.4 M	52.1 M	39.5 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		64.2 M	74.7 M	103 M	75.5 M	75.6 M	67.4 M
PAH, Total Detected USEPA 16 + Coronene	<318 µg/kg	TM410		<318	<318	<318	<318	<318	<318
Coronene	<200 µg/kg	TM410		<200	<200	<200	<200	<200	<200

Validated

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081642	23081508	23081514	23081519	23081502	23081580
			AGS Reference	ES1	ES3	ES1	ES3	ES1	ES4
EPH >C8-C40	<35 mg/kg	TM415		<35	<35	<35	<35	<35	<35

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP004	TP004	TP005	TP005	TP006	TP006
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081629	23081636	23081593	23081599	23081526	23081533
			AGS Reference	ES1	ES2	ES1	ES4	ES1	ES4
Moisture Content Ratio (% of as received sample)	%	PM024		17	12	19	16	16	15
Loss on ignition	<0.7 %	TM018		5.51 M	2.16 M	6.16 M	2.1 M	3.12 M	5.23 M
Organic Carbon, Total	<0.2 %	TM132		0.483 M	<0.2 M	0.36 M	<0.2 M	0.226 M	0.293 M
pH	1 pH Units	TM133		6.97 M	7.55 M	7.11 M	7.82 M	7.15 M	7.82 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Free	<1 mg/kg	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Complex	<1 mg/kg	TM153		<1	<1	<1	<1	<1	<1
PCB congener 28	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 52	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 101	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 118	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 138	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 153	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 180	<3 µg/kg	TM168		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168		<21	<21	<21	<21	<21	<21
Sulphide, Easily liberated	<15 mg/kg	TM180		<15 @ M	<15 @ M	<15 @ M	<15 @ M	<15 @ M	<15 @ M
Chromium, Trivalent	<0.9 mg/kg	TM181		50.7	23.8	48	27.3	32.4	51.7
Antimony	<0.6 mg/kg	TM181		<0.6 #	<0.6 #	0.909 #	<0.6 #	<0.6 #	0.654 #
Arsenic	<0.6 mg/kg	TM181		17.8 M	10.6 M	14.9 M	10.5 M	11.4 M	19.4 M
Barium	<0.6 mg/kg	TM181		60.9 #	46.7 #	64.3 #	55.4 #	38 #	107 #
Cadmium	<0.02 mg/kg	TM181		<0.02 M	0.115 M	<0.02 M	0.0645 M	<0.02 M	0.129 M
Chromium	<0.9 mg/kg	TM181		50.7 M	24 M	48 M	27.3 M	32.4 M	51.7 M
Copper	<1.4 mg/kg	TM181		16.5 M	15.1 M	18.6 M	17.4 M	12.5 M	32.6 M
Lead	<0.7 mg/kg	TM181		11.6 M	10.1 M	12.5 M	10.6 M	9.47 M	17.6 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		0.399 #	0.152 #	0.36 #	0.236 #	0.289 #	0.296 #
Nickel	<0.2 mg/kg	TM181		33.1 M	31.6 M	28.8 M	28.2 M	21.2 M	61.1 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		76.2 M	39.3 M	55 M	39 M	40.6 M	85.2 M
PAH, Total Detected USEPA 16 + Coronene	<318 µg/kg	TM410		<318	<318	<318	<318	<318	<318
Coronene	<200 µg/kg	TM410		<200	<200	<200	<200	<200	<200

Validated

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP004	TP004	TP005	TP005	TP006	TP006
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081629	23081636	23081593	23081599	23081526	23081533
			AGS Reference	ES1	ES2	ES1	ES4	ES1	ES4
EPH >C8-C40	<35 mg/kg	TM415		<35	<35	<35	<35	<35	<35

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	TP010	TP010	TP011	TP011	TP012	TP012
Customer Sample Ref.			TP010	TP010	TP011	TP011	TP012	TP012
Depth (m)			0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50
Sample Type			Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Date Sampled			14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020
Sampled Time			.	.	.	.	.	.
Date Received			21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
SDG Ref			201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
Lab Sample No.(s)			23081538	23081550	23081573	23081587	23081559	23081567
AGS Reference			ES1	ES4	ES1	ES4	ES1	ES4
Moisture Content Ratio (% of as received sample)	%	PM024	19	14	18	20	17	17
Loss on ignition	<0.7 %	TM018	7.18 M	4.52 M	7.95 M	4.51 M	5.26 M	5.75 M
Organic Carbon, Total	<0.2 %	TM132	0.333 M	<0.2 M	0.355 M	<0.2 M	0.35 M	0.202 M
pH	1 pH Units	TM133	7.4 M	8.85 M	7.93 M	8.77 M	7.42 M	8.65 M
Chromium, Hexavalent	<0.6 mg/kg	TM151	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Cyanide, Total	<1 mg/kg	TM153	<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Free	<1 mg/kg	TM153	<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Cyanide, Complex	<1 mg/kg	TM153	<1	<1	<1	<1	<1	<1
PCB congener 28	<3 µg/kg	TM168	<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 52	<3 µg/kg	TM168	<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 101	<3 µg/kg	TM168	<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 118	<3 µg/kg	TM168	<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 138	<3 µg/kg	TM168	<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 153	<3 µg/kg	TM168	<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
PCB congener 180	<3 µg/kg	TM168	<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168	<21	<21	<21	<21	<21	<21
Sulphide, Easily liberated	<15 mg/kg	TM180	<15 @ M	<15 @ M	<15 @ M	<15 @ M	<15 @ M	<15 @ M
Chromium, Trivalent	<0.9 mg/kg	TM181	43.5	29.3	44.8	33.6	28.4	40.8
Antimony	<0.6 mg/kg	TM181	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Arsenic	<0.6 mg/kg	TM181	17.7 M	12.8 M	18.8 M	14.6 M	16.2 M	15.6 M
Barium	<0.6 mg/kg	TM181	86.2 #	68.1 #	115 #	89.9 #	49.4 #	111 #
Cadmium	<0.02 mg/kg	TM181	<0.02 M	<0.02 M	<0.02 M	0.274 M	<0.02 M	<0.02 M
Chromium	<0.9 mg/kg	TM181	43.5 M	29.3 M	44.8 M	33.6 M	28.4 M	40.8 M
Copper	<1.4 mg/kg	TM181	23.9 M	19.9 M	28.6 M	23.7 M	10 M	26.4 M
Lead	<0.7 mg/kg	TM181	22.6 M	13.9 M	23.3 M	21.3 M	14.9 M	17.8 M
Mercury	<0.14 mg/kg	TM181	0.151 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181	0.247 #	0.25 #	0.226 #	0.235 #	0.375 #	0.365 #
Nickel	<0.2 mg/kg	TM181	42.4 M	37.3 M	70.6 M	41.3 M	25.3 M	50.3 M
Selenium	<1 mg/kg	TM181	<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181	72.8 M	63.8 M	78.8 M	66.8 M	56.3 M	81.8 M
PAH, Total Detected USEPA 16 + Coronene	<318 µg/kg	TM410	<318	<318	<318	<318	<318	<318
Coronene	<200 µg/kg	TM410	<200	<200	<200	<200	<200	<200

Validated

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP010	TP010	TP011	TP011	TP012	TP012
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081538	23081550	23081573	23081587	23081559	23081567
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
EPH >C8-C40	<35 mg/kg	TM415		<35	<35	<35	<35	<35	<35

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP201	TP201				
			Depth (m)	0.50 - 0.60	1.50 - 1.60				
			Sample Type	Soil/Solid (S)	Soil/Solid (S)				
			Date Sampled	15/10/2020	15/10/2020				
			Sampled Time	.	.				
			Date Received	21/10/2020	21/10/2020				
			SDG Ref	201021-100	201021-100				
			Lab Sample No.(s)	23081608	23081621				
			AGS Reference	ES1	ES4				
Moisture Content Ratio (% of as received sample)	%	PM024		16	16				
Loss on ignition	<0.7 %	TM018		5.21 M	4.1 M				
Organic Carbon, Total	<0.2 %	TM132		0.223 M	0.258 M				
pH	1 pH Units	TM133		7.42 M	8.6 M				
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #				
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M				
Cyanide, Free	<1 mg/kg	TM153		<1 M	<1 M				
Cyanide, Complex	<1 mg/kg	TM153		<1	<1				
PCB congener 28	<3 µg/kg	TM168		<3 M	<3 M				
PCB congener 52	<3 µg/kg	TM168		<3 M	<3 M				
PCB congener 101	<3 µg/kg	TM168		<3 M	<3 M				
PCB congener 118	<3 µg/kg	TM168		<3 M	<3 M				
PCB congener 138	<3 µg/kg	TM168		<3 M	<3 M				
PCB congener 153	<3 µg/kg	TM168		<3 M	<3 M				
PCB congener 180	<3 µg/kg	TM168		<3 M	<3 M				
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168		<21	<21				
Sulphide, Easily liberated	<15 mg/kg	TM180		<15 @ M	<15 @ M				
Chromium, Trivalent	<0.9 mg/kg	TM181		44.9	35.9				
Antimony	<0.6 mg/kg	TM181		0.708 #	<0.6 #				
Arsenic	<0.6 mg/kg	TM181		14.2 M	15 M				
Barium	<0.6 mg/kg	TM181		101 #	85.2 #				
Cadmium	<0.02 mg/kg	TM181		<0.02 M	0.0466 M				
Chromium	<0.9 mg/kg	TM181		44.9 M	35.9 M				
Copper	<1.4 mg/kg	TM181		24.3 M	23.1 M				
Lead	<0.7 mg/kg	TM181		15.4 M	10.7 M				
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M				
Molybdenum	<0.1 mg/kg	TM181		0.223 #	0.49 #				
Nickel	<0.2 mg/kg	TM181		42.9 M	39.7 M				
Selenium	<1 mg/kg	TM181		<1 #	<1 #				
Zinc	<1.9 mg/kg	TM181		65.3 M	62.6 M				
PAH, Total Detected USEPA 16 + Coronene	<318 µg/kg	TM410		<318	<318				
Coronene	<200 µg/kg	TM410		<200	<200				

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP201	TP201				
			Depth (m)	0.50 - 0.60	1.50 - 1.60				
			Sample Type	Soil/Solid (S)	Soil/Solid (S)				
			Date Sampled	15/10/2020	15/10/2020				
			Sampled Time	.	.				
			Date Received	21/10/2020	21/10/2020				
			SDG Ref	201021-100	201021-100				
			Lab Sample No.(s)	23081608	23081621				
			AGS Reference	ES1	ES4				
EPH >C8-C40	<35 mg/kg	TM415		<35	<35				

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081642	23081508	23081514	23081519	23081502	23081580
			AGS Reference	ES1	ES3	ES1	ES3	ES1	ES4
Naphthalene-d8 % recovery**	%	TM218		91.4	93.8	94.7	96	93	91.7
Acenaphthene-d10 % recovery**	%	TM218		92.2	85	86.3	85.8	83.6	83.9
Phenanthrene-d10 % recovery**	%	TM218		95.1	93	93.5	92.6	91.3	92.4
Chrysene-d12 % recovery**	%	TM218		89.7	91.8	91.3	91.9	90.8	91.7
Perylene-d12 % recovery**	%	TM218		93.6	80.2	80.3	79.2	82.9	83
Naphthalene	<9 µg/kg	TM218		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Acenaphthylene	<12 µg/kg	TM218		<12 M	<12 M	<12 M	<12 M	<12 M	<12 M
Acenaphthene	<8 µg/kg	TM218		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
Fluorene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Phenanthrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Anthracene	<16 µg/kg	TM218		<16 M	<16 M	<16 M	<16 M	<16 M	<16 M
Fluoranthene	<17 µg/kg	TM218		<17 M	<17 M	<17 M	<17 M	<17 M	<17 M
Pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benz(a)anthracene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Chrysene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Benzo(a)pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		<18 M	<18 M	<18 M	<18 M	<18 M	<18 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	<23 M	<23 M	<23 M	<23 M	<23 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		<24 M	<24 M	<24 M	<24 M	<24 M	<24 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		<118	<118	<118	<118	<118	<118

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP004	TP004	TP005	TP005	TP006	TP006
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081629	23081636	23081593	23081599	23081526	23081533
			AGS Reference	ES1	ES2	ES1	ES4	ES1	ES4
Naphthalene-d8 % recovery**	%	TM218		94.9	96.5	95.4	93.5	94.2	97.6
Acenaphthene-d10 % recovery**	%	TM218		89.4	90.6	85.4	85.1	88.7	89.1
Phenanthrene-d10 % recovery**	%	TM218		93.1	94.5	88.6	93.9	96.4	94.7
Chrysene-d12 % recovery**	%	TM218		76.3	80.1	88.7	90.3	79.5	79.3
Perylene-d12 % recovery**	%	TM218		70.8	73.3	85.4	84.4	71.2	71.4
Naphthalene	<9 µg/kg	TM218		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Acenaphthylene	<12 µg/kg	TM218		<12 M	<12 M	<12 M	<12 M	<12 M	<12 M
Acenaphthene	<8 µg/kg	TM218		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
Fluorene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Phenanthrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Anthracene	<16 µg/kg	TM218		<16 M	<16 M	<16 M	<16 M	<16 M	<16 M
Fluoranthene	<17 µg/kg	TM218		<17 M	<17 M	<17 M	<17 M	<17 M	<17 M
Pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benz(a)anthracene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Chrysene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Benzo(a)pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		<18 M	<18 M	<18 M	<18 M	<18 M	<18 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	<23 M	<23 M	<23 M	<23 M	<23 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		<24 M	<24 M	<24 M	<24 M	<24 M	<24 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		<118	<118	<118	<118	<118	<118

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP010	TP010	TP011	TP011	TP012	TP012
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081538	23081550	23081573	23081587	23081559	23081567
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
Naphthalene-d8 % recovery**	%	TM218		93.4	94.1	93.6	93.8	96	90.9
Acenaphthene-d10 % recovery**	%	TM218		83.7	85.1	84.8	91.8	87.3	82.8
Phenanthrene-d10 % recovery**	%	TM218		91.4	93.5	92.4	92.5	95.8	90.5
Chrysene-d12 % recovery**	%	TM218		88.3	91.7	96.5	87.4	95.5	88.1
Perylene-d12 % recovery**	%	TM218		81.3	83.7	89.3	90	87.2	79.3
Naphthalene	<9 µg/kg	TM218		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Acenaphthylene	<12 µg/kg	TM218		<12 M	<12 M	<12 M	<12 M	<12 M	<12 M
Acenaphthene	<8 µg/kg	TM218		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
Fluorene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Phenanthrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Anthracene	<16 µg/kg	TM218		<16 M	<16 M	<16 M	<16 M	<16 M	<16 M
Fluoranthene	<17 µg/kg	TM218		<17 M	<17 M	<17 M	<17 M	<17 M	<17 M
Pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benz(a)anthracene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Chrysene	<10 µg/kg	TM218		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Benzo(a)pyrene	<15 µg/kg	TM218		<15 M	<15 M	<15 M	<15 M	<15 M	<15 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		<18 M	<18 M	<18 M	<18 M	<18 M	<18 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	<23 M	<23 M	<23 M	<23 M	<23 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		<24 M	<24 M	<24 M	<24 M	<24 M	<24 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		<118	<118	<118	<118	<118	<118

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP201	TP201				
			Depth (m)	0.50 - 0.60	1.50 - 1.60				
			Sample Type	Soil/Solid (S)	Soil/Solid (S)				
			Date Sampled	15/10/2020	15/10/2020				
			Sampled Time	.	.				
			Date Received	21/10/2020	21/10/2020				
			SDG Ref	201021-100	201021-100				
			Lab Sample No.(s)	23081608	23081621				
			AGS Reference	ES1	ES4				
Naphthalene-d8 % recovery**	%	TM218		95.1	93.9				
Acenaphthene-d10 % recovery**	%	TM218		86.5	84.6				
Phenanthrene-d10 % recovery**	%	TM218		94.3	93				
Chrysene-d12 % recovery**	%	TM218		93	89.5				
Perylene-d12 % recovery**	%	TM218		83.8	82.3				
Naphthalene	<9 µg/kg	TM218		<9 M	<9 M				
Acenaphthylene	<12 µg/kg	TM218		<12 M	<12 M				
Acenaphthene	<8 µg/kg	TM218		<8 M	<8 M				
Fluorene	<10 µg/kg	TM218		<10 M	<10 M				
Phenanthrene	<15 µg/kg	TM218		<15 M	<15 M				
Anthracene	<16 µg/kg	TM218		<16 M	<16 M				
Fluoranthene	<17 µg/kg	TM218		<17 M	<17 M				
Pyrene	<15 µg/kg	TM218		<15 M	<15 M				
Benz(a)anthracene	<14 µg/kg	TM218		<14 M	<14 M				
Chrysene	<10 µg/kg	TM218		<10 M	<10 M				
Benzo(b)fluoranthene	<15 µg/kg	TM218		<15 M	<15 M				
Benzo(k)fluoranthene	<14 µg/kg	TM218		<14 M	<14 M				
Benzo(a)pyrene	<15 µg/kg	TM218		<15 M	<15 M				
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		<18 M	<18 M				
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	<23 M				
Benzo(g,h,i)perylene	<24 µg/kg	TM218		<24 M	<24 M				
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		<118	<118				

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081642	23081508	23081514	23081519	23081502	23081580
			AGS Reference	ES1	ES3	ES1	ES3	ES1	ES4
Phenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pentachlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Nitrobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Isophorone	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachloroethane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorocyclopentadiene	<100 µg/kg	TM157		<400	<100	<100	<100	<200	<200
Hexachlorobutadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dioctyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dimethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Diethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dibutyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzofuran	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Carbazole	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Butylbenzyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethyl)ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Azobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chlorophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Bromophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
3-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2,4-Trichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081642	23081508	23081514	23081519	23081502	23081580
			AGS Reference	ES1	ES3	ES1	ES3	ES1	ES4
2-Chlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylnaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(b)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(k)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(g,h,i)perylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Chrysene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluorene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Phenanthrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Naphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
TIC report		TM157		Detected	Detected	Not Detected	Detected	Not Detected	Not Detected
Total SVOC TIC	<100 µg/kg	TM157		7380	2200	<1000	16400	<1000	<1000
Unknown	µg/kg	TM157		7380	2200		16400		

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Customer Sample Ref.	TP004	TP004	TP005	TP005	TP006	TP006
Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50
Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020	14/10/2020
Sampled Time	.	.	.	.	.	.
Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
Lab Sample No.(s)	23081629	23081636	23081593	23081599	23081526	23081533
AGS Reference	ES1	ES2	ES1	ES4	ES1	ES4

Component	LOD/Units	Method					
Phenol	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Pentachlorophenol	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Nitrobenzene	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Isophorone	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Hexachloroethane	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Hexachlorocyclopentadiene	<100 µg/kg	TM157	<200	<200	<200	<200	<200	<200
Hexachlorobutadiene	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Hexachlorobenzene	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
n-Dioctyl phthalate	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Dimethyl phthalate	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Diethyl phthalate	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
n-Dibutyl phthalate	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Dibenzofuran	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Carbazole	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Butylbenzyl phthalate	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
bis(2-Chloroethyl)ether	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
Azobenzene	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
4-Nitrophenol	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
4-Nitroaniline	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
4-Methylphenol	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
4-Chlorophenylphenylether	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
4-Chloroaniline	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
4-Bromophenylphenylether	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
3-Nitroaniline	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
2-Nitrophenol	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
2-Nitroaniline	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
2-Methylphenol	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100
1,2,4-Trichlorobenzene	<100 µg/kg	TM157	<100	<100	<100	<100	<100	<100

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP004	TP004	TP005	TP005	TP006	TP006
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081629	23081636	23081593	23081599	23081526	23081533
			AGS Reference	ES1	ES2	ES1	ES4	ES1	ES4
2-Chlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylnaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(b)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(k)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(g,h,i)perylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Chrysene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluorene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Phenanthrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Naphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
TIC report		TM157		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Total SVOC TIC	<100 µg/kg	TM157		<1000	<1000	<1000	<1000	<1000	<1000

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP010	TP010	TP011	TP011	TP012	TP012
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081538	23081550	23081573	23081587	23081559	23081567
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
Phenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pentachlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Nitrobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Isophorone	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachloroethane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorocyclopentadiene	<100 µg/kg	TM157		<200	<200	<200	<200	<200	<200
Hexachlorobutadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dioctyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dimethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Diethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dibutyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzofuran	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Carbazole	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Butylbenzyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethyl)ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Azobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chlorophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Bromophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
3-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2,4-Trichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP010	TP010	TP011	TP011	TP012	TP012
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081538	23081550	23081573	23081587	23081559	23081567
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
2-Chlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylnaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(b)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(k)fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(a)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Benzo(g,h,i)perylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Chrysene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluoranthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Fluorene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Phenanthrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pyrene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Naphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
TIC report		TM157		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Total SVOC TIC	<100 µg/kg	TM157		<1000	<1000	<1000	<1000	<1000	<1000

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Customer Sample Ref.	TP201	TP201
Depth (m)	0.50 - 0.60	1.50 - 1.60
Sample Type	Soil/Solid (S)	Soil/Solid (S)
Date Sampled	15/10/2020	15/10/2020
Sampled Time	.	.
Date Received	21/10/2020	21/10/2020
SDG Ref	201021-100	201021-100
Lab Sample No.(s)	23081608	23081621
AGS Reference	ES1	ES4

Component	LOD/Units	Method						
Phenol	<100 µg/kg	TM157	<100	<100				
Pentachlorophenol	<100 µg/kg	TM157	<100	<100				
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157	<100	<100				
Nitrobenzene	<100 µg/kg	TM157	<100	<100				
Isophorone	<100 µg/kg	TM157	<100	<100				
Hexachloroethane	<100 µg/kg	TM157	<100	<100				
Hexachlorocyclopentadiene	<100 µg/kg	TM157	<100	<200				
Hexachlorobutadiene	<100 µg/kg	TM157	<100	<100				
Hexachlorobenzene	<100 µg/kg	TM157	<100	<100				
n-Dioctyl phthalate	<100 µg/kg	TM157	<100	<100				
Dimethyl phthalate	<100 µg/kg	TM157	<100	<100				
Diethyl phthalate	<100 µg/kg	TM157	<100	<100				
n-Dibutyl phthalate	<100 µg/kg	TM157	<100	<100				
Dibenzofuran	<100 µg/kg	TM157	<100	<100				
Carbazole	<100 µg/kg	TM157	<100	<100				
Butylbenzyl phthalate	<100 µg/kg	TM157	<100	<100				
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157	<100	<100				
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157	<100	<100				
bis(2-Chloroethyl)ether	<100 µg/kg	TM157	<100	<100				
Azobenzene	<100 µg/kg	TM157	<100	<100				
4-Nitrophenol	<100 µg/kg	TM157	<100	<100				
4-Nitroaniline	<100 µg/kg	TM157	<100	<100				
4-Methylphenol	<100 µg/kg	TM157	<100	<100				
4-Chlorophenylphenylether	<100 µg/kg	TM157	<100	<100				
4-Chloroaniline	<100 µg/kg	TM157	<100	<100				
4-Chloro-3-methylphenol	<100 µg/kg	TM157	<100	<100				
4-Bromophenylphenylether	<100 µg/kg	TM157	<100	<100				
3-Nitroaniline	<100 µg/kg	TM157	<100	<100				
2-Nitrophenol	<100 µg/kg	TM157	<100	<100				
2-Nitroaniline	<100 µg/kg	TM157	<100	<100				
2-Methylphenol	<100 µg/kg	TM157	<100	<100				
1,2,4-Trichlorobenzene	<100 µg/kg	TM157	<100	<100				

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Semi Volatile Organic Compounds

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP201	TP201				
			Depth (m)	0.50 - 0.60	1.50 - 1.60				
			Sample Type	Soil/Solid (S)	Soil/Solid (S)				
			Date Sampled	15/10/2020	15/10/2020				
			Sampled Time	.	.				
			Date Received	21/10/2020	21/10/2020				
			SDG Ref	201021-100	201021-100				
			Lab Sample No.(s)	23081608	23081621				
			AGS Reference	ES1	ES4				
2-Chlorophenol	<100 µg/kg	TM157		<100	<100				
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100				
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100				
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<100				
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<100				
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<100				
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<100				
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<100				
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<100				
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<100				
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<100				
2-Methylnaphthalene	<100 µg/kg	TM157		<100	<100				
Acenaphthylene	<100 µg/kg	TM157		<100	<100				
Acenaphthene	<100 µg/kg	TM157		<100	<100				
Anthracene	<100 µg/kg	TM157		<100	<100				
Benzo(a)anthracene	<100 µg/kg	TM157		<100	<100				
Benzo(b)fluoranthene	<100 µg/kg	TM157		<100	<100				
Benzo(k)fluoranthene	<100 µg/kg	TM157		<100	<100				
Benzo(a)pyrene	<100 µg/kg	TM157		<100	<100				
Benzo(g,h,i)perylene	<100 µg/kg	TM157		<100	<100				
Chrysene	<100 µg/kg	TM157		<100	<100				
Fluoranthene	<100 µg/kg	TM157		<100	<100				
Fluorene	<100 µg/kg	TM157		<100	<100				
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		<100	<100				
Phenanthrene	<100 µg/kg	TM157		<100	<100				
Pyrene	<100 µg/kg	TM157		<100	<100				
Naphthalene	<100 µg/kg	TM157		<100	<100				
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		<100	<100				
Bis(2-chloroisopropyl) ether	<100 µg/kg	TM157		<100	<100				
TIC report		TM157		Not Detected	Not Detected				
Total SVOC TIC	<100 µg/kg	TM157		<1000	<1000				

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081642	23081508	23081514	23081519	23081502	23081580
			AGS Reference	ES1	ES3	ES1	ES3	ES1	ES4
GRO Surrogate % recovery**	%	TM089		101	93	99.6	90	101	101
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C10-C12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C12-C16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C16-C21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C21-C35	<1000 µg/kg	TM414		<1000	3890	4090	5350	4020	2300
Aliphatics >C35-C44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Total Aliphatics >C10-C44	<5000 µg/kg	TM414		<5000	<5000	<5000	5420	<5000	<5000
Total Aliphatics & Aromatics >C10-C44	<10000 µg/kg	TM414		<10000	<10000	10300	14300	<10000	<10000
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics > EC10-EC12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC12-EC16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC16-EC21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC21-EC35	<1000 µg/kg	TM414		1300	2370	5000	7800	1270	<1000
Aromatics >EC35-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC40-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Total Aromatics > EC10-EC44	<5000 µg/kg	TM414		<5000	<5000	6240	8900	<5000	<5000
Total Aliphatics & Aromatics >C5-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	14300	<10000	<10000
Total Aliphatics >C5-C10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
Total Aromatics >EC5-EC10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
GRO >C5-C10	<20 µg/kg	TM089		<20	<20	<20	<20	<20	<20

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP004	TP004	TP005	TP005	TP006	TP006
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081629	23081636	23081593	23081599	23081526	23081533
			AGS Reference	ES1	ES2	ES1	ES4	ES1	ES4
GRO Surrogate % recovery**	%	TM089		94.3	95.6	92.9	115	122	97.9
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C10-C12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C12-C16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C16-C21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C21-C35	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C35-C44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Total Aliphatics >C10-C44	<5000 µg/kg	TM414		<5000	<5000	<5000	<5000	<5000	<5000
Total Aliphatics & Aromatics >C10-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	<10000	<10000	<10000
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics > EC10-EC12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC12-EC16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC16-EC21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC21-EC35	<1000 µg/kg	TM414		<1000	<1000	1130	<1000	<1000	<1000
Aromatics >EC35-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC40-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Total Aromatics > EC10-EC44	<5000 µg/kg	TM414		<5000	<5000	<5000	<5000	<5000	<5000
Total Aliphatics & Aromatics >C5-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	<10000	<10000	<10000
Total Aliphatics >C5-C10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
Total Aromatics >EC5-EC10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
GRO >C5-C10	<20 µg/kg	TM089		<20	<20	<20	<20	<20	<20

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP010	TP010	TP011	TP011	TP012	TP012
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081538	23081550	23081573	23081587	23081559	23081567
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
GRO Surrogate % recovery**	%	TM089		122	102	123	104	104	105
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aliphatics >C10-C12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C12-C16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C16-C21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aliphatics >C21-C35	<1000 µg/kg	TM414		2470	2110	2300	<1000	3000	2960
Aliphatics >C35-C44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Total Aliphatics >C10-C44	<5000 µg/kg	TM414		<5000	<5000	<5000	<5000	<5000	<5000
Total Aliphatics & Aromatics >C10-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	<10000	<10000	<10000
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics > EC10-EC12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC12-EC16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC16-EC21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC21-EC35	<1000 µg/kg	TM414		1270	<1000	1570	5250	1600	2670
Aromatics >EC35-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Aromatics > EC40-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000	<1000	<1000
Total Aromatics > EC10-EC44	<5000 µg/kg	TM414		<5000	<5000	<5000	6380	<5000	<5000
Total Aliphatics & Aromatics >C5-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	<10000	<10000	<10000
Total Aliphatics >C5-C10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
Total Aromatics >EC5-EC10	<50 µg/kg	TM089		<50	<50	<50	<50	<50	<50
GRO >C5-C10	<20 µg/kg	TM089		<20	<20	<20	<20	<20	<20

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP201	TP201				
			Depth (m)	0.50 - 0.60	1.50 - 1.60				
			Sample Type	Soil/Solid (S)	Soil/Solid (S)				
			Date Sampled	15/10/2020	15/10/2020				
			Sampled Time	.	.				
			Date Received	21/10/2020	21/10/2020				
			SDG Ref	201021-100	201021-100				
			Lab Sample No.(s)	23081608	23081621				
			AGS Reference	ES1	ES4				
GRO Surrogate % recovery**	%	TM089		95.9	115				
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10				
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10				
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10				
Aliphatics >C10-C12	<1000 µg/kg	TM414		<1000	<1000				
Aliphatics >C12-C16	<1000 µg/kg	TM414		<1000	<1000				
Aliphatics >C16-C21	<1000 µg/kg	TM414		<1000	<1000				
Aliphatics >C21-C35	<1000 µg/kg	TM414		1920	2920				
Aliphatics >C35-C44	<1000 µg/kg	TM414		<1000	<1000				
Total Aliphatics >C10-C44	<5000 µg/kg	TM414		<5000	<5000				
Total Aliphatics & Aromatics >C10-C44	<10000 µg/kg	TM414		<10000	<10000				
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10				
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10				
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10				
Aromatics > EC10-EC12	<1000 µg/kg	TM414		<1000	<1000				
Aromatics > EC12-EC16	<1000 µg/kg	TM414		<1000	<1000				
Aromatics > EC16-EC21	<1000 µg/kg	TM414		<1000	<1000				
Aromatics > EC21-EC35	<1000 µg/kg	TM414		<1000	<1000				
Aromatics >EC35-EC44	<1000 µg/kg	TM414		<1000	<1000				
Aromatics > EC40-EC44	<1000 µg/kg	TM414		<1000	<1000				
Total Aromatics > EC10-EC44	<5000 µg/kg	TM414		<5000	<5000				
Total Aliphatics & Aromatics >C5-C44	<10000 µg/kg	TM414		<10000	<10000				
Total Aliphatics >C5-C10	<50 µg/kg	TM089		<50	<50				
Total Aromatics >EC5-EC10	<50 µg/kg	TM089		<50	<50				
GRO >C5-C10	<20 µg/kg	TM089		<20	<20				

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081642	23081508	23081514	23081519	23081502	23081580
			AGS Reference	ES1	ES3	ES1	ES3	ES1	ES4
Dibromofluoromethane**	%	TM116		113	109	114	103	103	111
Toluene-d8**	%	TM116		96.1	96	94.6	98	95.9	94.5
4-Bromofluorobenzene**	%	TM116		84.7	72.9	79.7	89.1	86.3	75.2
Dichlorodifluoromethane	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
Chloromethane	<7 µg/kg	TM116		<7 #	<7 #	<7 #	<7 #	<7 #	<7 #
Vinyl Chloride	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
Bromomethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Chloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Trichlorofluorormethane	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
1,1-Dichloroethene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Carbon Disulphide	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
Dichloromethane	<10 µg/kg	TM116		<10 #	20.7 #	<10 #	<10 #	<10 #	22.6 #
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
trans-1,2-Dichloroethene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,1-Dichloroethane	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
cis-1,2-Dichloroethene	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
2,2-Dichloropropane	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<10
Bromochloromethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Chloroform	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
1,1,1-Trichloroethane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
1,1-Dichloropropene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Carbontetrachloride	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,2-Dichloroethane	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
Benzene	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Trichloroethene	<9 µg/kg	TM116		<9 #	<9 #	<9 #	<9 #	<9 #	<9 #
1,2-Dichloropropane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Dibromomethane	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
Bromodichloromethane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
cis-1,3-Dichloropropene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Toluene	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
trans-1,3-Dichloropropene	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<10
1,1,2-Trichloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081642	23081508	23081514	23081519	23081502	23081580
			AGS Reference	ES1	ES3	ES1	ES3	ES1	ES4
1,3-Dichloropropane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<7 M
Tetrachloroethene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
Dibromochloromethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,2-Dibromoethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Chlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Ethylbenzene	<4 µg/kg	TM116		<4 M	<4 M	<4 M	<4 M	<4 M	<4 M
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
o-Xylene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Styrene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Bromoform	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Isopropylbenzene	<5 µg/kg	TM116		<5 #	<5 #	<5 #	<5 #	<5 #	<5 #
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
1,2,3-Trichloropropane	<16 µg/kg	TM116		<16 M	<16 M	<16 M	<16 M	<16 M	<16 M
Bromobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Propylbenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
2-Chlorotoluene	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<9 M
1,3,5-Trimethylbenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
4-Chlorotoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
tert-Butylbenzene	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
1,2,4-Trimethylbenzene	<9 µg/kg	TM116		<9 #	<9 #	<9 #	<9 #	<9 #	<9 #
sec-Butylbenzene	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<10
4-Isopropyltoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,3-Dichlorobenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<8 M
1,4-Dichlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
n-Butylbenzene	<11 µg/kg	TM116		<11	<11	<11	<11	<11	<11
1,2-Dichlorobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<14 M	<14 M	<14 M
Tert-amyl methyl ether	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
1,2,4-Trichlorobenzene	<20 µg/kg	TM116		<20	<20	<20	<20	<20	<20
Hexachlorobutadiene	<20 µg/kg	TM116		<20	<20	<20	<20	<20	<20
Naphthalene	<13 µg/kg	TM116		<13 M	<13 M	<13 M	<13 M	<13 M	<13 M

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081642	23081508	23081514	23081519	23081502	23081580
			AGS Reference	ES1	ES3	ES1	ES3	ES1	ES4
1,2,3-Trichlorobenzene	<20 µg/kg	TM116		<20 #	<20 #	<20 #	<20 #	<20 #	<20 #
VOC TIC		TM116		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Sum of Detected Xylenes	<0.02 mg/kg	TM116		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Sum of BTEX	<40 µg/kg	TM116		<40	<40	<40	<40	<40	<40
Total VOC TIC	<50 µg/kg	TM116		<50	<50	<50	<50	<50	<50

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP004	TP004	TP005	TP005	TP006	TP006
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081629	23081636	23081593	23081599	23081526	23081533
			AGS Reference	ES1	ES2	ES1	ES4	ES1	ES4
Dibromofluoromethane**	%	TM116		108	108	108	111	111	117
Toluene-d8**	%	TM116		97.6	99.5	98.1	98.6	95.3	98.4
4-Bromofluorobenzene**	%	TM116		95.8	99.2	92.7	102	84.8	91.6
Dichlorodifluoromethane	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<60 M
Chloromethane	<7 µg/kg	TM116		<7 #	<7 #	<7 #	<7 #	<7 #	<70 #
Vinyl Chloride	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<60 M
Bromomethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Chloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Trichlorofluorormethane	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<60 M
1,1-Dichloroethene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<100 #
Carbon Disulphide	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<70 M
Dichloromethane	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<100 #
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
trans-1,2-Dichloroethene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
1,1-Dichloroethane	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<80 M
cis-1,2-Dichloroethene	<6 µg/kg	TM116		<6 M	<6 M	<6 M	<6 M	<6 M	<60 M
2,2-Dichloropropane	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<100
Bromochloromethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Chloroform	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<80 M
1,1,1-Trichloroethane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<70 M
1,1-Dichloropropene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Carbontetrachloride	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
1,2-Dichloroethane	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<50 M
Benzene	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<90 M
Trichloroethene	<9 µg/kg	TM116		<9 #	<9 #	<9 #	<9 #	<9 #	<90 #
1,2-Dichloropropane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Dibromomethane	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<90 M
Bromodichloromethane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<70 M
cis-1,3-Dichloropropene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Toluene	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<70 M
trans-1,3-Dichloropropene	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<100
1,1,2-Trichloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP004	TP004	TP005	TP005	TP006	TP006
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081629	23081636	23081593	23081599	23081526	23081533
			AGS Reference	ES1	ES2	ES1	ES4	ES1	ES4
1,3-Dichloropropane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<7 M	<7 M	<70 M
Tetrachloroethene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<50 M
Dibromochloromethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
1,2-Dibromoethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Chlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<50 M
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Ethylbenzene	<4 µg/kg	TM116		<4 M	<4 M	<4 M	<4 M	<4 M	<40 M
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<100 #
o-Xylene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Styrene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<100 #
Bromoform	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Isopropylbenzene	<5 µg/kg	TM116		<5 #	<5 #	<5 #	<5 #	<5 #	<50 #
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<100 #
1,2,3-Trichloropropane	<16 µg/kg	TM116		<16 M	<16 M	<16 M	<16 M	<16 M	<160 M
Bromobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
Propylbenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
2-Chlorotoluene	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<9 M	<9 M	<90 M
1,3,5-Trimethylbenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<80 M
4-Chlorotoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
tert-Butylbenzene	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<14 M	<14 M	<140 M
1,2,4-Trimethylbenzene	<9 µg/kg	TM116		<9 #	<9 #	<9 #	<9 #	<9 #	<90 #
sec-Butylbenzene	<10 µg/kg	TM116		<10	<10	<10	<10	<10	<100
4-Isopropyltoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
1,3-Dichlorobenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<8 M	<8 M	<80 M
1,4-Dichlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<5 M	<5 M	<50 M
n-Butylbenzene	<11 µg/kg	TM116		<11	<11	<11	<11	<11	<110
1,2-Dichlorobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<10 M	<10 M	<100 M
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<14 M	<14 M	<140 M
Tert-amyl methyl ether	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #	<10 #	<100 #
1,2,4-Trichlorobenzene	<20 µg/kg	TM116		<20	<20	<20	<20	<20	<200
Hexachlorobutadiene	<20 µg/kg	TM116		<20	<20	<20	<20	<20	<200
Naphthalene	<13 µg/kg	TM116		<13 M	<13 M	<13 M	<13 M	<13 M	<130 M

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP004	TP004	TP005	TP005	TP006	TP006
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081629	23081636	23081593	23081599	23081526	23081533
			AGS Reference	ES1	ES2	ES1	ES4	ES1	ES4
1,2,3-Trichlorobenzene	<20 µg/kg	TM116		<20 #	<20 #	<20 #	<20 #	<20 #	<200 #
VOC TIC		TM116		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Sum of Detected Xylenes	<0.02 mg/kg	TM116		<0.02	<0.02	<0.02	<0.02	<0.02	<0.2
Sum of BTEX	<40 µg/kg	TM116		<40	<40	<40	<40	<40	<400
Total VOC TIC	<50 µg/kg	TM116		<50	<50	<50	<50	<50	<500

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP010	TP010	TP011	TP011	TP012	TP012
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081538	23081550	23081573	23081587	23081559	23081567
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
Dibromofluoromethane**	%	TM116		102	109	103	108	111	107
Toluene-d8**	%	TM116		98.1	97.3	96.9	100	95.2	100
4-Bromofluorobenzene**	%	TM116		91.1	83.5	87.5	102	87.2	103
Dichlorodifluoromethane	µg/kg	TM116	<6 M	<6 M	<6 M	<120 M	<6 M	<120 M	
Chloromethane	µg/kg	TM116	<7 #	<7 #	<7 #	<140 #	<7 #	<140 #	
Vinyl Chloride	µg/kg	TM116	<6 M	<6 M	<6 M	<120 M	<6 M	<120 M	
Bromomethane	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	
Chloroethane	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	
Trichlorofluorormethane	µg/kg	TM116	<6 M	<6 M	<6 M	<120 M	<6 M	<120 M	
1,1-Dichloroethene	µg/kg	TM116	<10 #	<10 #	<10 #	<200 #	<10 #	<200 #	
Carbon Disulphide	µg/kg	TM116	<7 M	<7 M	<7 M	<140 M	<7 M	<140 M	
Dichloromethane	µg/kg	TM116	<10 #	12.3 #	<10 #	<200 #	<10 #	<200 #	
Methyl Tertiary Butyl Ether	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	
trans-1,2-Dichloroethene	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	
1,1-Dichloroethane	µg/kg	TM116	<8 M	<8 M	<8 M	<160 M	<8 M	<160 M	
cis-1,2-Dichloroethene	µg/kg	TM116	<6 M	<6 M	<6 M	<120 M	<6 M	<120 M	
2,2-Dichloropropane	µg/kg	TM116	<10	<10	<10	<200	<10	<200	
Bromochloromethane	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	
Chloroform	µg/kg	TM116	<8 M	<8 M	<8 M	<160 M	<8 M	<160 M	
1,1,1-Trichloroethane	µg/kg	TM116	<7 M	<7 M	<7 M	<140 M	<7 M	<140 M	
1,1-Dichloropropene	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	
Carbontetrachloride	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	
1,2-Dichloroethane	µg/kg	TM116	<5 M	<5 M	<5 M	<100 M	<5 M	<100 M	
Benzene	µg/kg	TM116	<9 M	<9 M	<9 M	<180 M	<9 M	<180 M	
Trichloroethene	µg/kg	TM116	<9 #	<9 #	<9 #	<180 #	<9 #	<180 #	
1,2-Dichloropropane	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	
Dibromomethane	µg/kg	TM116	<9 M	<9 M	<9 M	<180 M	<9 M	<180 M	
Bromodichloromethane	µg/kg	TM116	<7 M	<7 M	<7 M	<140 M	<7 M	<140 M	
cis-1,3-Dichloropropene	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	
Toluene	µg/kg	TM116	<7 M	<7 M	<7 M	<140 M	<7 M	<140 M	
trans-1,3-Dichloropropene	µg/kg	TM116	<10	<10	<10	<200	<10	<200	
1,1,2-Trichloroethane	µg/kg	TM116	<10 M	<10 M	<10 M	<200 M	<10 M	<200 M	

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP010	TP010	TP011	TP011	TP012	TP012
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081538	23081550	23081573	23081587	23081559	23081567
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
1,3-Dichloropropane	<7 µg/kg	TM116		<7 M	<7 M	<7 M	<140 M	<7 M	<140 M
Tetrachloroethene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<100 M	<5 M	<100 M
Dibromochloromethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
1,2-Dibromoethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
Chlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<100 M	<5 M	<100 M
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
Ethylbenzene	<4 µg/kg	TM116		<4 M	<4 M	<4 M	<80 M	<4 M	<80 M
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<200 #	<10 #	<200 #
o-Xylene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
Styrene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<200 #	<10 #	<200 #
Bromoform	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
Isopropylbenzene	<5 µg/kg	TM116		<5 #	<5 #	<5 #	<100 #	<5 #	<100 #
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<200 #	<10 #	<200 #
1,2,3-Trichloropropane	<16 µg/kg	TM116		<16 M	<16 M	<16 M	<320 M	<16 M	<320 M
Bromobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
Propylbenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
2-Chlorotoluene	<9 µg/kg	TM116		<9 M	<9 M	<9 M	<180 M	<9 M	<180 M
1,3,5-Trimethylbenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<160 M	<8 M	<160 M
4-Chlorotoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
tert-Butylbenzene	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<280 M	<14 M	<280 M
1,2,4-Trimethylbenzene	<9 µg/kg	TM116		<9 #	<9 #	<9 #	<180 #	<9 #	<180 #
sec-Butylbenzene	<10 µg/kg	TM116		<10	<10	<10	<200	<10	<200
4-Isopropyltoluene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
1,3-Dichlorobenzene	<8 µg/kg	TM116		<8 M	<8 M	<8 M	<160 M	<8 M	<160 M
1,4-Dichlorobenzene	<5 µg/kg	TM116		<5 M	<5 M	<5 M	<100 M	<5 M	<100 M
n-Butylbenzene	<11 µg/kg	TM116		<11	<11	<11	<220	<11	<220
1,2-Dichlorobenzene	<10 µg/kg	TM116		<10 M	<10 M	<10 M	<200 M	<10 M	<200 M
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116		<14 M	<14 M	<14 M	<280 M	<14 M	<280 M
Tert-amyl methyl ether	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<200 #	<10 #	<200 #
1,2,4-Trichlorobenzene	<20 µg/kg	TM116		<20	<20	<20	<400	<20	<400
Hexachlorobutadiene	<20 µg/kg	TM116		<20	<20	<20	<400	<20	<400
Naphthalene	<13 µg/kg	TM116		<13 M	<13 M	<13 M	<260 M	<13 M	<260 M

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP010	TP010	TP011	TP011	TP012	TP012
			Depth (m)	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020	14/10/2020
			Sampled Time	.	.	.	.	.	.
			Date Received	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100	201021-100	201021-100	201021-100	201021-100
			Lab Sample No.(s)	23081538	23081550	23081573	23081587	23081559	23081567
			AGS Reference	ES1	ES4	ES1	ES4	ES1	ES4
1,2,3-Trichlorobenzene	<20 µg/kg	TM116		<20 #	<20 #	<20 #	<400 #	<20 #	<400 #
VOC TIC		TM116		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Sum of Detected Xylenes	<0.02 mg/kg	TM116		<0.02	<0.02	<0.02	<0.4	<0.02	<0.4
Sum of BTEX	<40 µg/kg	TM116		<40	<40	<40	<800	<40	<800
Total VOC TIC	<50 µg/kg	TM116		<50	<50	<50	<50	<50	<50

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP201	TP201				
			Depth (m)	0.50 - 0.60	1.50 - 1.60				
			Sample Type	Soil/Solid (S)	Soil/Solid (S)				
			Date Sampled	15/10/2020	15/10/2020				
			Sampled Time	.	.				
			Date Received	21/10/2020	21/10/2020				
			SDG Ref	201021-100	201021-100				
			Lab Sample No.(s)	23081608	23081621				
			AGS Reference	ES1	ES4				
Dibromofluoromethane**	%	TM116		107	113				
Toluene-d8**	%	TM116		98.3	98.5				
4-Bromofluorobenzene**	%	TM116		100	93.5				
Dichlorodifluoromethane	µg/kg	TM116		<6 M	<6 M				
Chloromethane	µg/kg	TM116		<7 #	<7 #				
Vinyl Chloride	µg/kg	TM116		<6 M	<6 M				
Bromomethane	µg/kg	TM116		<10 M	<10 M				
Chloroethane	µg/kg	TM116		<10 M	<10 M				
Trichlorofluorormethane	µg/kg	TM116		<6 M	<6 M				
1,1-Dichloroethene	µg/kg	TM116		<10 #	<10 #				
Carbon Disulphide	µg/kg	TM116		<7 M	<7 M				
Dichloromethane	µg/kg	TM116		<10 #	<10 #				
Methyl Tertiary Butyl Ether	µg/kg	TM116		<10 M	<10 M				
trans-1,2-Dichloroethene	µg/kg	TM116		<10 M	<10 M				
1,1-Dichloroethane	µg/kg	TM116		<8 M	<8 M				
cis-1,2-Dichloroethene	µg/kg	TM116		<6 M	<6 M				
2,2-Dichloropropane	µg/kg	TM116		<10	<10				
Bromochloromethane	µg/kg	TM116		<10 M	<10 M				
Chloroform	µg/kg	TM116		<8 M	<8 M				
1,1,1-Trichloroethane	µg/kg	TM116		<7 M	<7 M				
1,1-Dichloropropene	µg/kg	TM116		<10 M	<10 M				
Carbontetrachloride	µg/kg	TM116		<10 M	<10 M				
1,2-Dichloroethane	µg/kg	TM116		<5 M	<5 M				
Benzene	µg/kg	TM116		<9 M	<9 M				
Trichloroethene	µg/kg	TM116		<9 #	<9 #				
1,2-Dichloropropane	µg/kg	TM116		<10 M	<10 M				
Dibromomethane	µg/kg	TM116		<9 M	<9 M				
Bromodichloromethane	µg/kg	TM116		<7 M	<7 M				
cis-1,3-Dichloropropene	µg/kg	TM116		<10 M	<10 M				
Toluene	µg/kg	TM116		<7 M	<7 M				
trans-1,3-Dichloropropene	µg/kg	TM116		<10	<10				
1,1,2-Trichloroethane	µg/kg	TM116		<10 M	<10 M				

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP201	TP201				
			Depth (m)	0.50 - 0.60	1.50 - 1.60				
			Sample Type	Soil/Solid (S)	Soil/Solid (S)				
			Date Sampled	15/10/2020	15/10/2020				
			Sampled Time	.	.				
			Date Received	21/10/2020	21/10/2020				
			SDG Ref	201021-100	201021-100				
			Lab Sample No.(s)	23081608	23081621				
			AGS Reference	ES1	ES4				
1,3-Dichloropropane	<7 µg/kg	TM116		<7 M	<7 M				
Tetrachloroethene	<5 µg/kg	TM116		<5 M	<5 M				
Dibromochloromethane	<10 µg/kg	TM116		<10 M	<10 M				
1,2-Dibromoethane	<10 µg/kg	TM116		<10 M	<10 M				
Chlorobenzene	<5 µg/kg	TM116		<5 M	<5 M				
1,1,1,2-Tetrachloroethane	<10 µg/kg	TM116		<10 M	<10 M				
Ethylbenzene	<4 µg/kg	TM116		<4 M	<4 M				
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 #				
o-Xylene	<10 µg/kg	TM116		<10 M	<10 M				
Styrene	<10 µg/kg	TM116		<10 #	<10 #				
Bromoform	<10 µg/kg	TM116		<10 M	<10 M				
Isopropylbenzene	<5 µg/kg	TM116		<5 #	<5 #				
1,1,2,2-Tetrachloroethane	<10 µg/kg	TM116		<10 #	<10 #				
1,2,3-Trichloropropane	<16 µg/kg	TM116		<16 M	<16 M				
Bromobenzene	<10 µg/kg	TM116		<10 M	<10 M				
Propylbenzene	<10 µg/kg	TM116		<10 M	<10 M				
2-Chlorotoluene	<9 µg/kg	TM116		<9 M	<9 M				
1,3,5-Trimethylbenzene	<8 µg/kg	TM116		<8 M	<8 M				
4-Chlorotoluene	<10 µg/kg	TM116		<10 M	<10 M				
tert-Butylbenzene	<14 µg/kg	TM116		<14 M	<14 M				
1,2,4-Trimethylbenzene	<9 µg/kg	TM116		<9 #	<9 #				
sec-Butylbenzene	<10 µg/kg	TM116		<10	<10				
4-Isopropyltoluene	<10 µg/kg	TM116		<10 M	<10 M				
1,3-Dichlorobenzene	<8 µg/kg	TM116		<8 M	<8 M				
1,4-Dichlorobenzene	<5 µg/kg	TM116		<5 M	<5 M				
n-Butylbenzene	<11 µg/kg	TM116		<11	<11				
1,2-Dichlorobenzene	<10 µg/kg	TM116		<10 M	<10 M				
1,2-Dibromo-3-chloropropane	<14 µg/kg	TM116		<14 M	<14 M				
Tert-amyl methyl ether	<10 µg/kg	TM116		<10 #	<10 #				
1,2,4-Trichlorobenzene	<20 µg/kg	TM116		<20	<20				
Hexachlorobutadiene	<20 µg/kg	TM116		<20	<20				
Naphthalene	<13 µg/kg	TM116		<13 M	<13 M				

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP201	TP201
			Depth (m)	0.50 - 0.60	1.50 - 1.60
			Sample Type	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020
			Sampled Time	.	.
			Date Received	21/10/2020	21/10/2020
			SDG Ref	201021-100	201021-100
			Lab Sample No.(s)	23081608	23081621
			AGS Reference	ES1	ES4
1,2,3-Trichlorobenzene	<20 µg/kg	TM116		<20 #	<20 #
VOC TIC		TM116		Not Detected	Not Detected
Sum of Detected Xylenes	<0.02 mg/kg	TM116		<0.02	<0.02
Sum of BTEX	<40 µg/kg	TM116		<40	<40
Total VOC TIC	<50 µg/kg	TM116		<50	<50

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Asbestos Identification - Solid Samples

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
*	Subcontracted test.
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP001ES1 0.40 - 0.50 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081642 TM048	27/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP001ES3 1.40 - 1.50 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081508 TM048	27/10/2020	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP002ES1 0.50 - 0.60 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081514 TM048	28/10/2020	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP002ES3 1.40 - 1.50 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081519 TM048	27/10/2020	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP003ES1 0.50 - 0.60 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081502 TM048	27/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP003ES4 1.50 - 1.60 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081580 TM048	28/10/2020	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP004ES1 0.40 - 0.50 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081629 TM048	27/10/2020	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP004ES2 1.40 - 1.50 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081636 TM048	28/10/2020	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG: 201021-100 **Client Reference:** 2020WW102 **Report Number:** 579754
Location: Arklow Bank **Order Number:** 9028 **Superseded Report:**

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP005ES1 0.40 - 0.50 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081593 TM048	28/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP005ES4 1.50 - 1.60 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081599 TM048	28/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP006ES1 0.40 - 0.50 SOLID 14/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081526 TM048	27/10/2020	Barbara Urbanek-Walsh	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP006ES4 1.40 - 1.50 SOLID 14/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081533 TM048	28/10/2020	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP010ES1 0.40 - 0.50 SOLID 14/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081538 TM048	27/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP010ES4 1.40 - 1.50 SOLID 14/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081550 TM048	27/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP011ES1 0.40 - 0.50 SOLID 14/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081573 TM048	28/10/2020	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP011ES4 1.40 - 1.50 SOLID 14/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081587 TM048	28/10/2020	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP012ES1 0.50 - 0.60 SOLID 14/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081559 TM048	27/10/2020	Barbara Urbanek-Walsh	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP012ES4 1.40 - 1.50 SOLID 14/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081567 TM048	27/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP201ES1 0.50 - 0.60 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081608 TM048	28/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP201ES4 1.50 - 1.60 SOLID 15/10/2020 00:00:00 21/10/2020 09:00:00 201021-100 23081621 TM048	28/10/2020	James Richards	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.119	**Natural Moisture Content (%)**	32.1
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	75.7
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081502
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP003 ES1
Depth (m)	0.50 - 0.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.0815	<0.0002	0.815	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000367	<0.0003	0.00367	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00263	<0.001	0.0263	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	4.4	<2	44	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	40.7	<5	407	<50	-	-	-

Leach Test Information

Date Prepared	25-Oct-2020
pH (pH Units)	7.93
Conductivity (µS/cm)	40.90
Temperature (°C)	20.30
Volume Leachant (Litres)	0.872

Mcerts Certification does not apply to leachates

14/12/2020 13:21:53

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.114	**Natural Moisture Content (%)**	26
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	79.4
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081508
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP001 ES3
Depth (m)	1.40 - 1.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	3.09	<3	30.9	<30	-	-	-
Fluoride	0.579	<0.5	5.79	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.00678	<0.0002	0.0678	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.00125	<0.0003	0.0125	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	0.0086	<0.003	0.086	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00148	<0.001	0.0148	<0.01	-	-	-
Chloride	2.7	<2	27	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	80.6	<5	806	<50	-	-	-

Leach Test Information

Date Prepared	24-Oct-2020
pH (pH Units)	8.70
Conductivity (µS/cm)	102.00
Temperature (°C)	18.10
Volume Leachant (Litres)	0.876

Mcerts Certification does not apply to leachates

14/12/2020 13:21:53

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.122	**Natural Moisture Content (%)**	35.9
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	73.6
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081514
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP002 ES1
Depth (m)	0.50 - 0.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00134	<0.0005	0.0134	<0.005	-	-	-
Barium	0.0461	<0.0002	0.461	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00238	<0.001	0.0238	<0.01	-	-	-
Copper	0.00187	<0.0003	0.0187	<0.003	-	-	-
Lead	0.00126	<0.0002	0.0126	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.00147	<0.0004	0.0147	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0185	<0.001	0.185	<0.01	-	-	-
Chloride	4.4	<2	44	<20	-	-	-
Sulphate (soluble)	4.6	<2	46	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	38.4	<5	384	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	8.36
Conductivity (µS/cm)	29.90
Temperature (°C)	20.70
Volume Leachant (Litres)	0.868

Mcerts Certification does not apply to leachates

14/12/2020 13:21:53

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.113	**Natural Moisture Content (%)**	24.9
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	80.1
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081519
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP002 ES3
Depth (m)	1.40 - 1.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	4.29	<3	42.9	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.00264	<0.0002	0.0264	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	<0.0003	<0.0003	<0.003	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	<0.001	<0.001	<0.01	<0.01	-	-	-
Chloride	2	<2	20	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	73.3	<5	733	<50	-	-	-

Leach Test Information

Date Prepared	24-Oct-2020
pH (pH Units)	8.36
Conductivity (µS/cm)	89.70
Temperature (°C)	16.70
Volume Leachant (Litres)	0.878

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.104	**Natural Moisture Content (%)**	14.8
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	87.1
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081526
Sampled Date	14-Oct-2020
Customer Sample Ref.	TP006 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.000504	<0.0005	0.00504	<0.005	-	-	-
Barium	0.000771	<0.0002	0.00771	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000769	<0.0003	0.00769	<0.003	-	-	-
Lead	0.000304	<0.0002	0.00304	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	<0.001	<0.001	<0.01	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	2.5	<2	25	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	24.9	<5	249	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	8.56
Conductivity (µS/cm)	28.10
Temperature (°C)	20.70
Volume Leachant (Litres)	0.887

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.121	**Natural Moisture Content (%)**	34.4
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	74.4
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081533
Sampled Date	14-Oct-2020
Customer Sample Ref.	TP006 ES4
Depth (m)	1.40 - 1.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	3.54	<3	35.4	<30	-	-	-
Fluoride	0.725	<0.5	7.25	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.0389	<0.0002	0.389	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000311	<0.0003	0.00311	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	<0.001	<0.001	<0.01	<0.01	-	-	-
Chloride	4.8	<2	48	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	73.5	<5	735	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	6.40
Conductivity (µS/cm)	99.30
Temperature (°C)	20.50
Volume Leachant (Litres)	0.868

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.116	**Natural Moisture Content (%)**	27.7
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	78.3
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081538
Sampled Date	14-Oct-2020
Customer Sample Ref.	TP010 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.00111	<0.0002	0.0111	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000817	<0.0003	0.00817	<0.003	-	-	-
Lead	0.000562	<0.0002	0.00562	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0011	<0.001	0.011	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	4.8	<2	48	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	36	<5	360	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	8.22
Conductivity (µS/cm)	44.10
Temperature (°C)	20.60
Volume Leachant (Litres)	0.875

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.109	**Natural Moisture Content (%)**	21.1
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	82.6
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081550
Sampled Date	14-Oct-2020
Customer Sample Ref.	TP010 ES4
Depth (m)	1.40 - 1.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	0.631	<0.5	6.31	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.00304	<0.0002	0.0304	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000813	<0.0003	0.00813	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	<0.001	<0.001	<0.01	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	80.9	<5	809	<50	-	-	-

Leach Test Information

Date Prepared	25-Oct-2020
pH (pH Units)	7.99
Conductivity (µS/cm)	104.00
Temperature (°C)	21.00
Volume Leachant (Litres)	0.882

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.107	**Natural Moisture Content (%)**	19.6
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	83.6
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081559
Sampled Date	14-Oct-2020
Customer Sample Ref.	TP012 ES1
Depth (m)	0.50 - 0.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00166	<0.0005	0.0166	<0.005	-	-	-
Barium	0.0371	<0.0002	0.371	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00167	<0.001	0.0167	<0.01	-	-	-
Copper	0.00146	<0.0003	0.0146	<0.003	-	-	-
Lead	0.000789	<0.0002	0.00789	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.000638	<0.0004	0.00638	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0175	<0.001	0.175	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	18.2	<5	182	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	8.23
Conductivity (µS/cm)	20.30
Temperature (°C)	20.70
Volume Leachant (Litres)	0.883

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.111	**Natural Moisture Content (%)**	22.8
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	81.4
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081567
Sampled Date	14-Oct-2020
Customer Sample Ref.	TP012 ES4
Depth (m)	1.40 - 1.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	3.48	<3	34.8	<30	-	-	-
Fluoride	0.787	<0.5	7.87	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.23	<0.0002	2.3	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000597	<0.0003	0.00597	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	0.00369	<0.003	0.0369	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0071	<0.001	0.071	<0.01	-	-	-
Chloride	3.9	<2	39	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	104	<5	1040	<50	-	-	-

Leach Test Information

Date Prepared	25-Oct-2020
pH (pH Units)	7.85
Conductivity (µS/cm)	134.00
Temperature (°C)	20.10
Volume Leachant (Litres)	0.879

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.115	**Natural Moisture Content (%)**	28.7
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	77.7
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081573
Sampled Date	14-Oct-2020
Customer Sample Ref.	TP011 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.142	<0.0002	1.42	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000347	<0.0003	0.00347	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00141	<0.001	0.0141	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	3.1	<2	31	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	41.9	<5	419	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	8.95
Conductivity (µS/cm)	49.30
Temperature (°C)	20.70
Volume Leachant (Litres)	0.875

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.106	**Natural Moisture Content (%)**	17
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	85.5
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081580
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP003 ES4
Depth (m)	1.50 - 1.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	0.517	<0.5	5.17	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.226	<0.0002	2.26	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.00052	<0.0003	0.0052	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00312	<0.001	0.0312	<0.01	-	-	-
Chloride	2.9	<2	29	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	75.4	<5	754	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	8.21
Conductivity (µS/cm)	94.80
Temperature (°C)	20.80
Volume Leachant (Litres)	0.884

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.108	**Natural Moisture Content (%)**	20.6
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	82.9
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081587
Sampled Date	14-Oct-2020
Customer Sample Ref.	TP011 ES4
Depth (m)	1.40 - 1.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	0.574	<0.5	5.74	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.00425	<0.0002	0.0425	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.0007	<0.0003	0.007	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00139	<0.001	0.0139	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	76	<5	760	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	6.82
Conductivity (µS/cm)	94.00
Temperature (°C)	20.50
Volume Leachant (Litres)	0.882

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.115	**Natural Moisture Content (%)**	28.3
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	78
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081593
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP005 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.000978	<0.0005	0.00978	<0.005	-	-	-
Barium	0.0275	<0.0002	0.275	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00149	<0.001	0.0149	<0.01	-	-	-
Copper	0.00105	<0.0003	0.0105	<0.003	-	-	-
Lead	0.000858	<0.0002	0.00858	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.00052	<0.0004	0.0052	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0209	<0.001	0.209	<0.01	-	-	-
Chloride	2.7	<2	27	<20	-	-	-
Sulphate (soluble)	3.9	<2	39	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	28.6	<5	286	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	8.60
Conductivity (µS/cm)	55.20
Temperature (°C)	20.70
Volume Leachant (Litres)	0.875

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.117	**Natural Moisture Content (%)**	29.9
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	77
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081599
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP005 ES4
Depth (m)	1.50 - 1.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	0.794	<0.5	7.94	<5	-	-	-
Mercury Dissolved (CVAF)	0.000011	<0.00001	0.00011	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00124	<0.0005	0.0124	<0.005	-	-	-
Barium	0.0314	<0.0002	0.314	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00218	<0.001	0.0218	<0.01	-	-	-
Copper	0.00166	<0.0003	0.0166	<0.003	-	-	-
Lead	0.000889	<0.0002	0.00889	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.00118	<0.0004	0.0118	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0112	<0.001	0.112	<0.01	-	-	-
Chloride	4.6	<2	46	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	33.4	<5	334	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	8.32
Conductivity (µS/cm)	41.60
Temperature (°C)	20.90
Volume Leachant (Litres)	0.873

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.110	**Natural Moisture Content (%)**	22.5
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	81.6
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081608
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP201 ES1
Depth (m)	0.50 - 0.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.105	<0.0002	1.05	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.00034	<0.0003	0.0034	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0031	<0.001	0.031	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	2.5	<2	25	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	23.5	<5	235	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	7.81
Conductivity (µS/cm)	26.10
Temperature (°C)	20.50
Volume Leachant (Litres)	0.880

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.106	**Natural Moisture Content (%)**	17.9
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	84.8
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081621
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP201 ES4
Depth (m)	1.50 - 1.60

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	0.957	<0.5	9.57	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.24	<0.0002	2.4	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	0.000559	<0.0003	0.00559	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.00364	<0.001	0.0364	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	76.5	<5	765	<50	-	-	-

Leach Test Information

Date Prepared	23-Oct-2020
pH (pH Units)	7.09
Conductivity (µS/cm)	97.60
Temperature (°C)	20.60
Volume Leachant (Litres)	0.884

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.113	**Natural Moisture Content (%)**	24.3
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	80.5
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081629
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP004 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	3.06	<3	30.6	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00155	<0.0005	0.0155	<0.005	-	-	-
Barium	0.0543	<0.0002	0.543	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00254	<0.001	0.0254	<0.01	-	-	-
Copper	0.00157	<0.0003	0.0157	<0.003	-	-	-
Lead	0.00121	<0.0002	0.0121	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.000672	<0.0004	0.00672	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0189	<0.001	0.189	<0.01	-	-	-
Chloride	2.9	<2	29	<20	-	-	-
Sulphate (soluble)	3.4	<2	34	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	26.6	<5	266	<50	-	-	-

Leach Test Information

Date Prepared	24-Oct-2020
pH (pH Units)	7.68
Conductivity (µS/cm)	30.80
Temperature (°C)	20.50
Volume Leachant (Litres)	0.878

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.104	**Natural Moisture Content (%)**	14.4
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	87.4
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081636
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP004 ES2
Depth (m)	1.40 - 1.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	0.532	<0.5	5.32	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	0.00203	<0.0005	0.0203	<0.005	-	-	-
Barium	0.0413	<0.0002	0.413	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	0.00291	<0.001	0.0291	<0.01	-	-	-
Copper	0.00236	<0.0003	0.0236	<0.003	-	-	-
Lead	0.0012	<0.0002	0.012	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	0.00128	<0.0004	0.0128	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	0.0135	<0.001	0.135	<0.01	-	-	-
Chloride	4.8	<2	48	<20	-	-	-
Sulphate (soluble)	<2	<2	<20	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	30.3	<5	303	<50	-	-	-

Leach Test Information

Date Prepared	22-Oct-2020
pH (pH Units)	6.65
Conductivity (µS/cm)	34.30
Temperature (°C)	20.70
Volume Leachant (Litres)	0.887

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Arklow Bank
Mass Sample taken (kg)	0.116	**Natural Moisture Content (%)**	28.6
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	77.8
Particle Size <4mm	>95%		

Case	
SDG	201021-100
Lab Sample Number(s)	23081642
Sampled Date	15-Oct-2020
Customer Sample Ref.	TP001 ES1
Depth (m)	0.40 - 0.50

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Fluoride	<0.5	<0.5	<5	<5	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	<0.001	<0.001	<0.01	<0.01	-	-	-
Arsenic	<0.0005	<0.0005	<0.005	<0.005	-	-	-
Barium	0.00118	<0.0002	0.0118	<0.002	-	-	-
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	-	-	-
Chromium	<0.001	<0.001	<0.01	<0.01	-	-	-
Copper	<0.0003	<0.0003	<0.003	<0.003	-	-	-
Lead	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Molybdenum	<0.003	<0.003	<0.03	<0.03	-	-	-
Nickel	<0.0004	<0.0004	<0.004	<0.004	-	-	-
Selenium	<0.001	<0.001	<0.01	<0.01	-	-	-
Zinc	<0.001	<0.001	<0.01	<0.01	-	-	-
Chloride	<2	<2	<20	<20	-	-	-
Sulphate (soluble)	4.4	<2	44	<20	-	-	-
Cresols by HPLC (W)	<0.006	<0.006	<0.06	<0.06	-	-	-
Phenol by HPLC (W)	<0.002	<0.002	<0.02	<0.02	-	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	-	-	-
Xylenols by HPLC (W)	<0.008	<0.008	<0.08	<0.08	-	-	-
Total Dissolved Solids	35.5	<5	355	<50	-	-	-

Leach Test Information

Date Prepared	24-Oct-2020
pH (pH Units)	8.08
Conductivity (µS/cm)	38.10
Temperature (°C)	20.60
Volume Leachant (Litres)	0.875

Mcerts Certification does not apply to leachates

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Table of Results - Appendix

Method No	Reference	Description
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step
TM018	BS 1377: Part 3 1990	Determination of Loss on Ignition
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) by Headspace GC-FID (C4-C12)
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water
TM132	In - house Method	ELTRA CS800 Operators Guide
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser
TM157	HP 6890 Gas Chromatograph (GC) system and HP 5973 Mass Selective Detector (MSD).	Determination of SVOC in Soils by GC-MS extracted by sonication in DCM/Acetone
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)'	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM218	Shaker extraction - EPA method 3546.	The determination of PAH in soil samples by GC-MS
TM259	by HPLC	Determination of Phenols in Waters and Leachates by HPLC
TM410	Shaker extraction-In house coronene method	Determination of Coronene in soils by GCMS
TM414	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID
TM415	Analysis of Petroleum Hydrocarbons in Environmental Media.	Determination of Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	23081508	23081642	23081514	23081519	23081502	23081580	23081629	23081636	23081593	23081599
Customer Sample Ref.	TP001	TP001	TP002	TP002	TP003	TP003	TP004	TP004	TP005	TP005
AGS Ref.	ES3	ES1	ES1	ES3	ES1	ES4	ES1	ES2	ES1	ES4
Depth	1.40 - 1.50	0.40 - 0.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.50 - 1.60
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (w)	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020
Asbestos ID in Solid Samples	27-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
CEN 10:1 Leachate (1 Stage)	25-Oct-2020	25-Oct-2020	24-Oct-2020	25-Oct-2020	25-Oct-2020	24-Oct-2020	25-Oct-2020	24-Oct-2020	24-Oct-2020	24-Oct-2020
CEN Readings	26-Oct-2020	28-Oct-2020	28-Oct-2020	26-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
Chromium III	28-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020
Coronene	25-Oct-2020	28-Oct-2020	25-Oct-2020	25-Oct-2020	24-Oct-2020	24-Oct-2020	27-Oct-2020	27-Oct-2020	25-Oct-2020	24-Oct-2020
Cyanide Comp/Free/Total/Thiocyanate	26-Oct-2020	28-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020
Dissolved Metals by ICP-MS	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020
Dissolved Organic/Inorganic Carbon	29-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	29-Oct-2020	29-Oct-2020
Easily Liberated Sulphide	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
EPH by GCxGC-FID	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020
EPH CWG GC (S)	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020
Fluoride	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
GRO by GC-FID (S)	26-Oct-2020	27-Oct-2020	23-Oct-2020	23-Oct-2020	25-Oct-2020	25-Oct-2020	26-Oct-2020	26-Oct-2020	25-Oct-2020	25-Oct-2020
Hexavalent Chromium (s)	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020
Loss on Ignition in soils	26-Oct-2020	28-Oct-2020	26-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020
Mercury Dissolved	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
Metals in solid samples by OES	26-Oct-2020	29-Oct-2020	26-Oct-2020	26-Oct-2020	29-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020
Moisture at 105C	24-Oct-2020	24-Oct-2020	23-Oct-2020	24-Oct-2020	25-Oct-2020	23-Oct-2020	24-Oct-2020	22-Oct-2020	23-Oct-2020	23-Oct-2020
PAH 16 & 17 Calc	24-Oct-2020	28-Oct-2020	24-Oct-2020	24-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020
PAH by GCMS	24-Oct-2020	27-Oct-2020	24-Oct-2020	24-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020
PCBs by GCMS	26-Oct-2020	28-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	26-Oct-2020
pH	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020
Phenols by HPLC (W)	28-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
Sample description	22-Oct-2020	24-Oct-2020	22-Oct-2020	22-Oct-2020	23-Oct-2020	23-Oct-2020	24-Oct-2020	24-Oct-2020	23-Oct-2020	23-Oct-2020
Semi Volatile Organic Compounds	26-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020
Total Dissolved Solids	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020	29-Oct-2020	28-Oct-2020	29-Oct-2020	29-Oct-2020
Total Organic Carbon	28-Oct-2020	29-Oct-2020	28-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	28-Oct-2020
TPH CWG GC (S)	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020
VOC MS (S)	24-Oct-2020	27-Oct-2020	24-Oct-2020	24-Oct-2020	25-Oct-2020	24-Oct-2020	26-Oct-2020	26-Oct-2020	25-Oct-2020	25-Oct-2020

Lab Sample No(s)	23081526	23081533	23081538	23081550	23081573	23081587	23081559	23081567	23081608	23081621
Customer Sample Ref.	TP006	TP006	TP010	TP010	TP011	TP011	TP012	TP012	TP201	TP201
AGS Ref.	ES1	ES4	ES1	ES4	ES1	ES4	ES1	ES4	ES1	ES4
Depth	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.40 - 0.50	1.40 - 1.50	0.50 - 0.60	1.40 - 1.50	0.50 - 0.60	1.50 - 1.60
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (w)	27-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020
Asbestos ID in Solid Samples	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020
CEN 10:1 Leachate (1 Stage)	24-Oct-2020	24-Oct-2020	24-Oct-2020	25-Oct-2020	24-Oct-2020	24-Oct-2020	24-Oct-2020	25-Oct-2020	24-Oct-2020	24-Oct-2020
CEN Readings	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
Chromium III	28-Oct-2020	28-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020
Coronene	27-Oct-2020	27-Oct-2020	24-Oct-2020	24-Oct-2020	24-Oct-2020	28-Oct-2020	24-Oct-2020	24-Oct-2020	24-Oct-2020	24-Oct-2020
Cyanide Comp/Free/Total/Thiocyanate	28-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020
Dissolved Metals by ICP-MS	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020
Dissolved Organic/Inorganic Carbon	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020
Easily Liberated Sulphide	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
EPH by GCxGC-FID	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020	14-Dec-2020
EPH CWG GC (S)	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020
Fluoride	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
GRO by GC-FID (S)	26-Oct-2020	26-Oct-2020	25-Oct-2020	24-Oct-2020	25-Oct-2020	26-Oct-2020	24-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020
Hexavalent Chromium (s)	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
Loss on Ignition in soils	27-Oct-2020	27-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	29-Oct-2020	27-Oct-2020	27-Oct-2020
Mercury Dissolved	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020
Metals in solid samples by OES	27-Oct-2020	27-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020	29-Oct-2020	29-Oct-2020	27-Oct-2020	27-Oct-2020
Moisture at 105C	22-Oct-2020	23-Oct-2020	23-Oct-2020	25-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	25-Oct-2020	23-Oct-2020	23-Oct-2020
PAH 16 & 17 Calc	27-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	28-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
PAH by GCMS	27-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
PCBs by GCMS	28-Oct-2020	28-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	28-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
pH	28-Oct-2020	28-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020
Phenols by HPLC (W)	28-Oct-2020	29-Oct-2020	28-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020
Sample description	24-Oct-2020	24-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	24-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020	23-Oct-2020
Semi Volatile Organic Compounds	27-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	27-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020	26-Oct-2020
Total Dissolved Solids	29-Oct-2020	29-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020	28-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020
Total Organic Carbon	28-Oct-2020	28-Oct-2020	29-Oct-2020	28-Oct-2020	29-Oct-2020	29-Oct-2020	28-Oct-2020	29-Oct-2020	28-Oct-2020	28-Oct-2020
TPH CWG GC (S)	27-Oct-2020	28-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020	27-Oct-2020
VOC MS (S)	26-Oct-2020	26-Oct-2020	25-Oct-2020	24-Oct-2020	25-Oct-2020	26-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020	25-Oct-2020

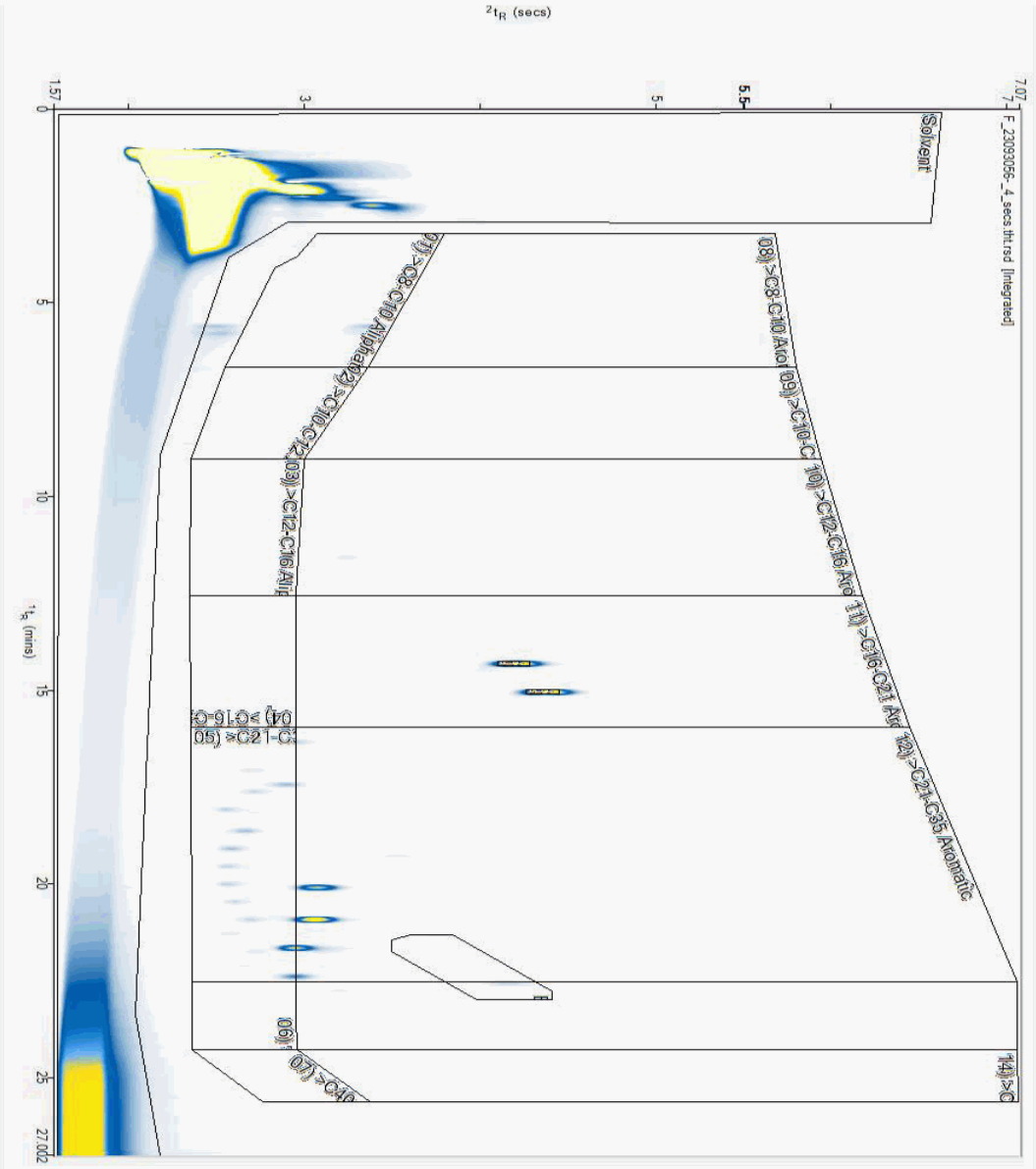
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23093056 **Depth :** 1.40 - 1.50
Sample ID : TP002

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23093056-_4_secs.tht
Date Acquired   :  26/10/20 07:44:47
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



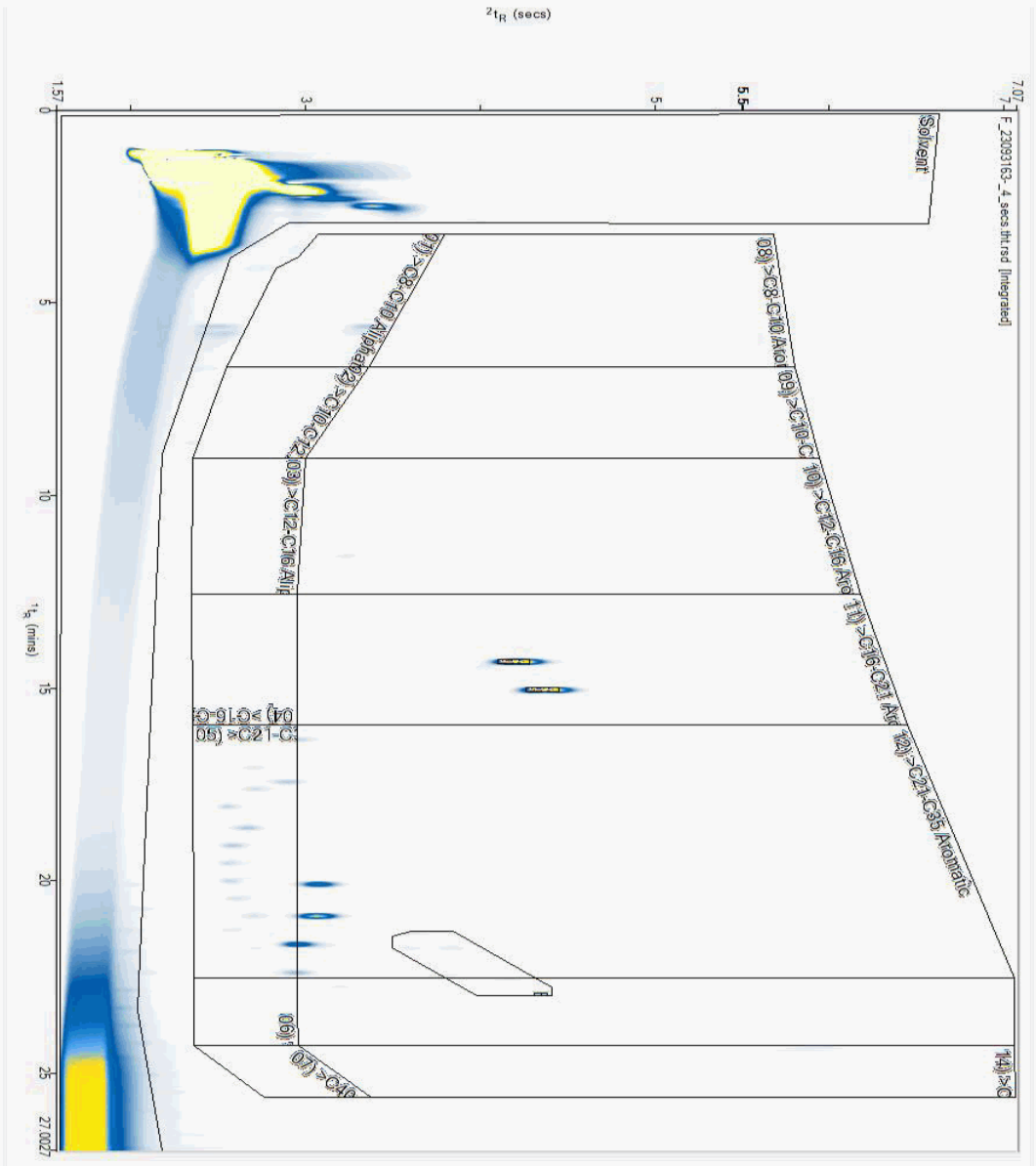
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23093163 **Depth :** 0.50 - 0.60
Sample ID : TP002

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23093163-_4_secs.tht
Date Acquired   :  26/10/20 06:41:40
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



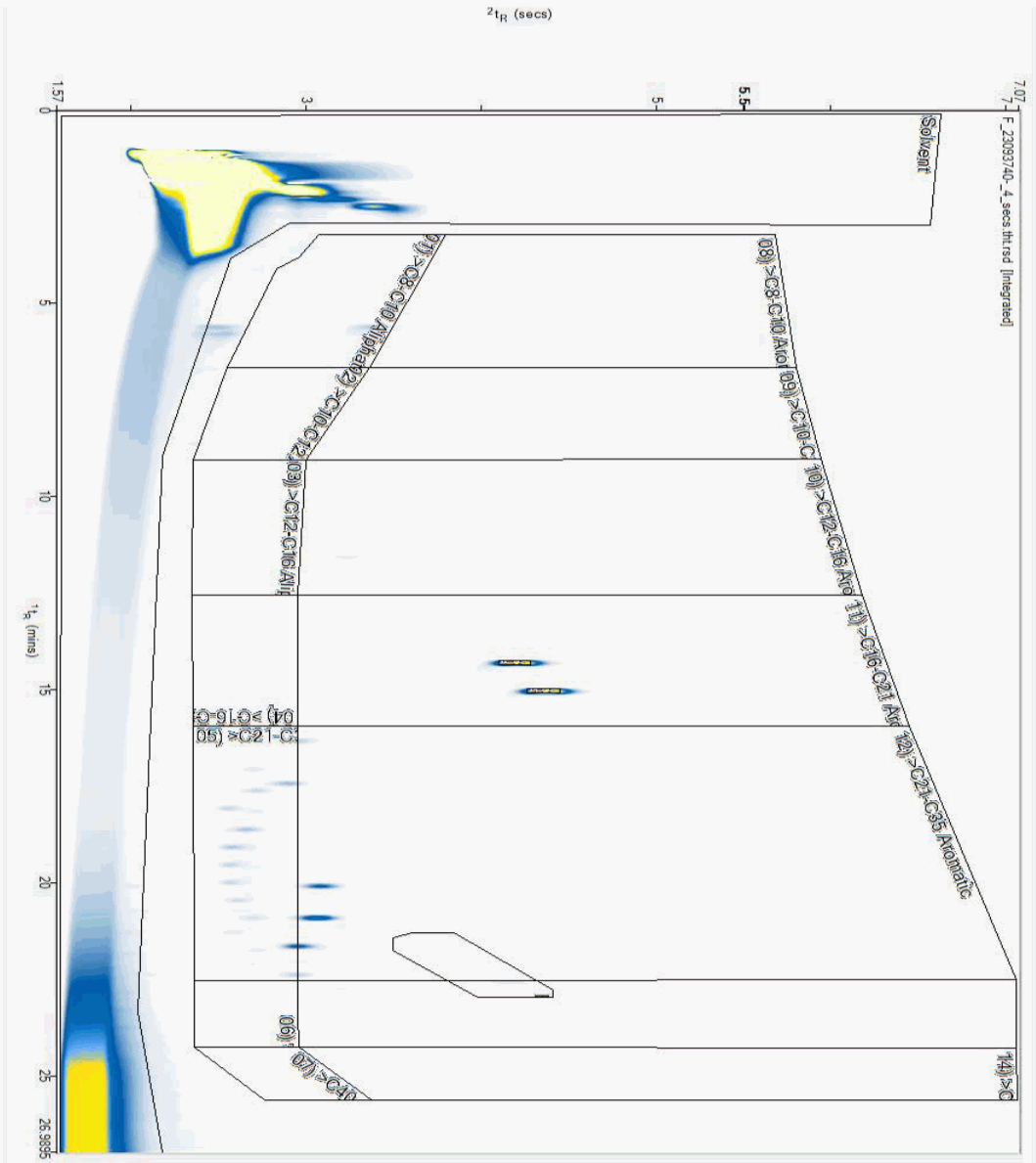
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23093740 **Depth :** 1.40 - 1.50
Sample ID : TP001

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23093740-_4_secs.tht
Date Acquired   :  26/10/20 07:13:14
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



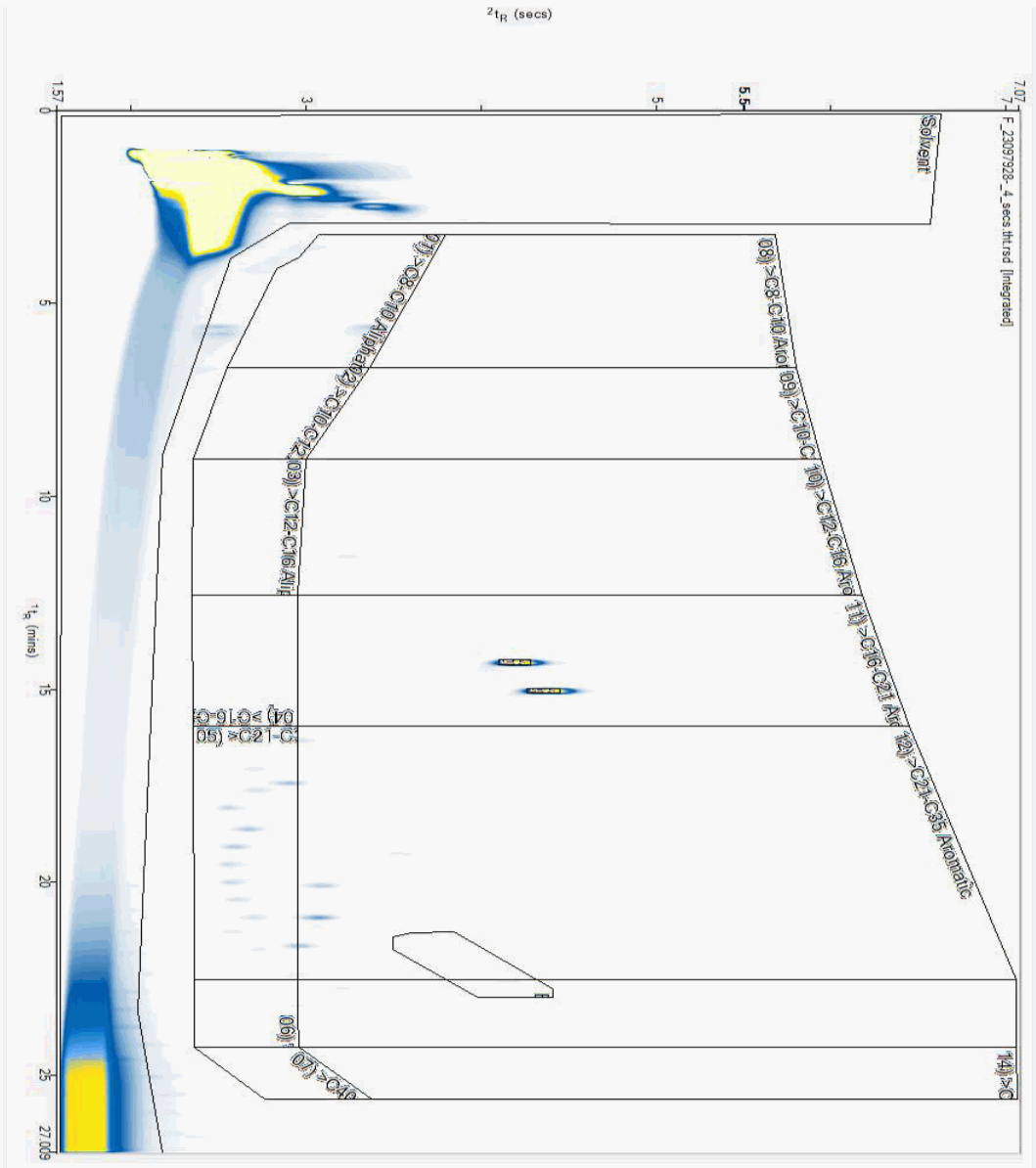
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23097928 **Depth :** 1.40 - 1.50
Sample ID : TP010

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  F_23097928-_4_secs.tht
Date Acquired  :  26/10/20 09:51:07
Units          :  ppm
Dilution       :  0
CF             :
Multiplier     :
```



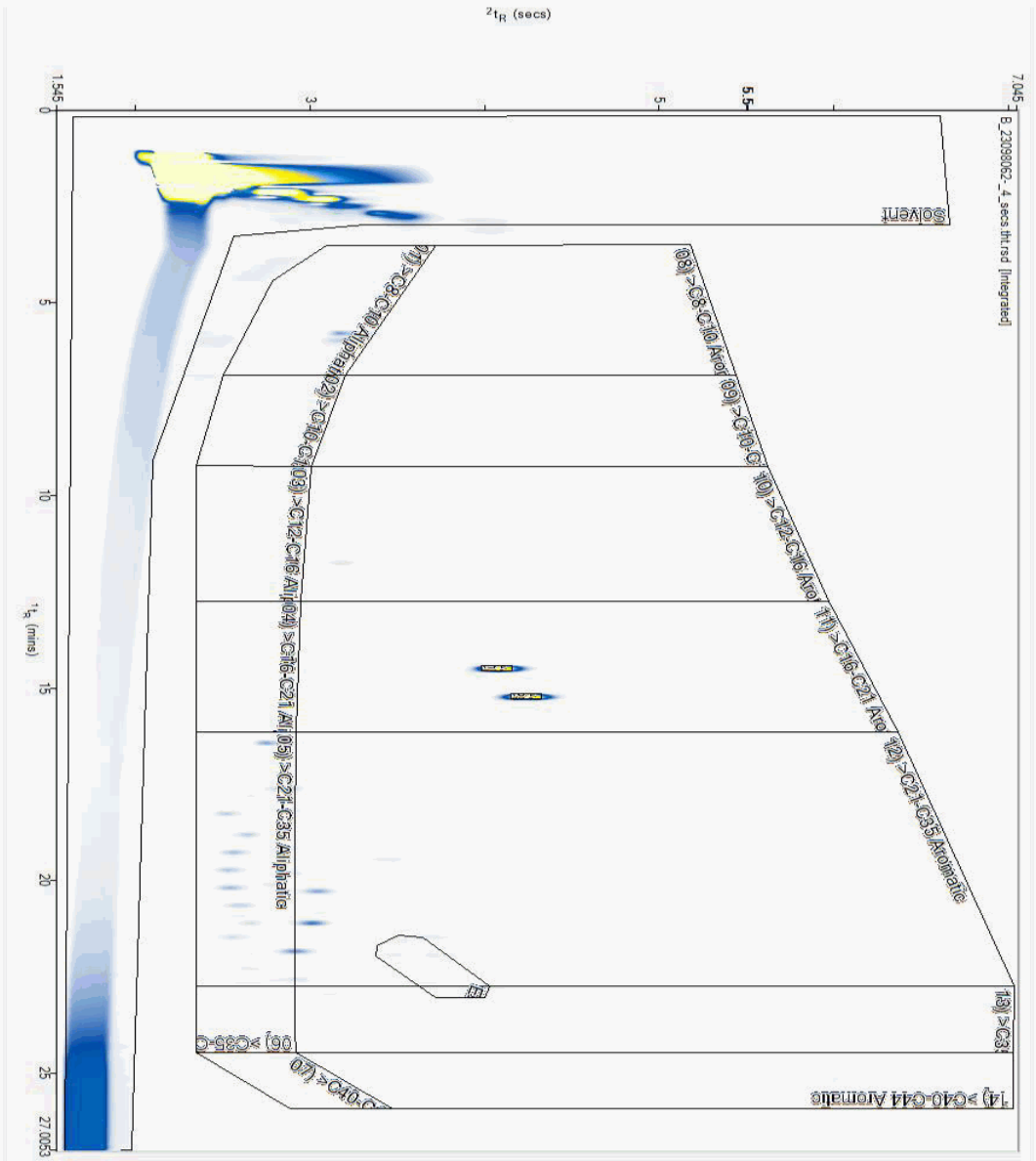
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23098062 **Depth :** 0.50 - 0.60
Sample ID : TP003

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23098062-_4_secs.tht
Date Acquired   :  26/10/20 05:43:52
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



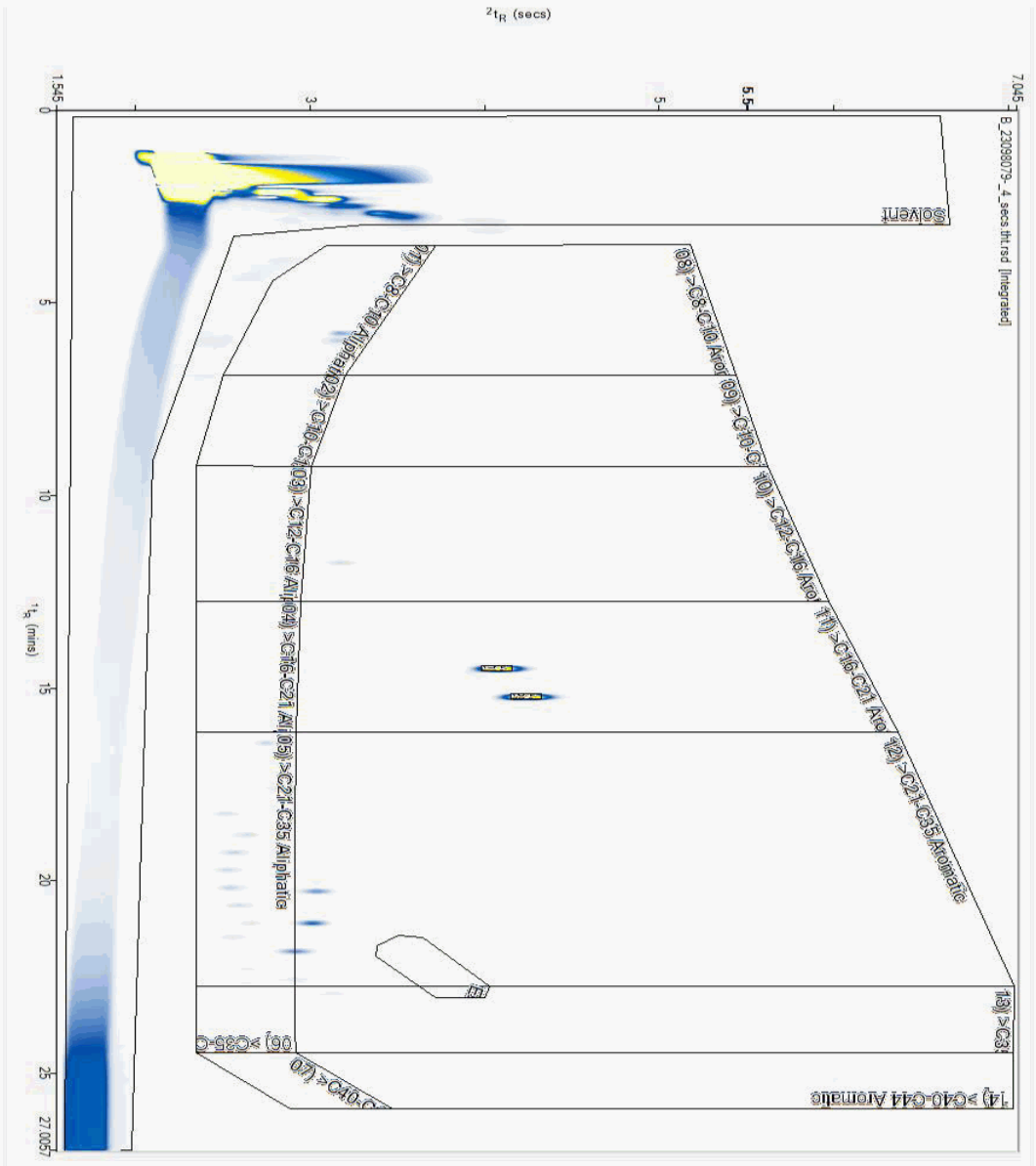
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23098079 **Depth :** 0.40 - 0.50
Sample ID : TP010

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23098079-_4_secs.tht
Date Acquired   :  26/10/20 08:20:55
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



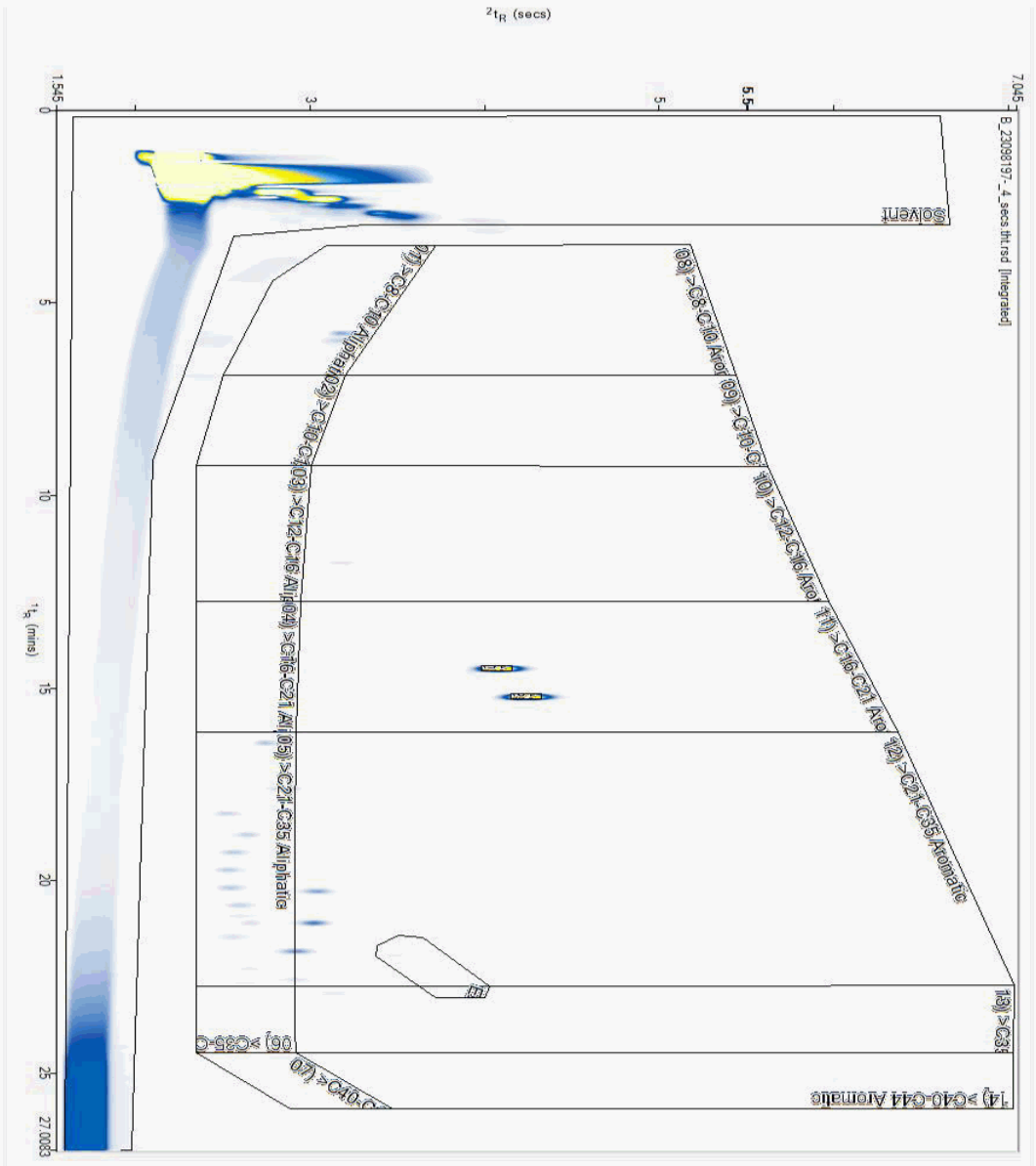
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23098197 **Depth :** 0.50 - 0.60
Sample ID : TP012

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23098197-_4_secs.tht
Date Acquired   :  26/10/20 06:46:41
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



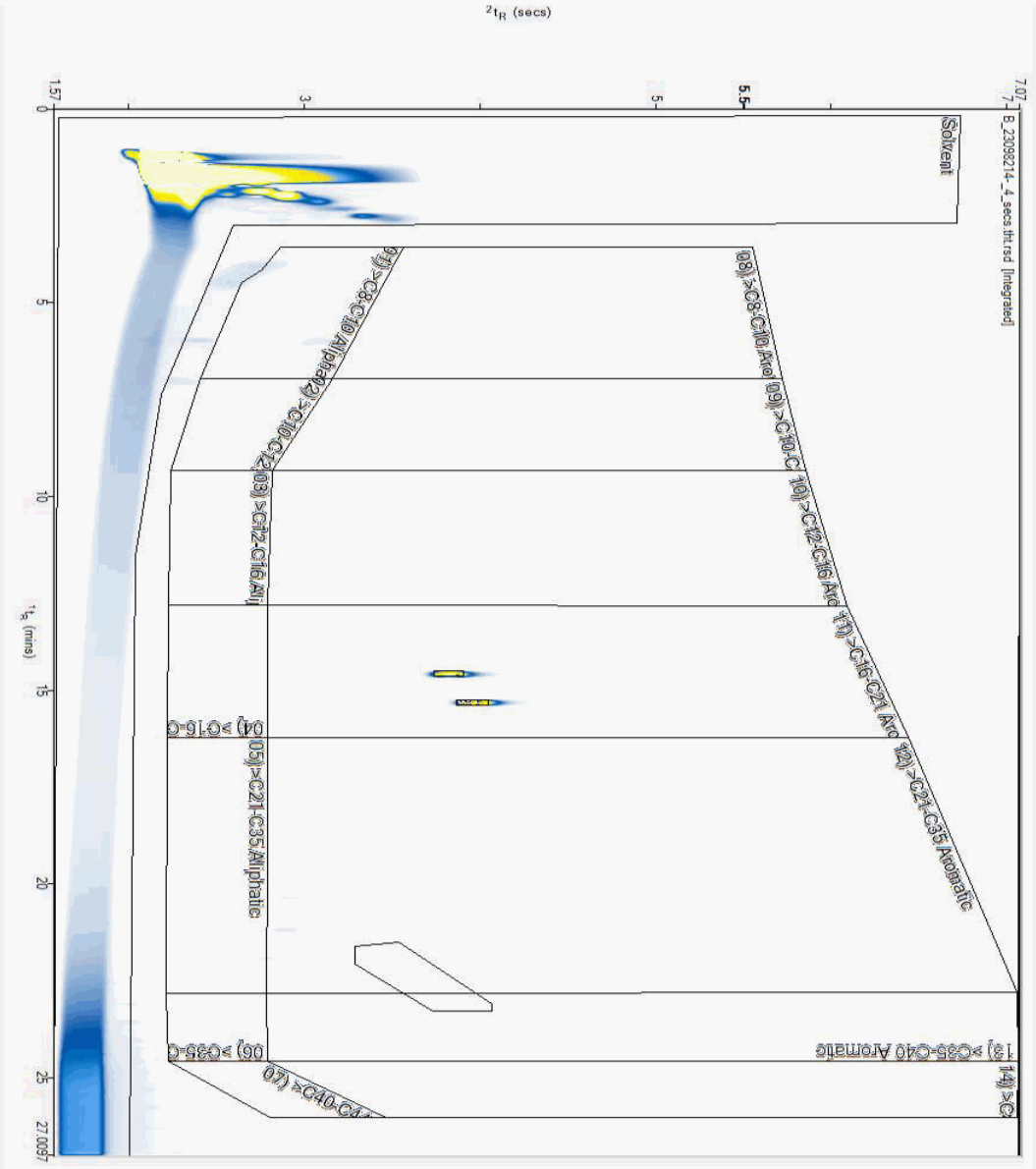
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23098214 **Depth :** 1.50 - 1.60
Sample ID : TP005

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  B_23098214-_4_secs.tht
Date Acquired   :  26/10/20 08:54:58
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



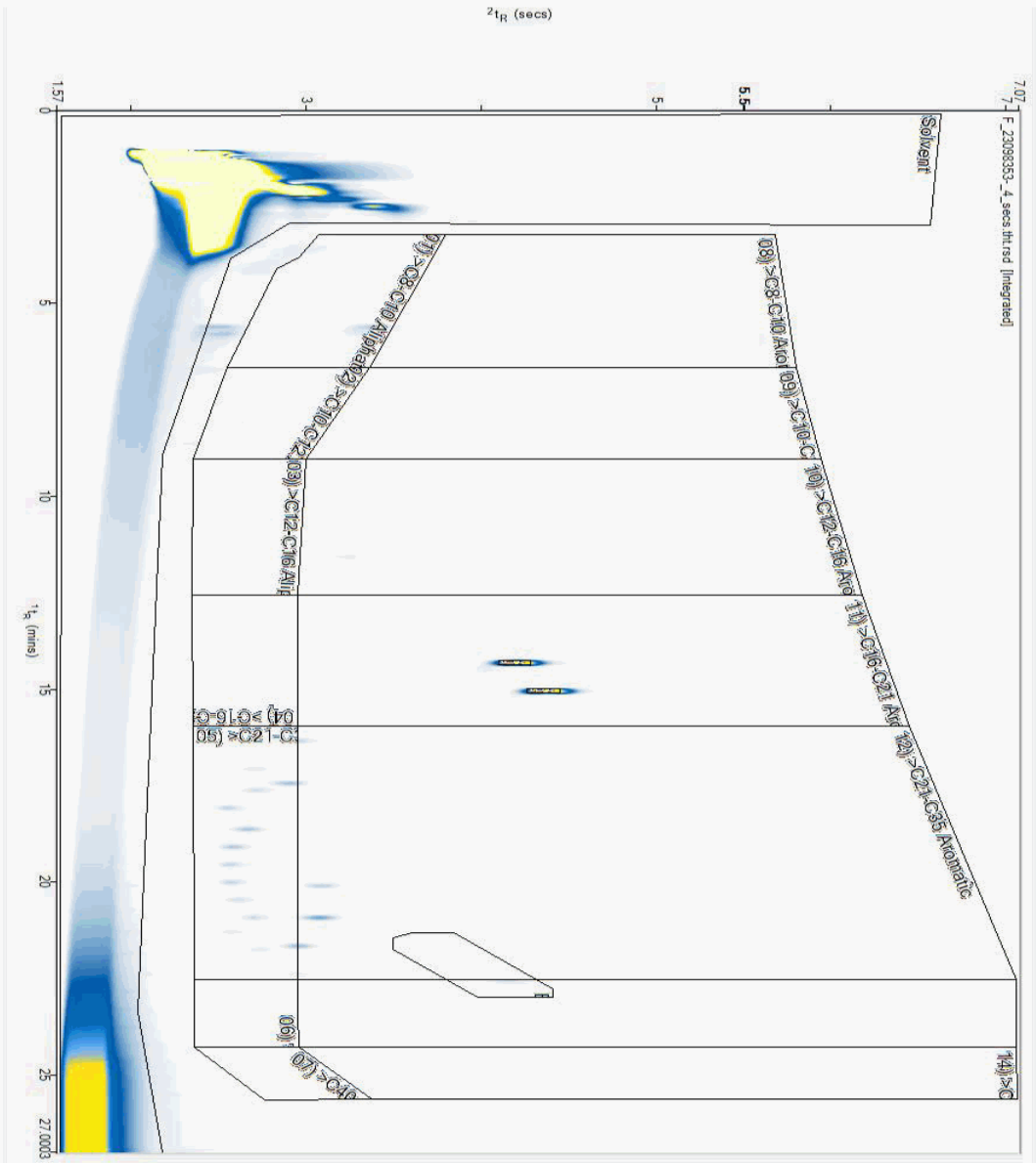
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23098353 **Depth :** 1.50 - 1.60
Sample ID : TP003

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  F_23098353-_4_secs.tht
Date Acquired  :  26/10/20 09:19:32
Units          :  ppm
Dilution       :  0
CF             :
Multiplier     :
```



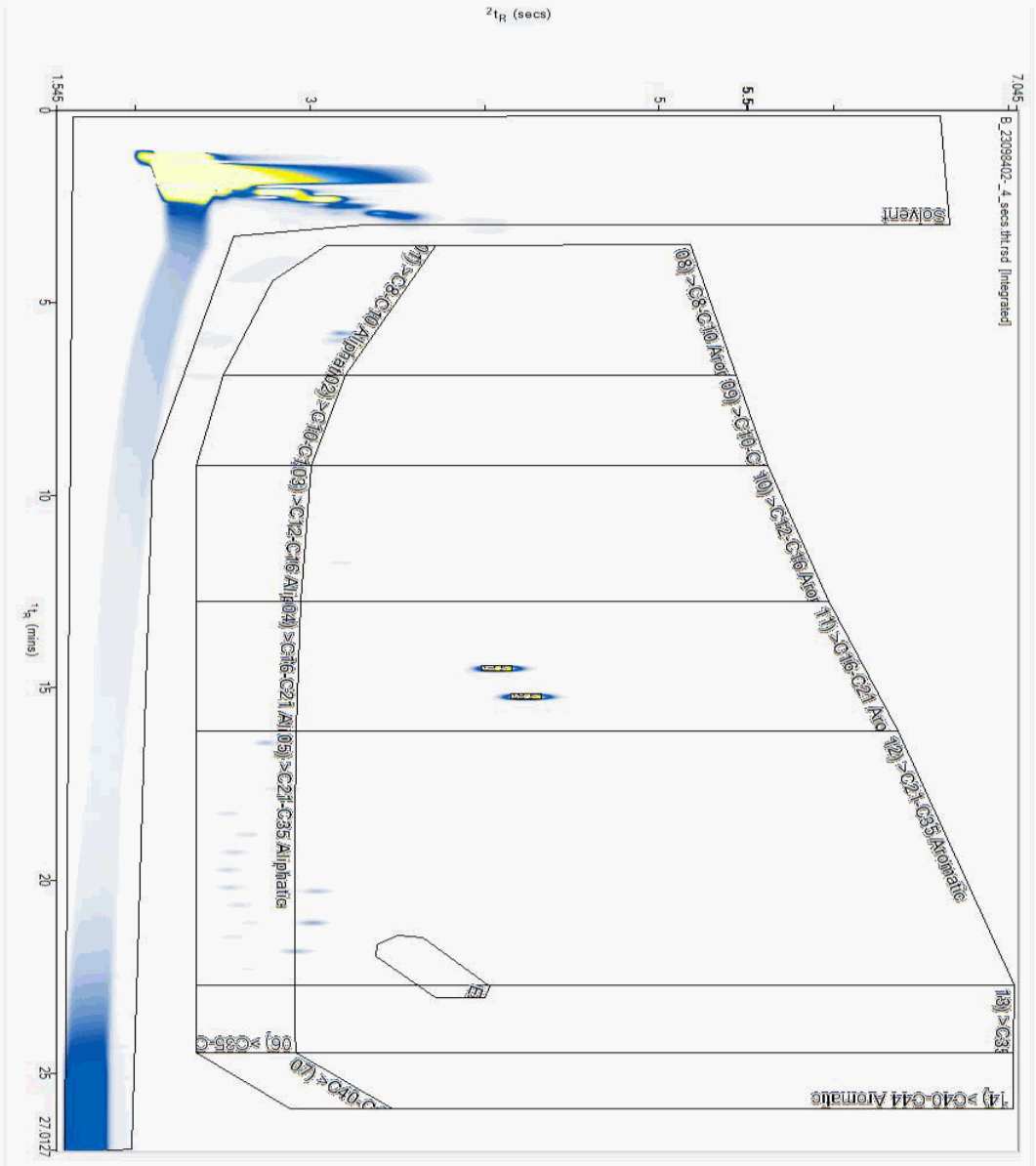
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23098402 **Depth :** 0.50 - 0.60
Sample ID : TP201

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  B_23098402-_4_secs.tht
Date Acquired   :  26/10/20 07:49:31
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



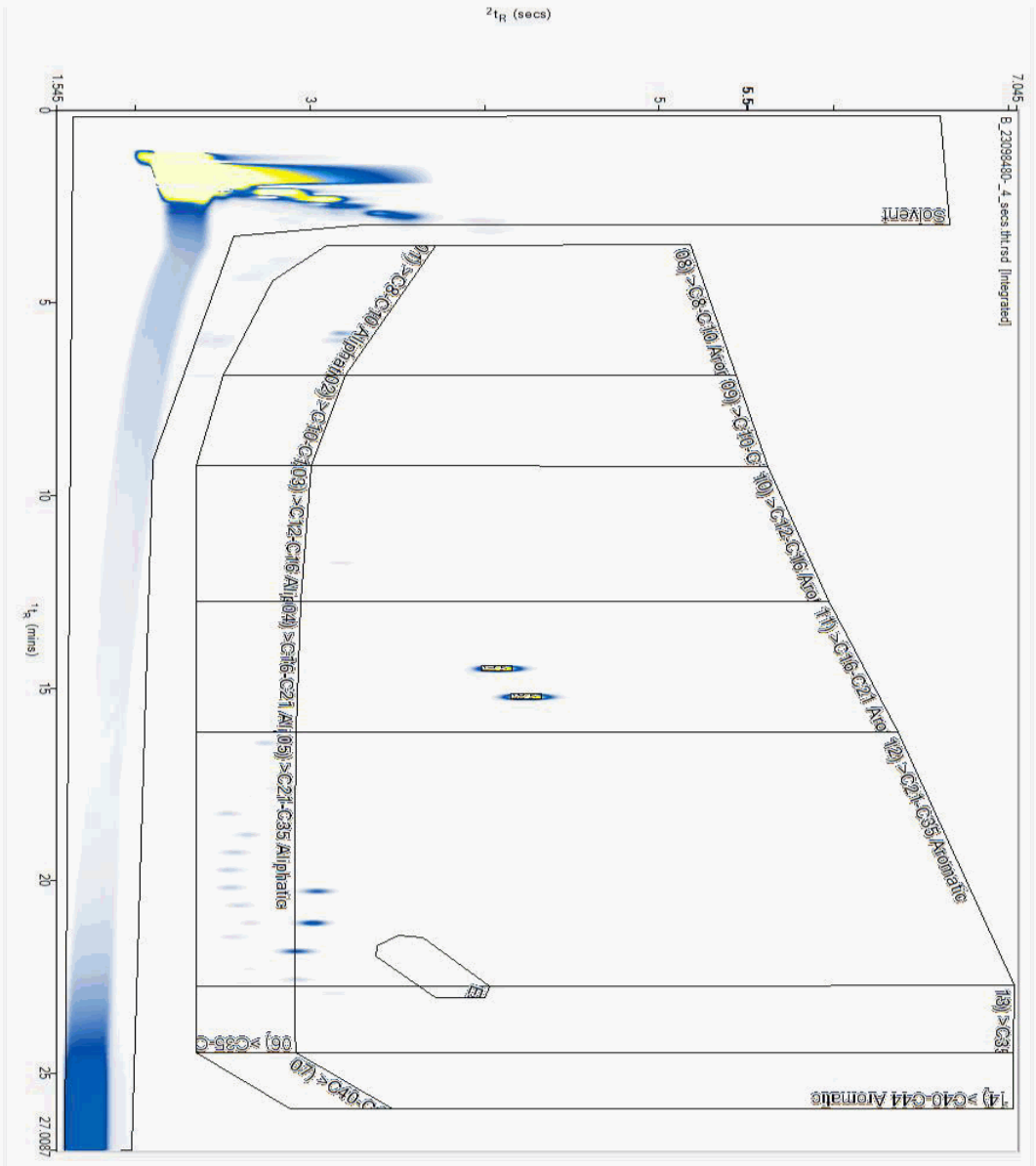
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23098480 **Depth :** 1.40 - 1.50
Sample ID : TP012

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23098480-_4_secs.tht
Date Acquired   :  26/10/20 07:18:07
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



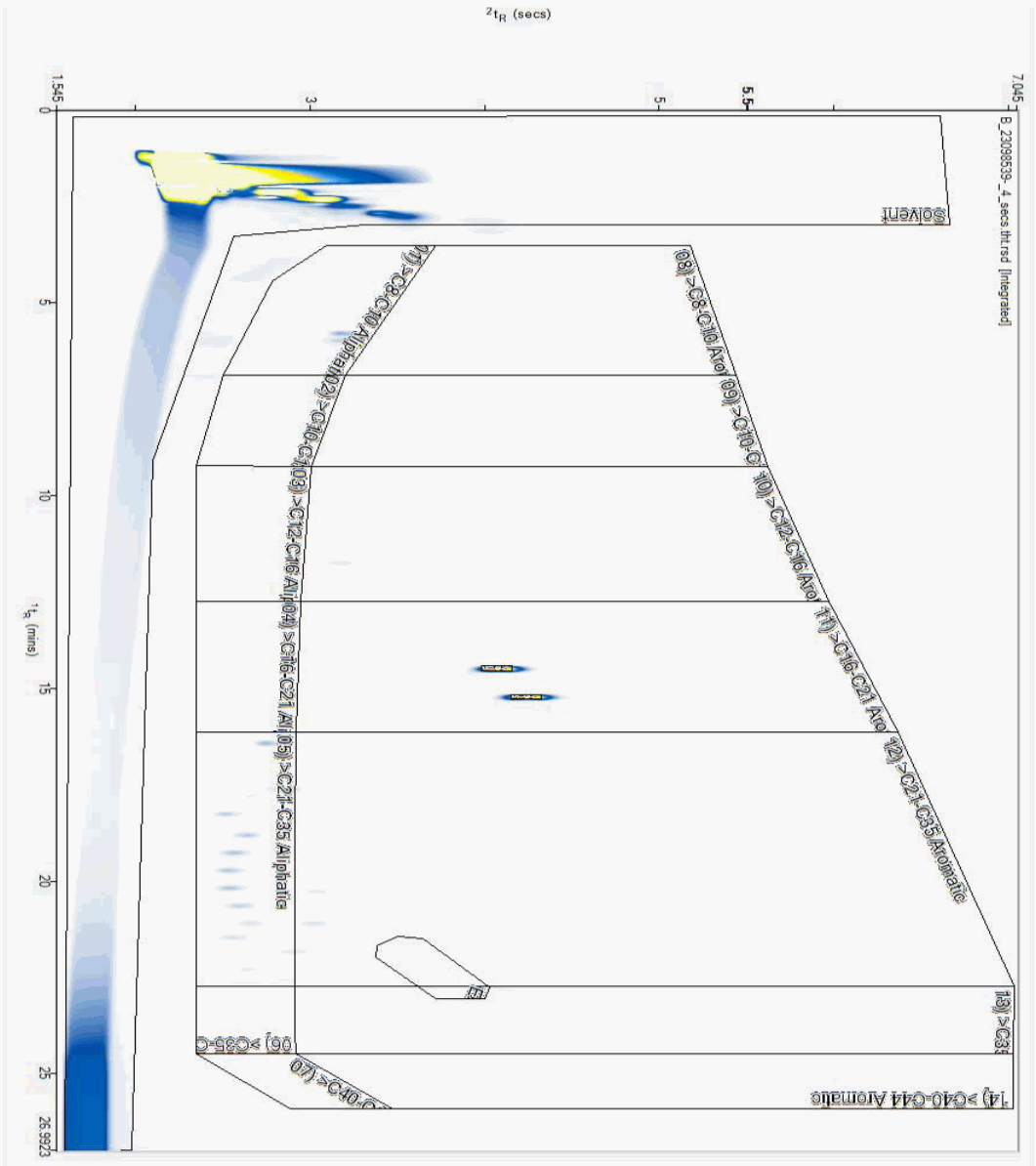
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23098539 **Depth :** 1.50 - 1.60
Sample ID : TP201

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23098539-_4_secs.tht
Date Acquired   :  26/10/20 06:15:16
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



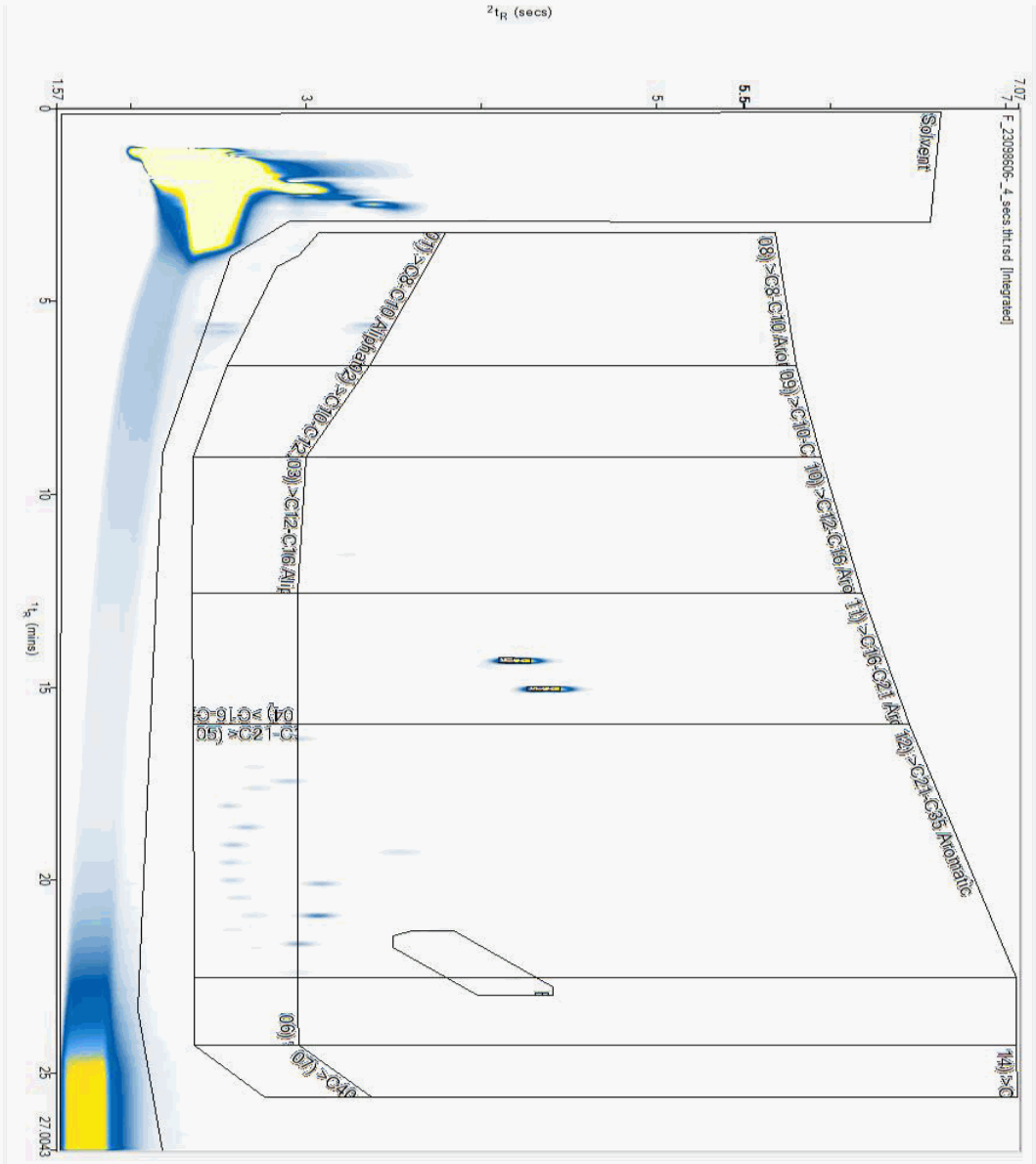
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23098606 **Depth :** 0.40 - 0.50
Sample ID : TP011

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  F_23098606-_4_secs.tht
Date Acquired   :  26/10/20 08:16:22
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



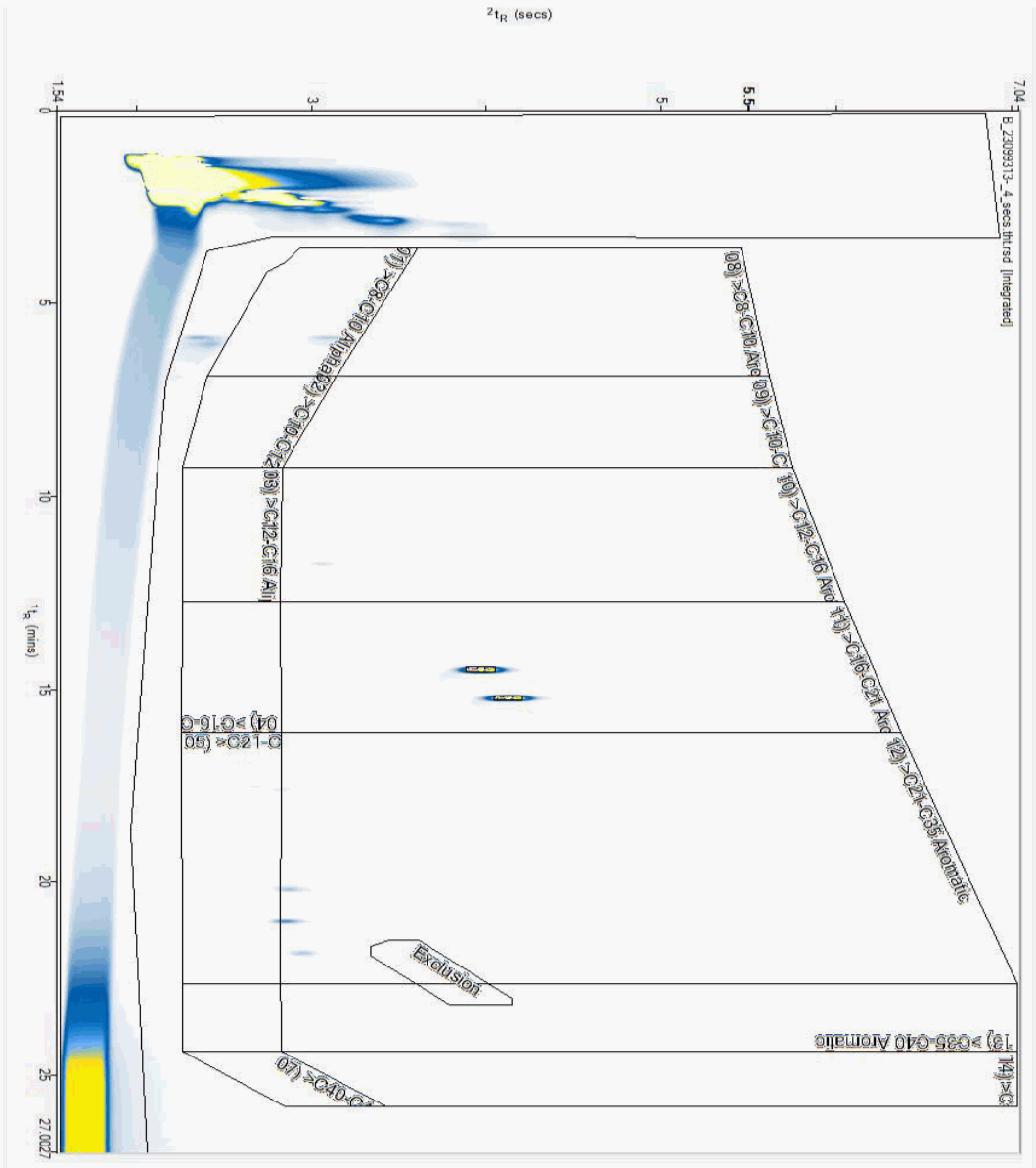
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23099313 **Depth :** 0.40 - 0.50
Sample ID : TP005

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  B_23099313-_4_secs.tht
Date Acquired   :  26/10/20 06:41:40
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



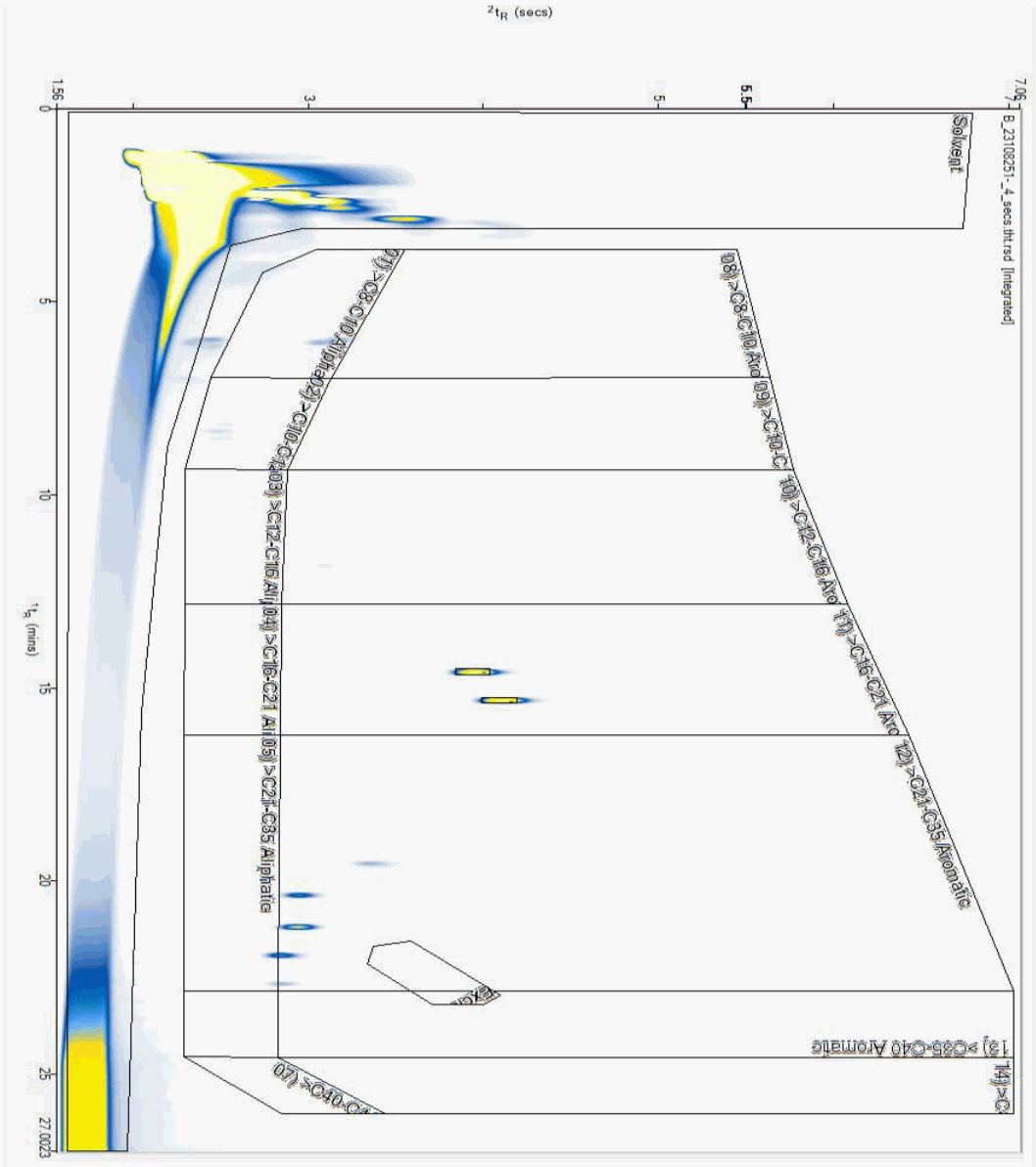
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23108251 **Depth :** 1.40 - 1.50
Sample ID : TP011

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  B_23108251-_4_secs.tht
Date Acquired   :  26/10/20 08:06:12
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



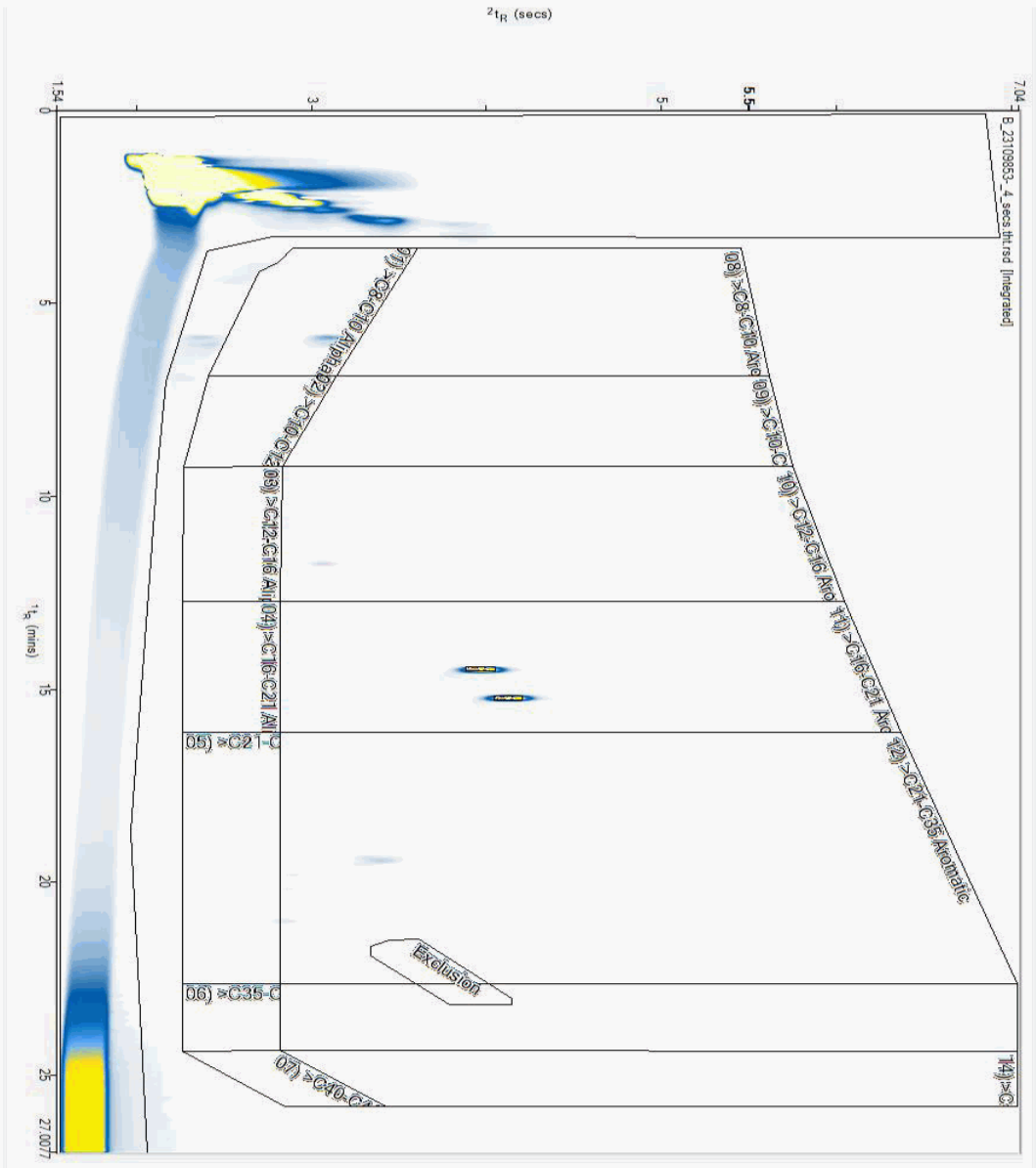
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23109853 **Depth :** 1.40 - 1.50
Sample ID : TP006

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23109853-_4_secs.tht
Date Acquired   :  27/10/20 05:41:49
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



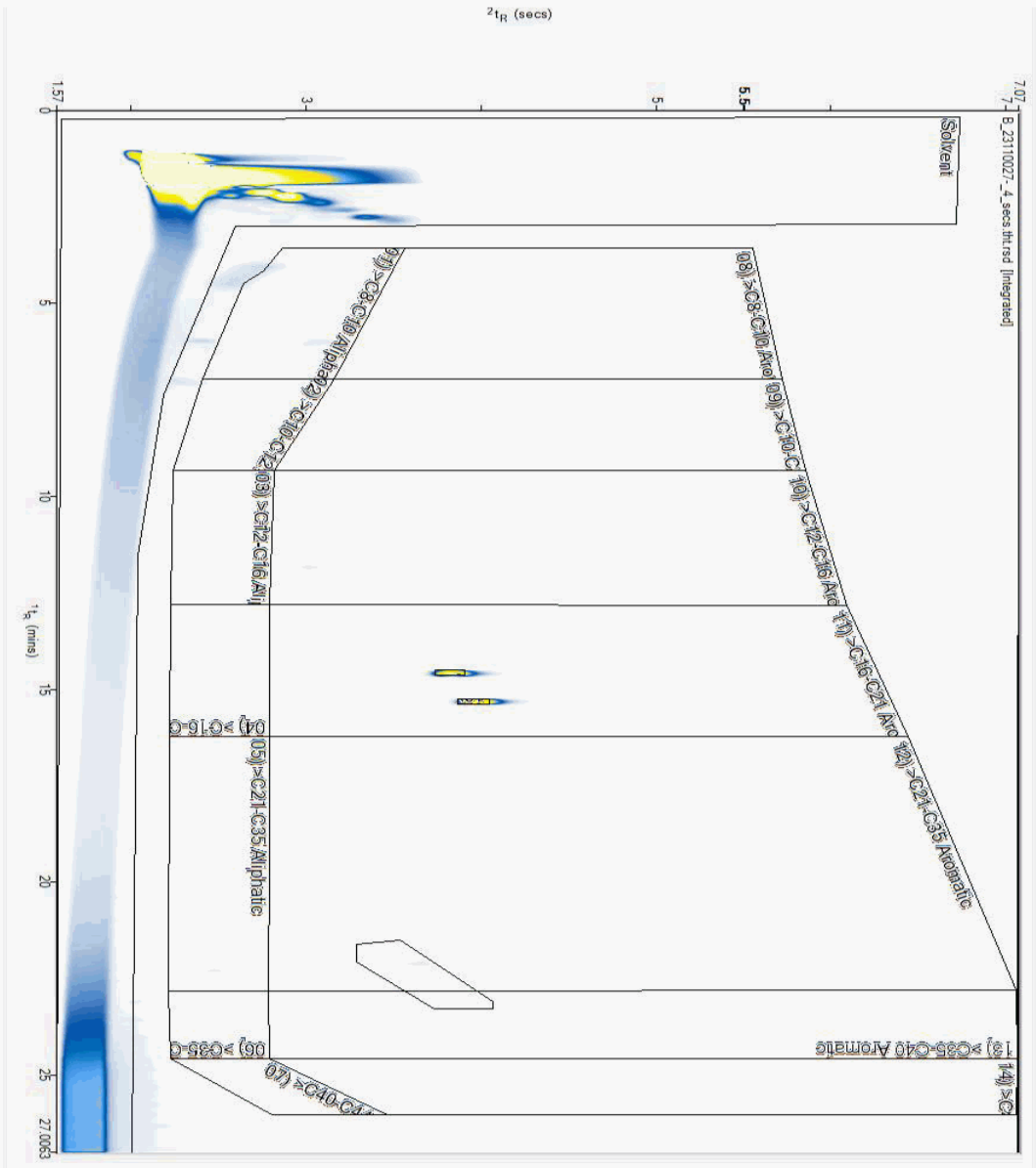
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23110027 **Depth :** 0.40 - 0.50
Sample ID : TP006

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  B_23110027-_4_secs.tht
Date Acquired   :  26/10/20 08:24:20
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



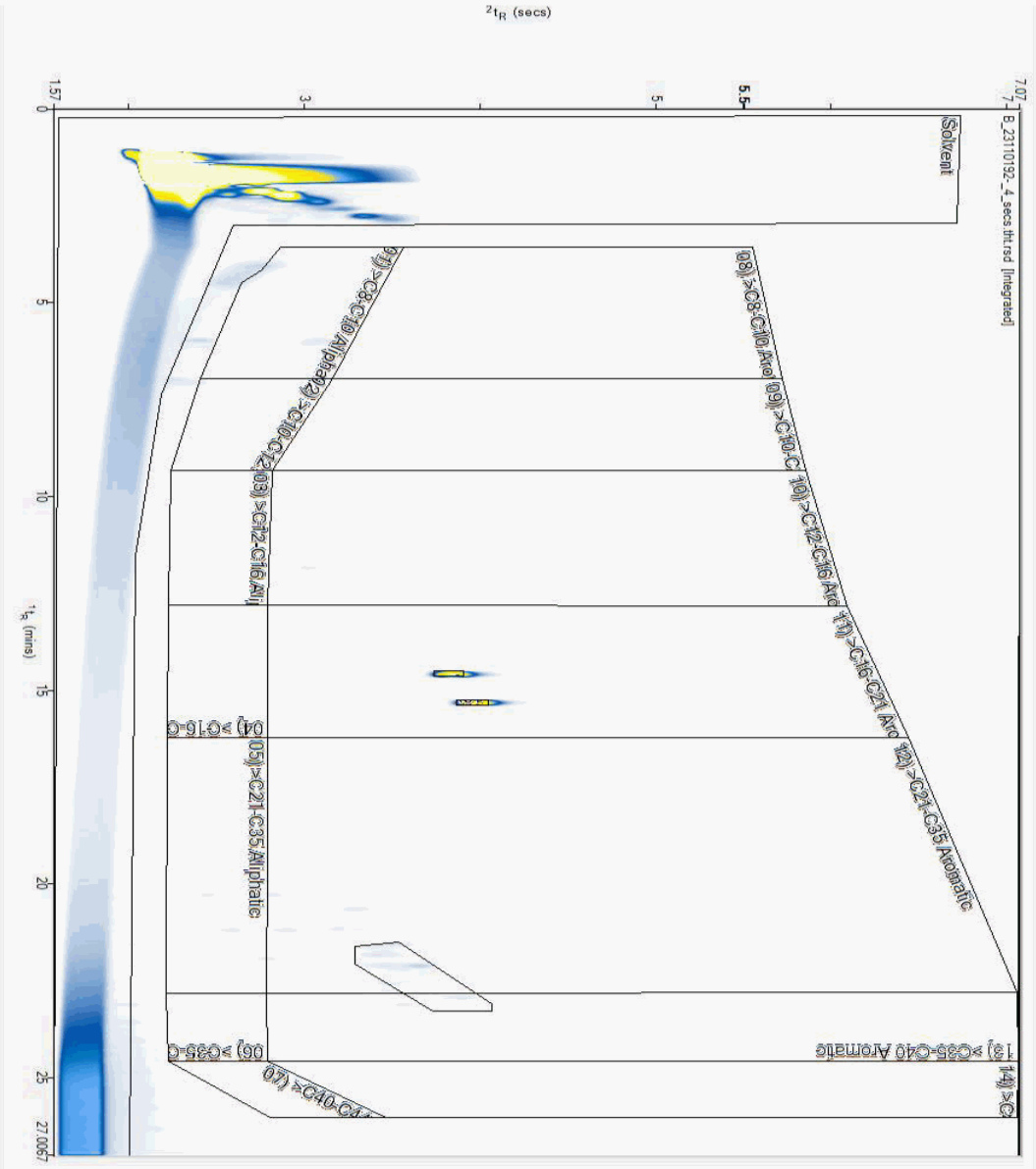
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23110192 **Depth :** 0.40 - 0.50
Sample ID : TP004

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  B_23110192-_4_secs.tht
Date Acquired   :  26/10/20 10:57:36
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



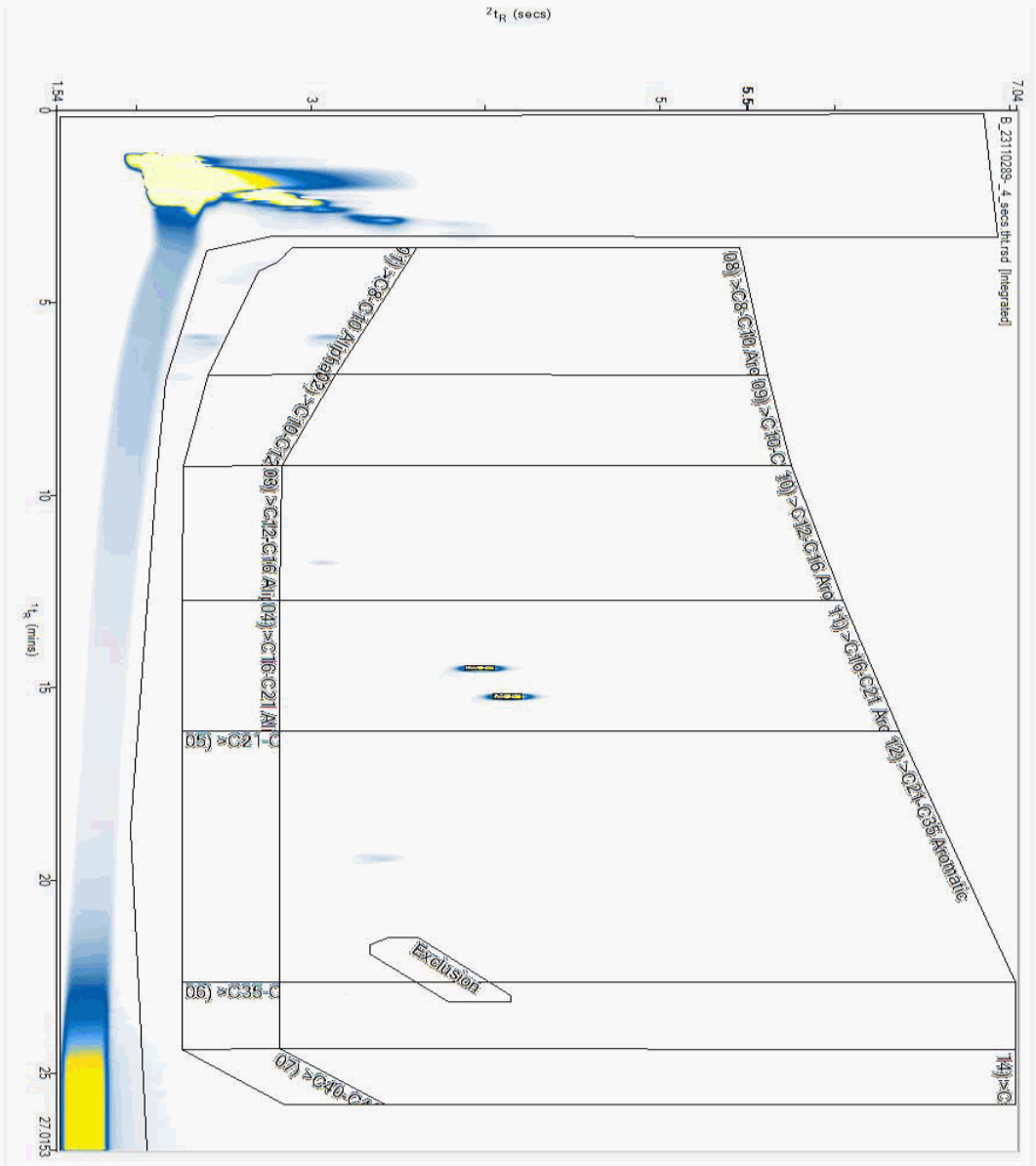
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23110289 **Depth :** 1.40 - 1.50
Sample ID : TP004

```
   ChromSpace LIMS export
  Current batch
Sample Identity:  B_23110289-_4_secs.tht
Date Acquired   :  27/10/20 06:13:24
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



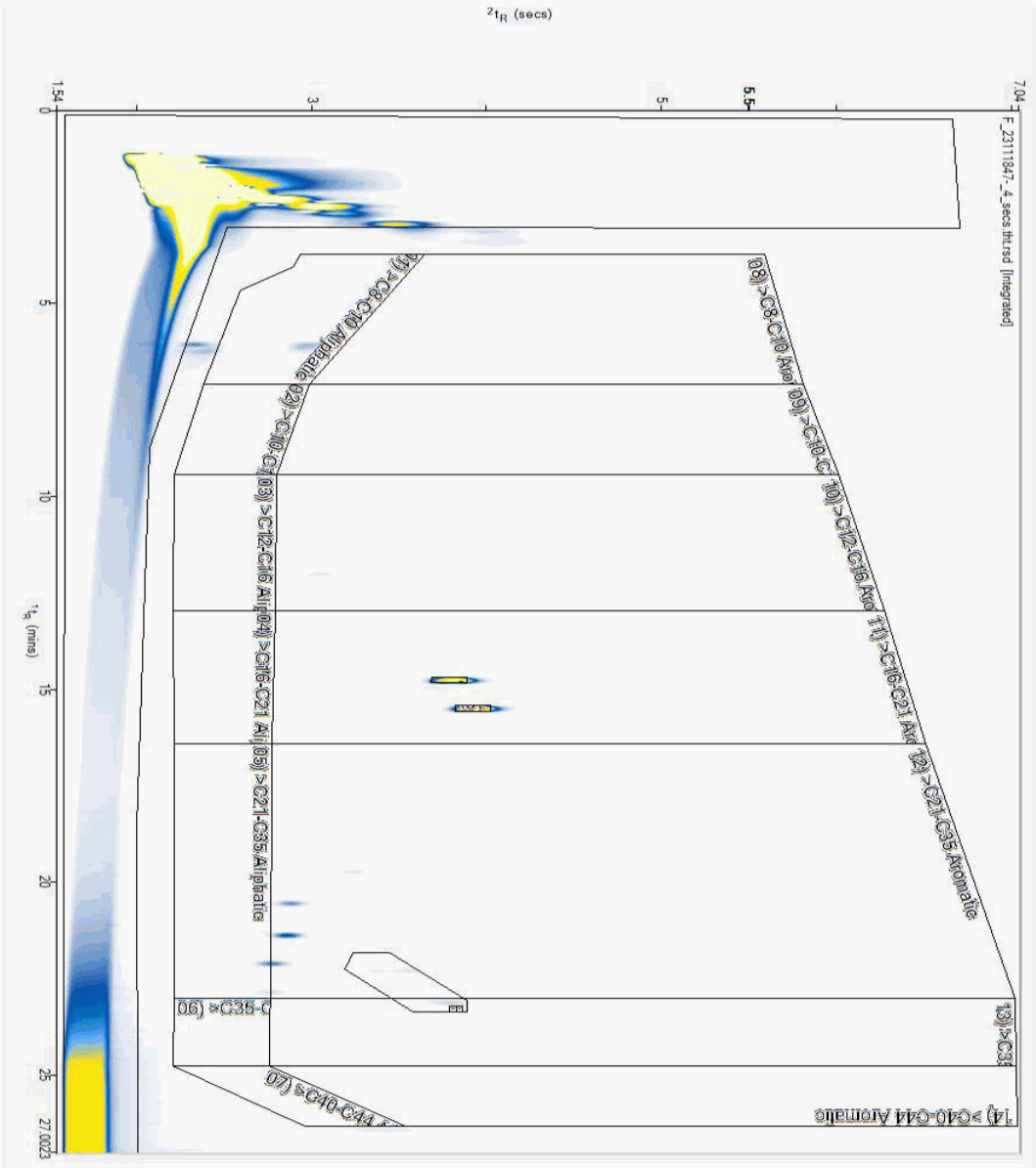
CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG GC (S) **Sample No :** 23111847 **Depth :** 0.40 - 0.50
Sample ID : TP001

```
  ChromSpace LIMS export
 Current batch
Sample Identity:  F_23111847-_4_secs.tht
Date Acquired   :  26/10/20 08:06:12
Units           :  ppm
Dilution        :  0
CF              :
Multiplier      :
```



CERTIFICATE OF ANALYSIS

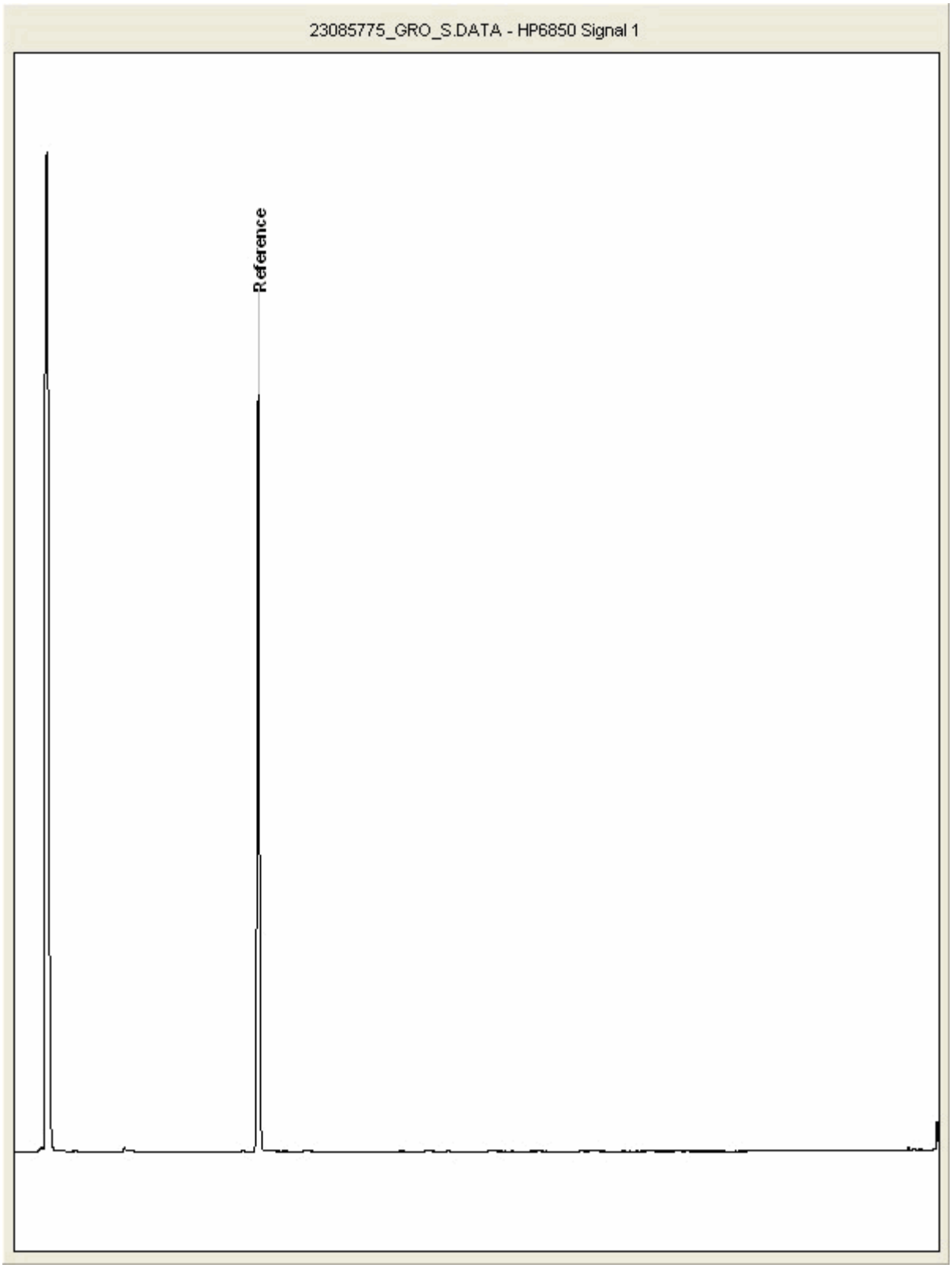
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23085775
Sample ID : TP201

Depth : 0.50 - 0.60

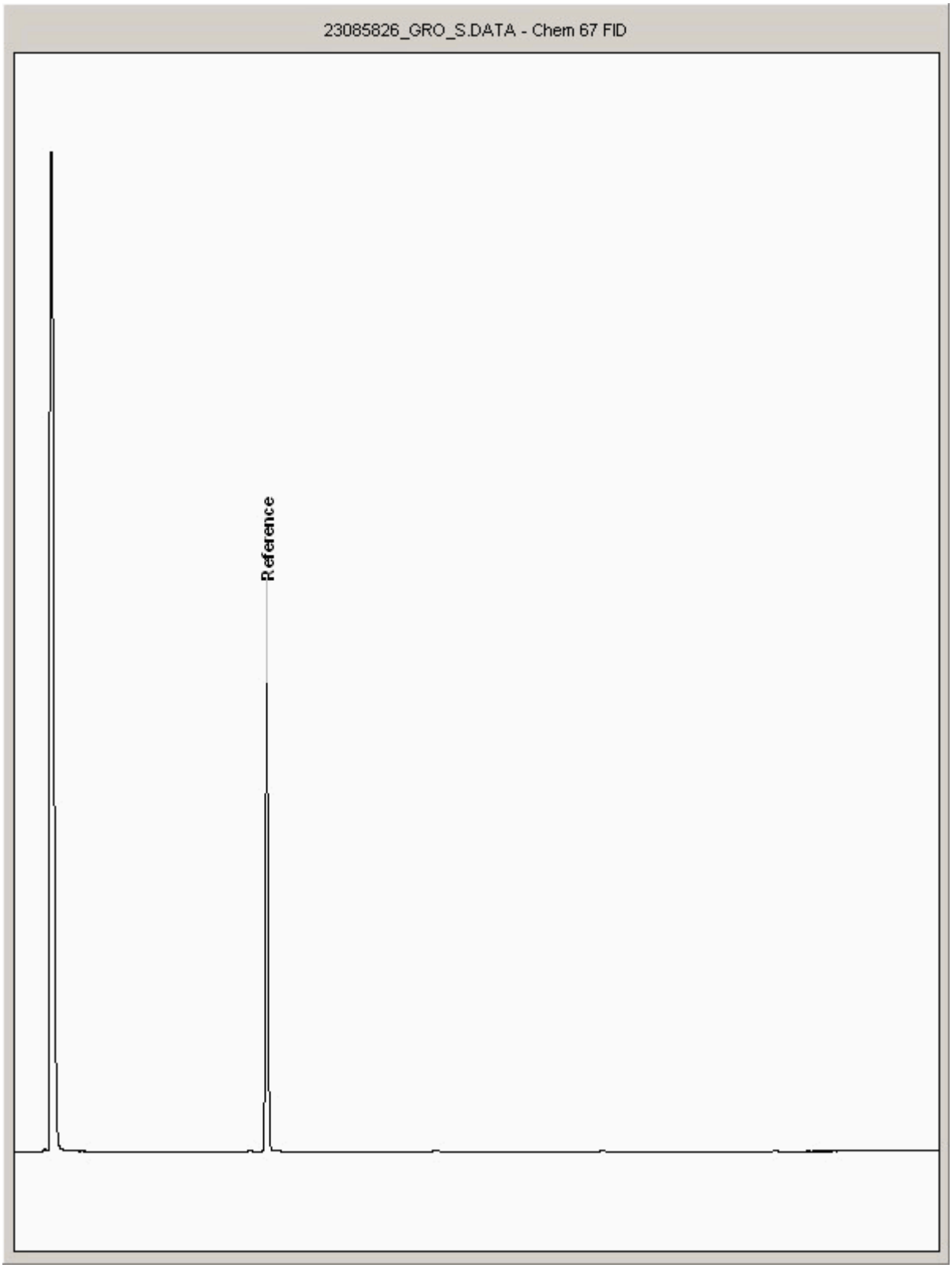


CERTIFICATE OF ANALYSIS

SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S) **Sample No :** 23085826 **Sample ID :** TP201 **Depth :** 1.50 - 1.60



CERTIFICATE OF ANALYSIS

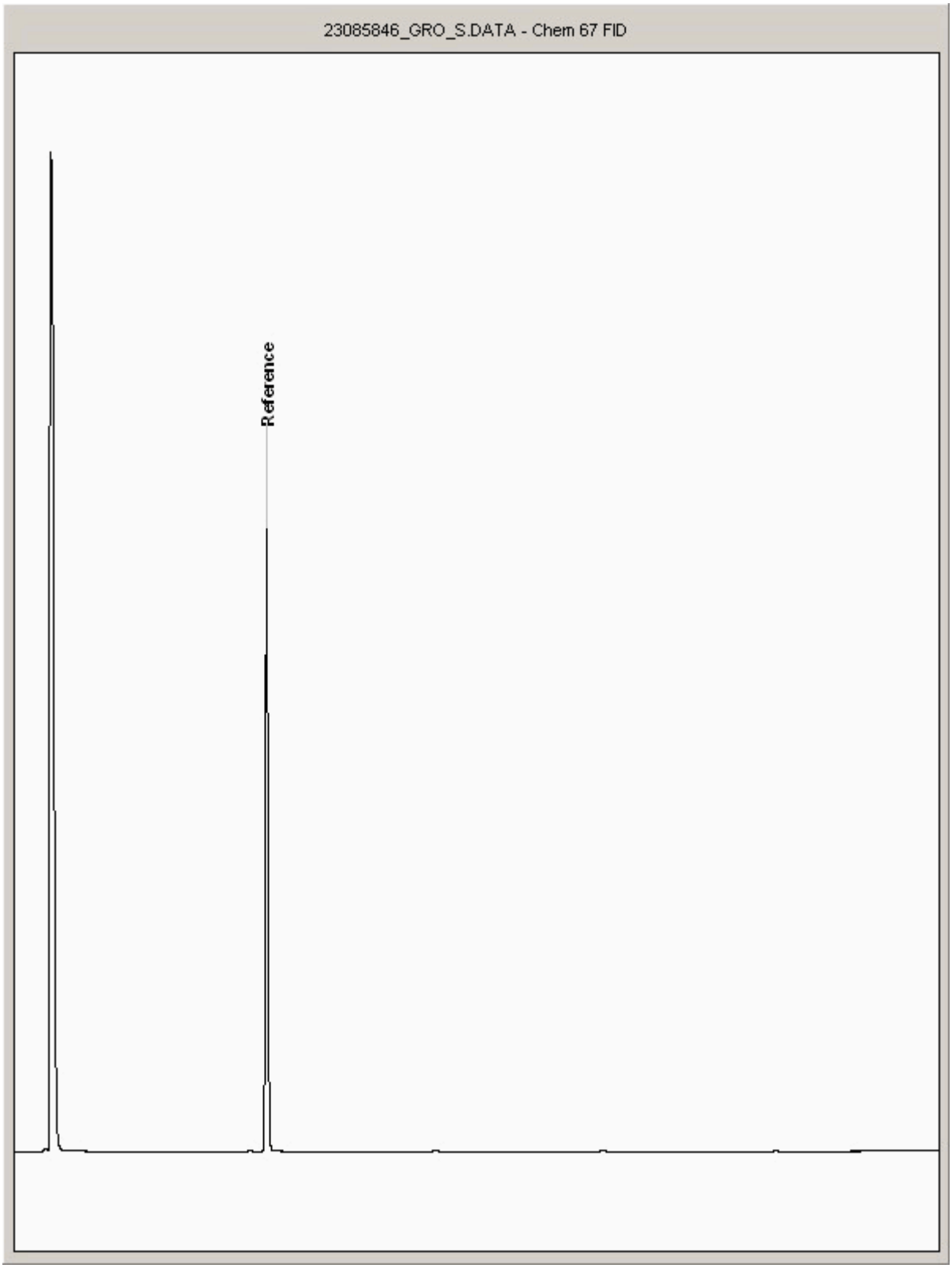
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23085846
Sample ID : TP005

Depth : 1.50 - 1.60



CERTIFICATE OF ANALYSIS

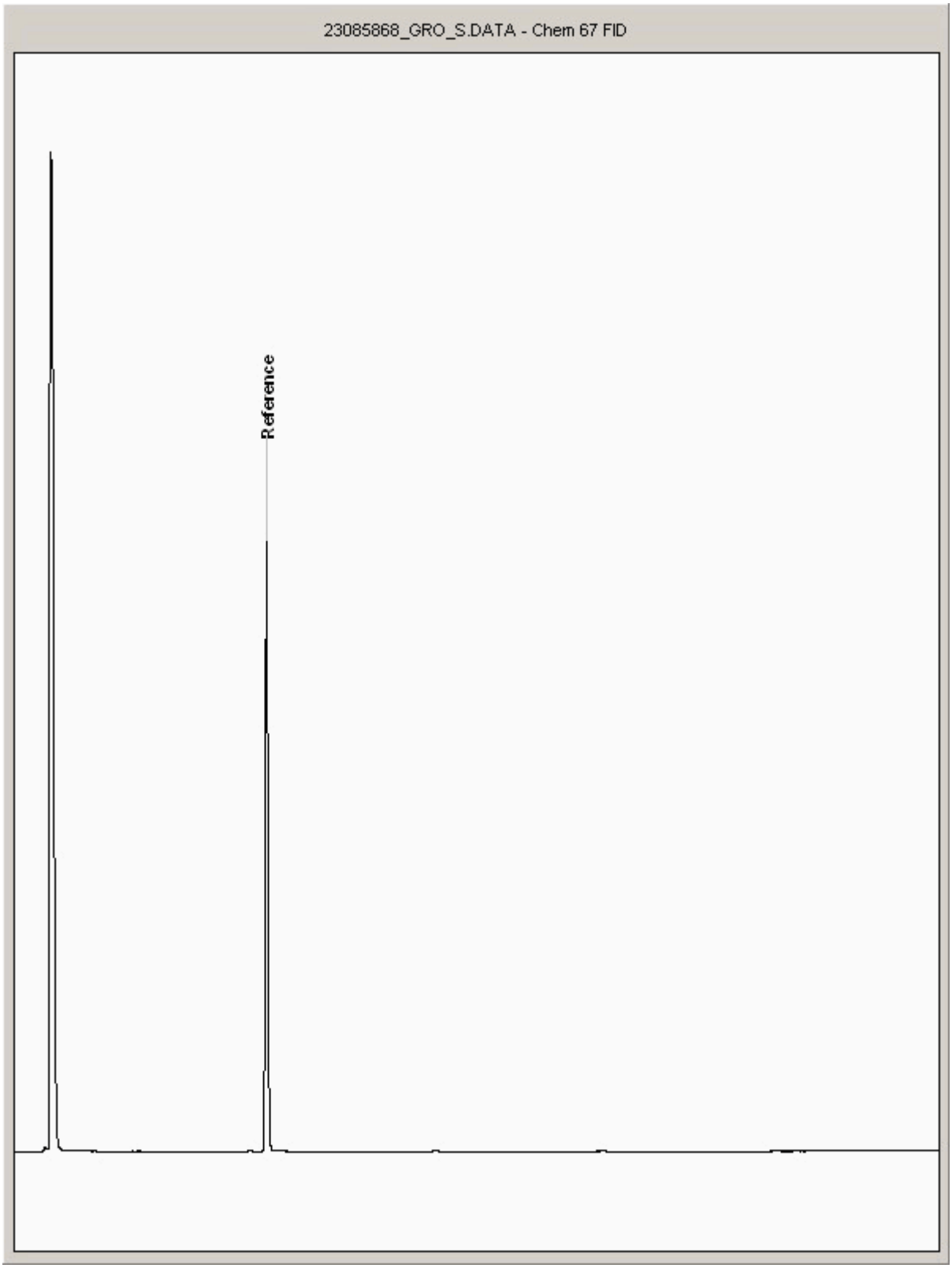
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23085868
Sample ID : TP002

Depth : 1.40 - 1.50



CERTIFICATE OF ANALYSIS

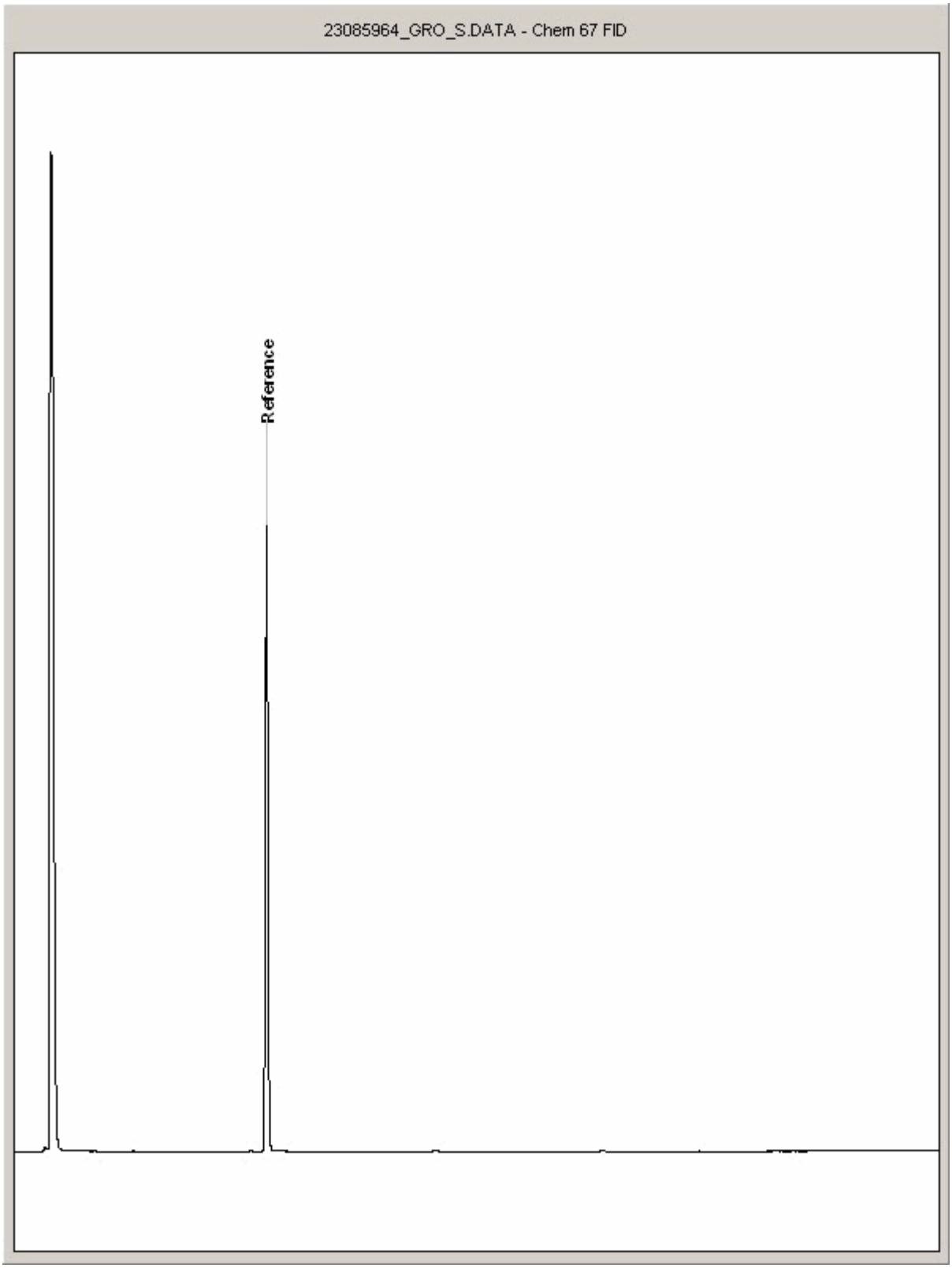
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23085964
Sample ID : TP005

Depth : 0.40 - 0.50



CERTIFICATE OF ANALYSIS

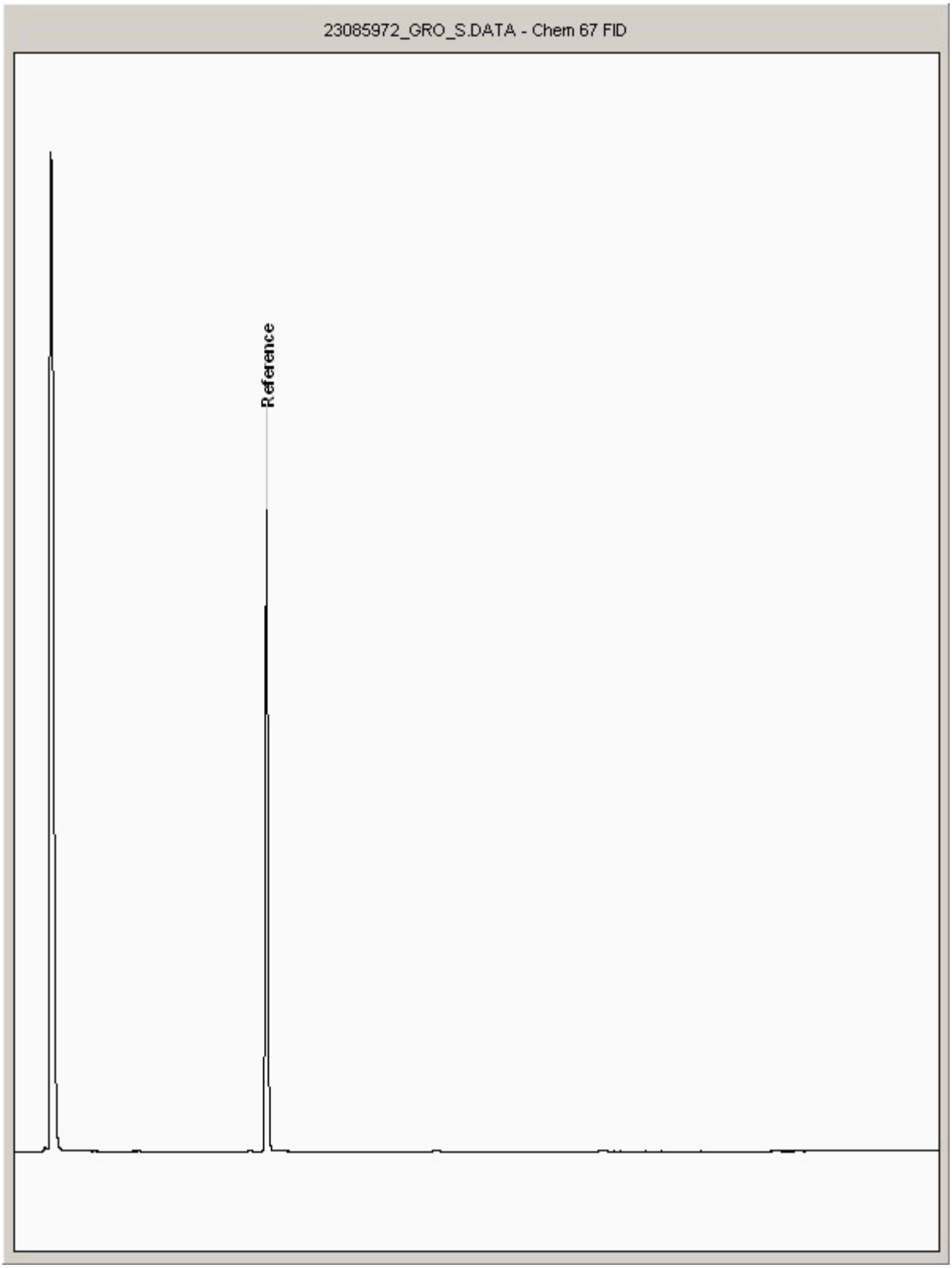
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23085972
Sample ID : TP004

Depth : 1.40 - 1.50



CERTIFICATE OF ANALYSIS

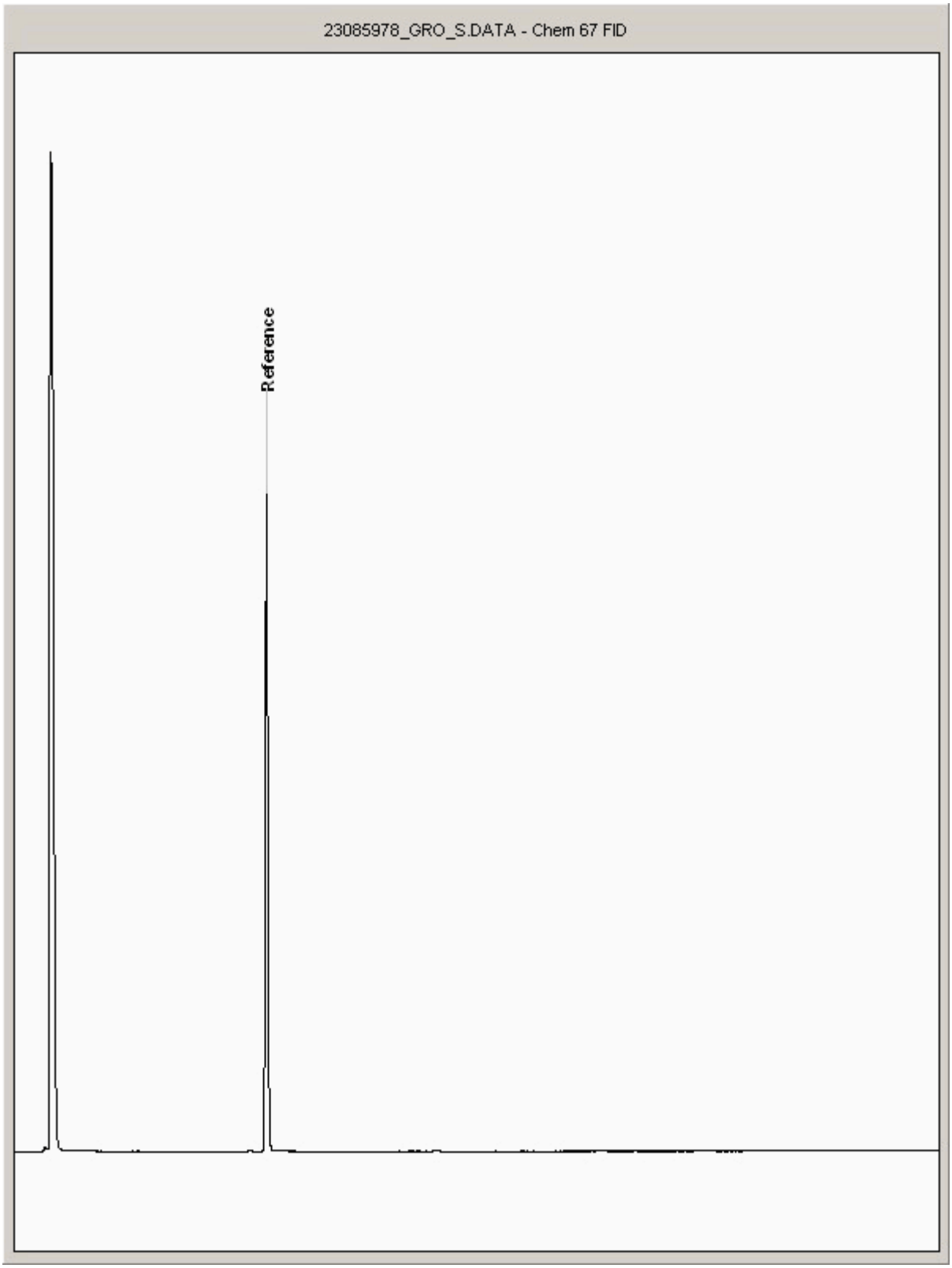
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23085978
Sample ID : TP004

Depth : 0.40 - 0.50



CERTIFICATE OF ANALYSIS

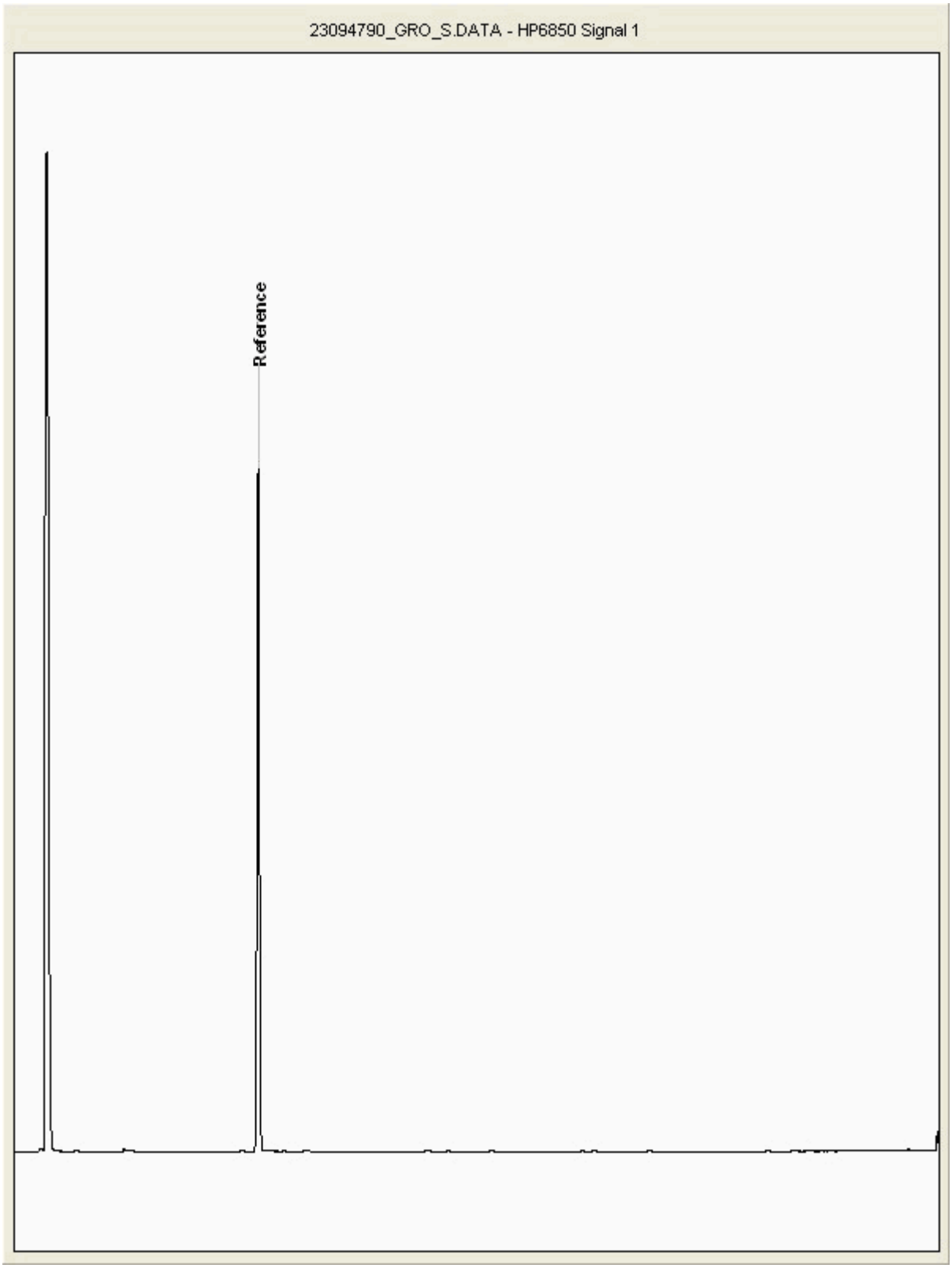
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23094790
Sample ID : TP011

Depth : 0.40 - 0.50



CERTIFICATE OF ANALYSIS

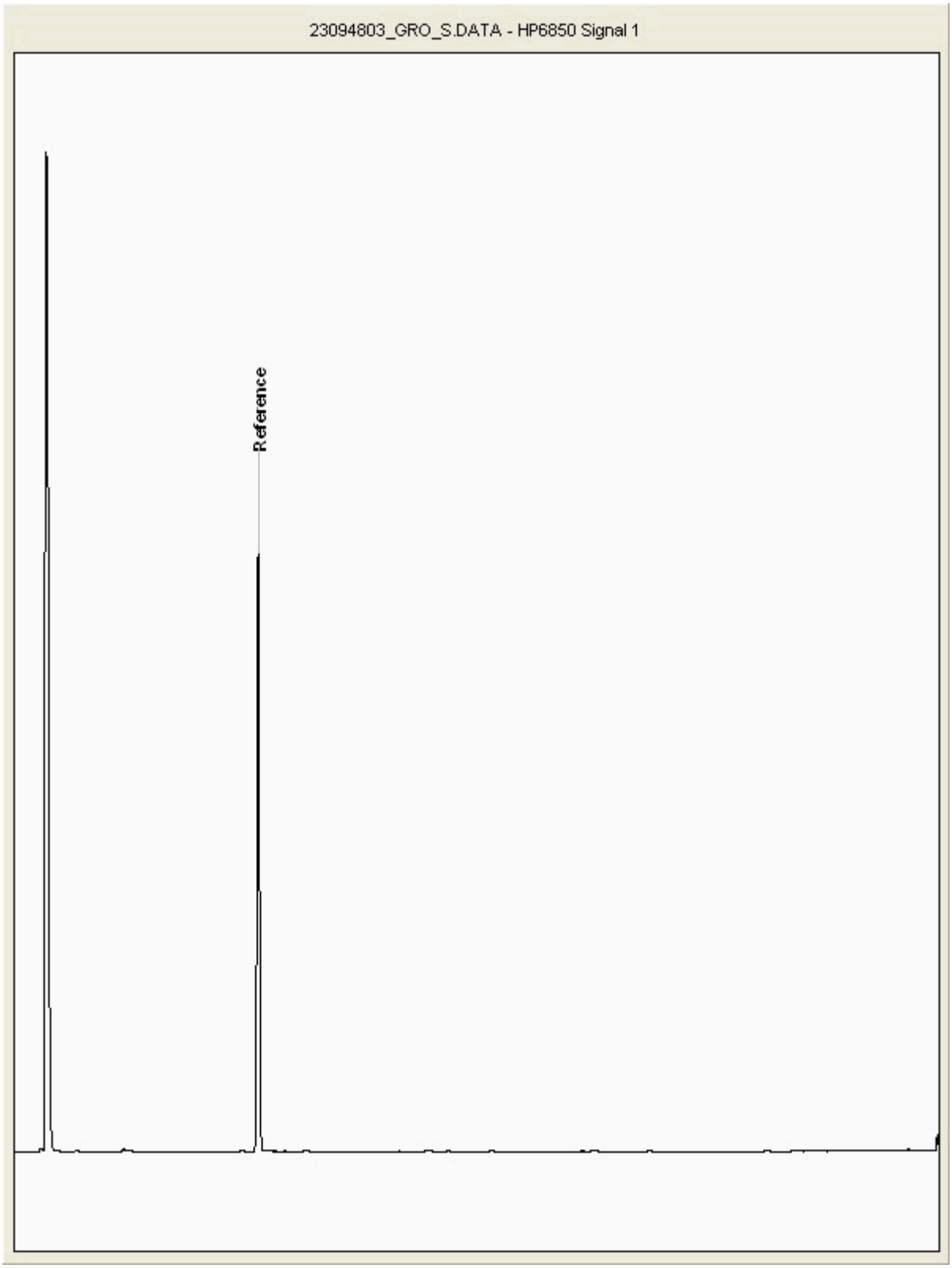
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23094803
Sample ID : TP010

Depth : 0.40 - 0.50



CERTIFICATE OF ANALYSIS

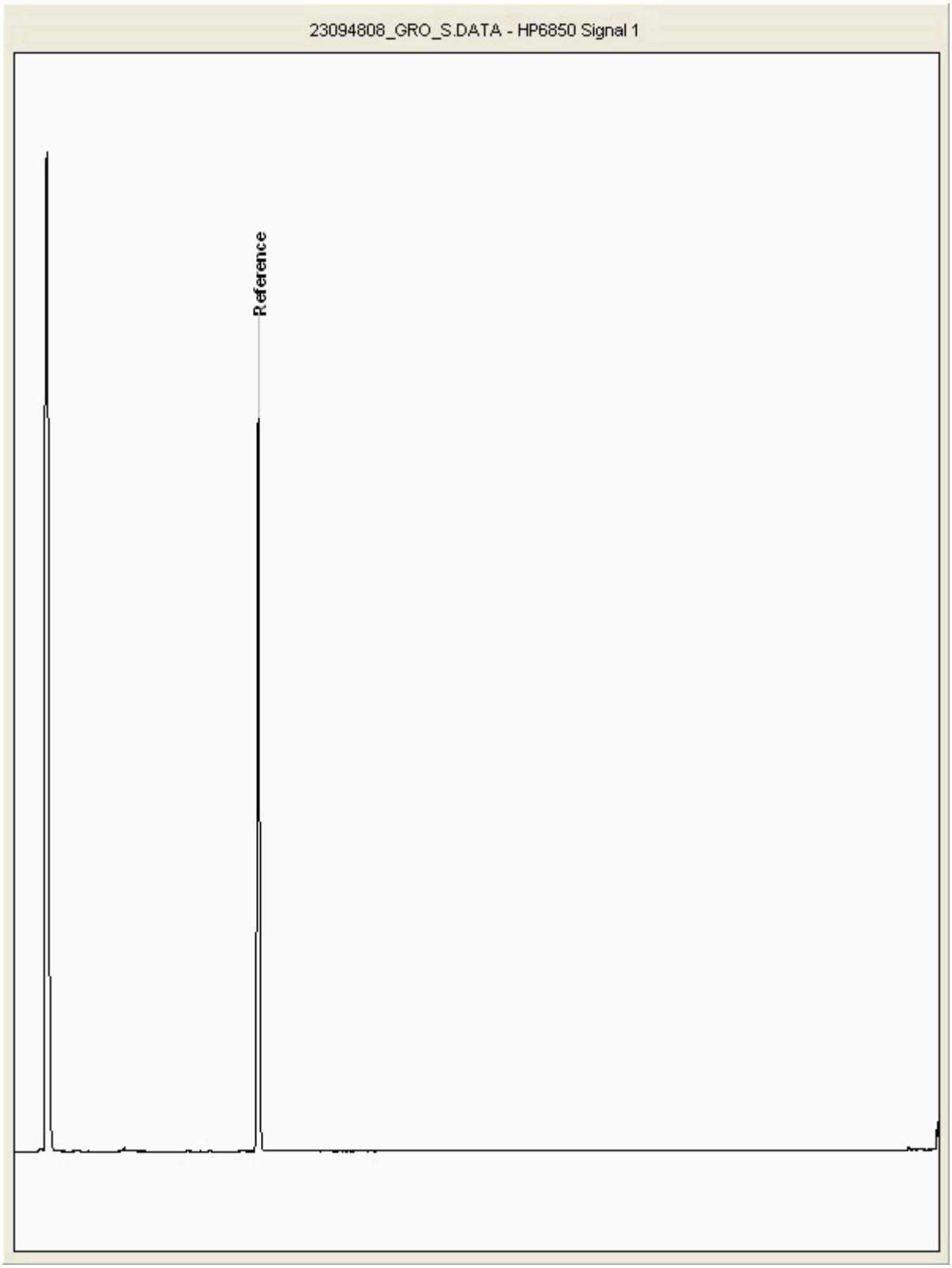
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23094808
Sample ID : TP003

Depth : 0.50 - 0.60



CERTIFICATE OF ANALYSIS

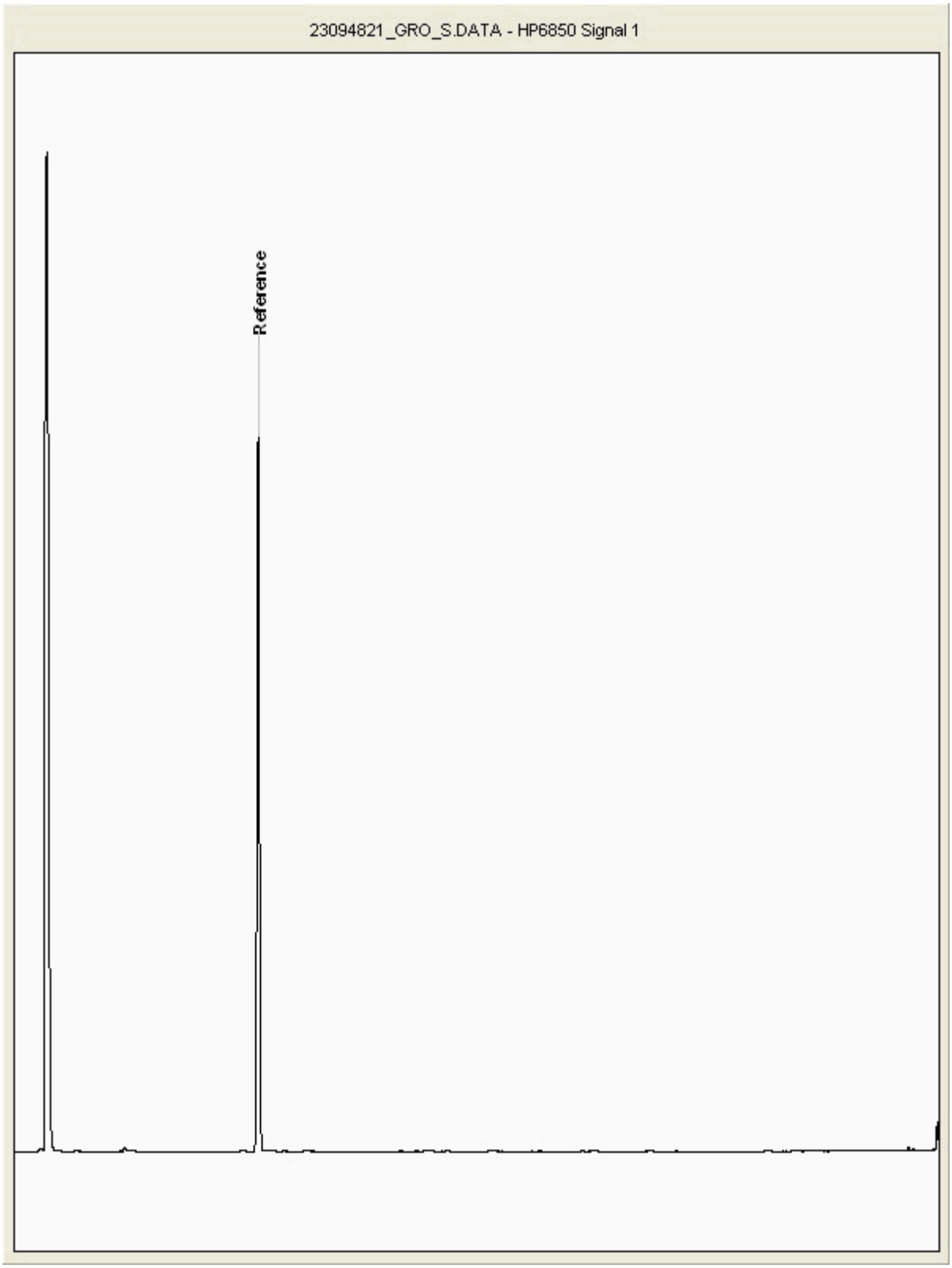
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23094821
Sample ID : TP011

Depth : 1.40 - 1.50



CERTIFICATE OF ANALYSIS

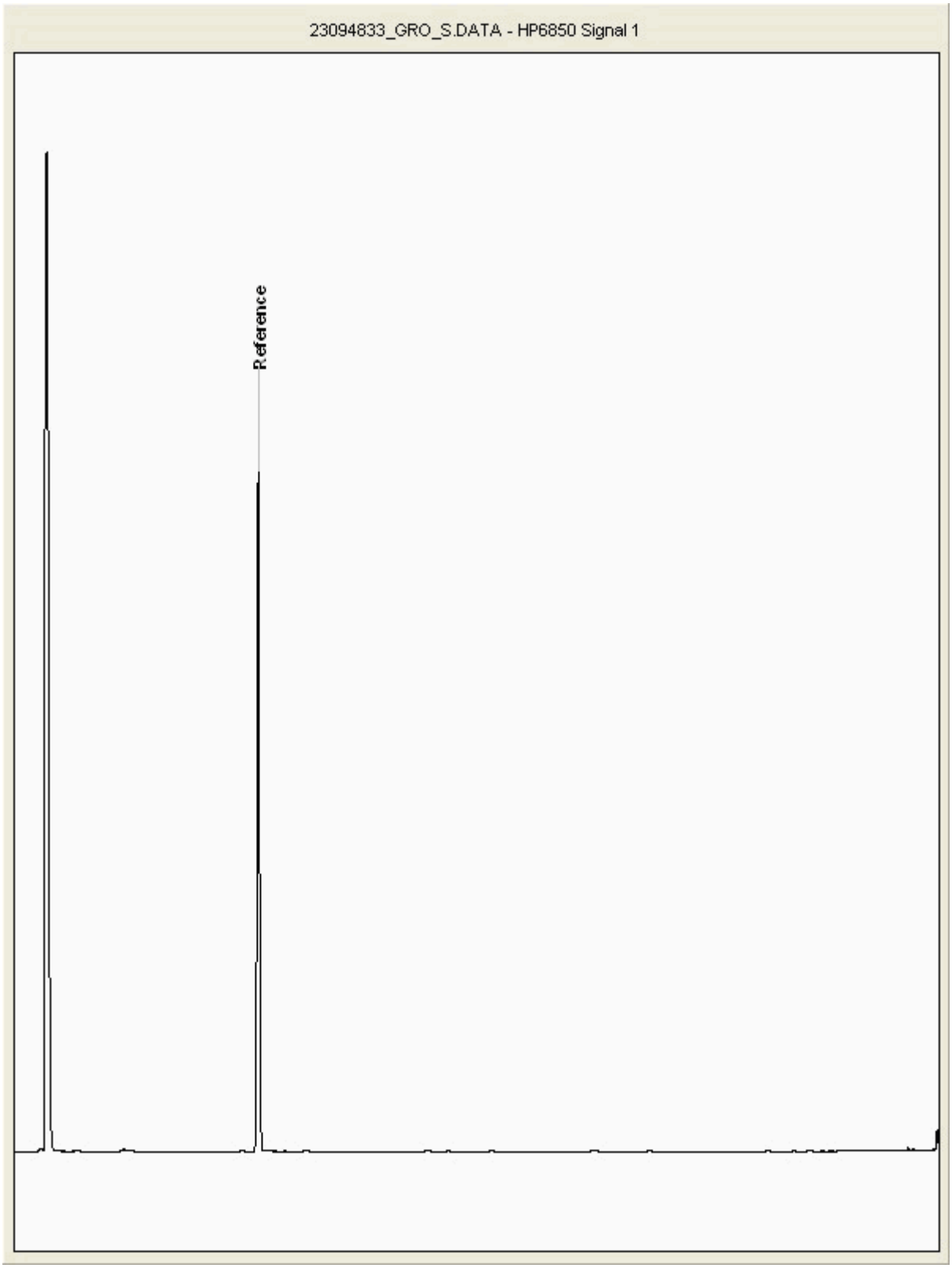
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23094833
Sample ID : TP012

Depth : 1.40 - 1.50



CERTIFICATE OF ANALYSIS

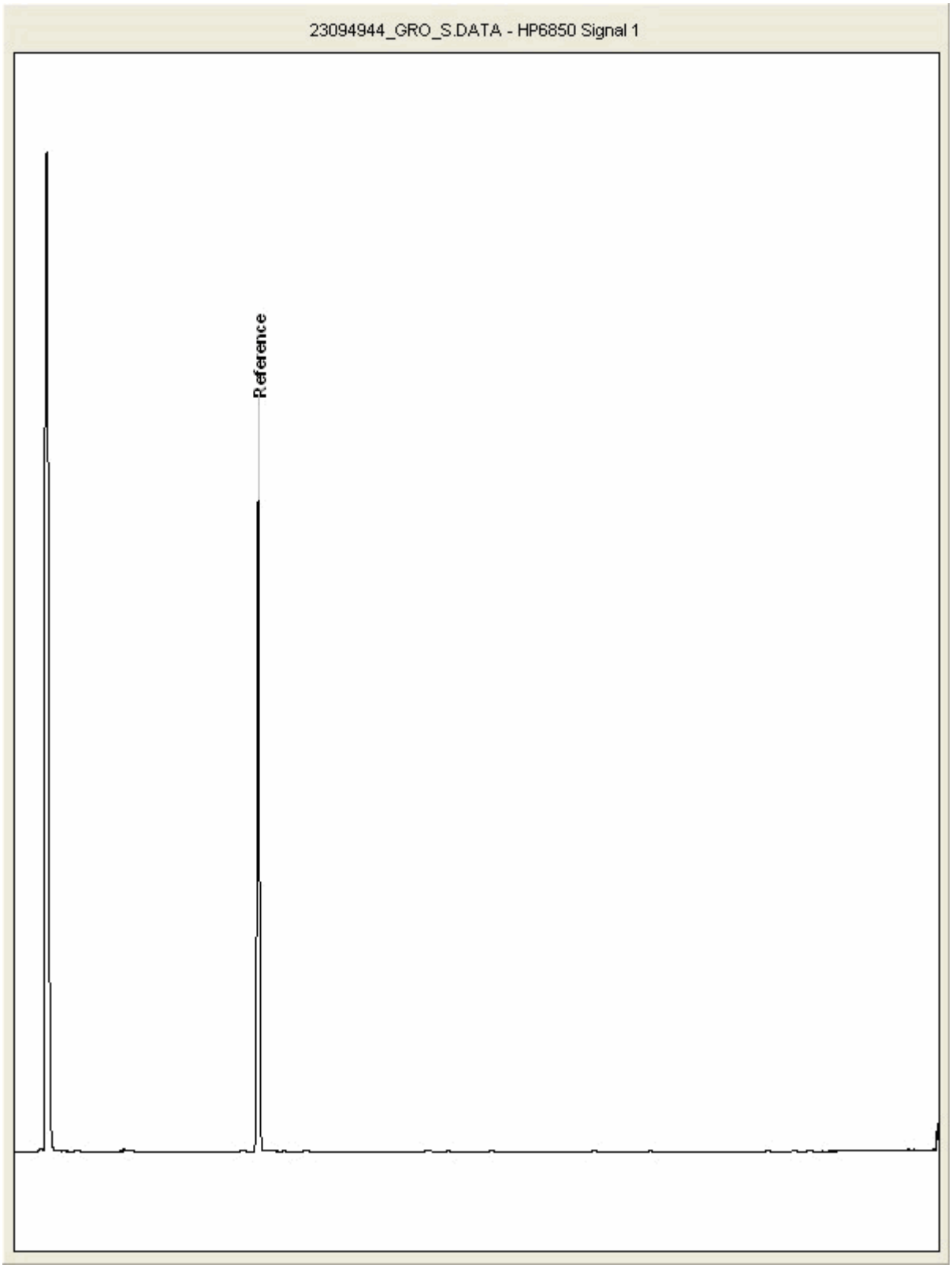
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23094944
Sample ID : TP003

Depth : 1.50 - 1.60



CERTIFICATE OF ANALYSIS

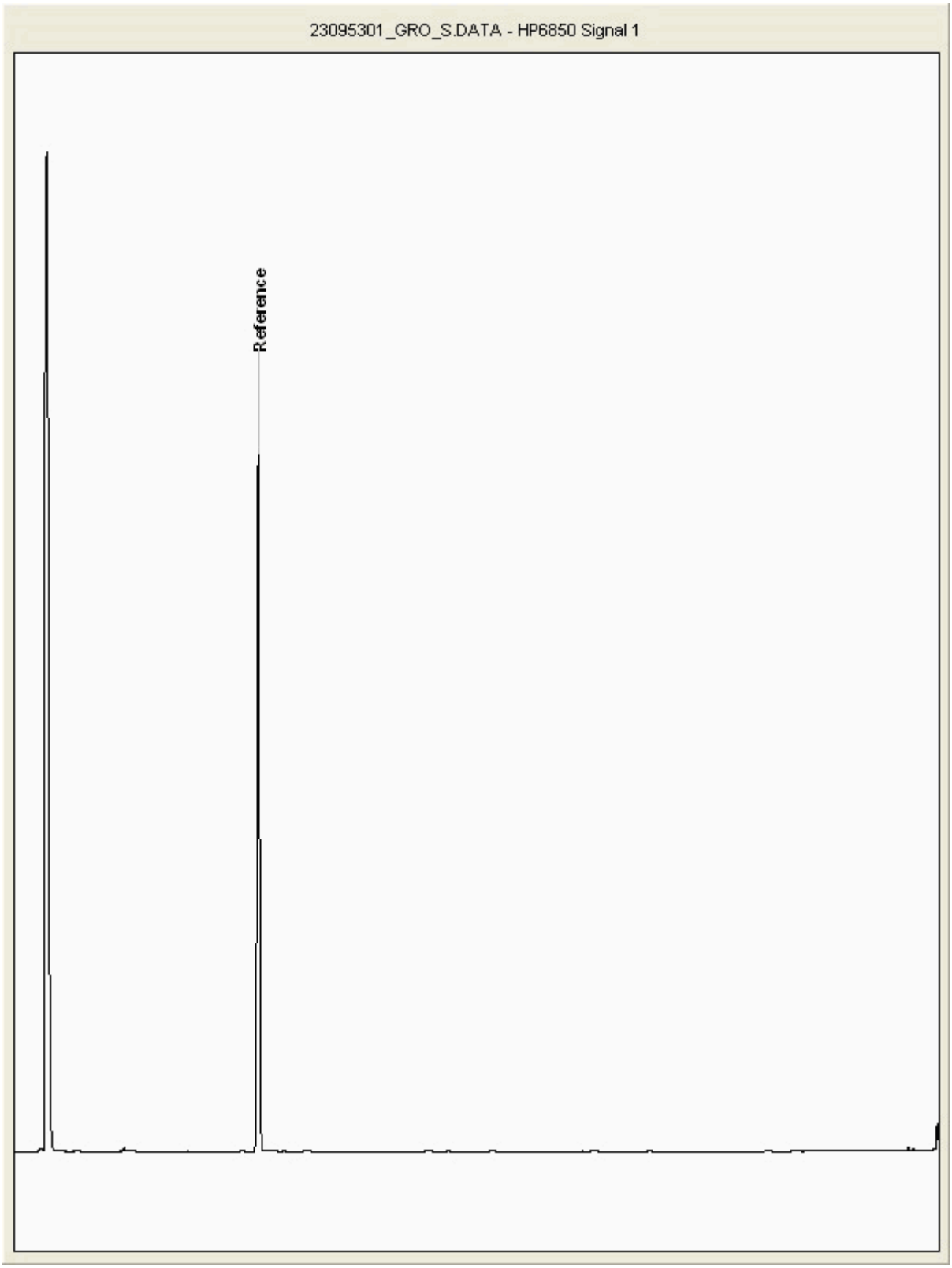
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23095301
Sample ID : TP010

Depth : 1.40 - 1.50



CERTIFICATE OF ANALYSIS

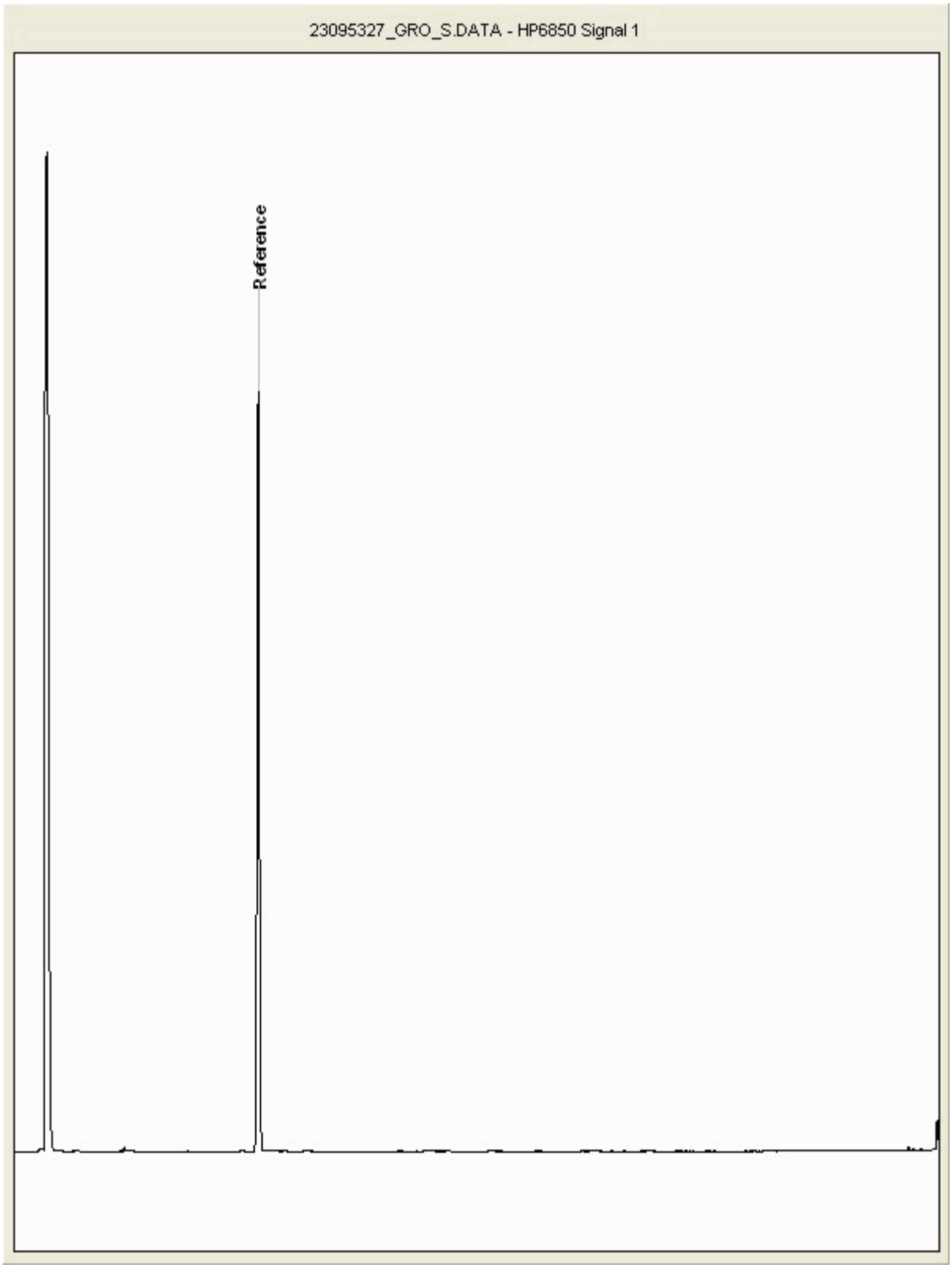
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23095327
Sample ID : TP012

Depth : 0.50 - 0.60



CERTIFICATE OF ANALYSIS

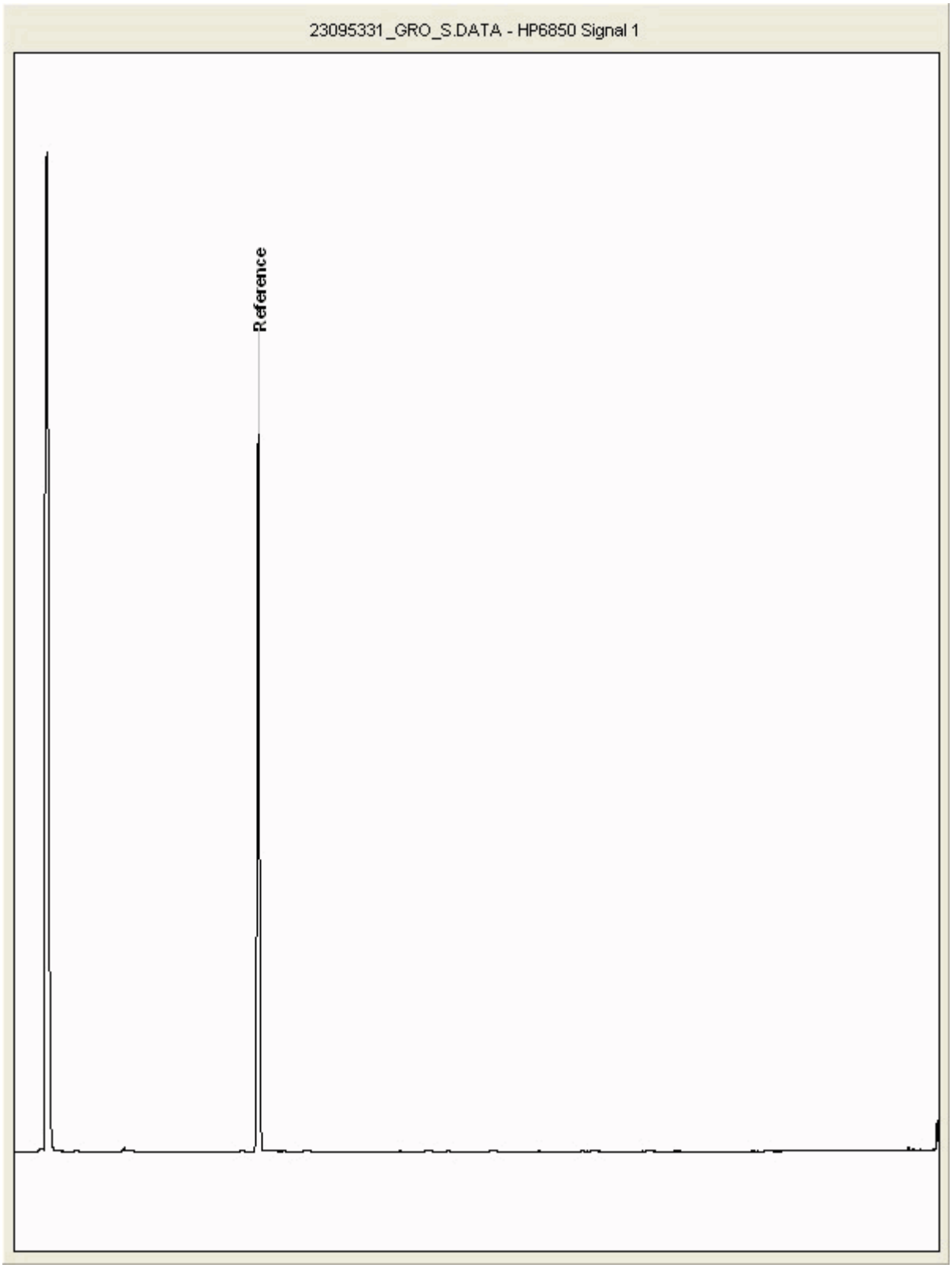
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23095331
Sample ID : TP002

Depth : 0.50 - 0.60



CERTIFICATE OF ANALYSIS

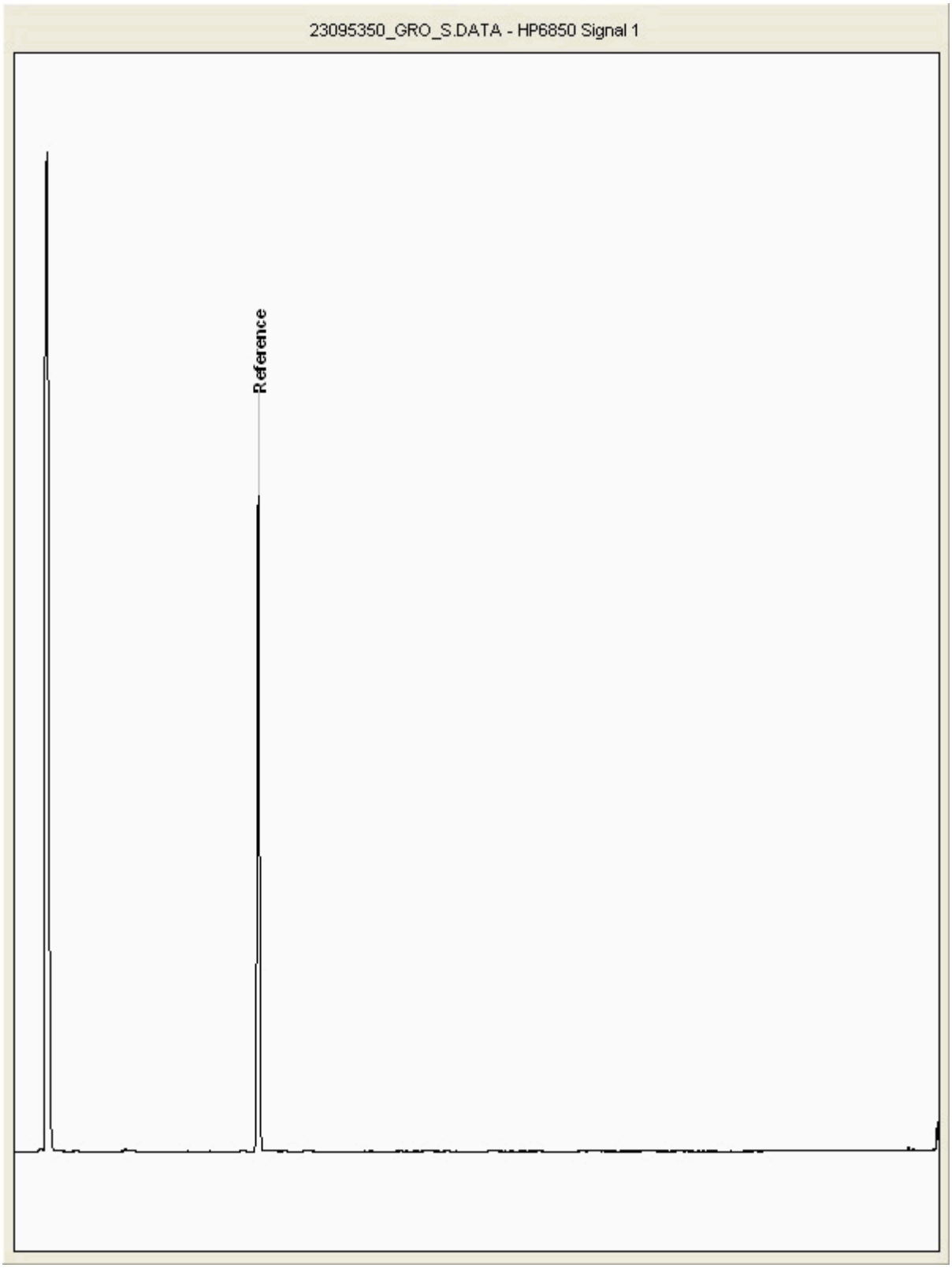
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23095350
Sample ID : TP006

Depth : 1.40 - 1.50



CERTIFICATE OF ANALYSIS

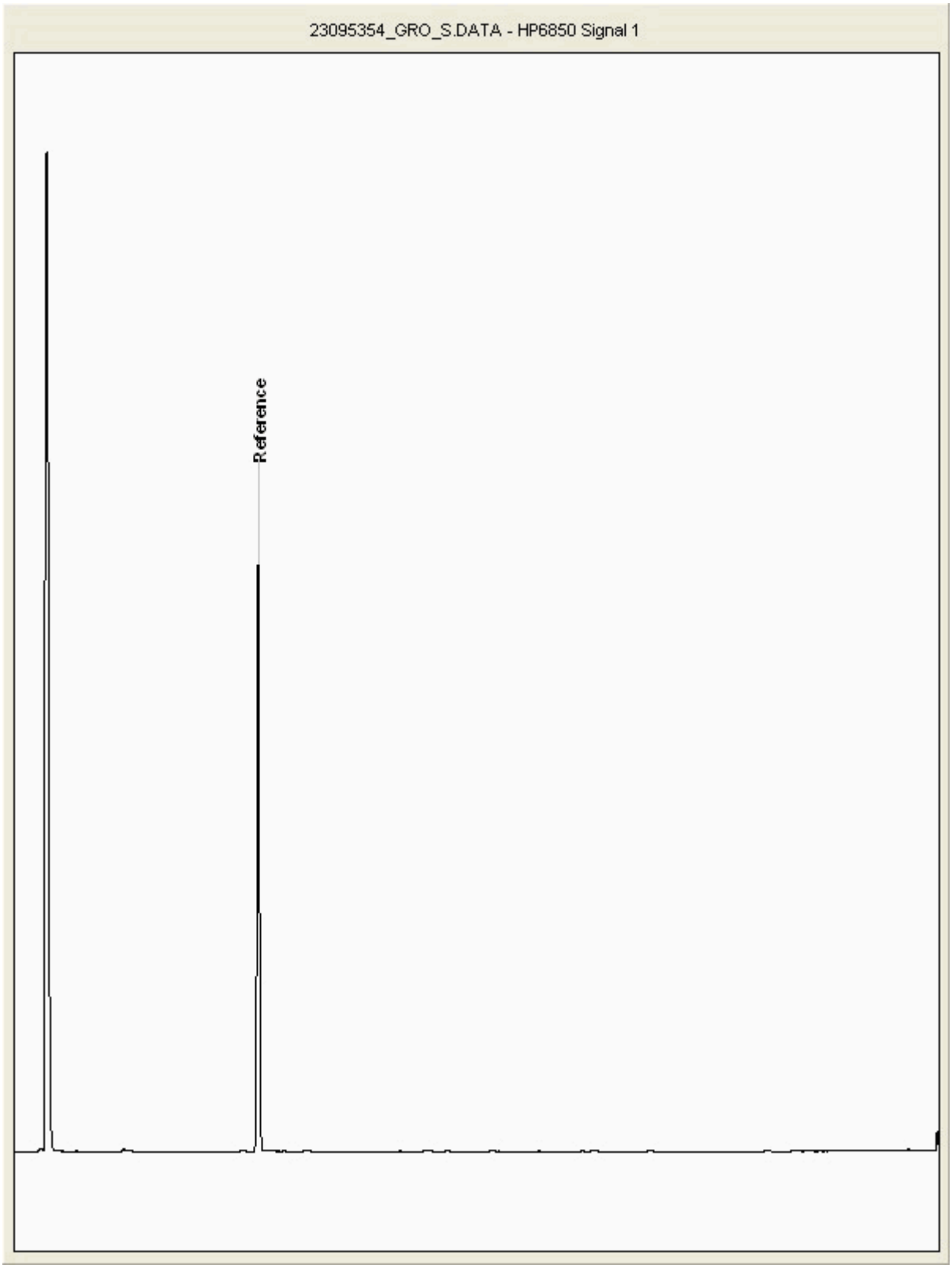
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23095354
Sample ID : TP006

Depth : 0.40 - 0.50



CERTIFICATE OF ANALYSIS

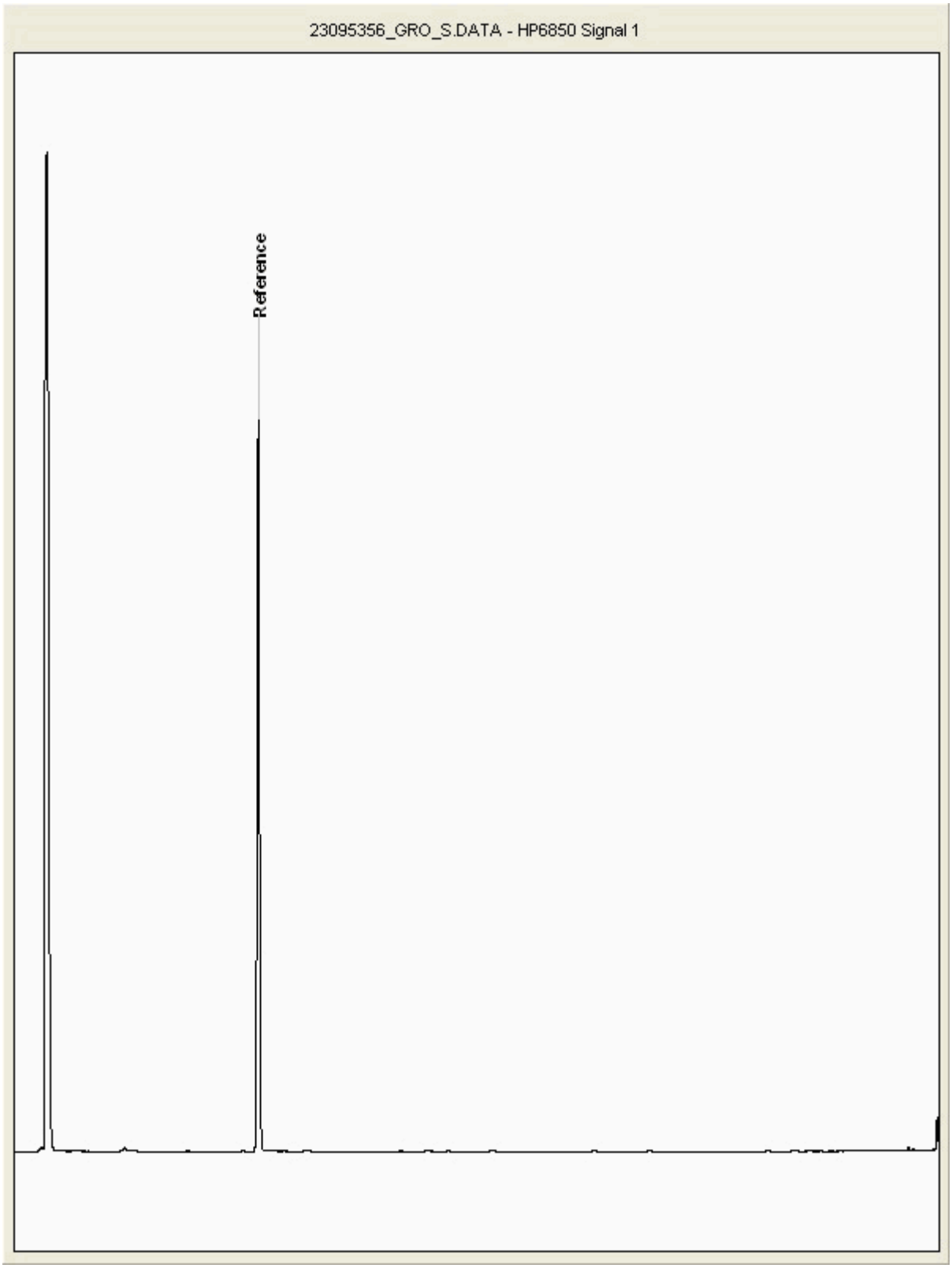
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23095356
Sample ID : TP001

Depth : 0.40 - 0.50



CERTIFICATE OF ANALYSIS

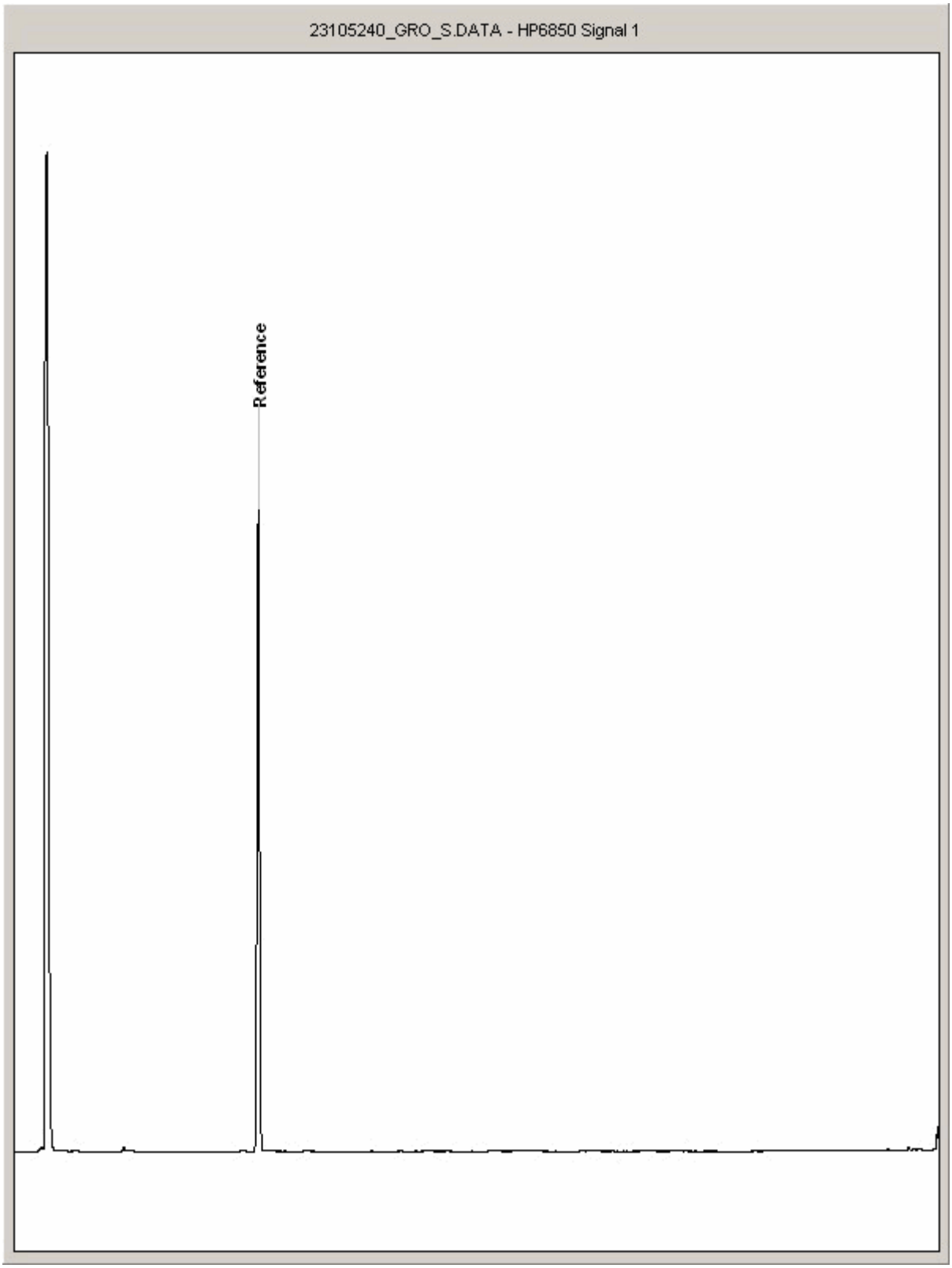
SDG:	201021-100	**Client Reference:**	2020WW102	**Report Number:**	579754
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 23105240
Sample ID : TP001

Depth : 1.40 - 1.50



Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

18. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

19. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2017).*

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway

Attention: Dympna Darcy

CERTIFICATE OF ANALYSIS

Date of report Generation:	06 January 2021
Customer:	Irish Drilling Limited
Sample Delivery Group (SDG):	201211-79
Your Reference:	2020WW102
Location:	Arklow Bank
Report No:	582350

This report has been revised and directly supersedes 580858 in its entirety.

We received 3 samples on Friday December 11, 2020 and 3 of these samples were scheduled for analysis which was completed on Wednesday January 06, 2021. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:



Sonia McWhan

Operations Manager

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
23412730	BH01	EW1	0.00 - 0.00	09/12/2020
23412753	BH03	EW1	0.00 - 0.00	09/12/2020
23412768	BH04	EW1	0.00 - 0.00	09/12/2020

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	23412730	23412753	23412768
			Customer Sample Reference	BH01	BH03	BH04
			AGS Reference	EW1	EW1	EW1
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
			Container	250ml Amber Gl. PTFE/PE	250ml Amber Gl. PTFE/PE	250ml Amber Gl. PTFE/PE
			Sample Type	GW	GW	GW
Alkalinity as CaCO3	All	NDPs: 0 Tests: 3			X		X		X		X		X
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 3				X				X				X
Anions by ion Chromatography	All	NDPs: 0 Tests: 3			X				X				X	
Anions by Kone (w)	All	NDPs: 0 Tests: 3			X				X				X	
BOD True Total	All	NDPs: 0 Tests: 3		X						X				X
Chromium III	All	NDPs: 0 Tests: 3				X					X			
COD Unfiltered	All	NDPs: 0 Tests: 3		X						X				X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 3				X					X			
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 3	X					X					X	
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 3	X					X					X	
GRO by GC-FID (W)	All	NDPs: 0 Tests: 3					X					X		
Low Level Hexavalent Chromium (w)	All	NDPs: 0 Tests: 3			X					X				X
Mercury Dissolved	All	NDPs: 0 Tests: 3				X					X			
Mineral Oil C10-40 Aqueous (W)	All	NDPs: 0 Tests: 3	X					X					X	
PCB Congeners - Aqueous (W)	All	NDPs: 0 Tests: 3	X					X					X	

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

| | | | | |

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	09/12/2020	09/12/2020	09/12/2020			
			Sampled Time	.	.	.			
			Date Received	11/12/2020	11/12/2020	11/12/2020			
			SDG Ref	201211-79	201211-79	201211-79			
			Lab Sample No.(s)	23412730	23412753	23412768			
			AGS Reference	EW1	EW1	EW1			
Suspended solids, Total	<2 mg/l	TM022		14600 #	25.9 #	3170 #			
Alkalinity, Total as CaCO3	<2 mg/l	TM043		349 #	178 #	431 #			
BOD, unfiltered	<1 mg/l	TM045		4.06 #	2.9 #	<10 #			
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099		<0.2 #	0.337 #	0.37 #			
COD, unfiltered	<7 mg/l	TM107		1050 #	14.5 #	252 #			
Dissolved solids, Total (meter)	<5 mg/l	TM123		661 #	451 #	369 #			
Chromium, Trivalent (Low)	<0.003 mg/l	TM152		<0.003	<0.003	<0.003			
Antimony (diss.filt)	<1 µg/l	TM152		<1 #	<1 #	<1 #			
Arsenic (diss.filt)	<0.5 µg/l	TM152		<0.5 #	1.58 #	1.61 #			
Barium (diss.filt)	<0.2 µg/l	TM152		136 #	46.1 #	45.5 #			
Cadmium (diss.filt)	<0.08 µg/l	TM152		<0.08 #	<0.08 #	<0.08 #			
Chromium (diss.filt)	<1 µg/l	TM152		<1 #	<1 #	<1 #			
Copper (diss.filt)	<0.3 µg/l	TM152		<0.3 #	0.508 #	0.462 #			
Lead (diss.filt)	<0.2 µg/l	TM152		<0.2 #	<0.2 #	<0.2 #			
Manganese (diss.filt)	<3 µg/l	TM152		3590 #	11.6 #	11.2 #			
Molybdenum (diss.filt)	<3 µg/l	TM152		<3 #	22.5 #	22.6 #			
Nickel (diss.filt)	<0.4 µg/l	TM152		1.44 #	3.29 #	3.33 #			
Selenium (diss.filt)	<1 µg/l	TM152		<1 #	1.28 #	1.13 #			
Zinc (diss.filt)	<1 µg/l	TM152		3.13 #	<1 #	<1 #			
Sodium (Dis.Filt)	<0.076 mg/l	TM152		71.2 #	122 #	124 #			
Magnesium (Dis.Filt)	<0.036 mg/l	TM152		17.1 #	5.12 #	5.23 #			
Potassium (Dis.Filt)	<0.2 mg/l	TM152		1.63 #	2.81 #	2.86 #			
Calcium (Dis.Filt)	<0.2 mg/l	TM152		77.9 #	6.19 #	6.16 #			
Iron (Dis.Filt)	<0.019 mg/l	TM152		<0.019 #	<0.019 #	<0.019 #			
Mineral oil >C10 C40 (aq)	<100 µg/l	TM172		162 @	168 @	354 @			
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #	<0.01 #			
Sulphate	<2 mg/l	TM184		27.9 #	18.7 #	42.5 #			
Phosphate (Ortho as P)	<0.02 mg/l	TM184		<0.02 #	<0.02 #	<0.02 #			
Nitrate as NO3	<0.3 mg/l	TM184		0.768	<0.3	0.337			
PCB congener 28	<0.015 µg/l	TM197		<0.015	<0.015	<0.015			
PCB congener 52	<0.015 µg/l	TM197		<0.015	<0.015	<0.015			
PCB congener 101	<0.015 µg/l	TM197		<0.015	<0.015	<0.015			

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	09/12/2020	09/12/2020	09/12/2020			
			Sampled Time	.	.	.			
			Date Received	11/12/2020	11/12/2020	11/12/2020			
			SDG Ref	201211-79	201211-79	201211-79			
			Lab Sample No.(s)	23412730	23412753	23412768			
			AGS Reference	EW1	EW1	EW1			
PCB congener 118	<0.015 µg/l	TM197		<0.015	<0.015	<0.015			
PCB congener 138	<0.015 µg/l	TM197		<0.015	<0.015	<0.015			
PCB congener 153	<0.015 µg/l	TM197		<0.015	<0.015	<0.015			
PCB congener 180	<0.015 µg/l	TM197		<0.015	<0.015	<0.015			
Sum of detected EC7 PCB's	<0.105 µg/l	TM197		<0.105	<0.105	<0.105			
Chloride	<0.08 mg/l	TM226		146 #	85.2 #	54.1 #			
Low Level Hexavalent Chromium	<0.003 mg/l	TM331		<0.003	<0.003	<0.003			

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

SVOC MS (W) - Aqueous

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Customer Sample Ref.	BH01	BH03	BH04			
Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00			
Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
Date Sampled	09/12/2020	09/12/2020	09/12/2020			
Sampled Time	.	.	.			
Date Received	11/12/2020	11/12/2020	11/12/2020			
SDG Ref	201211-79	201211-79	201211-79			
Lab Sample No.(s)	23412730	23412753	23412768			
AGS Reference	EW1	EW1	EW1			

Component	LOD/Units	Method						
1,2,4-Trichlorobenzene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
1,2-Dichlorobenzene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
1,3-Dichlorobenzene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
1,4-Dichlorobenzene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2,4,5-Trichlorophenol (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2,4,6-Trichlorophenol (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2,4-Dichlorophenol (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2,4-Dimethylphenol (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2,4-Dinitrotoluene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2,6-Dinitrotoluene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2-Chloronaphthalene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2-Chlorophenol (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2-Methylnaphthalene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2-Methylphenol (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2-Nitroaniline (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
2-Nitrophenol (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
3-Nitroaniline (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
4-Bromophenylphenylether (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
4-Chloro-3-methylphenol (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
4-Chloroaniline (aq)	<1 µg/l	TM176	<4		<1		<20	
4-Chlorophenylphenylether (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
4-Methylphenol (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
4-Nitroaniline (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
4-Nitrophenol (aq)	<1 µg/l	TM176	<4		<1		<20	
Azobenzene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
Acenaphthylene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
Acenaphthene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
Anthracene (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
bis(2-Chloroethyl)ether (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
bis(2-Chloroethoxy)methane (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#
bis(2-Ethylhexyl) phthalate (aq)	<2 µg/l	TM176	<8	#	<2	#	<40	#
Butylbenzyl phthalate (aq)	<1 µg/l	TM176	<4	#	<1	#	<20	#

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

SVOC MS (W) - Aqueous

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	09/12/2020	09/12/2020	09/12/2020			
			Sampled Time	.	.	.			
			Date Received	11/12/2020	11/12/2020	11/12/2020			
			SDG Ref	201211-79	201211-79	201211-79			
			Lab Sample No.(s)	23412730	23412753	23412768			
			AGS Reference	EW1	EW1	EW1			
Benzo(a)anthracene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Benzo(b)fluoranthene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Benzo(k)fluoranthene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Benzo(a)pyrene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Benzo(g,h,i)perylene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Carbazole (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Chrysene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Dibenzofuran (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
n-Dibutyl phthalate (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Diethyl phthalate (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Dibenzo(a,h)anthracene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Dimethyl phthalate (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
n-Dioctyl phthalate (aq)	<5 µg/l	TM176		<20 #	<5 #	<100 #			
Fluoranthene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Fluorene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Hexachlorobenzene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Hexachlorobutadiene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Pentachlorophenol (aq)	<1 µg/l	TM176		<4	<1	<20			
Phenol (aq)	<1 µg/l	TM176		<4	<1	<20			
n-Nitroso-n-dipropylamine (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Hexachloroethane (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Nitrobenzene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Naphthalene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Isophorone (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Hexachlorocyclopentadiene (aq)	<1 µg/l	TM176		<4	<1	<20			
Phenanthrene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Indeno(1,2,3-cd)pyrene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			
Pyrene (aq)	<1 µg/l	TM176		<4 #	<1 #	<20 #			

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

TPH CWG (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	09/12/2020	09/12/2020	09/12/2020			
			Sampled Time	.	.	.			
			Date Received	11/12/2020	11/12/2020	11/12/2020			
			SDG Ref	201211-79	201211-79	201211-79			
			Lab Sample No.(s)	23412730	23412753	23412768			
			AGS Reference	EW1	EW1	EW1			
GRO Surrogate % recovery**	%	TM245		109	101	117			
GRO >C5-C12	<50 µg/l	TM245		<50 #	<50 #	<50 #			
Methyl tertiary butyl ether (MTBE)	<3 µg/l	TM245		<3 #	<3 #	<3 #			
Benzene	<7 µg/l	TM245		<7 #	<7 #	<7 #			
Toluene	<4 µg/l	TM245		<4 #	<4 #	<4 #			
Ethylbenzene	<5 µg/l	TM245		<5 #	<5 #	<5 #			
m,p-Xylene	<8 µg/l	TM245		<8 #	<8 #	<8 #			
o-Xylene	<3 µg/l	TM245		<3 #	<3 #	<3 #			
Sum of detected Xylenes	<11 µg/l	TM245		<11	<11	<11			
Sum of detected BTEX	<28 µg/l	TM245		<28	<28	<28			
Aliphatics >C5-C6	<10 µg/l	TM245		<10	<10	<10			
Aliphatics >C6-C8	<10 µg/l	TM245		<10	<10	<10			
Aliphatics >C8-C10	<10 µg/l	TM245		<10	<10	<10			
Aliphatics >C10-C12	<10 µg/l	TM245		<10	<10	<10			
Aliphatics >C12-C16 (aq)	<10 µg/l	TM174		65	<10	28			
Aliphatics >C16-C21 (aq)	<10 µg/l	TM174		42	<10	36			
Aliphatics >C21-C35 (aq)	<10 µg/l	TM174		250	<10	173			
Total Aliphatics >C12-C35 (aq)	<10 µg/l	TM174		357	<10	237			
Aromatics >EC5-EC7	<10 µg/l	TM245		<10	<10	<10			
Aromatics >EC7-EC8	<10 µg/l	TM245		<10	<10	<10			
Aromatics >EC8-EC10	<10 µg/l	TM245		<10	<10	<10			
Aromatics >EC10-EC12	<10 µg/l	TM245		<10	<10	<10			
Aromatics >EC12-EC16 (aq)	<10 µg/l	TM174		<10	<10	<10			
Aromatics >EC16-EC21 (aq)	<10 µg/l	TM174		<10	<10	<10			
Aromatics >EC21-EC35 (aq)	<10 µg/l	TM174		<10	<10	<10			
Total Aromatics >EC12-EC35 (aq)	<10 µg/l	TM174		<10	<10	<10			
Total Aliphatics & Aromatics >C5-35 (aq)	<10 µg/l	TM174		357	<10	237			
Aliphatics >C16-C35 Aqueous	<10 µg/l	TM174		292	<10	209			

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

VOC MS (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	09/12/2020	09/12/2020	09/12/2020			
			Sampled Time	.	.	.			
			Date Received	11/12/2020	11/12/2020	11/12/2020			
			SDG Ref	201211-79	201211-79	201211-79			
			Lab Sample No.(s)	23412730	23412753	23412768			
			AGS Reference	EW1	EW1	EW1			
Dibromofluoromethane**	%	TM208		109	105	108			
Toluene-d8**	%	TM208		98.5	103	98.4			
4-Bromofluorobenzene**	%	TM208		98.9	100	97.7			
Dichlorodifluoromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Chloromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Vinyl chloride	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Bromomethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Chloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Trichlorofluoromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1-Dichloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Carbon disulphide	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Dichloromethane	<3 µg/l	TM208		<3 #	<3 #	<3 #			
Methyl tertiary butyl ether (MTBE)	<1 µg/l	TM208		<1 #	<1 #	<1 #			
trans-1,2-Dichloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1-Dichloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
cis-1,2-Dichloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
2,2-Dichloropropane	<1 µg/l	TM208		<1	<1	<1			
Bromochloromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Chloroform	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1,1-Trichloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1-Dichloropropene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Carbontetrachloride	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dichloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Benzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Trichloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dichloropropane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Dibromomethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Bromodichloromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
cis-1,3-Dichloropropene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Toluene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
trans-1,3-Dichloropropene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1,2-Trichloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

VOC MS (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	09/12/2020	09/12/2020	09/12/2020			
			Sampled Time	.	.	.			
			Date Received	11/12/2020	11/12/2020	11/12/2020			
			SDG Ref	201211-79	201211-79	201211-79			
			Lab Sample No.(s)	23412730	23412753	23412768			
			AGS Reference	EW1	EW1	EW1			
1,3-Dichloropropane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Tetrachloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Dibromochloromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dibromoethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Chlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1,1,2-Tetrachloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Ethylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
m,p-Xylene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
o-Xylene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Styrene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Bromoform	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Isopropylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1,2,2-Tetrachloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2,3-Trichloropropane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Bromobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Propylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
2-Chlorotoluene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,3,5-Trimethylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
4-Chlorotoluene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
tert-Butylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2,4-Trimethylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
sec-Butylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
4-iso-Propyltoluene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,3-Dichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,4-Dichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
n-Butylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dibromo-3-chloropropane	<1 µg/l	TM208		<1	<1	<1			
1,2,4-Trichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Hexachlorobutadiene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
tert-Amyl methyl ether (TAME)	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Naphthalene	<1 µg/l	TM208		<1 #	<1 #	<1 #			

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

VOC MS (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	09/12/2020	09/12/2020	09/12/2020			
			Sampled Time	.	.	.			
			Date Received	11/12/2020	11/12/2020	11/12/2020			
			SDG Ref	201211-79	201211-79	201211-79			
			Lab Sample No.(s)	23412730	23412753	23412768			
			AGS Reference	EW1	EW1	EW1			
1,2,3-Trichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,3,5-Trichlorobenzene	<1 µg/l	TM208		<1	<1	<1			

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Table of Results - Appendix

Method No	Reference	Description
TM022	Method 2540D, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part120 1981;BS EN 872	Determination of total suspended solids in waters
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM172	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	EPH in Waters
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID
TM176	EPA 8270D Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Determination of SVOCs in Water by GCMS
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM197	Modified: US EPA Method 8082.EA Method 174 and 5109631	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Waters
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters
TM226	In-House Method	Determination of Anions in Waters using Ion Chromatography
TM245	By GC-FID	Determination of GRO by Headspace in waters
TM331		Low Level Hexavalent Chromium

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Test Completion Dates

Lab Sample No(s)	23412730	23412753	23412768
Customer Sample Ref.	BH01	BH03	BH04
AGS Ref.	EW1	EW1	EW1
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	Ground Water	Ground Water	Ground Water
Alkalinity as CaCO3	18-Dec-2020	18-Dec-2020	18-Dec-2020
Ammoniacal Nitrogen	18-Dec-2020	18-Dec-2020	18-Dec-2020
Anions by ion Chromatography	17-Dec-2020	17-Dec-2020	17-Dec-2020
Anions by Kone (w)	17-Dec-2020	17-Dec-2020	17-Dec-2020
BOD True Total	16-Dec-2020	17-Dec-2020	17-Dec-2020
Chromium III	17-Dec-2020	17-Dec-2020	17-Dec-2020
COD Unfiltered	18-Dec-2020	18-Dec-2020	18-Dec-2020
Dissolved Metals by ICP-MS	18-Dec-2020	18-Dec-2020	18-Dec-2020
EPH CWG (Aliphatic) Aqueous GC (W)	17-Dec-2020	16-Dec-2020	16-Dec-2020
EPH CWG (Aromatic) Aqueous GC (W)	17-Dec-2020	16-Dec-2020	16-Dec-2020
GRO by GC-FID (W)	15-Dec-2020	17-Dec-2020	15-Dec-2020
Low Level Hexavalent Chromium (w)	14-Dec-2020	14-Dec-2020	14-Dec-2020
Mercury Dissolved	14-Dec-2020	14-Dec-2020	14-Dec-2020
Mineral Oil C10-40 Aqueous (W)	06-Jan-2021	06-Jan-2021	06-Jan-2021
Nitrite by Kone (w)	16-Dec-2020	16-Dec-2020	16-Dec-2020
PCB Congeners - Aqueous (W)	17-Dec-2020	17-Dec-2020	17-Dec-2020
Phosphate by Kone (w)	14-Dec-2020	14-Dec-2020	14-Dec-2020
Suspended Solids	14-Dec-2020	14-Dec-2020	12-Dec-2020
SVOC MS (W) - Aqueous	18-Dec-2020	17-Dec-2020	18-Dec-2020
Total Dissolved Solids	11-Dec-2020	11-Dec-2020	11-Dec-2020
TPH CWG (W)	17-Dec-2020	17-Dec-2020	17-Dec-2020
VOC MS (W)	16-Dec-2020	16-Dec-2020	16-Dec-2020

CERTIFICATE OF ANALYSIS

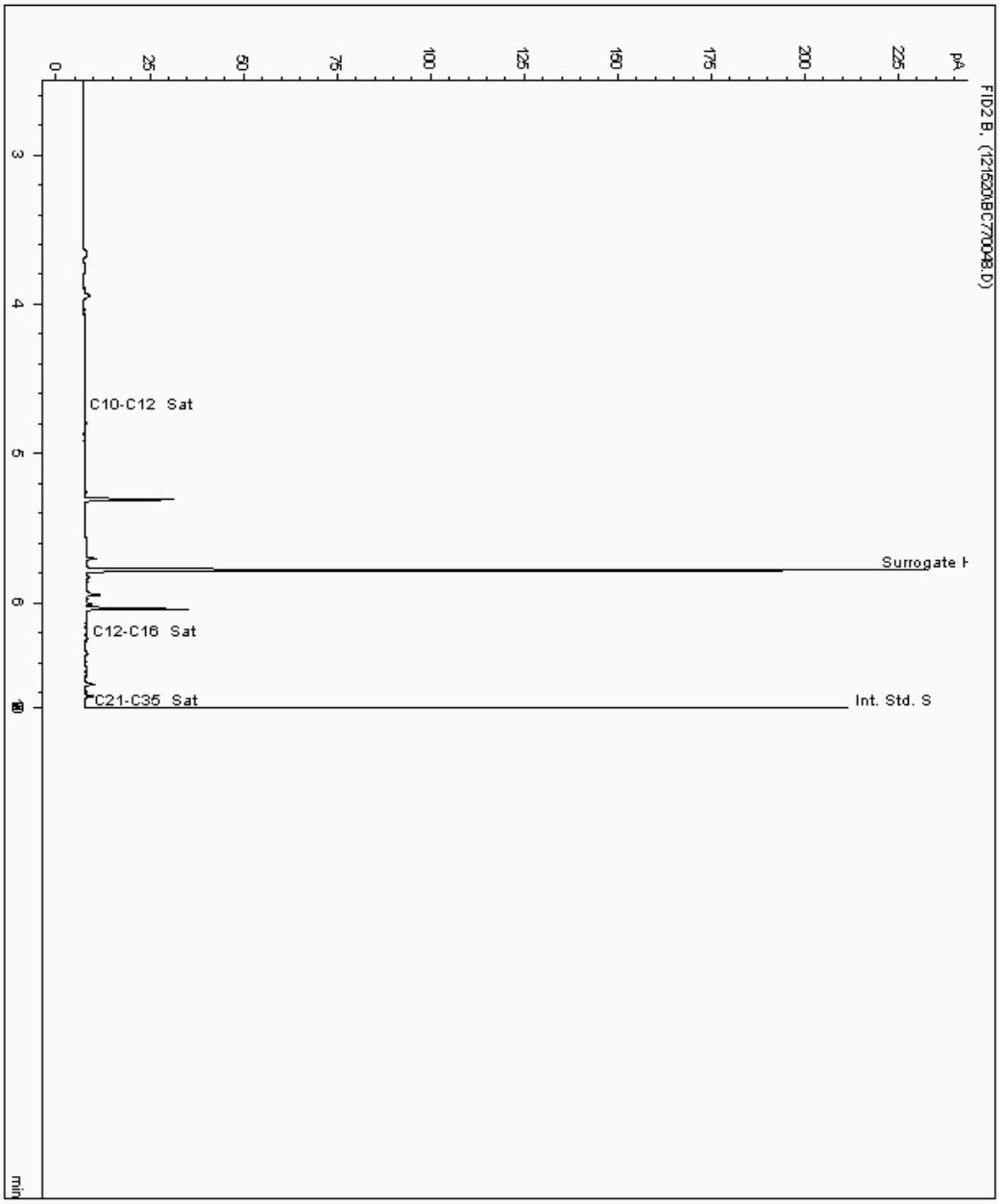
SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: EPH CWG (Aliphatic) Aqueous GC (W) **Sample No :** 23413362 **Sample ID :** BH04 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 21965233-
Date Acquired : 12/16/2020 3:55:18 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

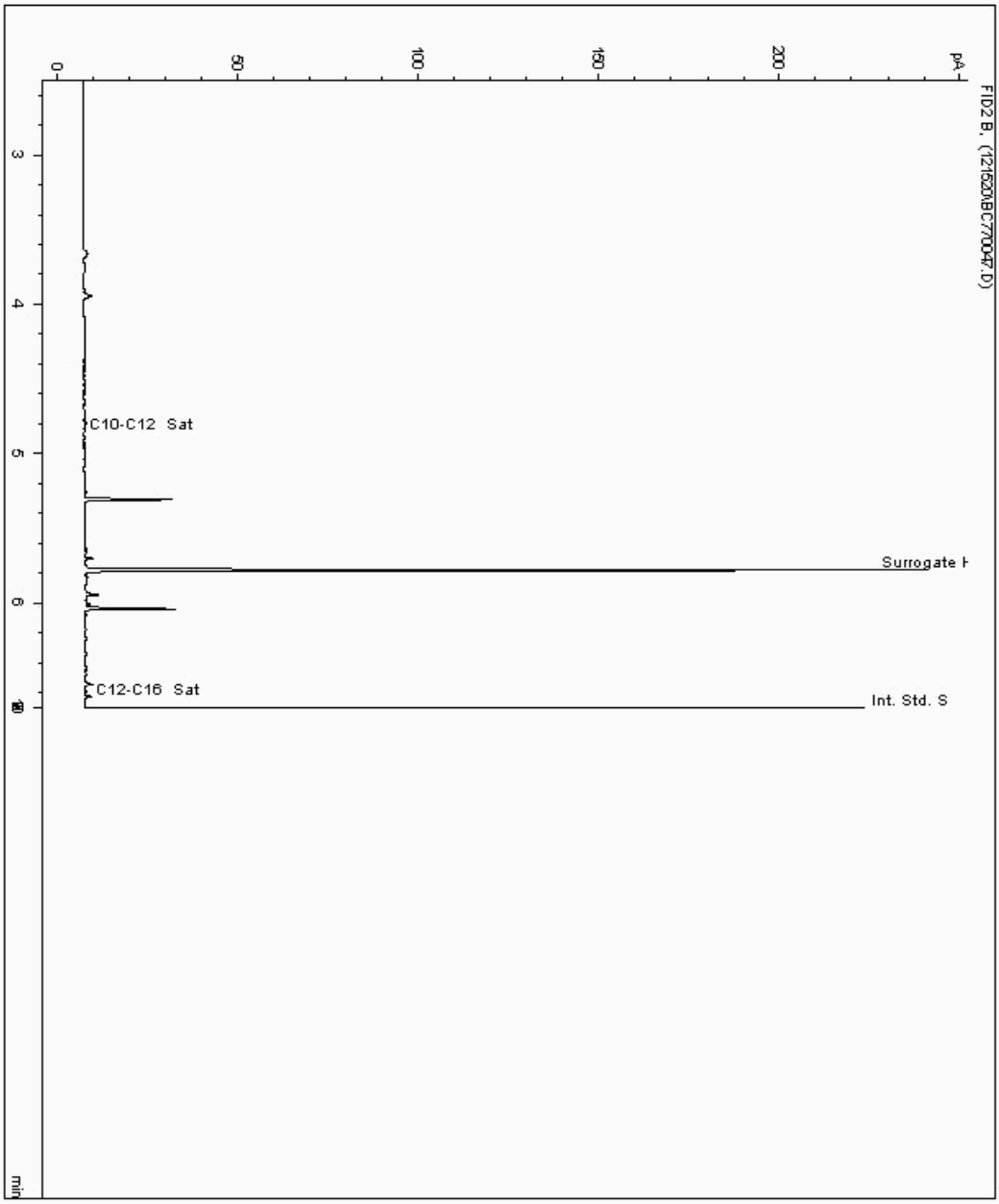
SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: EPH CWG (Aliphatic) Aqueous GC (W) **Sample No :** 23413419 **Sample ID :** BH03 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 21965202-
Date Acquired : 12/16/2020 3:31:32 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

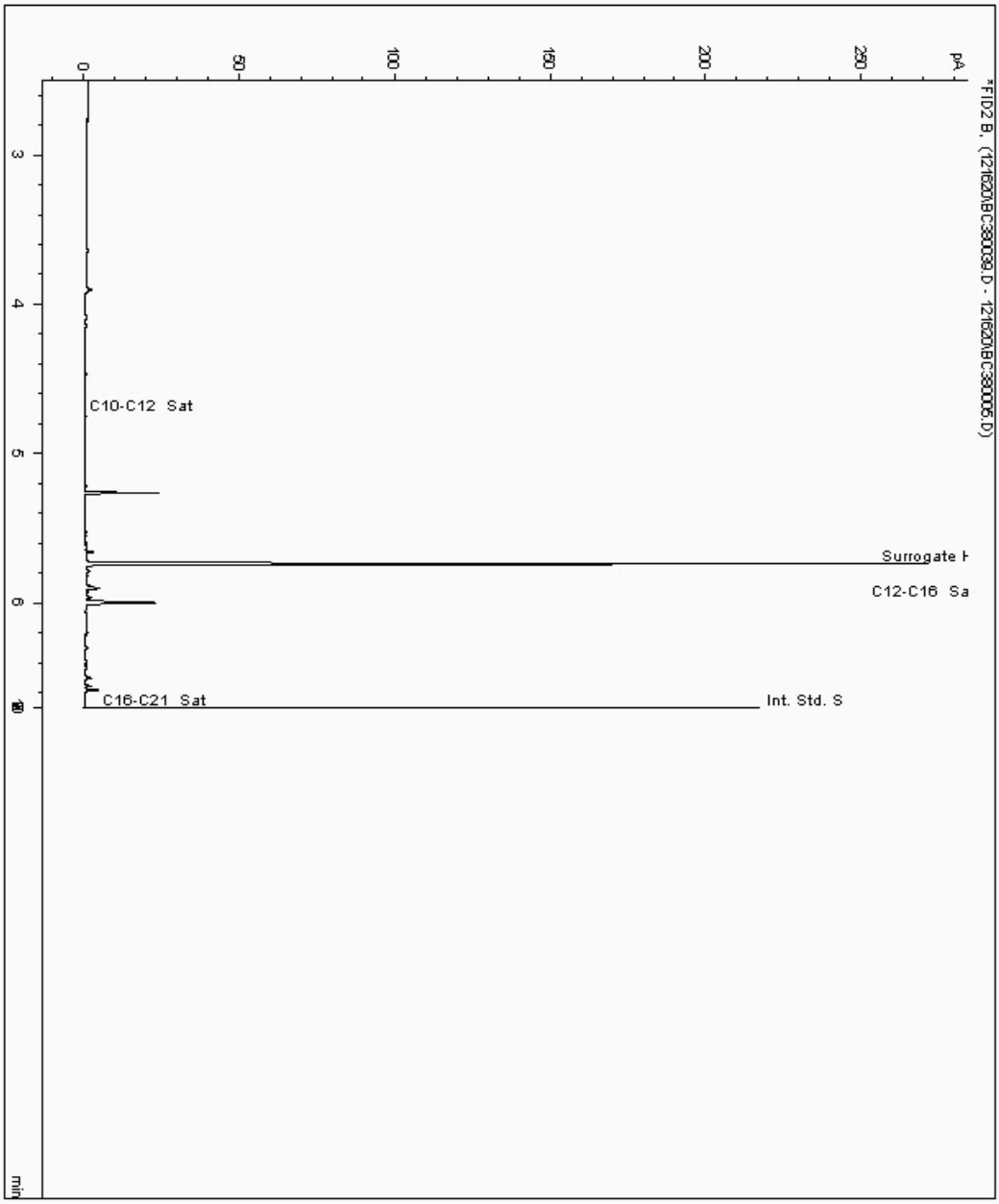
SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: EPH CWG (Aliphatic) Aqueous GC (W) **Sample No :** 23413431 **Sample ID :** BH01 **Depth :** 0.00 - 0.00

Speciated TPH - SATS (C12 - C40)

Sample Identity: 21965174-
Date Acquired : 17/12/20 10:44:45 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

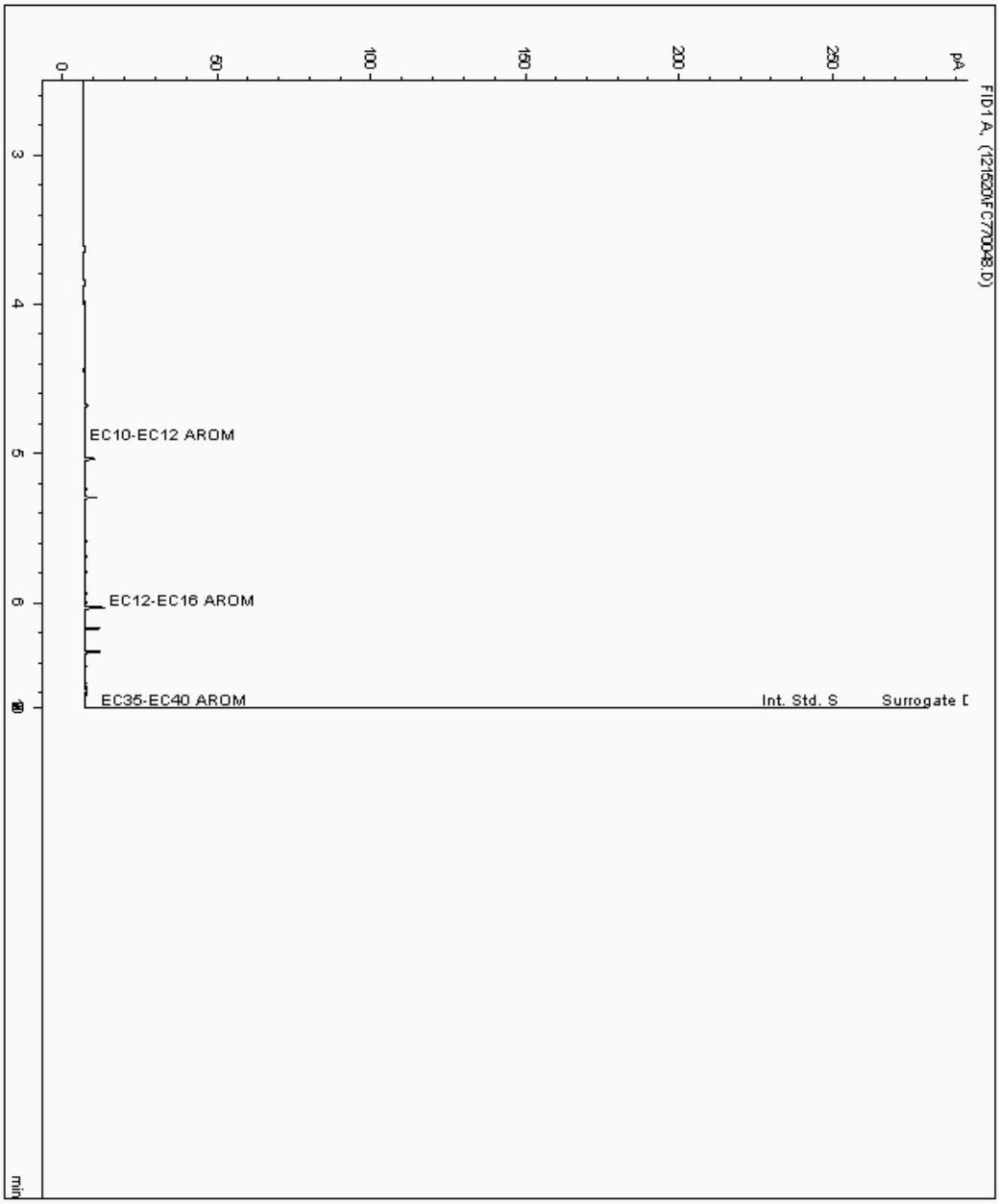
SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: EPH CWG (Aromatic) Aqueous GC (W) **Sample No :** 23413362 **Sample ID :** BH04 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 21965234-
Date Acquired : 12/16/2020 3:55:18 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

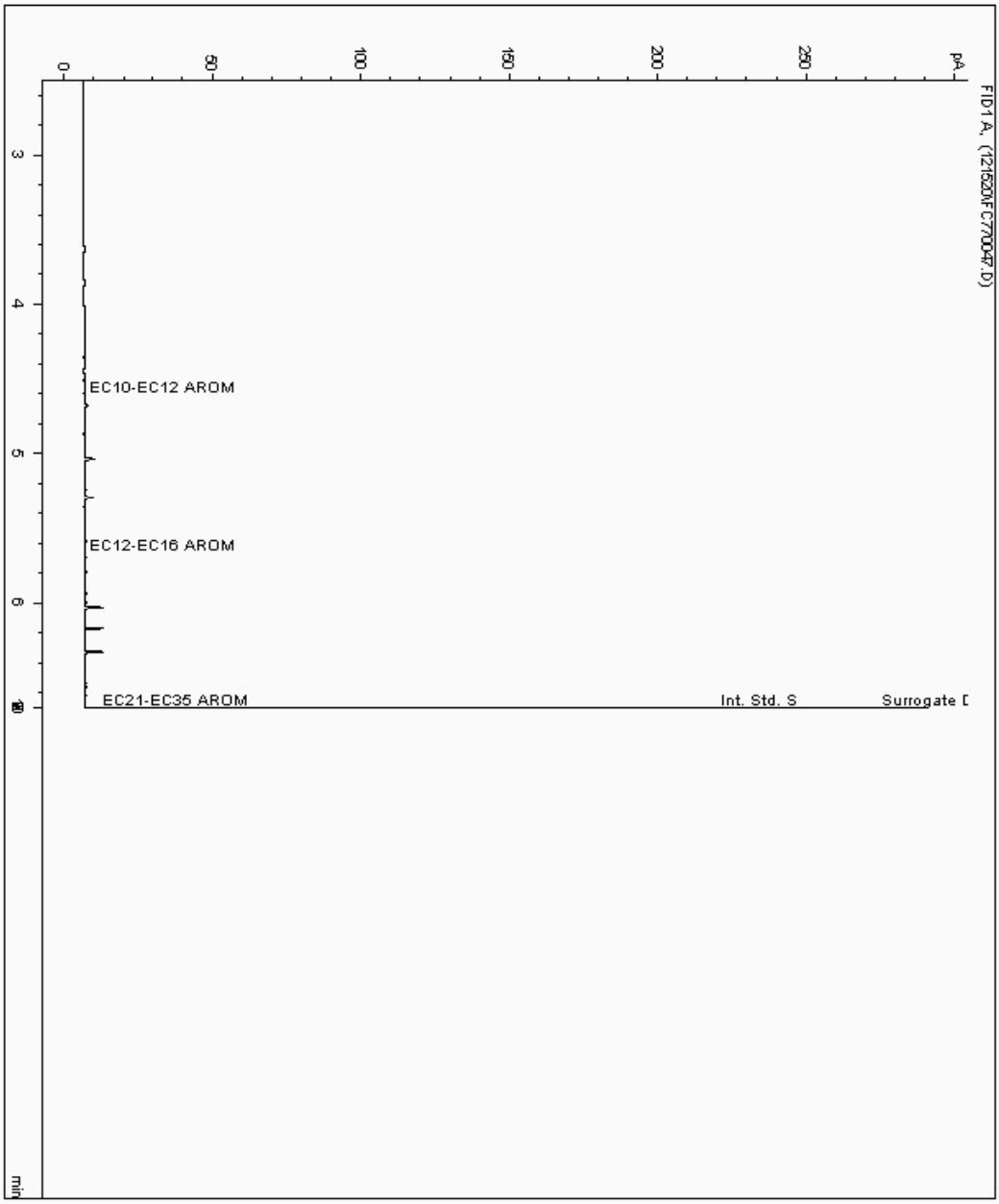
SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: EPH CWG (Aromatic) Aqueous GC (W) **Sample No :** 23413419 **Sample ID :** BH03 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 21965203-
Date Acquired : 12/16/2020 3:31:32 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

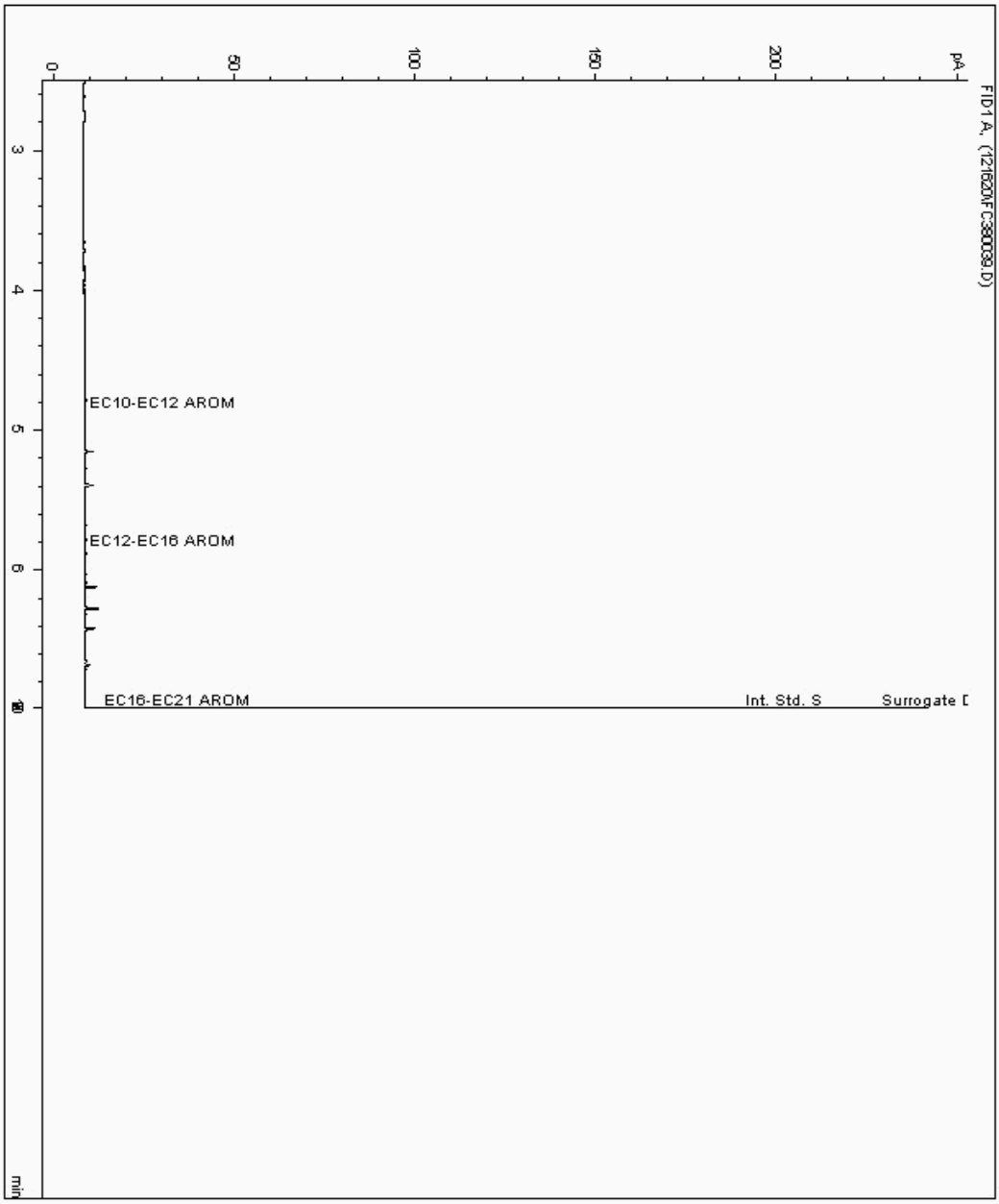
SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: EPH CWG (Aromatic) Aqueous GC (W) **Sample No :** 23413431 **Sample ID :** BH01 **Depth :** 0.00 - 0.00

Speciated TPH - AROM (C12 - C40)

Sample Identity: 21965175-
Date Acquired : 17/12/20 10:44:45 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.025

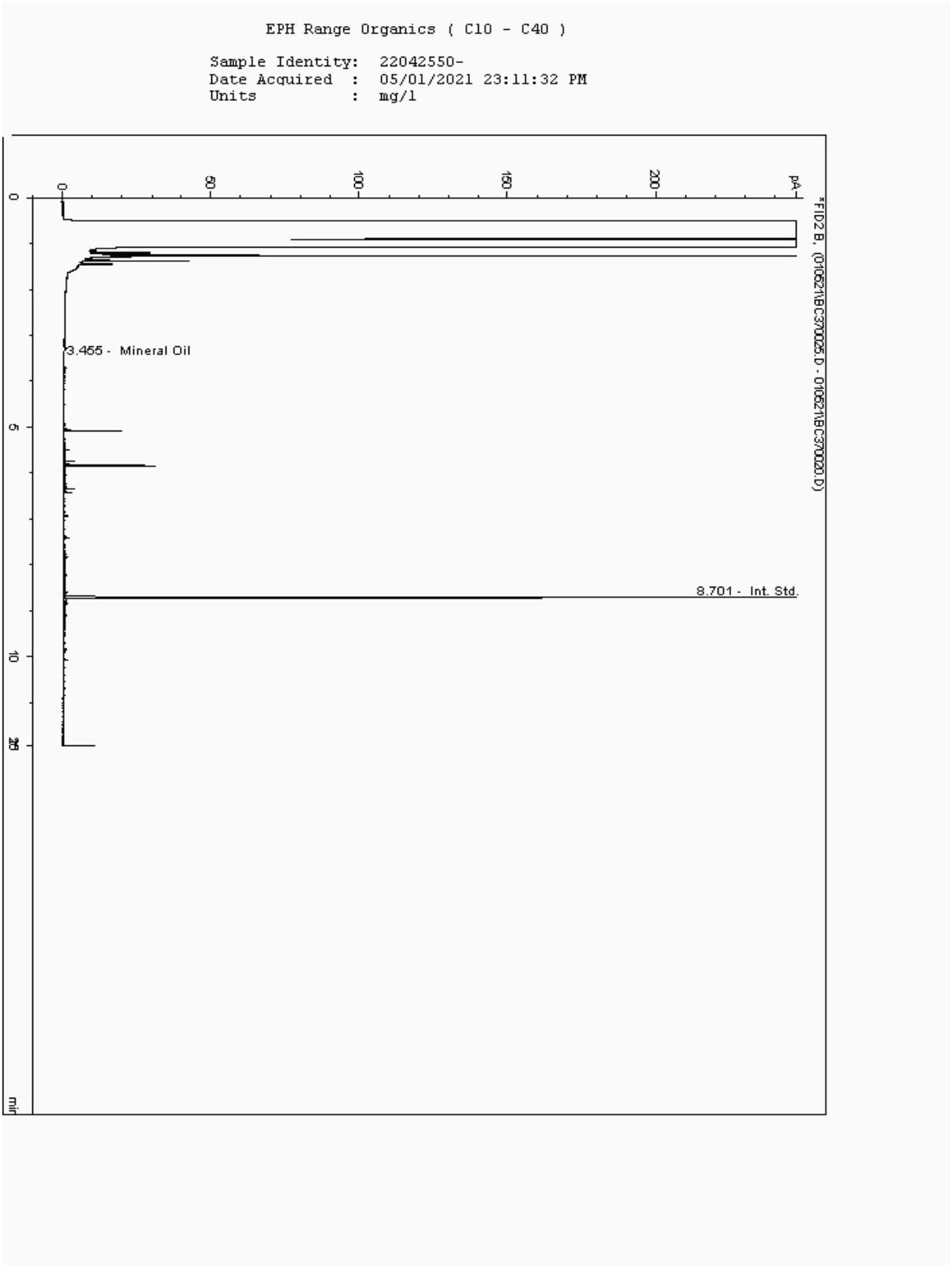


CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: Mineral Oil C10-40 Aqueous (W) **Sample No :** 23498911 **Sample ID :** BH03 **Depth :** 0.00 - 0.00

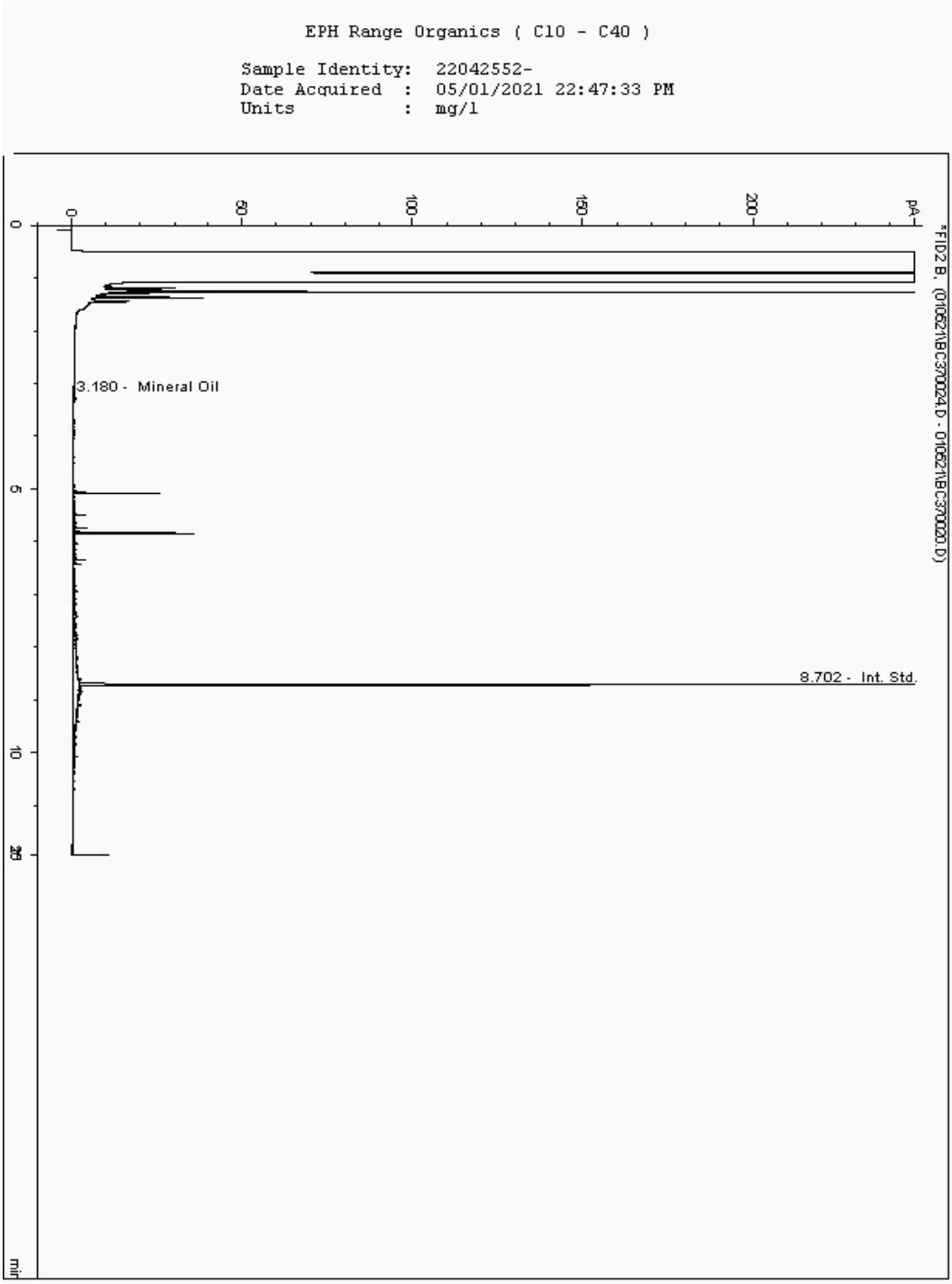


CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: Mineral Oil C10-40 Aqueous (W) **Sample No :** 23498912 **Sample ID :** BH04 **Depth :** 0.00 - 0.00

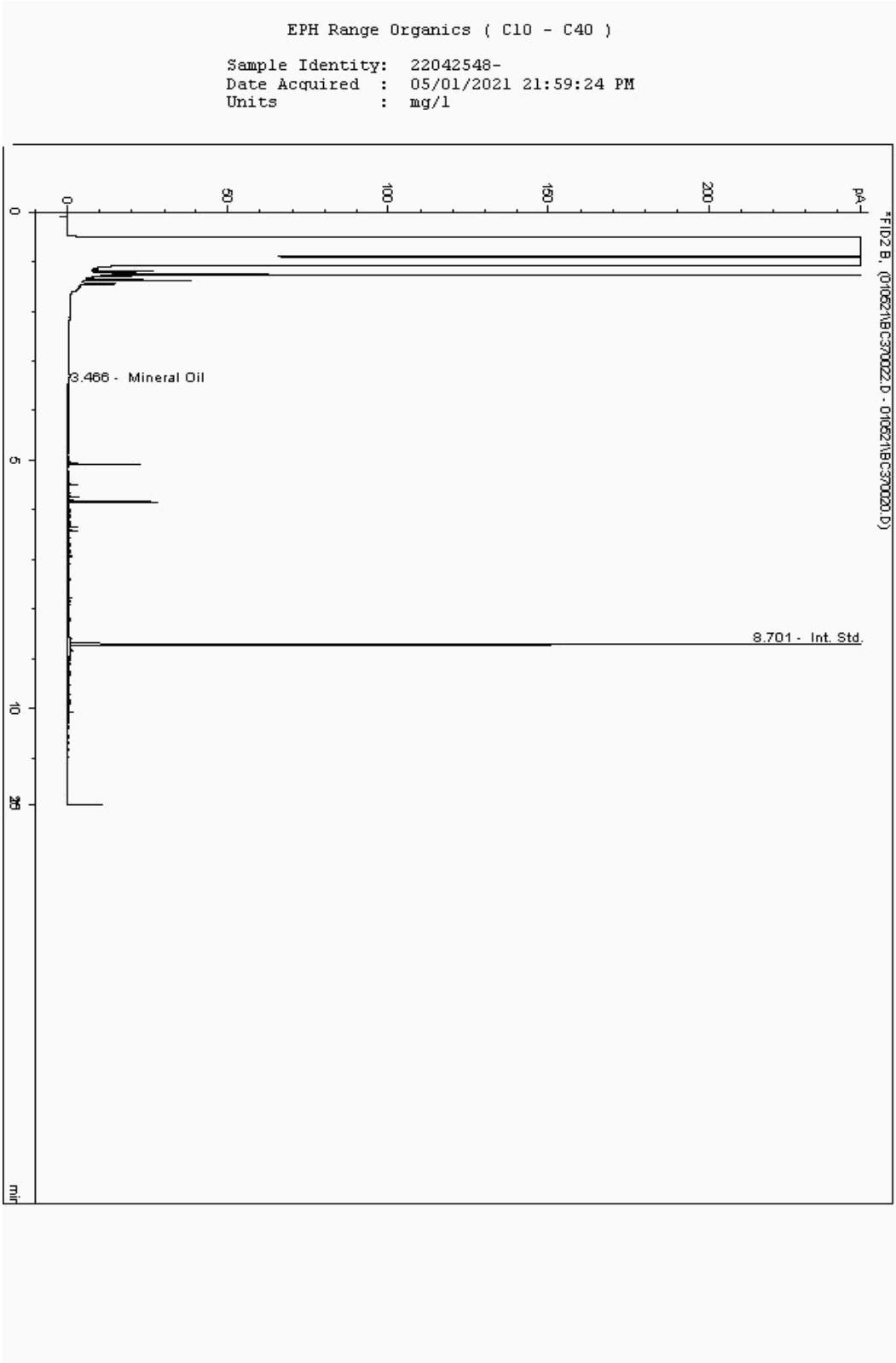


CERTIFICATE OF ANALYSIS

SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: Mineral Oil C10-40 Aqueous (W) **Sample No :** 23498913 **Sample ID :** BH01 **Depth :** 0.00 - 0.00



CERTIFICATE OF ANALYSIS

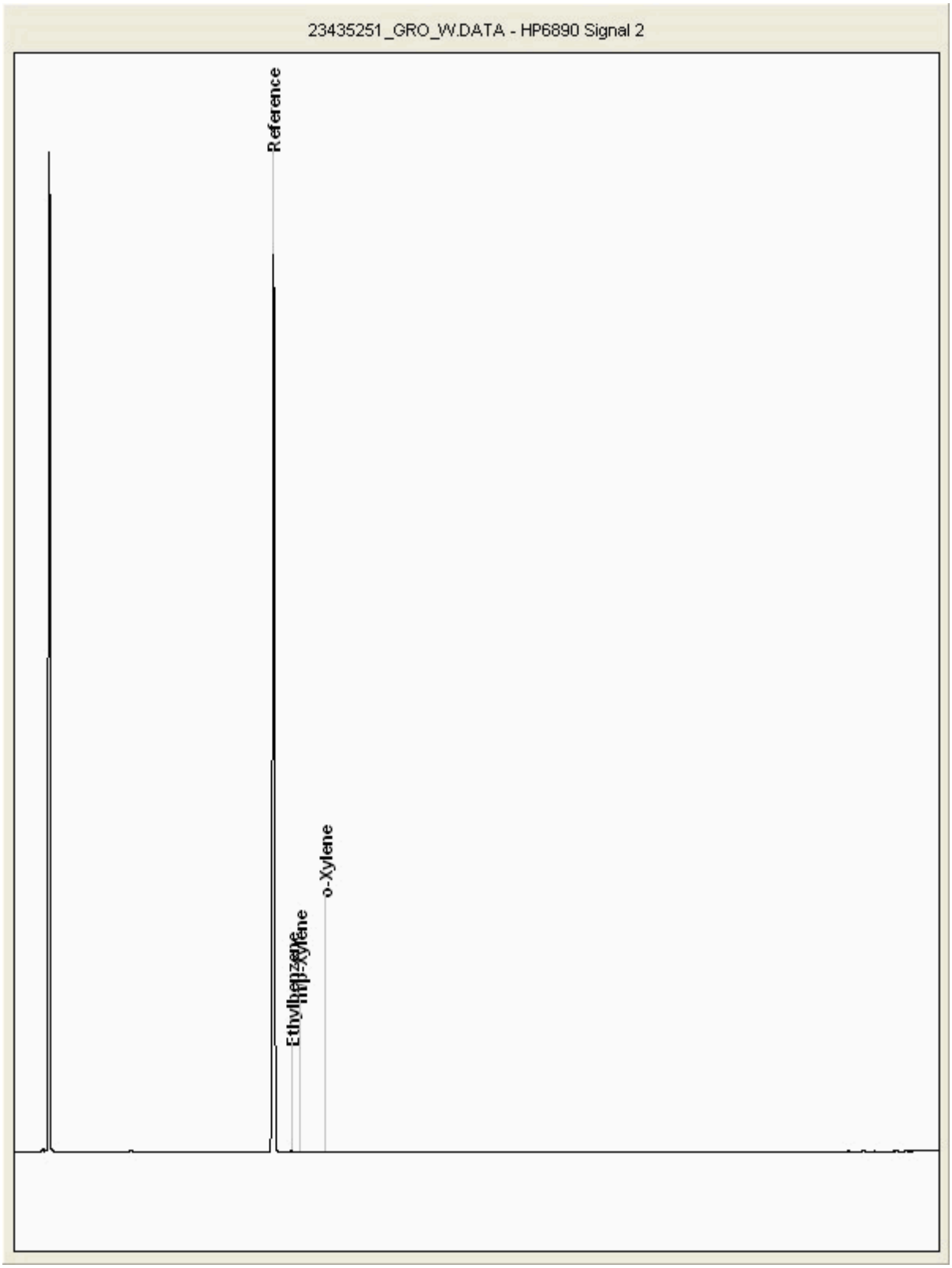
SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 23435251
Sample ID : BH04

Depth : 0.00 - 0.00



CERTIFICATE OF ANALYSIS

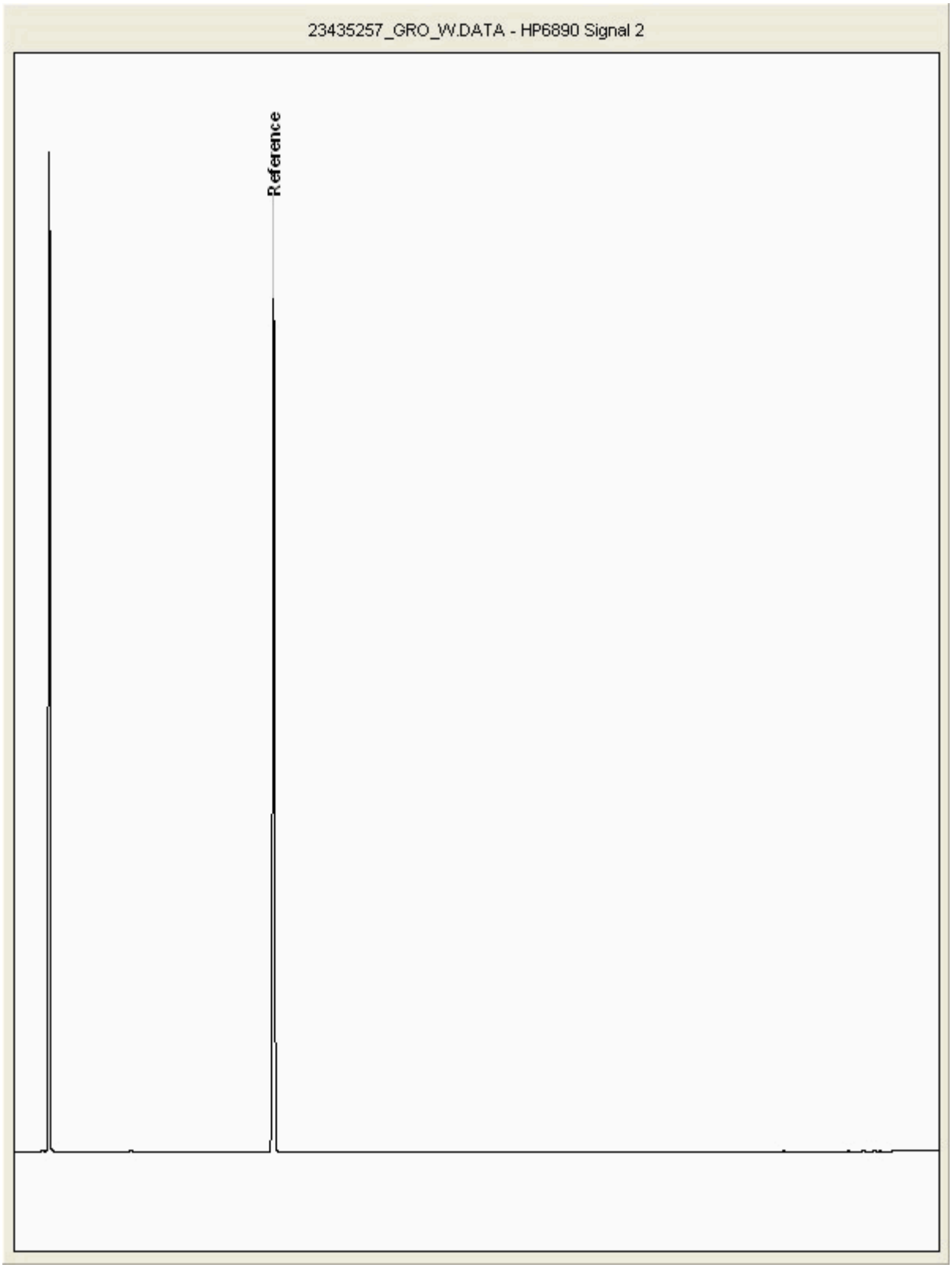
SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 23435257
Sample ID : BH01

Depth : 0.00 - 0.00



CERTIFICATE OF ANALYSIS

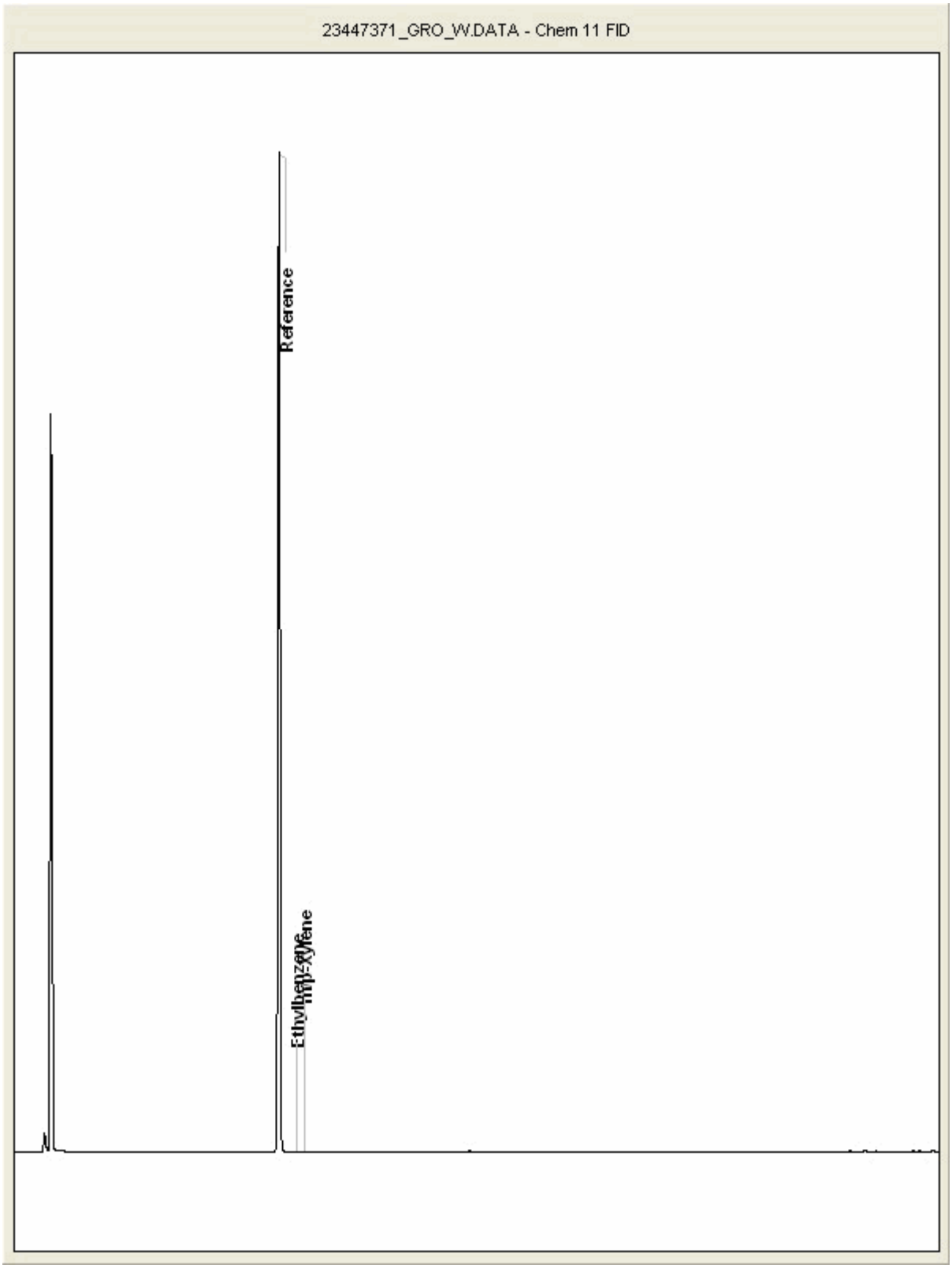
SDG:	201211-79	**Client Reference:**	2020WW102	**Report Number:**	582350
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	580858

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 23447371
Sample ID : BH03

Depth : 0.00 - 0.00



Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

18. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

19. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2017).*

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix 7 Photographs (Trial Pits)



Figure 1 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP01(1).JPG



Figure 2 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP01(2).JPG



Figure 3 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP01(3).JPG



Figure 4 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP02(1).JPG



Figure 5 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP02(2).JPG



Figure 6 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP02(3).JPG



Figure 7 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP03(1).JPG



Figure 8 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP03(2).JPG



Figure 9 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP04(1).JPG



Figure 10 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP04(2).JPG



Figure 11 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP05(1).JPG



Figure 12 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP05(2).JPG

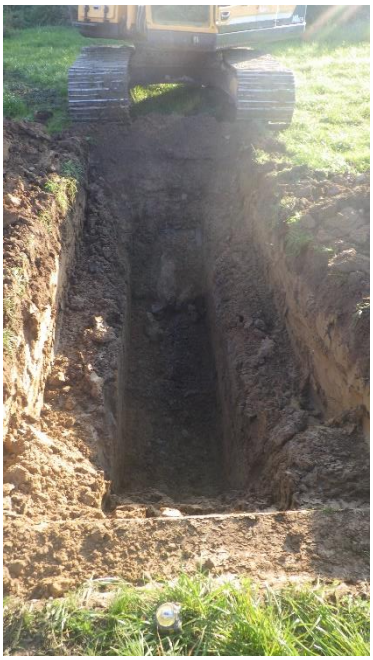


Figure 13 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP06(1).JPG



Figure 14 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP06(2).JPG



Figure 15 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP06(3).JPG



Figure 16 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP07(1).JPG



Figure 17 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP07(2).JPG



Figure 18 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP07(3).JPG



Figure 19 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP08(1).JPG



Figure 20 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP08(2).JPG



Figure 21 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP09(1).JPG



Figure 22 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP09(2).JPG



Figure 23 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP10(1).JPG



Figure 24 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP10(2).JPG



Figure 25 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP10(3).JPG



Figure 28 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP11(3).JPG



Figure 26 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP11(1).JPG

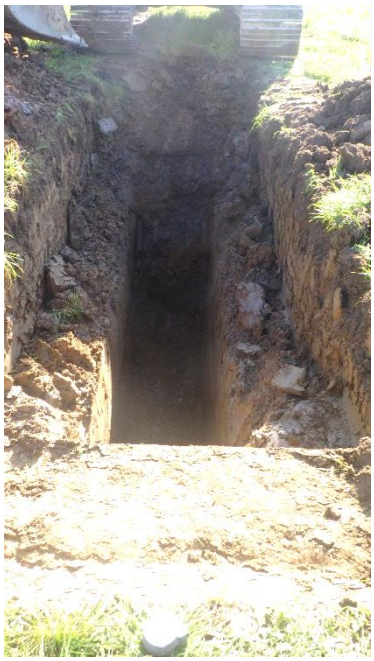


Figure 29 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP12(1).JPG



Figure 27 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP11(2).JPG



Figure 30 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP12(2).JPG



Figure 31 H:\2020-WW-102 Arklow Bank\Arklow Bank Tp Photos\TP12(3).JPG

Appendix 8 Photographs (Rotary Core)


Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 01-
Box
1. 2. 3.
4. 5. 6.

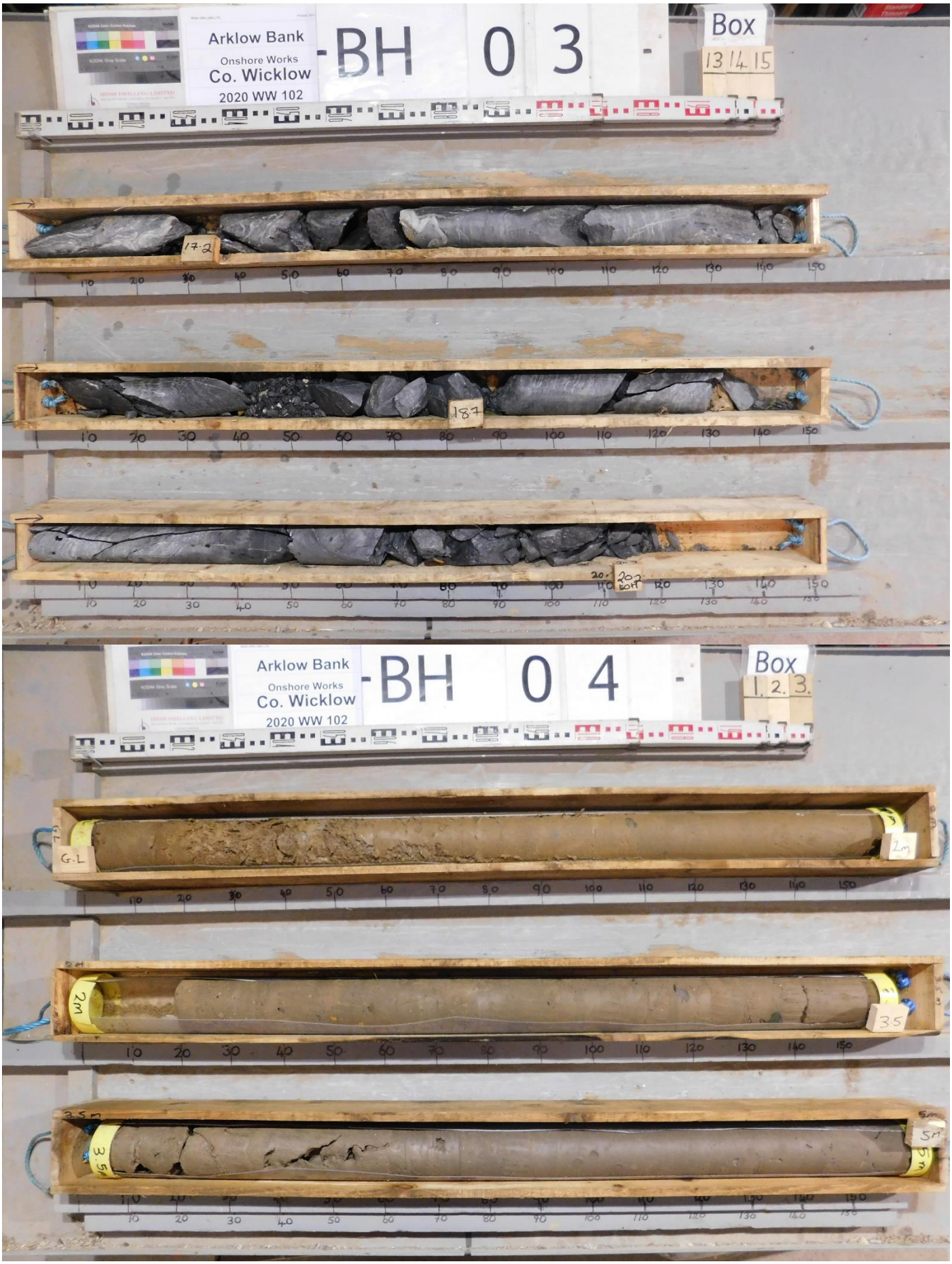

Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 01 -
Box
7 8.
Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 02 -
Box
1. 2. 3.
2m
3.5
5m


Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH02-
Box
4.5
6.3
7.7
Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH02-
Box
6.7
8.5
9.4
10.1


Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 03 -
Box
1. 2. 3.


Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 03 -
Box
4. 5. 6.


Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 03-
Box
7 8 9
Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 03-
Box
10 11 12

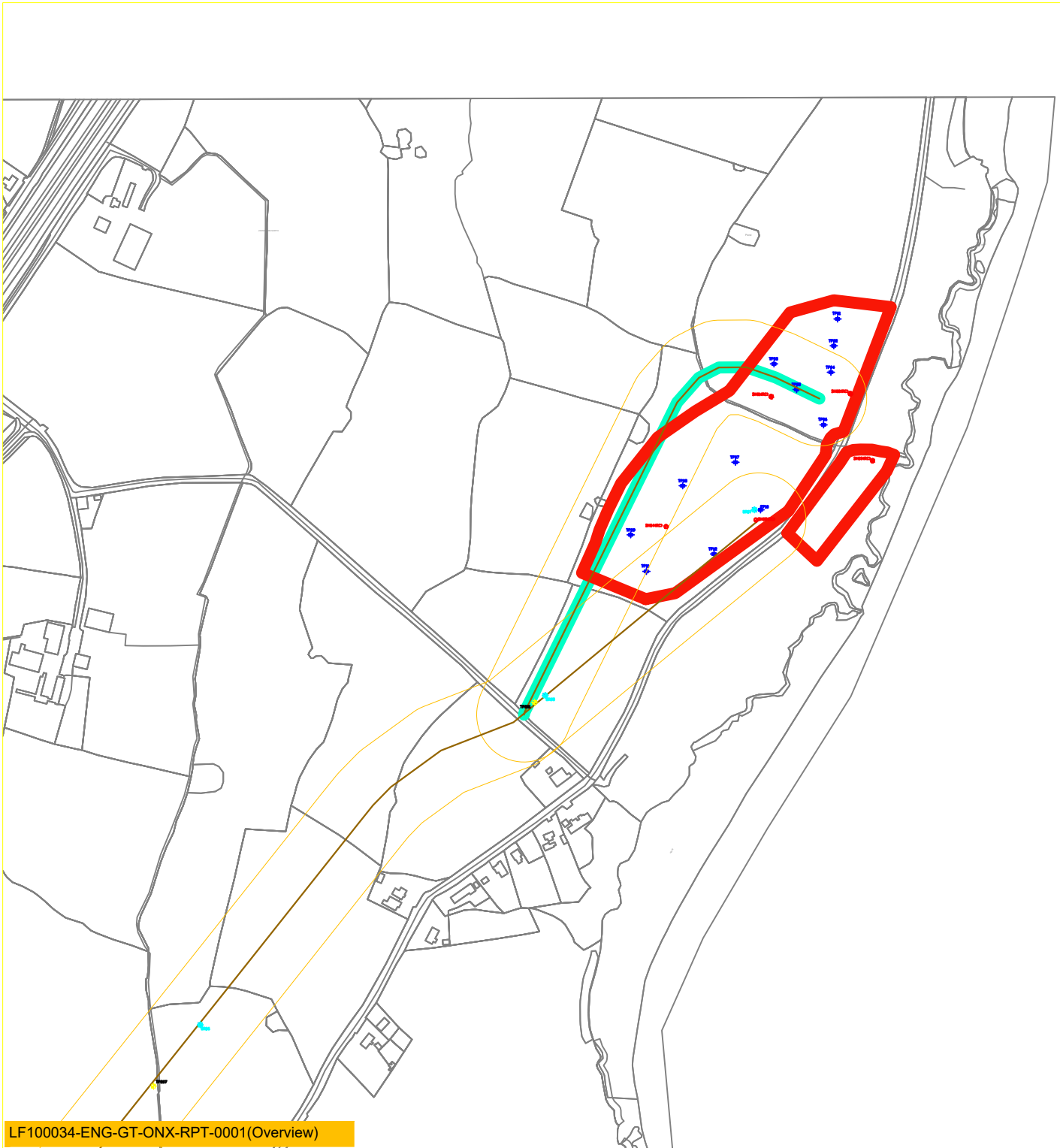

Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 03-
Box
13 14 15
17.2
187
Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 04-
Box
1. 2. 3.
G.L
2m
3.5


Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 04-
Box
4. 5. 6.
Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 04-
Box
7 8.


Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 05 -
Box
1. 2. 3.
G.L
2m
3.5
4.7m
Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 05 -
Box
4. 5. 6.
5.3
6.5
8.3

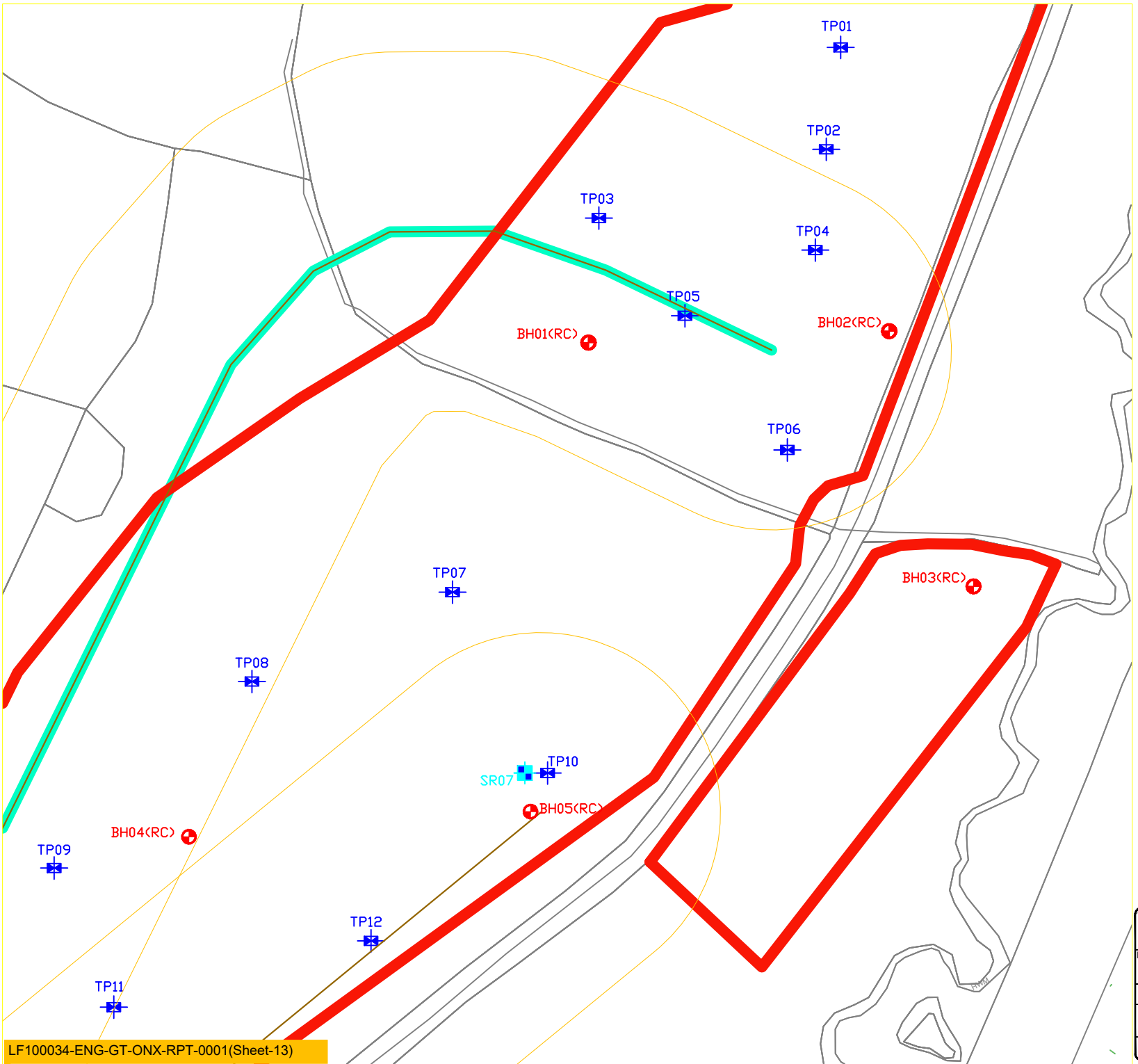

Arklow Bank
Onshore Works
Co. Wicklow
2020 WW 102
-BH 05 -
Box
7 8
10·4
EOH.

Appendix 9 ‘As-Built’ Drawings



LF100034-ENG-GT-ONX-RPT-0001(Overview)

Client :	SURE PARTNERS LIMITED (SPL)
Project :	ARKLOW BANK WIND PARK (LAND-FALL)
Date : 23-11-2020	**Scale :** not to scale
Description :	I.D.L (AS BUILT)
Drawing Number :	LF100034-ENG-GT-ONX-RPT-0001(Overview)



LEGEND

TRIAL PIT

BOREHOLE (CP+RC)

CP- CABLE PERCUSSIVE

RC- ROTARY CORE

SOIL RESISTIVITY

Client :	SURE PARTNERS LIMITED (SPL)
Project :	ARKLOW BANK WIND PARK (LAND-FALL)
Date : 23-11-2020	**Scale :** not to scale
Description :	I.D.L (AS BUILT)
Drawing Number :	LF100034-ENG-GT-ONX-RPT-0001 (Sheet-13)

Appendix 10 Digital Data

Project Title	Arklow Bank Wind Park Phase 2
Document Reference Number	LF100034-ENG-GT-REP-001

Onshore Ground Investigation Report: Landfall Site - ADDENDUM

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Rev	Date	Reason for Issue	Originator	Checker	Approver
01	14/07/2021	Approved for Use	Irish Drilling Limited	Arup	

IRISH DRILLING LIMITED

LOUGHREA, CO. GALWAY, IRELAND

CONTRACT DRILLING
SITE INVESTIGATION

Phone: (091) 841 274
Fax: (091) 847 687

email: info@irishdrilling.ie

ARKLOW BANK WIND PARK ONSHORE GROUND INVESTIGATIONS

LANDFALL SITE INVESTIGATIONS FACTUAL REPORT

ADDENDUM

Sure Partners Ltd,
South County Business Park,
Leopardstown,
Dublin 18.

ARUP,
Consulting Engineers,
50 Ringsend Road,
Dublin,
D04 T6X0.

	Prepared by	Approved by	Rev. Issue Date:	Revision No.
	Ronan Killeen	Declan Joyce	14th July 2021	20 WW_101/02e
Signature	RK	DJ		

Report No.: LF100034-ENG-GT-REP-0001

FOREWORD

The borehole and trial pit records have been compiled from an examination of the samples by a Geotechnical Engineer and from the Drillers' descriptions.

The report presents an opinion on the configuration of the strata within the site based on the borehole and trial pit results. The assumptions, though reasonable, are given for guidance only and no liability can be accepted for changes in conditions not revealed by the boreholes and trial pits.

The fieldwork was carried out in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations with precedence given to IS EN 1997-2 where applicable.

Contents:

1.0 Introduction

Book 1 of 1

Appendix 1 Laboratory Test Results

Appendix 1a Environmental Test Results (Water)

Appendix 2 Groundwater Readings (Data Loggers)

Appendix 2a Groundwater Readings (Dipmeter)

Appendix 2b Water Quality Readings

Appendix 3 Digital Data

1.0 Introduction.

Irish Drilling Ltd. (IDL) was instructed by Sure Partners Limited (SPL), to carry out a site investigation at the site of the proposed landfall site for the Arklow Bank Wind Park (ABWP) Onshore Grid Infrastructure Project.

This site investigation was carried out to provide detailed factual geotechnical information of the underlying ground conditions at the proposed landfall site.

The fieldwork commenced on October 13th 2020 and was completed on November 4th 2020.

A Factual Report was subsequently issued on January 22nd 2021.

A number of laboratory test results and on-site groundwater readings were not available at the time of issuance of this report and the records of same are presented here now as an Addendum Report.

Data Loggers:
Three data loggers were installed in the following boreholes to allow for the monitoring of groundwater levels over a prolonged period of time: BH 01, BH 03 and BH 04.

The loggers commenced recordings on November 25th 2020 and the data was downloaded on December 9th 2020. The records of the readings from November 25th 2020 to December 9th 2020 are included as Appendix 2 of this Addendum Report.

The data loggers were subsequently removed from the landfall site and inserted into boreholes at the proposed substation site.

Water quality readings consisting of Temperature, Dissolved Oxygen Level and Ph Value were also taken on December 9th 2020 and the records of these readings are included as Appendix 2b of this Addendum Report.

Further groundwater readings were subsequently taken from boreholes BH 01, BH 03 and BH 04 using a dipmeter on February 24th 2021 and May 5th 2021.The records of these groundwater readings are included as Appendix 2a of this Addendum Report.

The standpipes in boreholes BH 01, BH 03 and BH 04 were subsequently decommissioned on May 5th 2021.

Laboratory Testing
Representative samples recovered from the boreholes and trial pits were scheduled for testing in the laboratory.

The test schedules were prepared by the Client's Engineer and included some or all of the following tests on disturbed and/or undisturbed soil samples recovered from the trial pits:

* 30nr Natural Moisture Content.
* 25nr Atterberg Limits.
* 27nr Particle Size Distribution.
* 23nr Sedimentation.
* 12nr Chemical (pH, Sulphate, Total Sulphur).
* 8nr Compaction.
* 8nr Moisture Content Relationship.
* 24nr Environmental Suite.
* 18nr Thermal Resistivity.

The test schedules also included some or all of the following tests on soil and/or rock core samples recovered from the boreholes:

* 11nr Natural Moisture Content.
* 10nr Atterberg Limits.
* 10nr Particle Size Distribution.
* 9nr Sedimentation.
* 7nr Triaxial.
* 21nr Point Load Tests.
* 1nr Unconfined Compressive Strength (UCS).
* 6n Natural Water Content (rock core).
* 4nr Chemical Analysis (TRL 447).
* 6nr Flakiness Index.
* 2nr Frost Heave.
* 2nr Resistance to Freezing and Thawing.
* 13nr Rebound Hardness.
* 4nr Petrographic Analyses

Many of these test results were presented as Appendix 6 of the Factual Report, dated January 22nd 2021 but for the avoidance of doubt a full set of laboratory test results are presented here again as Appendix 1 of this Addendum.

Groundwater samples recovered from boreholes BH 01, BH 03 and BH 04 during the site visit of May 5th 2021 were presented to the laboratory for environmental testing and the records of these test results are presented as Appendix 1a of this Addendum Report.

The test schedules were carried out predominantly at the IDL Laboratory located at Loughrea, County Galway.

A number of specialist tests not available at the IDL laboratory were carried out by designated laboratories on a subcontract basis as follows:

Laboratory chemical and environmental tests were carried out by Alcontrol Laboratories, UK.
Triaxial soil tests were carried out by NMTL, Carlow.
Specialist rock tests were carried out by Celtest Laboratories, UK.
Petrographic Analysis of rock core samples was carried out by Petriva Ltd., UK.

The soil and rock descriptions as noted on the borehole and trial pit logs are in general visual descriptions as observed and logged by our Engineers and are described in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations.

Soils descriptions (cohesive or otherwise) are also initially assessed based on the texture and ‘feel’ of the soil materials as witnessed by our Geotechnical Engineers.

Where laboratory classification tests have been carried out on soil or rock samples then these visual descriptions have been amended accordingly to take into account the results of these classification tests.

The records of the data loggers, groundwater readings and laboratory test results are included in the appendices of this Addendum Report.

Ronan Killeen

Ronan Killeen
Chartered Engineer
Irish Drilling Limited
July 14th 2021

Appendix 1 Laboratory Test Results

Summary of Classification Test Results

Project No.: 2020WW102

Project Name: Arklow Bank Windpark

Hole No.	Sample Ref	Top	Base	Type		Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Remarks
BH01		2.00	3.50	C		Dark brown slightly gravelly slightly sandy SILT.			21.0	90	41	20	21		CI
BH02		2.00	3.50	C		Dark brown slightly sandy SILT.			26.0	98	50	29	21		MH
BH04		2.00	3.50	C		Dark brown slightly gravelly slightly sandy SILT.			17.0	93	32	17	15		CL
BH05		0.00	2.00	C		Brown sandy SILT. Sand is fine and medium.			19.0	92	52	26	26		CH
TP01	2	0.40	0.50	B		Brown slightly sandy SILT.			34.0	99	77	29	48		CV
TP01	6	3.60	3.70	B		Dark brown slightly sandy SILT.			26.0	99	55	30	25		MH
TP02	2	0.50	0.60	B		Light brown slightly sandy SILT.			37.0	99	66	45	21		MH
TP02	4	1.40	1.50	B		Dark brown slightly sandy SILT.			28.0	97	61	36	25		MH
TP02	6	3.30	3.40	B		Dark brown slightly sandy SILT.			29.0	100	56	26	30		CH
TP03	2	0.50	0.60	B		Light brown slightly sandy SILT.			34.0	99	66	37	29		MH
TP03	5	1.50	1.60	B		Dark brown slightly gravelly slightly sandy SILT.			24.0	93	47	30	17		MI
TP03	6	2.80	2.90	B		Brown slightly gravelly slightly sandy SILT.			21.0	96	32	19	13		CL
TP04	2	0.40	0.50	B		Brown slightly sandy silty CLAY.			31.0	99	66	31	35		CH
TP04	5	1.40	1.50	B		Brown gravelly very silty fine SAND.			13.0	92					NP
TP04	6	1.40	1.50	B		Brown slightly gravelly slightly sandy SILT.			22.0	95	37	17	20		CI
TP04	8	3.70	3.80	B		Mottled brown-grey slightly gravelly slightly sandy SILT.			18.0	90	60	31	29		MH
TP05	2	0.40	0.50	B		Orange-brown slightly sandy SILT.			28.0	98	58	28	30		CH
TP05	3	1.10	1.20	D		Brown slightly sandy SILT.			21.0						
TP05	5	1.50	1.60	B		Brown slightly sandy SILT.			30.0	97	35	25	10		CI
TP05	6	2.60	2.70	B		Brown slightly sandy SILT.			28.0	99	56	29	27		MH
TP06	2	0.40	0.50	B		Orange-brown slightly gravelly slightly sandy SILT.			22.0	96	50	27	23		MH
TP06	6	2.10	2.20	B		Orange-brown sandy SILT. Sand is medium and fine.			24.0	95					
TP07	2	0.40	0.50	B		Brown slightly gravelly slightly sandy SILT.			27.0						
TP07	5	1.50	1.60	B		Brown slightly sandy SILT.			24.0	95	55	32	23		MH
TP07	8	4.40	4.50	B		Dark brown slightly sandy SILT.			27.0	99	49	24	25		CI
TP08	2	0.40	0.50	B		Brown slightly sandy SILT.			27.0	96	86	31	55		CV

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

Key: w = water content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index

Density test: wd - water displacement; wi - immersion in water

Linear measurement unless : 4pt cone unless : 1pt - single point test; NP - Non Plastic

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

Date Printed: 13/01/2021

QC From No: R1

Approved By: DCD

Table 1 sheet 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

Summary of Classification Test Results

Project No.: 2020WW102

Project Name: Arklow Bank Windpark

Hole No.	Sample Ref	Top	Base	Type		Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Remarks
TP08	8	4.40	4.50	B		Dark brown slightly sandy SILT.			27.0	99	39	20	19		CI
TP09	5	1.50	1.60	B		Brown slightly sandy SILT.			24.0	95	43	21	22		CI
TP10	2	0.40	0.50	B		Brown slightly sandy SILT.			33.0						
TP10	6	2.00	2.10	B		Brown silty medium and fine SAND.			14.0	88					
TP11	2	0.40	0.50	B		Brown slightly sandy SILT.			31.0	96	57	33	24		MH
TP11	6	2.50	2.60	B		Dark brown slightly sandy SILT.			28.0	99	85	38	47		MV
TP11	7	3.80	3.90	B		Dark brown slightly sandy SILT.			19.0	99	42	21	21		CI
TP12	6	2.40	2.50	B		Brown slightly gravelly sandy SILT. Sand is fine.			17.0	94	32	16	16		CL

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

Key: w = water content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index

Density test: wd - water displacement; wi - immersion in water

Linear measurement unless : 4pt cone unless : Liquid Limit; 1pt - single point test; NP - Non Plastic

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

Date Printed: 13/01/2021

QC From No: R1

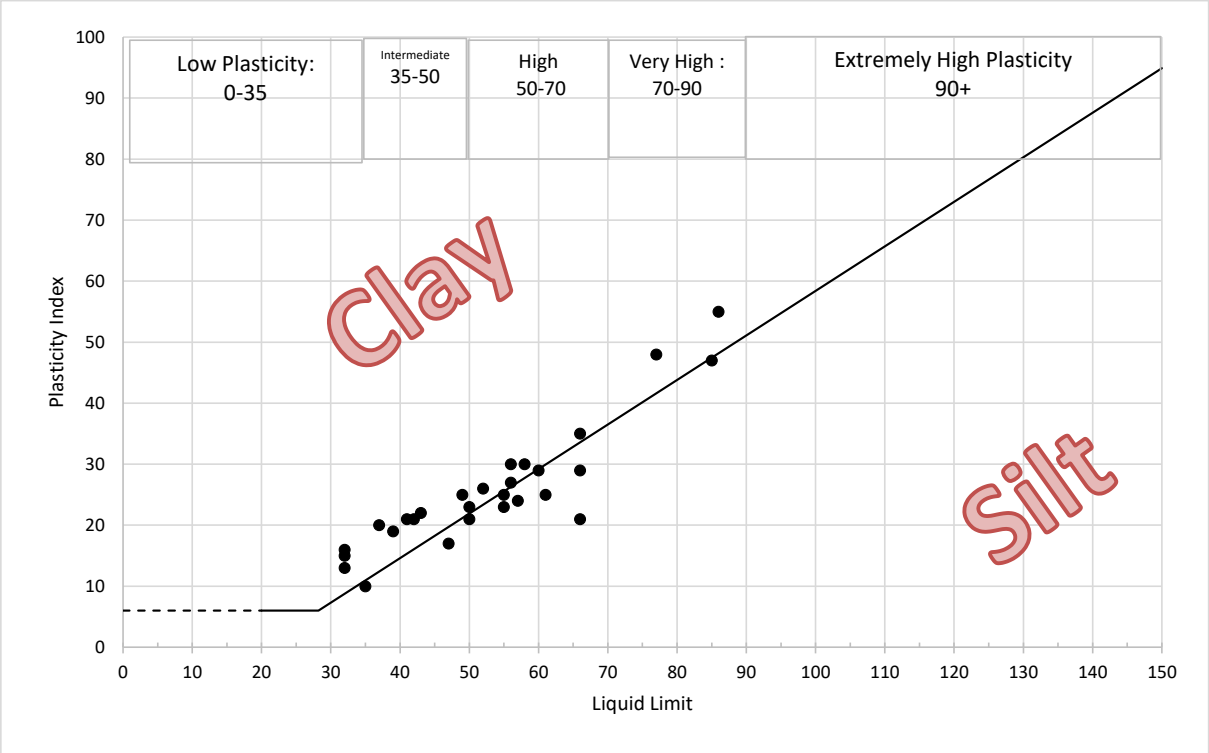
Approved By: DCD

Table 1 sheet 2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Plasticity (A-Line) Chart	Project Number
Project Name:	**Arklow Bank Windpark**	
Location:		2020WW102



Abreviations in the remarks column of the Classification Summary Sheet: C = Clay, M = Silt

Plasticity abeviations: L = Low, I = Intermediate = H = High, V = Very High, E = Extremely High.

The letter O is added to the symbol of any material containing a significant proportion of organic material.

Chart taken from BS5930: 2010

Approved By: DCD

QC Form: R1

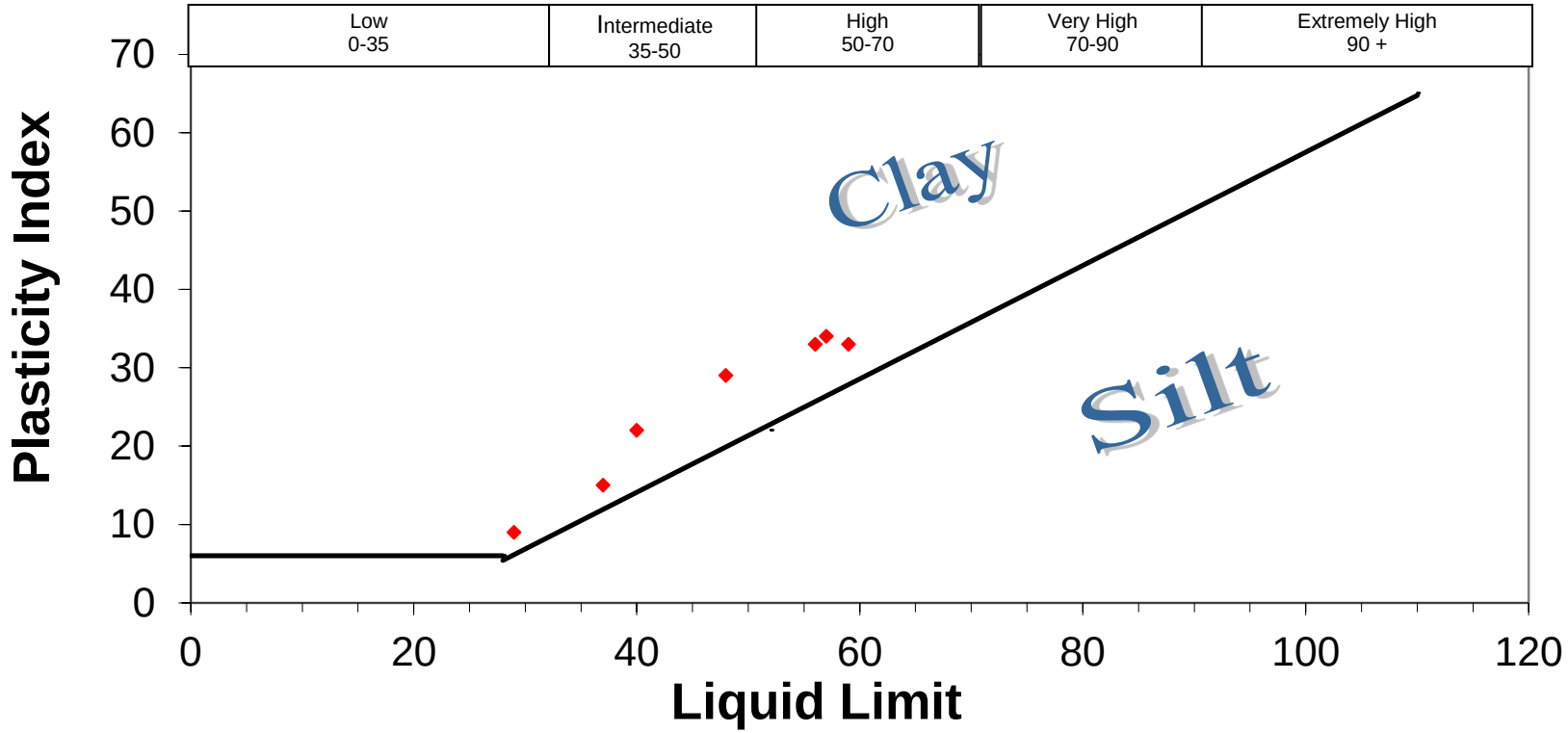
National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Shear	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Strenght	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
BH01	0.8-1.22	C	30.3						1.93	50	59.6	14.94	30	PSD-UUTXL
BH02	0.8-1.22	C	23.4		85.9	48	19	29	1.99	50	85.1	12.07	43	LL&PI-PSD-UUTXL
BH02	4.3-4.80	C	28.9		98.7	59	26	33	1.97	100	159.0	6.32	80	LL&PI-PSD-UUTXL
BH03	0.70-1.30	C	12.2		50.7	37	22	15	2.23	50	186.3	9.27	93	LL&PI-PSD-UUTXL
BH04	1.4-1.84	C	15.6		90.2	40	18	22	2.21	50	288.2	16.91	144	LL&PI-PSD-UUTXL
BH04	4.4-4.80	C	28.6		98.3	56	23	33	1.96	100	121.7	5.80	61	LL&PI-PSD-UUTXL
BH05	1.3-1.70	C	27.9		95.2	57	23	34	1.96	50	79.2	16.92	40	LL&PI-PSD-UUTXL
~~RC201~~	~~15.0-15.45~~	~~RC~~	~~21.9~~		~~98.0~~	~~29~~	~~20~~	~~9~~	~~2.01~~	~~300~~	~~144.5~~	~~17.41~~	~~72~~	~~LL&PI-PSD-UUTXL~~
~~RC201~~	~~22.0-22.45~~	~~RC~~	~~12.1~~						~~2.29~~	~~450~~	~~411.0~~	~~15.53~~	~~206~~	~~UU TXL~~

NMTL	Notes :	Job ref No.	NMTL	IDL Project ID:	2020WW102
	1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Arklow Bank		

NMTL LTD	**Contract:** Arklow Bank
Unit 18c, Tullow Industrial Estate	**Client:** Irish Drilling Limited
Tullow	**Engineer:** Dympna Darcy
County Carlow	**GII Project ID** 2020WW102
Tel: 00353 59 9180822	**Date:** 22/02/2021
Mob: 00353 872575508	**Tested By:** Sb/Tch/Ms **Checked:** Bc
billa@nmtl.ie	**Job ref No.** NMTL

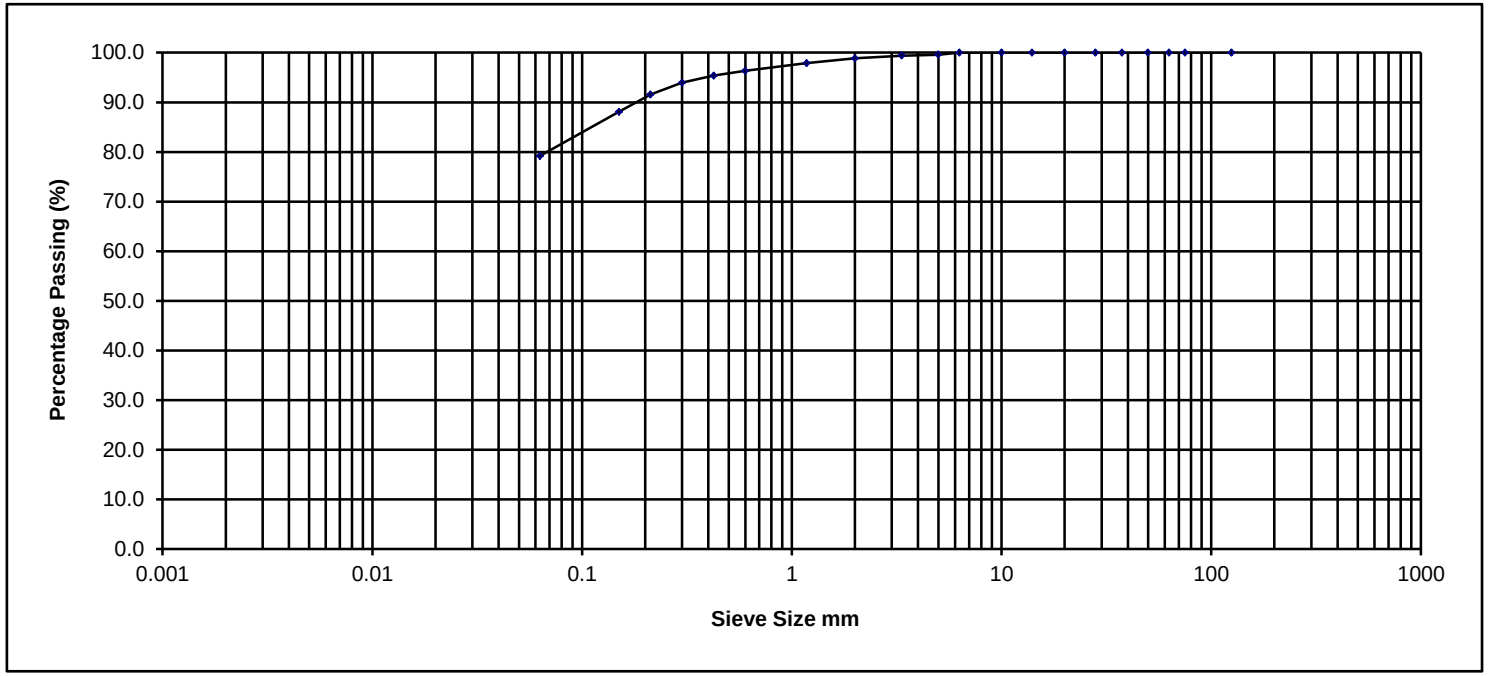


NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	100.0
10.000	100.0
6.300	100.0
5.000	99.6
3.350	99.4
2.000	98.8
1.180	97.9
0.600	96.3
0.425	95.4
0.300	93.9
0.212	91.6
0.150	88.1
0.063	79.2



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
		79.2			19.7			1.2		0.0	0.0

Sample Description	Grey/brown/orange slightly gravelly slightly sandy silty CLAY.					Project No.	NMTL 3333
						BH/TP No.	BH01
Project	Arklow Bank			IDL Project ID-2020WW102		Sample No.	C
Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	19/02/2021	Depth	0.8-1.20

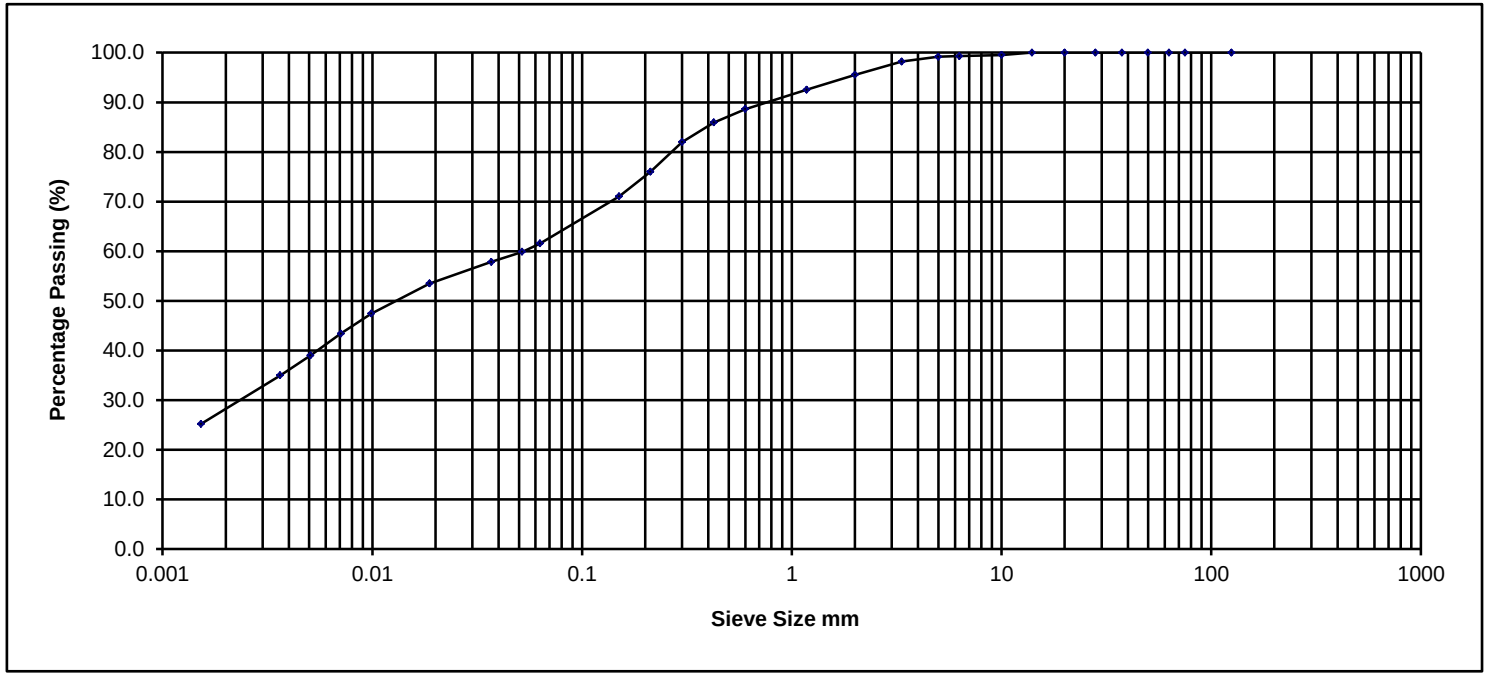
NM TL Ltd

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Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	100.0
10.000	99.5
6.300	99.3
5.000	99.2
3.350	98.2
2.000	95.5
1.180	92.5
0.600	88.6
0.425	85.9
0.300	82.0
0.212	76.0
0.150	71.0
0.063	61.6
0.052	59.9
0.037	57.9
0.019	53.5
0.010	47.4
0.007	43.4
0.005	39.0
0.004	35.0
0.002	25.2



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
25.2		36.3			34.0			4.5		0.0	0.0

Sample Description	Brown/grey slightly gravelly slightly sandy silty CLAY.					Project No.	NMTL 3333
						BH/TP No.	BH02
Project	Arklow Bank			IDL Project ID-2020WW102		Sample No.	C
Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	19/02/2021	Depth	0.8-1.22m

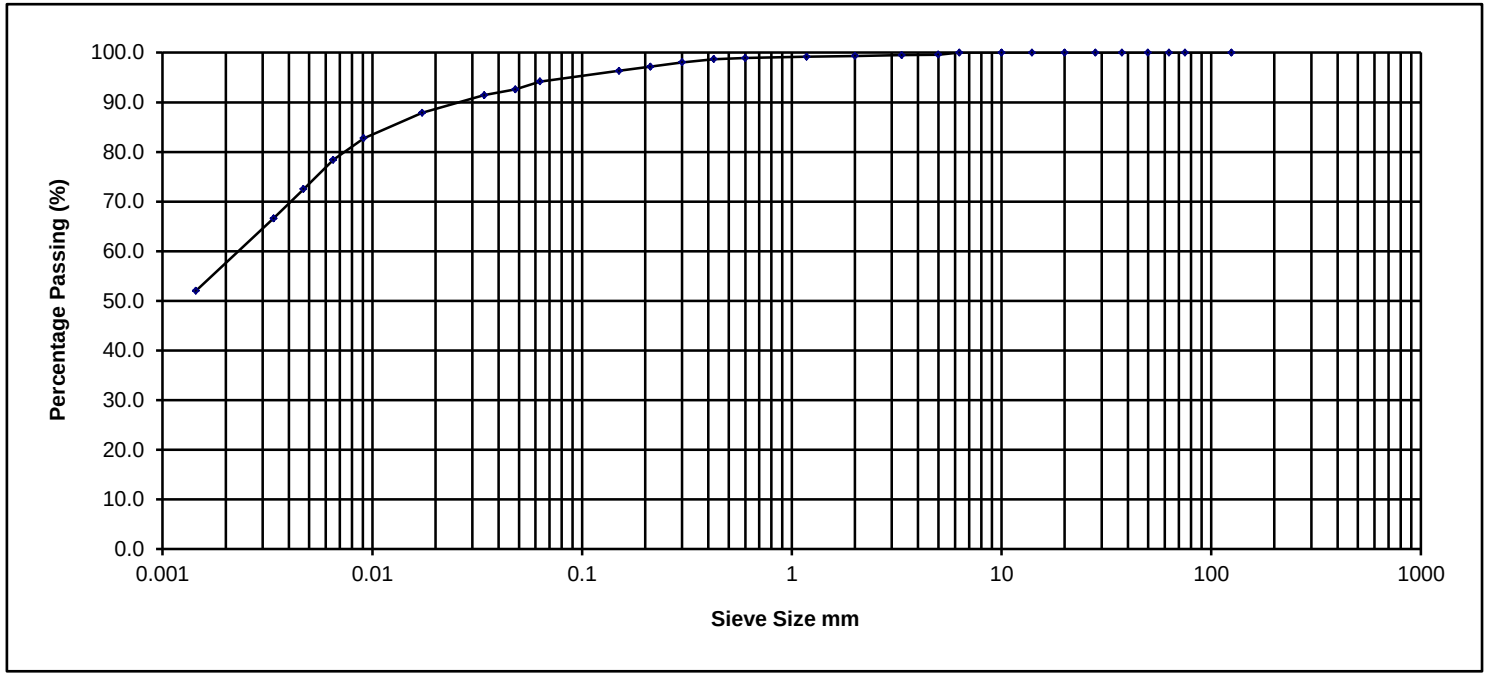
NMTL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	100.0
10.000	100.0
6.300	100.0
5.000	99.6
3.350	99.5
2.000	99.3
1.180	99.2
0.600	98.9
0.425	98.7
0.300	98.0
0.212	97.2
0.150	96.3
0.063	94.2
0.048	92.6
0.034	91.4
0.017	87.9
0.009	82.8
0.007	78.4
0.005	72.5
0.003	66.6
0.001	52.0



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
52.0		42.2			5.2			0.7		0.0	0.0

Sample Description	Brown/grey slightly sandy silty CLAY.					Project No.	NMTL 3333
						BH/TP No.	BH02
Project	Arklow Bank			IDL Project ID-2020WW102		Sample No.	C
Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	19/02/2021	Depth	4.3-4.80m

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Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	91.4
28.000	86.2
20.000	80.7
14.000	77.8
10.000	73.8
6.300	68.2
5.000	65.2
3.350	63.2
2.000	60.2
1.180	57.6
0.600	53.9
0.425	50.7
0.300	46.4
0.212	40.7
0.150	36.4
0.063	29.7
0.056	28.3
0.040	25.3
0.021	19.6
0.011	15.0
0.008	13.9
0.005	11.4
0.004	10.6
0.002	6.8



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
6.8		22.9			30.5			39.8		0.0	0.0

Sample Description	Brown clayey silty very sandy GRAVEL.					Project No.	NMTL 3333
						BH/TP No.	BH03
Project	Arklow Bank			IDL Project ID-2020WW102		Sample No.	C
Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	19/02/2021	Depth	4.3-4.80m

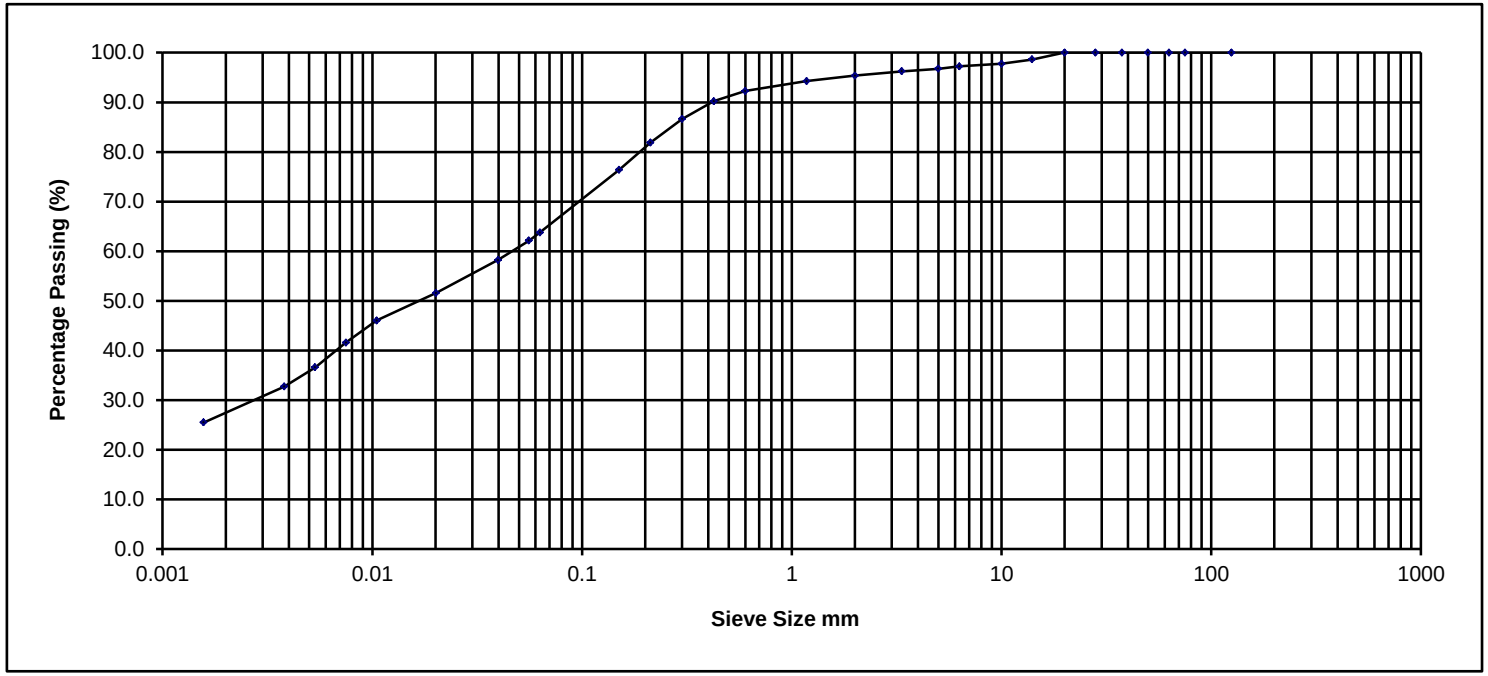
NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	98.6
10.000	97.8
6.300	97.3
5.000	96.8
3.350	96.2
2.000	95.4
1.180	94.3
0.600	92.3
0.425	90.2
0.300	86.6
0.212	81.9
0.150	76.4
0.063	63.8
0.056	62.1
0.040	58.2
0.020	51.6
0.010	46.0
0.007	41.6
0.005	36.6
0.004	32.7
0.002	25.5



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
25.5		38.3			31.6			4.6		0.0	0.0

Sample Description	Brown slightly gravelly slightly sandy silty CLAY.					Project No.	NMTL 3333
						BH/TP No.	BH04
Project	Arklow Bank			IDL Project ID-2020WW102		Sample No.	C
Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	19/02/2021	Depth	1.4-1.84m

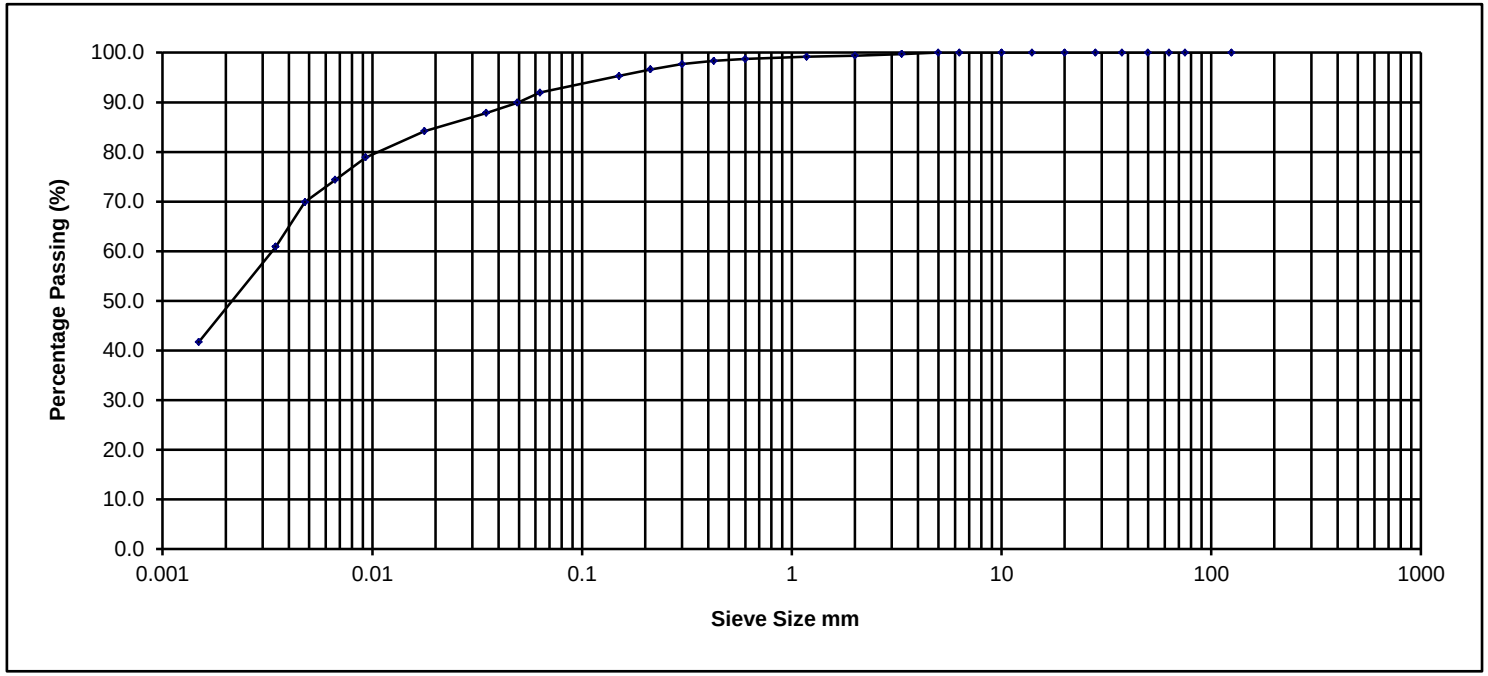
NMTL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	100.0
10.000	100.0
6.300	100.0
5.000	100.0
3.350	99.7
2.000	99.4
1.180	99.2
0.600	98.7
0.425	98.3
0.300	97.7
0.212	96.6
0.150	95.3
0.063	92.0
0.049	89.9
0.035	87.9
0.018	84.2
0.009	78.9
0.007	74.4
0.005	69.9
0.003	60.9
0.001	41.7



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
41.7		50.3			7.5			0.6		0.0	0.0

Sample Description	Brown/grey slightly sandy silty CLAY.					Project No.	NMTL 3333
						BH/TP No.	BH04
Project	Arklow Bank			IDL Project ID-2020WW102		Sample No.	C
Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	20/02/2021	Depth	4.4-4.88

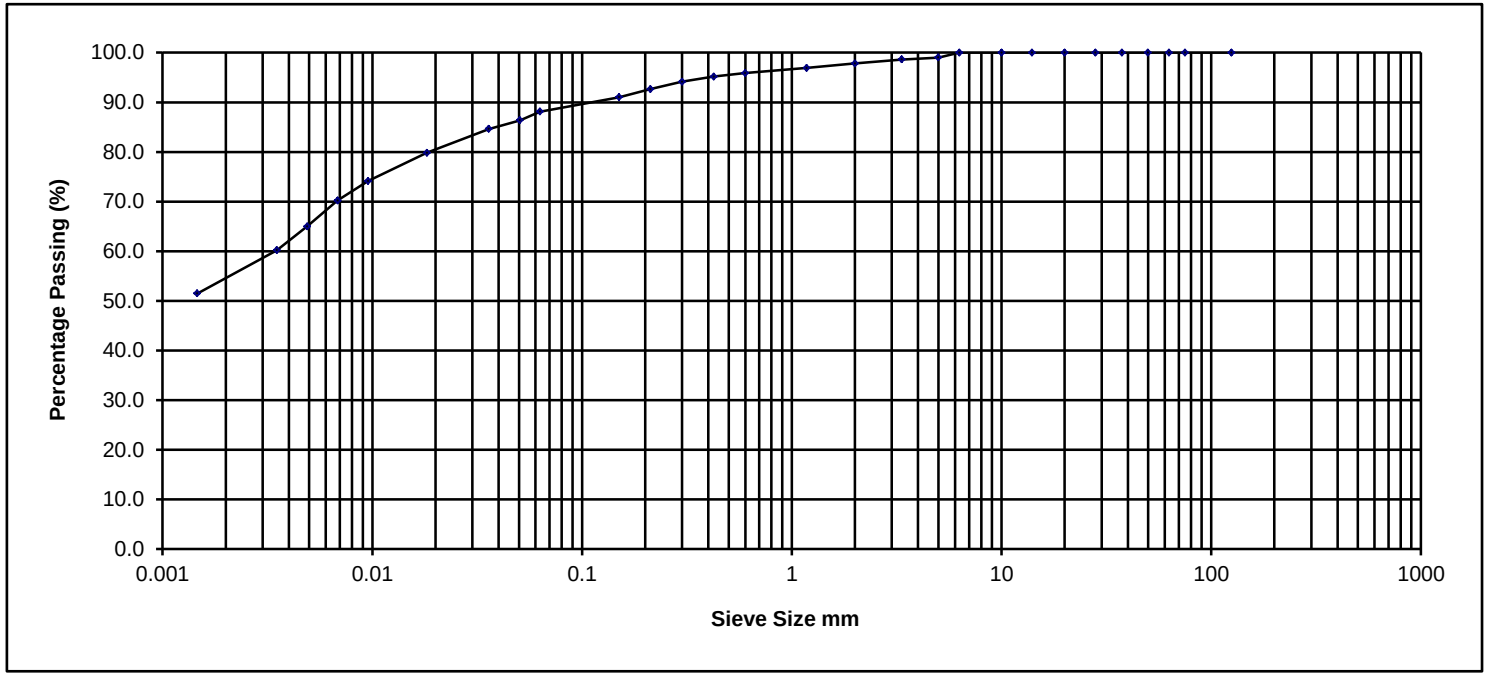
NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	100.0
10.000	100.0
6.300	100.0
5.000	99.0
3.350	98.6
2.000	97.8
1.180	96.9
0.600	95.9
0.425	95.2
0.300	94.2
0.212	92.6
0.150	91.0
0.063	88.1
0.051	86.4
0.036	84.6
0.018	79.8
0.010	74.2
0.007	70.2
0.005	65.0
0.004	60.2
0.001	51.5



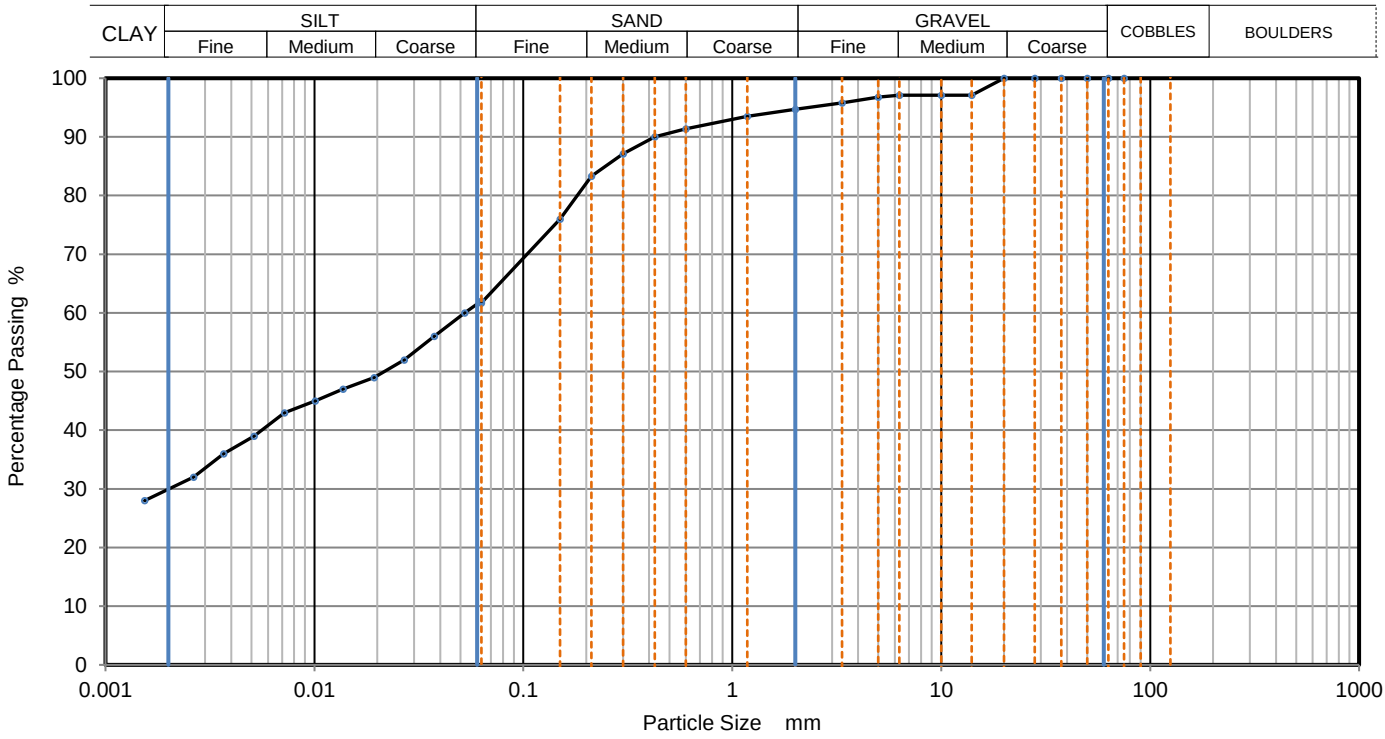
Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
51.5		36.6			9.7			2.2		0.0	0.0

Sample Description	Brown/grey slightly gravelly slightly sandy silty CLAY.			Project No.	NMTL 3333
				BH/TP No.	BH05
Project	Arklow Bank		IDL Project ID-2020WW102	Sample No.	C
Operator Tzr	Checked Nc	Approved Bc	Date sample tested 20/02/2021	Depth	1.3-1.70m

NM TL Ltd

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	BH01
Site Name	Arklow Bank Windpark			Sample No.	
Soil Description	Dark brown slightly gravelly slightly sandy SILT.			Depth, m	2.00
Specimen Reference		Specimen Depth	m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202011069



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	62
		0.0523	60
75	100	0.0375	56
63	100	0.0269	52
50	100	0.0193	49
37.5	100	0.0137	47
28	100	0.0101	45
20	100	0.0072	43
14	97	0.0051	39
10	97	0.0037	36
6.3	97	0.0026	32
5	97	0.0015	28
3.35	96		
2	95		
1.18	94		
0.6	91	Particle density (assumed)	
0.425	90	2.65 Mg/m3	
0.3	87		
0.212	83		
0.15	76		
0.063	62		

Dry Mass of sample, g	835

Sample Proportions	% dry mass
Very coarse	0
Gravel	5
Sand	33
Silt	32
Clay	30

Grading Analysis		
D_{100}	mm	
D_{60}	mm	0.0532
D_{30}	mm	0.00204
D_{10}	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

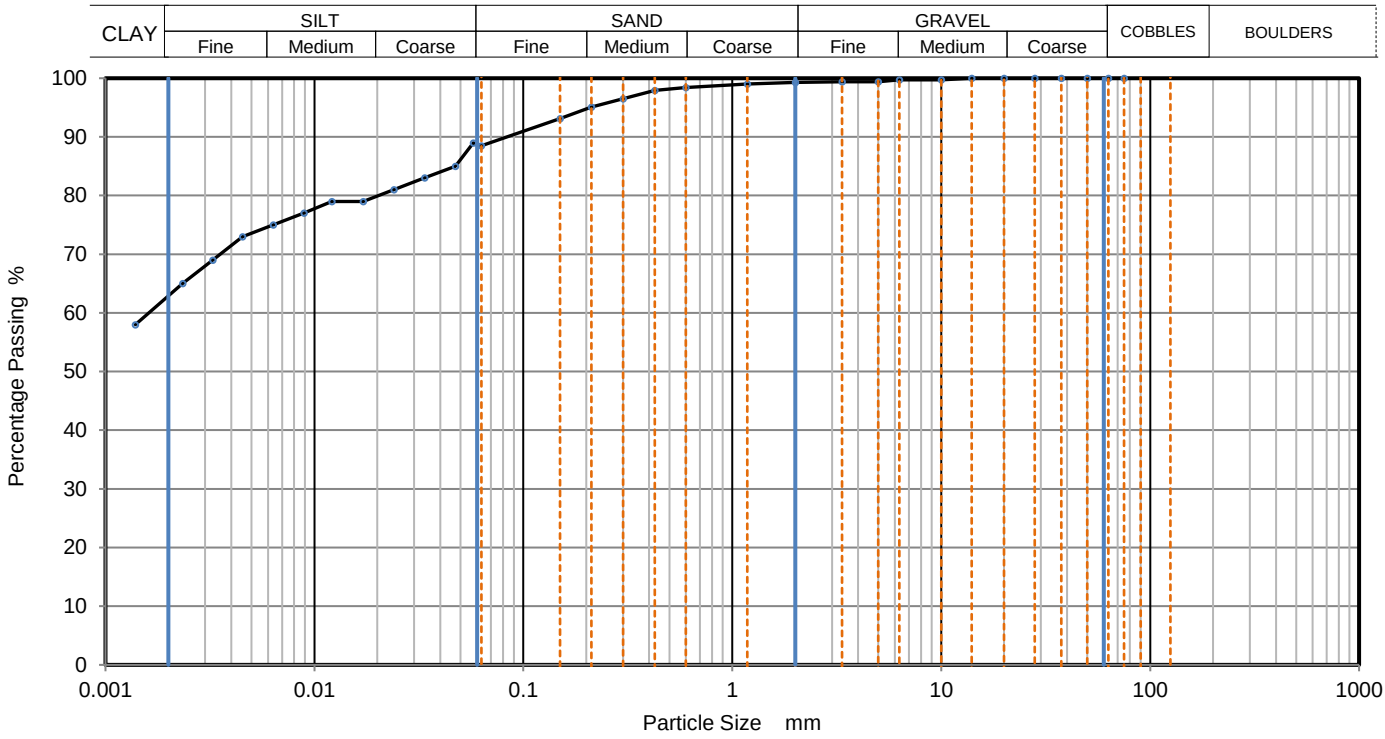
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 16:47	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	BH02
Site Name	Arklow Bank Windpark			Sample No.	
Soil Description	Dark brown slightly sandy SILT.			Depth, m	2.00
Specimen Reference		Specimen Depth	m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020110618



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0575	89
		0.0472	85
75	100	0.0337	83
63	100	0.0240	81
50	100	0.0171	79
37.5	100	0.0121	79
28	100	0.0089	77
20	100	0.0064	75
14	100	0.0045	73
10	100	0.0033	69
6.3	100	0.0023	65
5	99	0.0014	58
3.35	99		
2	99		
1.18	99		
0.6	98	Particle density (assumed)	
0.425	98	2.65 Mg/m3	
0.3	97		
0.212	95		
0.15	93		
0.063	89		

Dry Mass of sample, g	424

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	11
Silt	25
Clay	63

Grading Analysis		
D100	mm	
D60	mm	0.00162
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

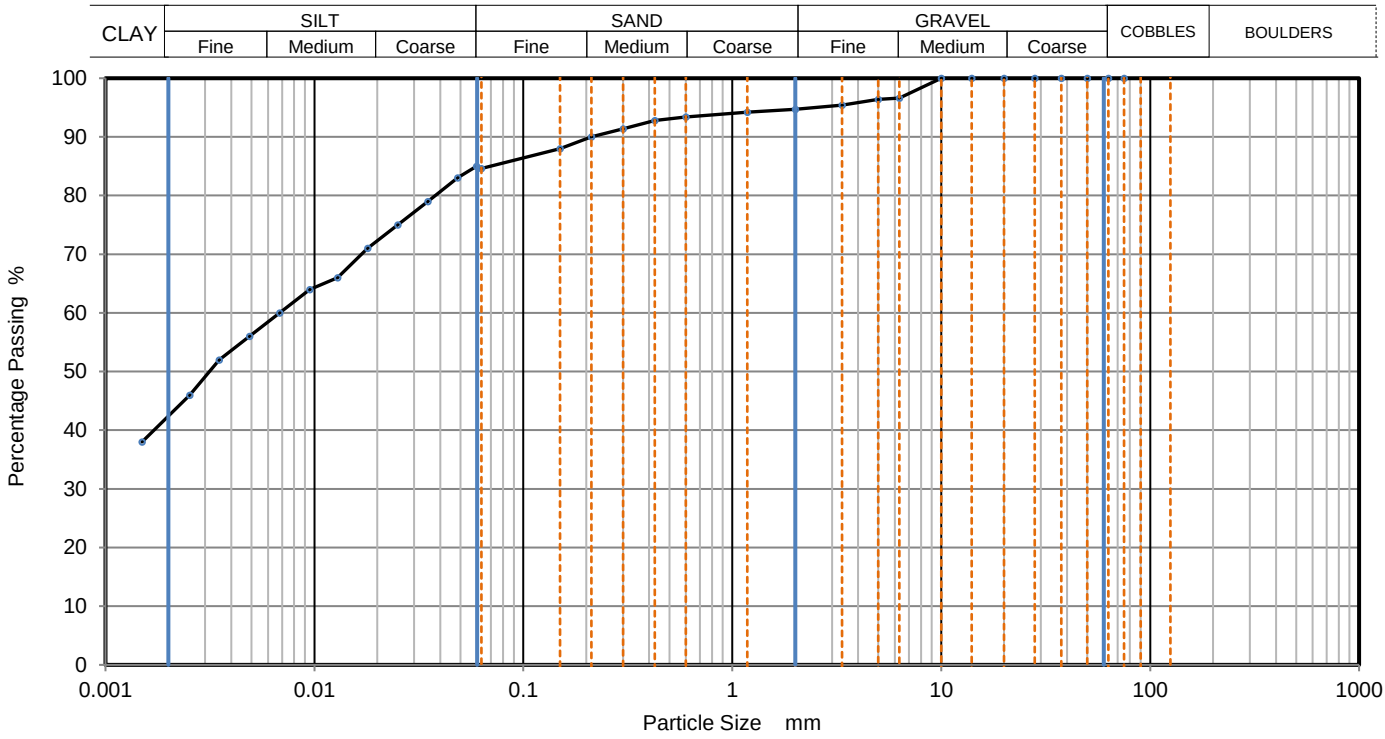
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:14	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	BH04
Site Name	Arklow Bank Windpark			Sample No.	
Soil Description	Dark brown slightly gravelly slightly sandy SILT.			Depth, m	2.00
Specimen Reference		Specimen Depth	m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020110644



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0596	85
		0.0485	83
75	100	0.0348	79
63	100	0.0250	75
50	100	0.0180	71
37.5	100	0.0129	66
28	100	0.0095	64
20	100	0.0068	60
14	100	0.0049	56
10	100	0.0035	52
6.3	97	0.0025	46
5	96	0.0015	38
3.35	95		
2	95		
1.18	94		
0.6	93	Particle density (assumed)	
0.425	93	2.65 Mg/m3	
0.3	91		
0.212	90		
0.15	88		
0.063	85		

Dry Mass of sample, g	527

Sample Proportions	% dry mass
Very coarse	0
Gravel	5
Sand	10
Silt	42
Clay	43

Grading Analysis		
D100	mm	
D60	mm	0.00658
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

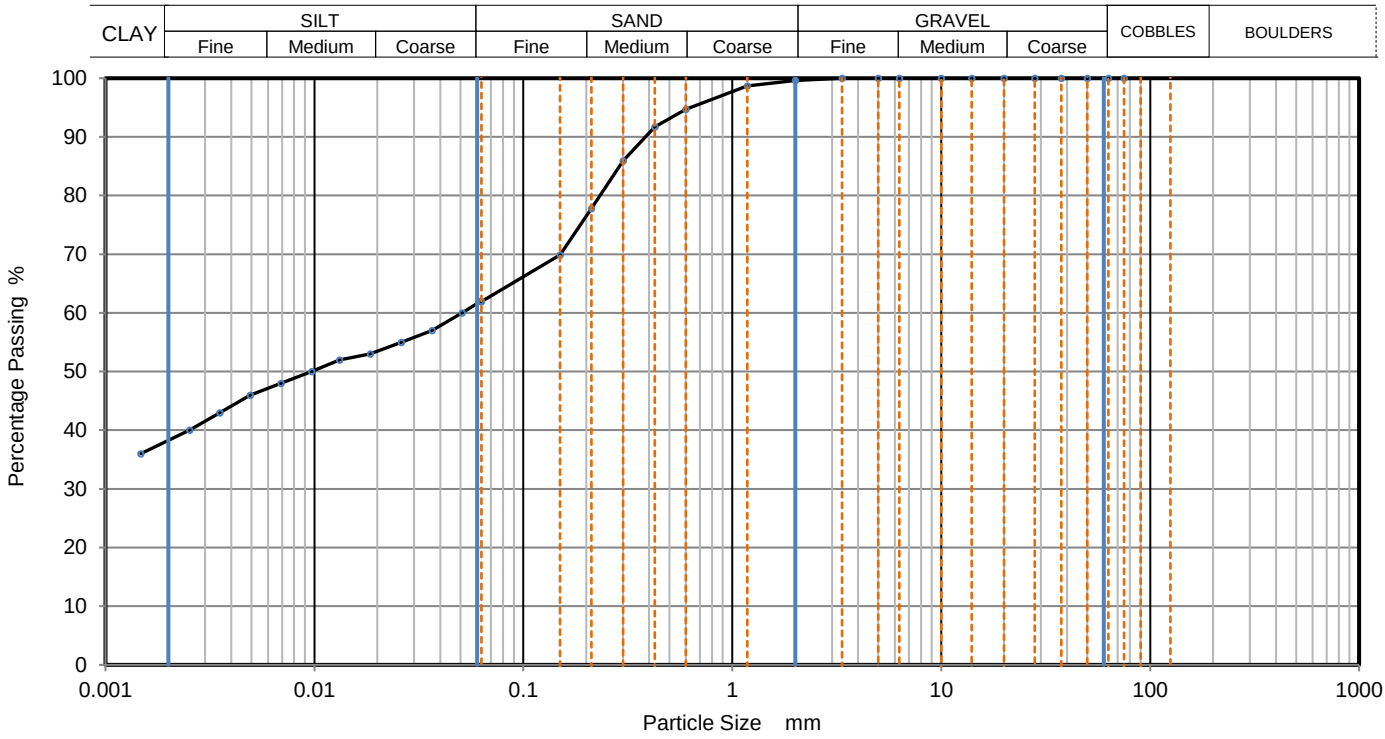
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
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Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	BH05
Site Name	Arklow Bank Windpark			Sample No.	
Soil Description	Brown sandy SILT. Sand is fine and medium.			Depth, m	0.00
Specimen Reference		Specimen Depth	m	Sample Type	C
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020110660



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0626	62
		0.0509	60
75	100	0.0365	57
63	100	0.0260	55
50	100	0.0185	53
37.5	100	0.0132	52
28	100	0.0097	50
20	100	0.0069	48
14	100	0.0049	46
10	100	0.0035	43
6.3	100	0.0025	40
5	100	0.0015	36
3.35	100		
2	100		
1.18	99		
0.6	95	Particle density (assumed)	
0.425	92	2.65 Mg/m3	
0.3	86		
0.212	78		
0.15	70		
0.063	62		

Dry Mass of sample, g	370

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	38
Silt	24
Clay	38

Grading Analysis		
D100	mm	
D60	mm	0.05
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

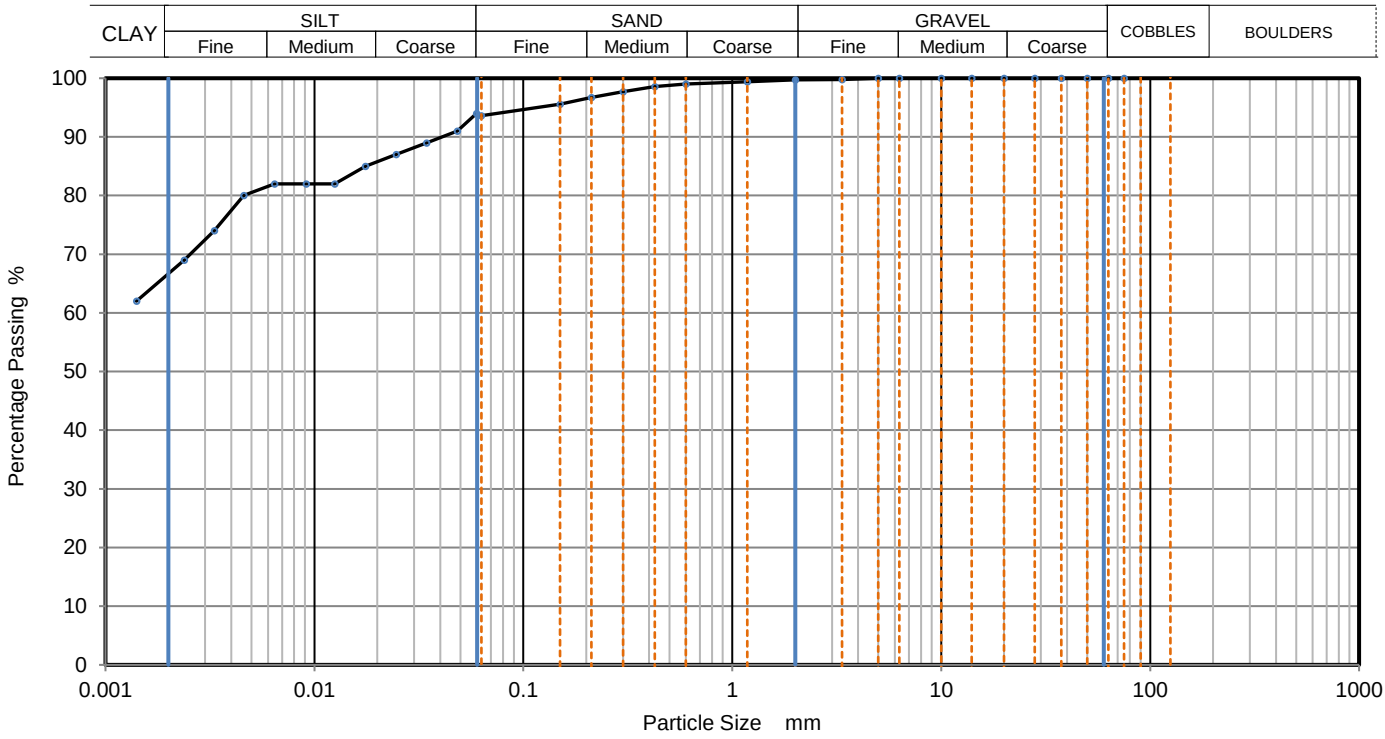
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:14	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP01
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202010291



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0596	94
		0.0483	91
75	100	0.0345	89
63	100	0.0246	87
50	100	0.0175	85
37.5	100	0.0125	82
28	100	0.0091	82
20	100	0.0064	82
14	100	0.0046	80
10	100	0.0033	74
6.3	100	0.0024	69
5	100	0.0014	62
3.35	100		
2	100		
1.18	99		
0.6	99	Particle density (assumed)	
0.425	99	2.65 Mg/m3	
0.3	98		
0.212	97		
0.15	96		
0.063	94		

Dry Mass of sample, g	226

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	6
Silt	27
Clay	67

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

Remarks

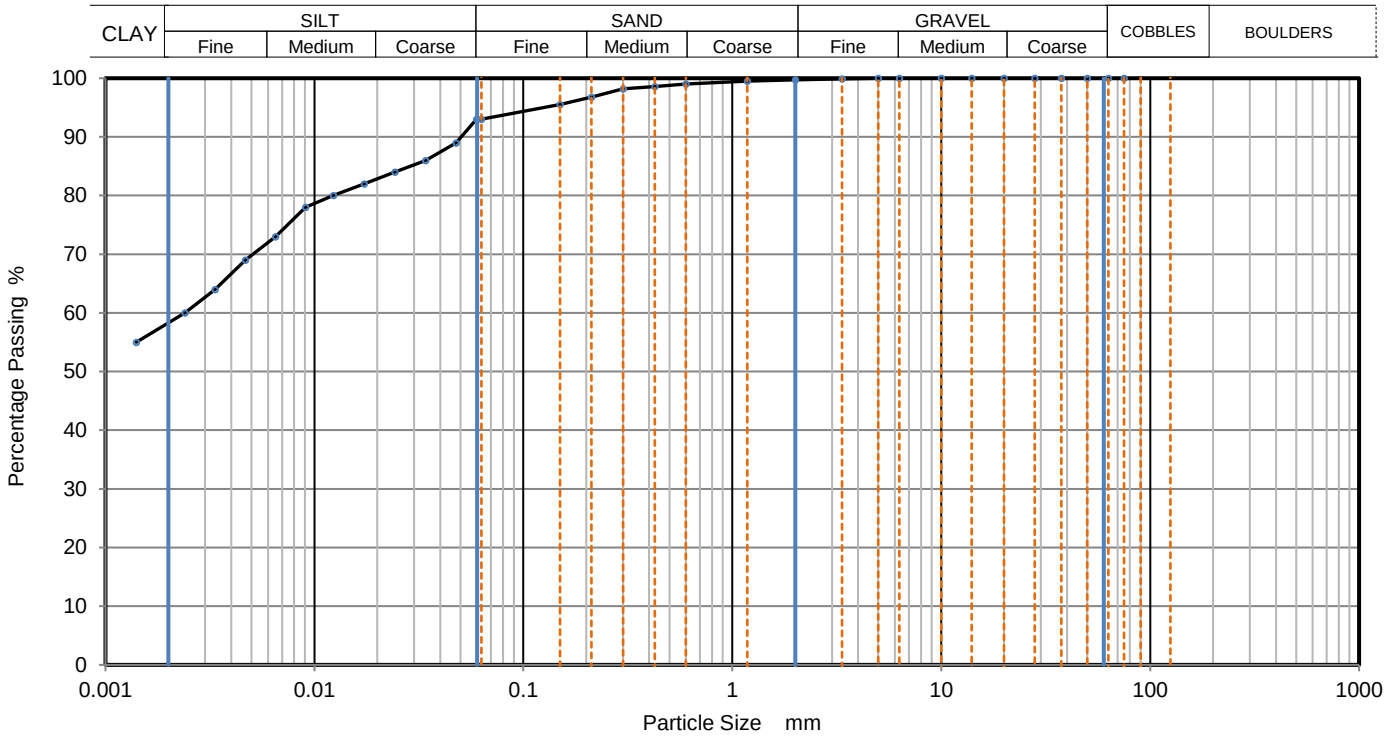
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
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Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP01
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Dark brown slightly sandy SILT.			Depth, m	3.60
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202010296



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0596	93
		0.0477	89
75	100	0.0340	86
63	100	0.0242	84
50	100	0.0173	82
37.5	100	0.0123	80
28	100	0.0091	78
20	100	0.0065	73
14	100	0.0047	69
10	100	0.0033	64
6.3	100	0.0024	60
5	100	0.0014	55
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	98		
0.212	97		
0.15	96		
0.063	93		

Dry Mass of sample, g	427

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	7
Silt	35
Clay	58

Grading Analysis		
D100	mm	
D60	mm	0.00244
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

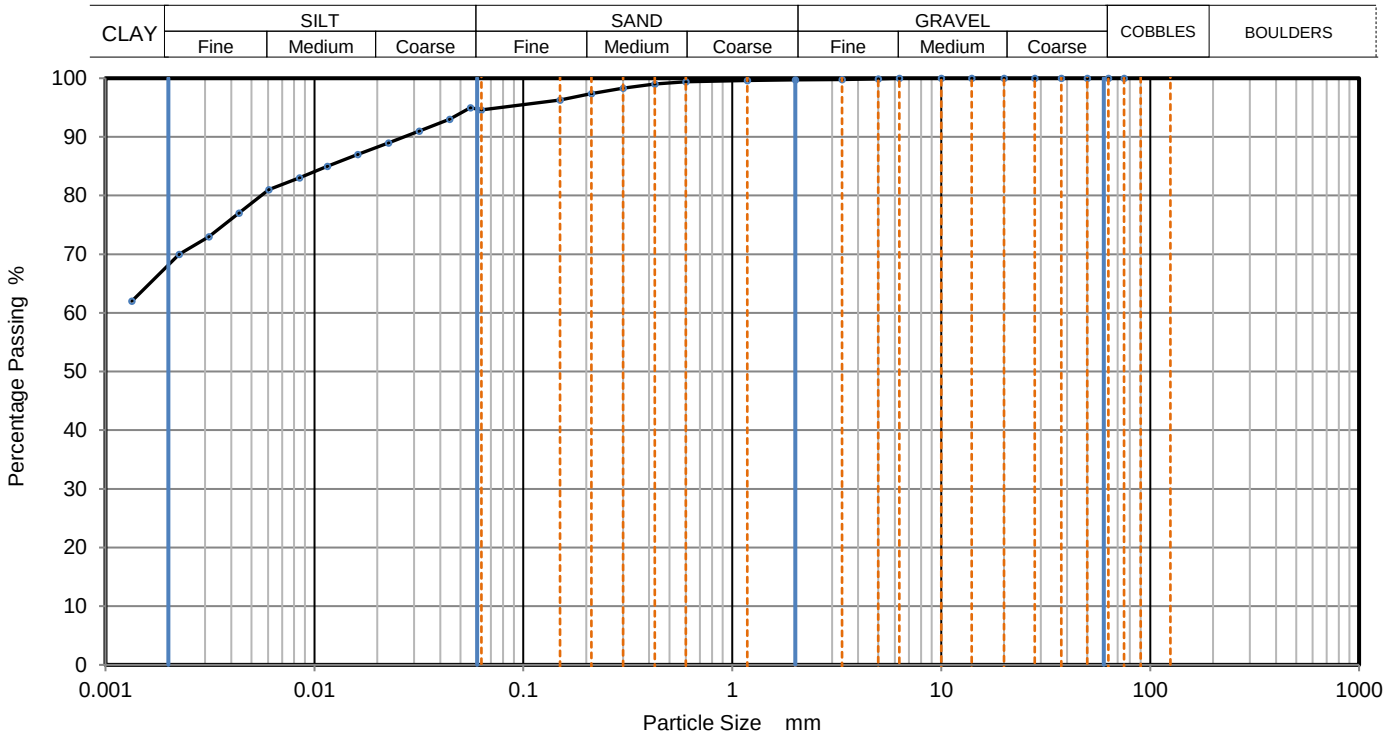
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Operator	Checked	Approved	Sheet printed	
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP02
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Light brown slightly sandy SILT.			Depth, m	0.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202010298



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0559	95
		0.0444	93
75	100	0.0317	91
63	100	0.0226	89
50	100	0.0161	87
37.5	100	0.0115	85
28	100	0.0085	83
20	100	0.0061	81
14	100	0.0044	77
10	100	0.0031	73
6.3	100	0.0022	70
5	100	0.0013	62
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density (assumed)	
0.425	99	2.65 Mg/m3	
0.3	98		
0.212	97		
0.15	96		
0.063	95		

Dry Mass of sample, g	474

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	5
Silt	27
Clay	68

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

Remarks

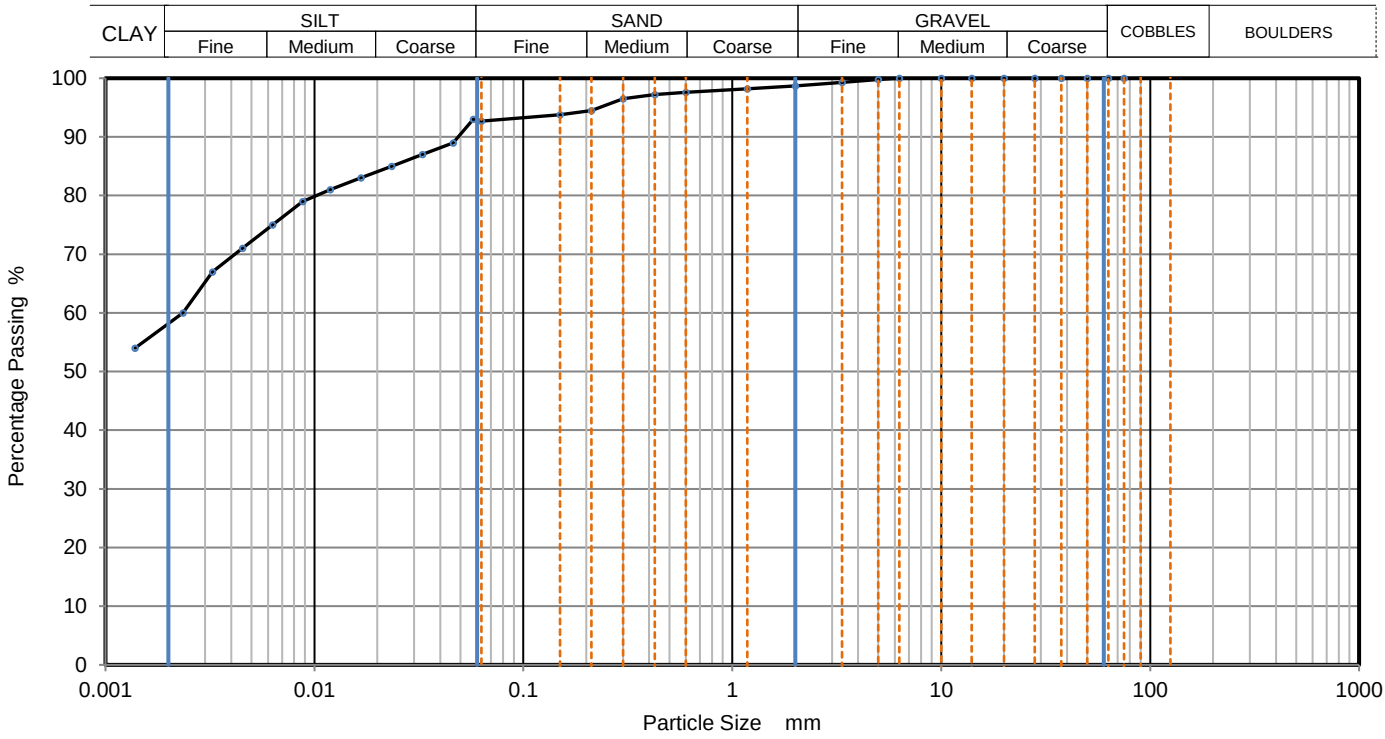
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP02
Site Name	Arklow Bank Windpark			Sample No.	4
Soil Description	Dark brown slightly sandy SILT.			Depth, m	1.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102911



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0575	93
		0.0461	89
75	100	0.0329	87
63	100	0.0234	85
50	100	0.0167	83
37.5	100	0.0119	81
28	100	0.0088	79
20	100	0.0063	75
14	100	0.0045	71
10	100	0.0033	67
6.3	100	0.0023	60
5	100	0.0014	54
3.35	99		
2	99		
1.18	98		
0.6	98	Particle density (assumed)	
0.425	97	2.65 Mg/m3	
0.3	97		
0.212	95		
0.15	94		
0.063	93		

Dry Mass of sample, g	373

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	6
Silt	34
Clay	59

Grading Analysis		
D100	mm	
D60	mm	0.00226
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

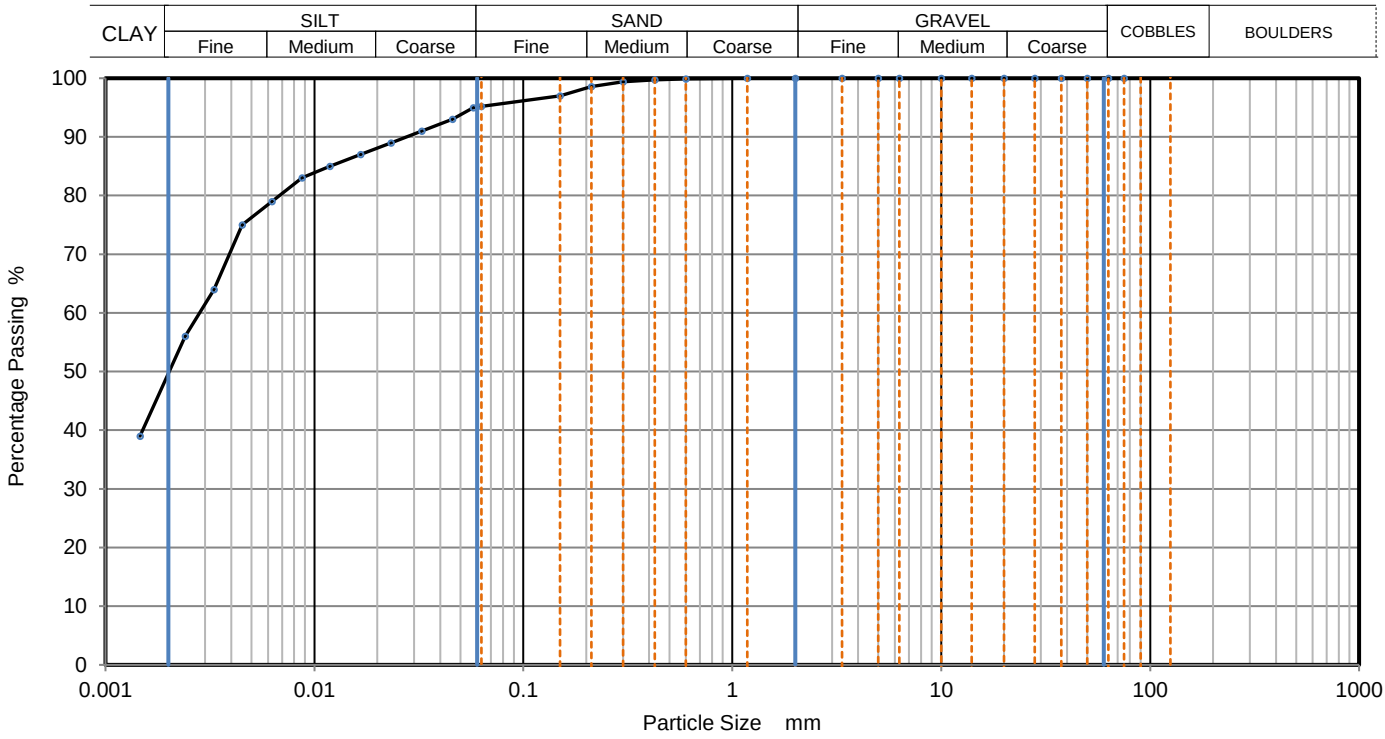
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP02
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Dark brown slightly sandy SILT.			Depth, m	3.30
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102913



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0575	95
		0.0458	93
75	100	0.0327	91
63	100	0.0233	89
50	100	0.0166	87
37.5	100	0.0119	85
28	100	0.0087	83
20	100	0.0063	79
14	100	0.0045	75
10	100	0.0033	64
6.3	100	0.0024	56
5	100	0.0015	39
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	100	2.65	Mg/m3
0.3	99		
0.212	99		
0.15	97		
0.063	95		

Dry Mass of sample, g	471

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	5
Silt	46
Clay	50

Grading Analysis		
D100	mm	
D60	mm	0.00282
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

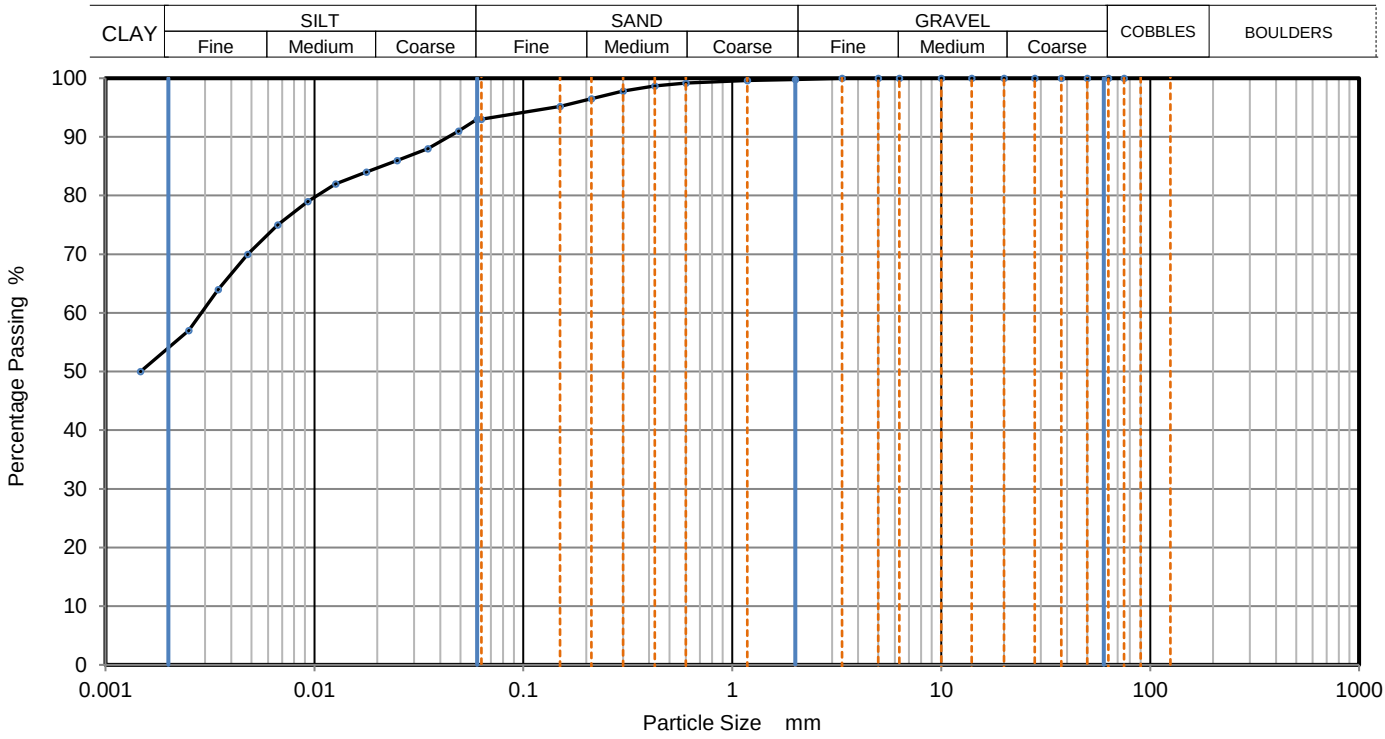
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP03
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Light brown slightly sandy SILT.			Depth, m	0.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102916



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0601	93
		0.0490	91
75	100	0.0349	88
63	100	0.0249	86
50	100	0.0177	84
37.5	100	0.0126	82
28	100	0.0093	79
20	100	0.0067	75
14	100	0.0048	70
10	100	0.0035	64
6.3	100	0.0025	57
5	100	0.0015	50
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density (assumed)	
0.425	99	2.65	Mg/m3
0.3	98		
0.212	97		
0.15	95		
0.063	93		

Dry Mass of sample, g	380

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	7
Silt	39
Clay	54

Grading Analysis		
D100	mm	
D60	mm	0.00292
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

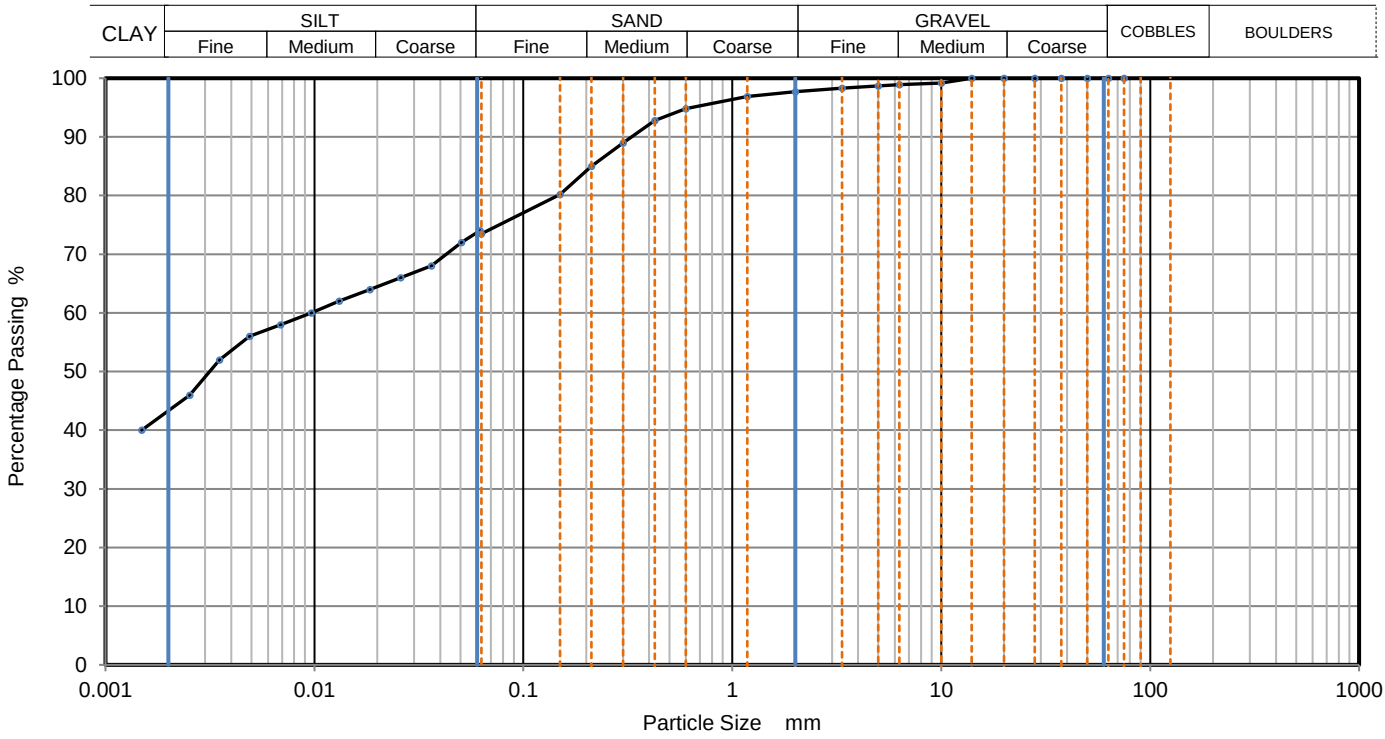
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP03
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Dark brown slightly gravelly slightly sandy SILT.			Depth, m	1.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102920



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0621	74
		0.0506	72
75	100	0.0363	68
63	100	0.0259	66
50	100	0.0184	64
37.5	100	0.0131	62
28	100	0.0097	60
20	100	0.0069	58
14	100	0.0049	56
10	99	0.0035	52
6.3	99	0.0025	46
5	99	0.0015	40
3.35	98		
2	98		
1.18	97		
0.6	95	Particle density (assumed)	
0.425	93	2.65 Mg/m3	
0.3	89		
0.212	85		
0.15	80		
0.063	74		

Dry Mass of sample, g	538

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	24
Silt	31
Clay	43

Grading Analysis		
D100	mm	
D60	mm	0.0103
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

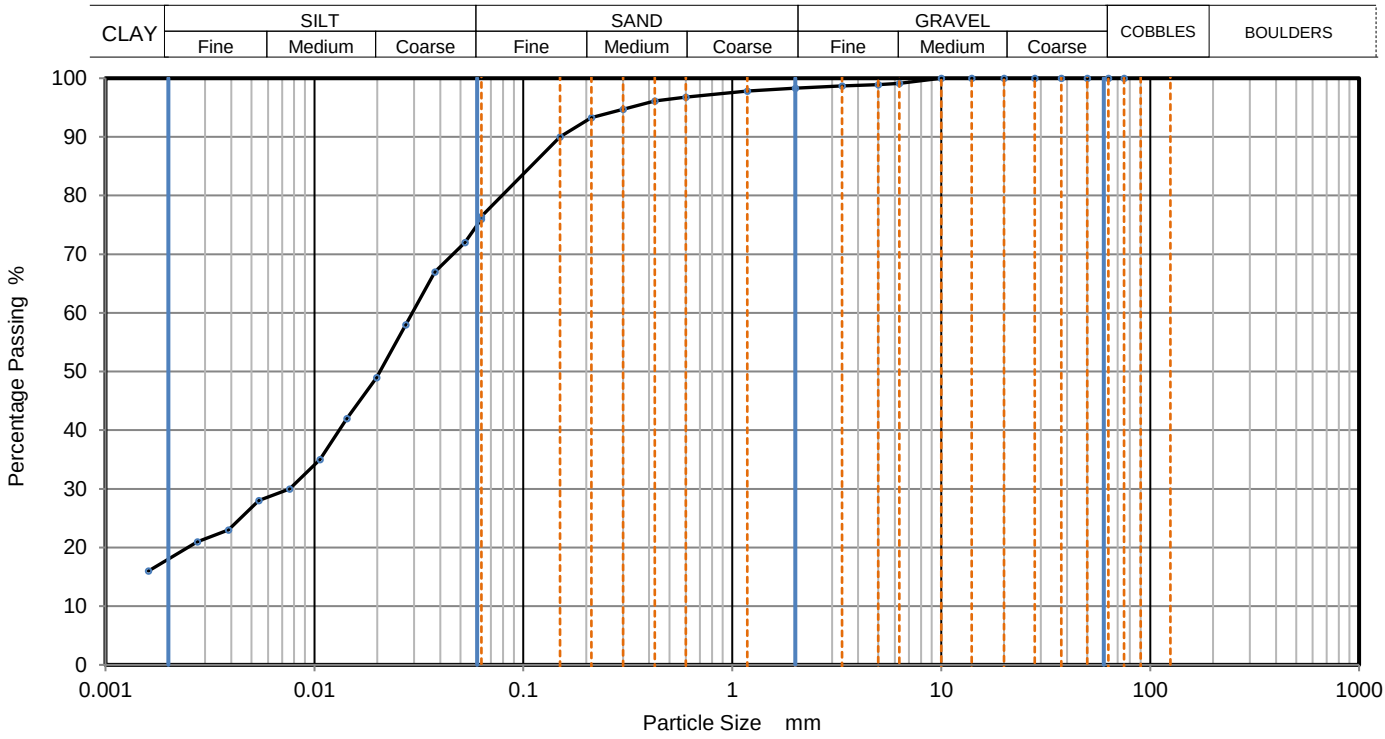
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP03
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth, m	2.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102921



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	76
		0.0525	72
75	100	0.0377	67
63	100	0.0274	58
50	100	0.0199	49
37.5	100	0.0143	42
28	100	0.0106	35
20	100	0.0076	30
14	100	0.0054	28
10	100	0.0039	23
6.3	99	0.0028	21
5	99	0.0016	16
3.35	99		
2	98		
1.18	98		
0.6	97	Particle density (assumed)	
0.425	96	2.65	Mg/m3
0.3	95		
0.212	93		
0.15	90		
0.063	76		

Dry Mass of sample, g	662

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	22
Silt	58
Clay	18

Grading Analysis		
D100	mm	
D60	mm	0.0295
D30	mm	0.0075
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

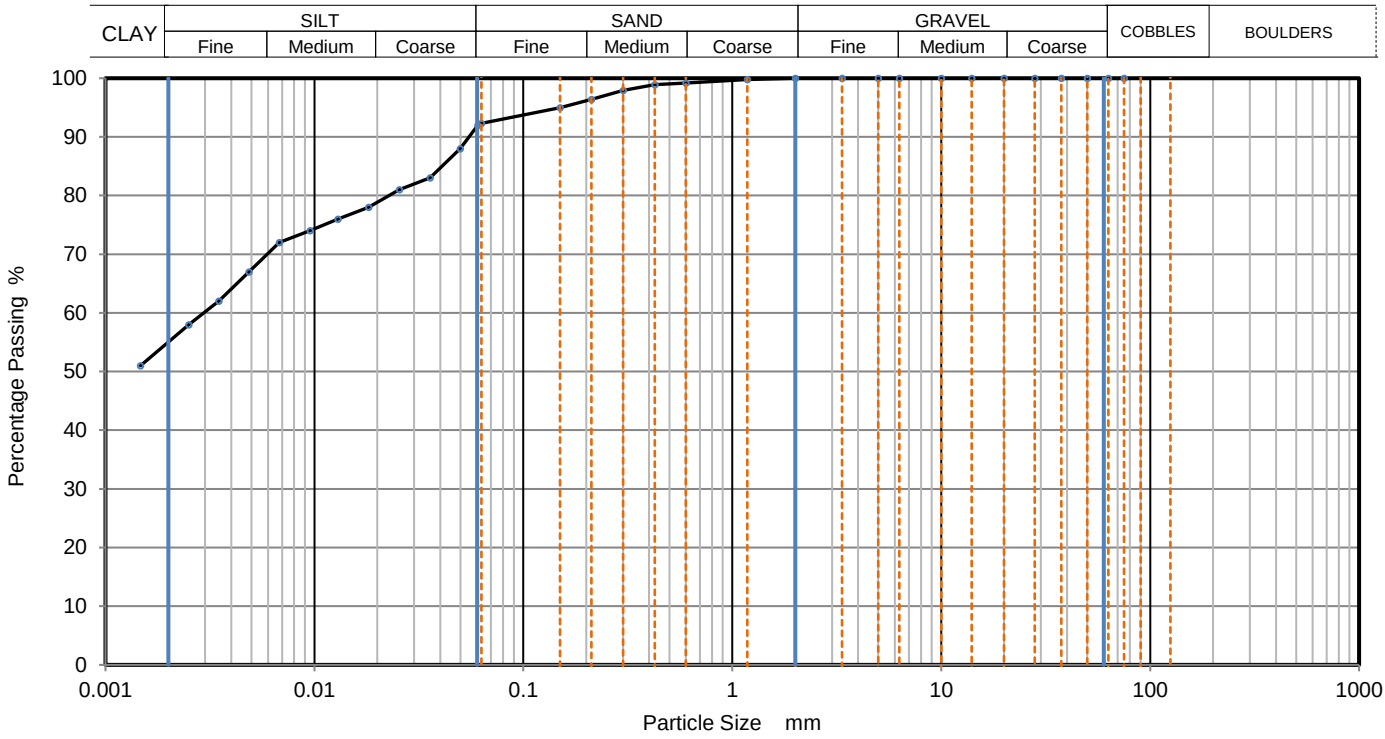
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly sandy silty CLAY.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102923



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0606	92
		0.0498	88
75	100	0.0358	83
63	100	0.0255	81
50	100	0.0182	78
37.5	100	0.0129	76
28	100	0.0095	74
20	100	0.0068	72
14	100	0.0049	67
10	100	0.0035	62
6.3	100	0.0025	58
5	100	0.0015	51
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	98		
0.212	96		
0.15	95		
0.063	92		

Dry Mass of sample, g	484

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	8
Silt	38
Clay	55

Grading Analysis		
D100	mm	
D60	mm	0.00295
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

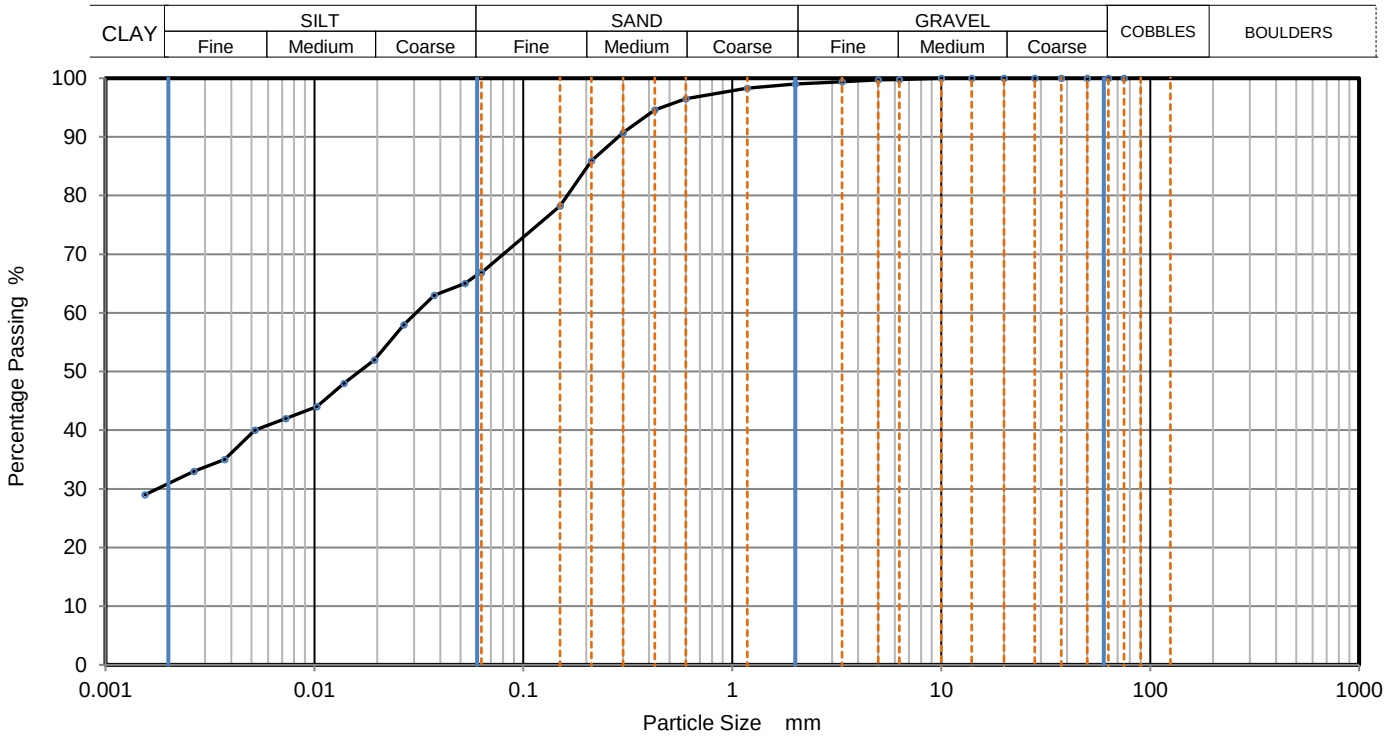
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth, m	1.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102929



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	67
		0.0525	65
75	100	0.0374	63
63	100	0.0268	58
50	100	0.0194	52
37.5	100	0.0139	48
28	100	0.0103	44
20	100	0.0073	42
14	100	0.0052	40
10	100	0.0037	35
6.3	100	0.0026	33
5	100	0.0015	29
3.35	99		
2	99		
1.18	98		
0.6	97	Particle density	(assumed)
0.425	95	2.65	Mg/m3
0.3	91		
0.212	86		
0.15	78		
0.063	67		

Dry Mass of sample, g	608

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	32
Silt	36
Clay	31

Grading Analysis		
D100	mm	
D60	mm	0.0303
D30	mm	0.00171
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

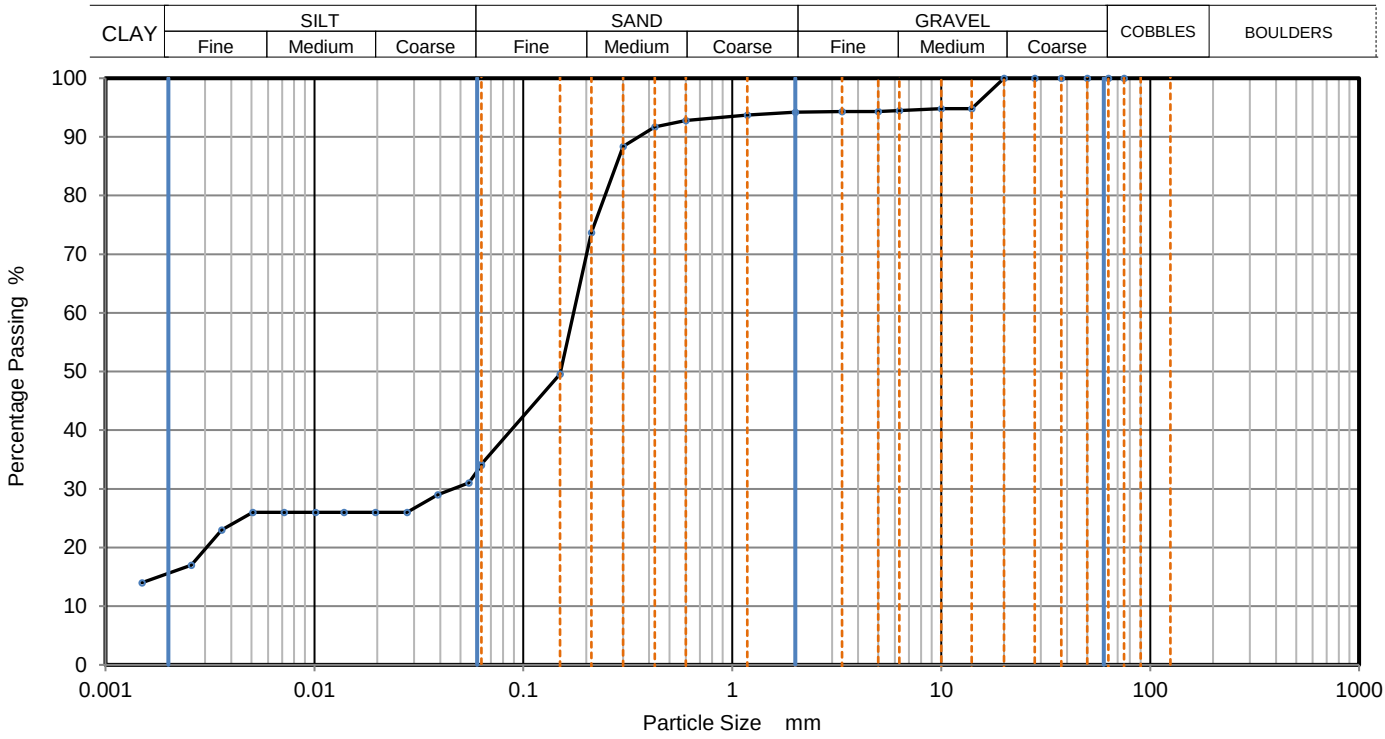
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown gravelly very silty fine SAND.			Depth, m	1.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102928



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	34
		0.0548	31
75	100	0.0390	29
63	100	0.0277	26
50	100	0.0196	26
37.5	100	0.0139	26
28	100	0.0101	26
20	100	0.0072	26
14	95	0.0051	26
10	95	0.0036	23
6.3	95	0.0026	17
5	94	0.0015	14
3.35	94		
2	94		
1.18	94		
0.6	93	Particle density (assumed)	
0.425	92	2.65	Mg/m3
0.3	88		
0.212	74		
0.15	50		
0.063	34		

Dry Mass of sample, g	462

Sample Proportions	% dry mass
Very coarse	0
Gravel	6
Sand	60
Silt	18
Clay	16

Grading Analysis		
D100	mm	
D60	mm	0.174
D30	mm	0.0467
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

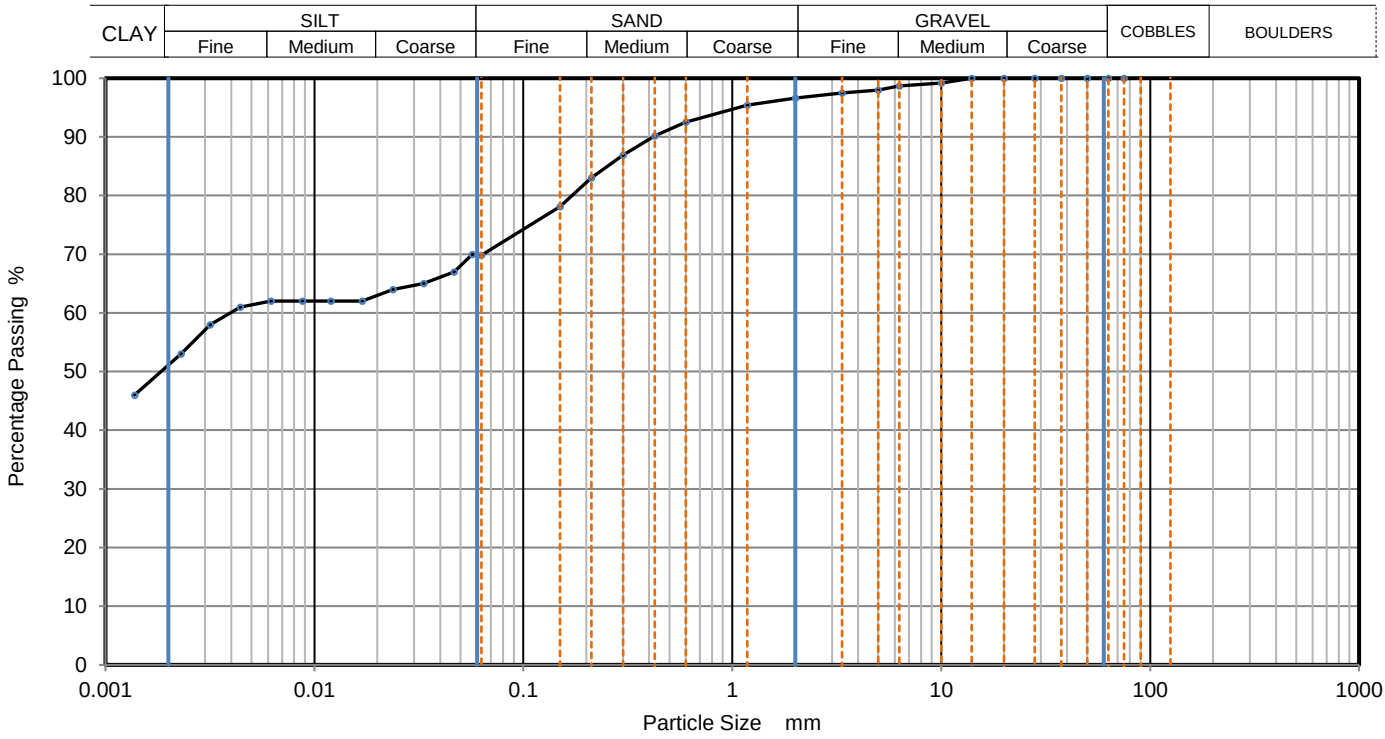
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	8
Soil Description	Mottled brown-grey slightly gravelly slightly sandy SILT.			Depth, m	3.70
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102931



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0570	70
		0.0467	67
75	100	0.0333	65
63	100	0.0238	64
50	100	0.0169	62
37.5	100	0.0120	62
28	100	0.0088	62
20	100	0.0062	62
14	100	0.0044	61
10	99	0.0032	58
6.3	99	0.0023	53
5	98	0.0014	46
3.35	98		
2	97		
1.18	95		
0.6	93	Particle density (assumed)	
0.425	90	2.65 Mg/m3	
0.3	87		
0.212	83		
0.15	78		
0.063	70		

Dry Mass of sample, g	741

Sample Proportions	% dry mass
Very coarse	0
Gravel	3
Sand	27
Silt	18
Clay	52

Grading Analysis		
D100	mm	
D60	mm	0.004
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

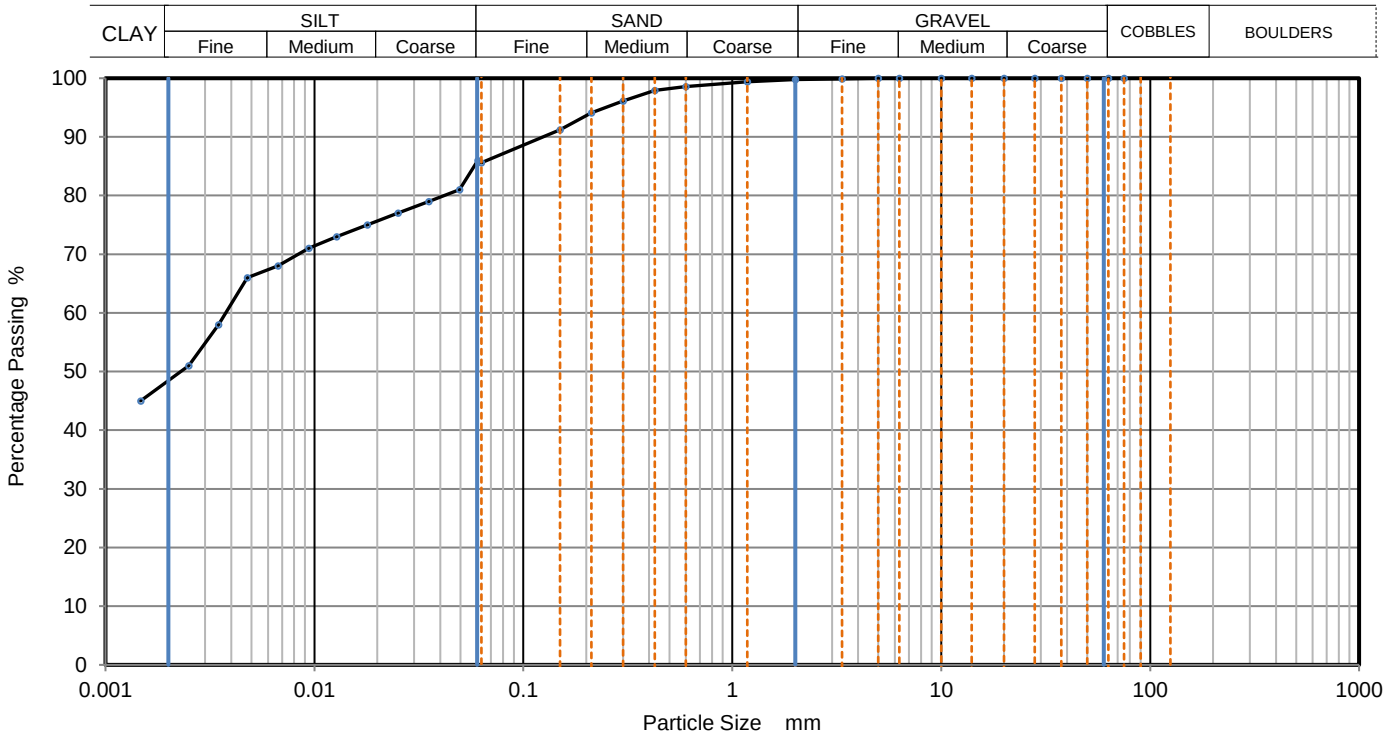
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Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP05
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Orange-brown slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102933



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0606	86
		0.0496	81
75	100	0.0353	79
63	100	0.0252	77
50	100	0.0179	75
37.5	100	0.0128	73
28	100	0.0094	71
20	100	0.0067	68
14	100	0.0048	66
10	100	0.0035	58
6.3	100	0.0025	51
5	100	0.0015	45
3.35	100		
2	100		
1.18	99		
0.6	99	Particle density	(assumed)
0.425	98	2.65	Mg/m3
0.3	96		
0.212	94		
0.15	91		
0.063	86		

Dry Mass of sample, g	433

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	14
Silt	37
Clay	49

Grading Analysis		
D100	mm	
D60	mm	0.00377
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

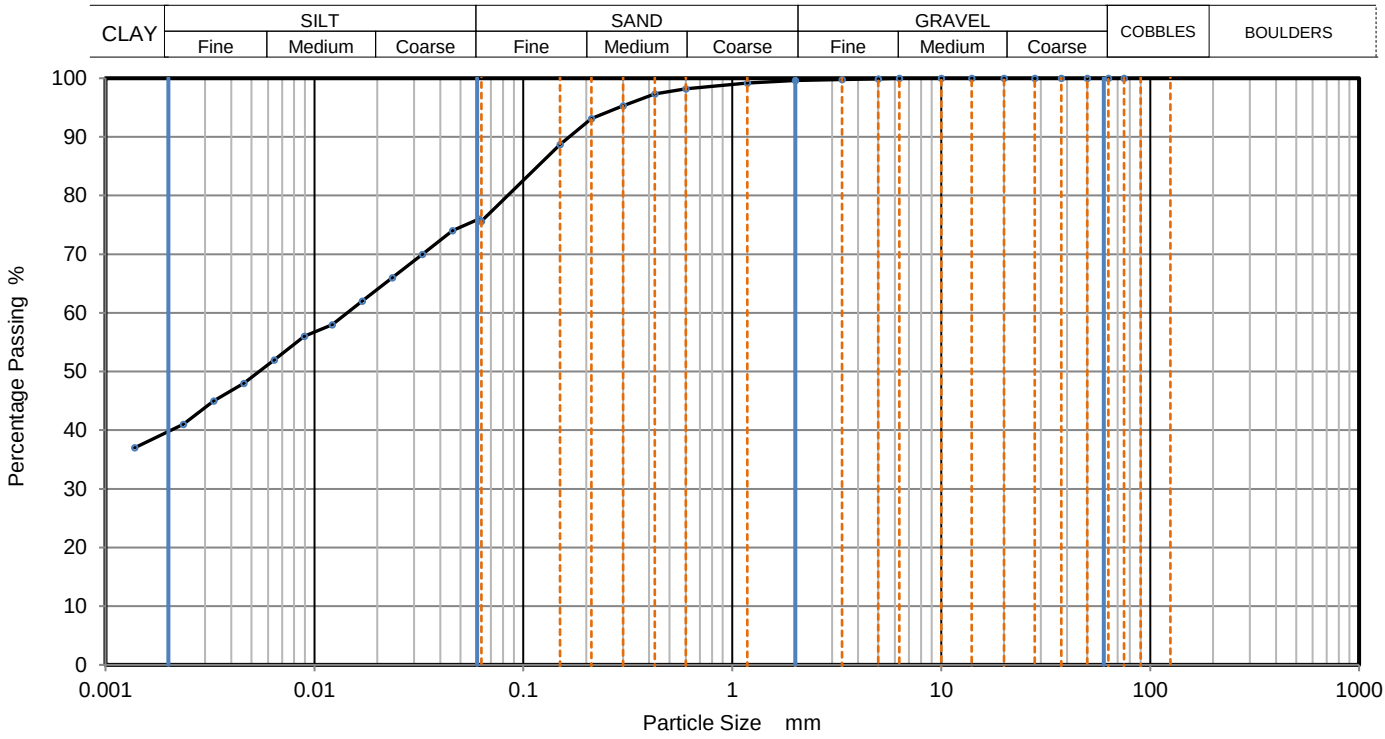
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP05
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly sandy SILT.			Depth, m	1.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102937



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0611	76
		0.0458	74
75	100	0.0329	70
63	100	0.0236	66
50	100	0.0170	62
37.5	100	0.0122	58
28	100	0.0089	56
20	100	0.0064	52
14	100	0.0046	48
10	100	0.0033	45
6.3	100	0.0024	41
5	100	0.0014	37
3.35	100		
2	100		
1.18	99		
0.6	98	Particle density (assumed)	
0.425	97	2.65 Mg/m3	
0.3	95		
0.212	93		
0.15	89		
0.063	76		

Dry Mass of sample, g	528

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	24
Silt	36
Clay	40

Grading Analysis		
D100	mm	
D60	mm	0.0142
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

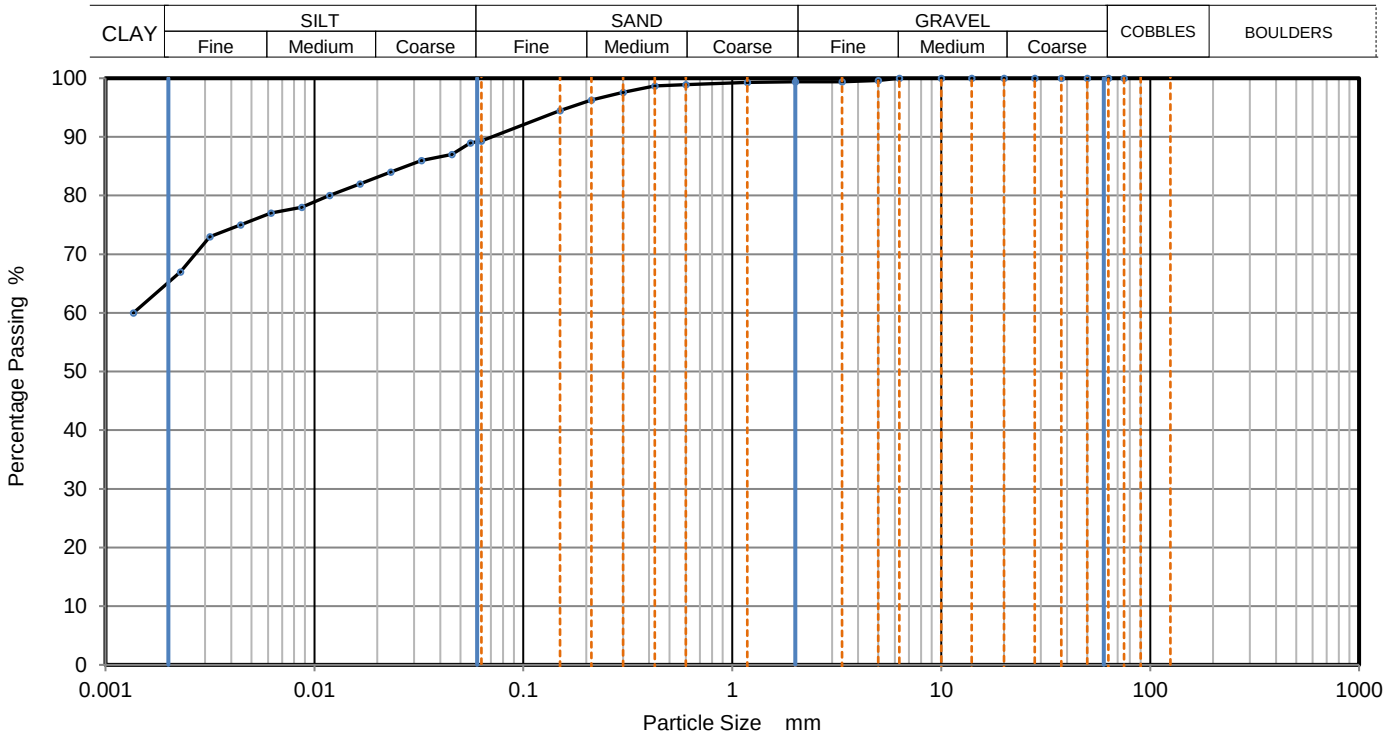
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP05
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown slightly sandy SILT.			Depth, m	2.60
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020102938



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0559	89
		0.0455	87
75	100	0.0325	86
63	100	0.0232	84
50	100	0.0165	82
37.5	100	0.0118	80
28	100	0.0087	78
20	100	0.0062	77
14	100	0.0044	75
10	100	0.0032	73
6.3	100	0.0023	67
5	100	0.0014	60
3.35	99		
2	99		
1.18	99		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	98		
0.212	96		
0.15	95		
0.063	89		

Dry Mass of sample, g	369

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	10
Silt	24
Clay	66

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

Remarks

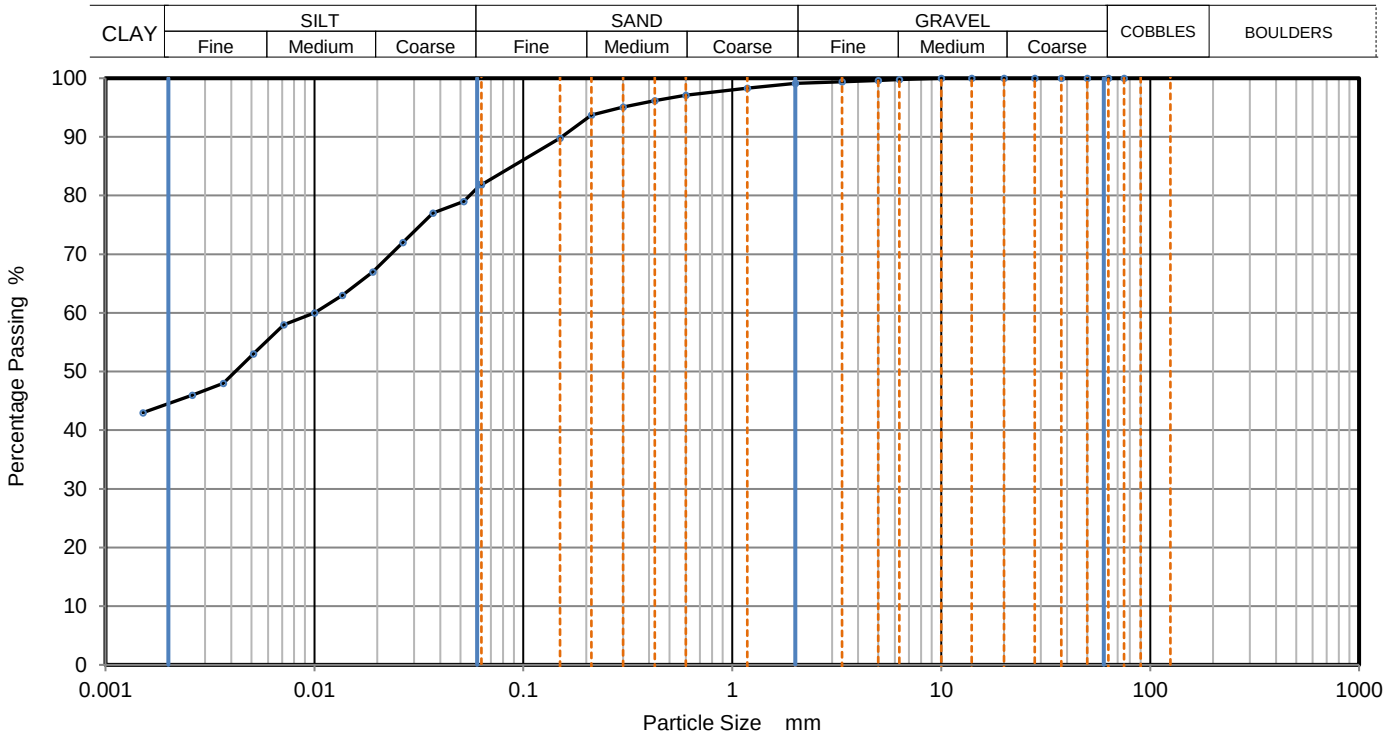
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP06
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Orange-brown slightly gravelly slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL1202010301



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	82
		0.0519	79
75	100	0.0370	77
63	100	0.0265	72
50	100	0.0190	67
37.5	100	0.0136	63
28	100	0.0100	60
20	100	0.0071	58
14	100	0.0051	53
10	100	0.0037	48
6.3	100	0.0026	46
5	100	0.0015	43
3.35	99		
2	99		
1.18	98		
0.6	97	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	95		
0.212	94		
0.15	90		
0.063	82		

Dry Mass of sample, g	395

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	17
Silt	37
Clay	45

Grading Analysis		
D100	mm	
D60	mm	0.00981
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

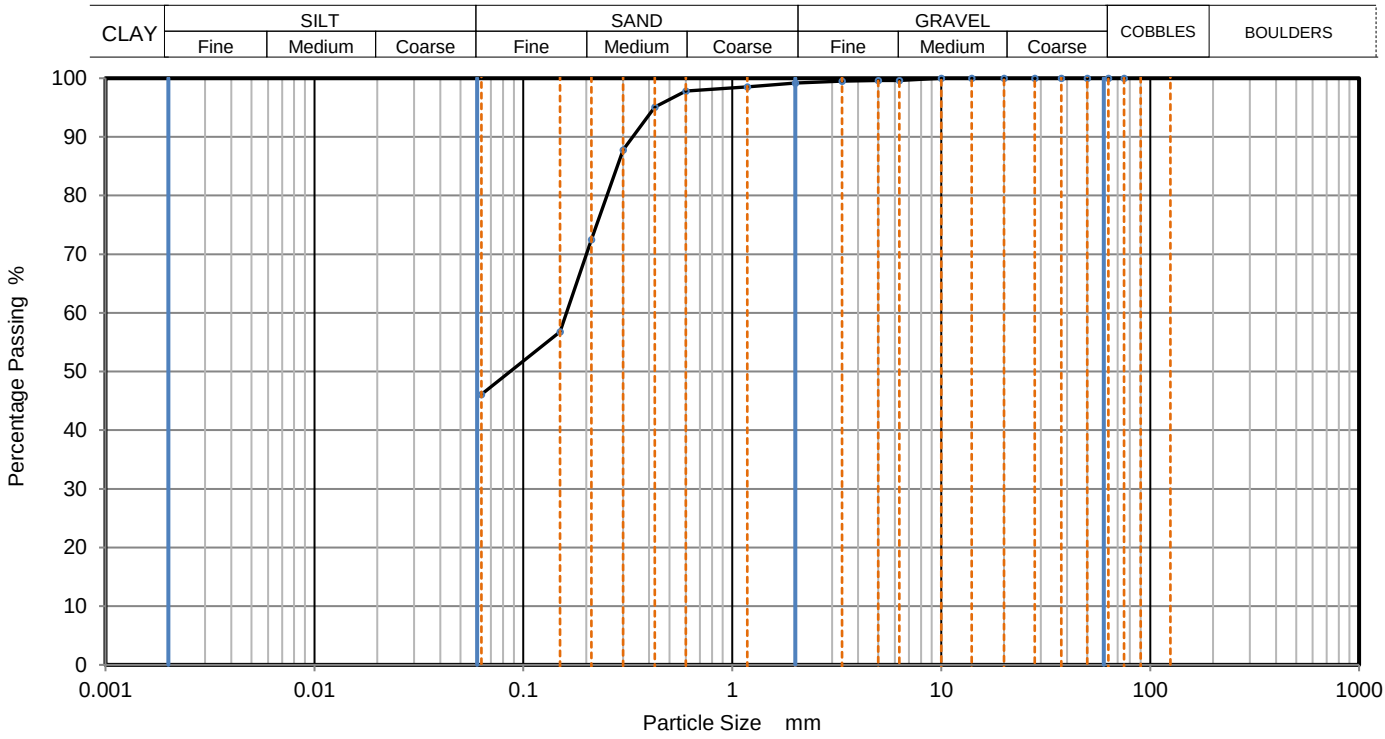
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP06
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Orange-brown sandy SILT. Sand is medium and fine.			Depth, m	2.10
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL1202010307



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98		
0.425	95		
0.3	88		
0.212	73		
0.15	57		
0.063	46		

Dry Mass of sample, g	603

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	53
Fines <0.063mm	46

Grading Analysis		
D100	mm	
D60	mm	0.161
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

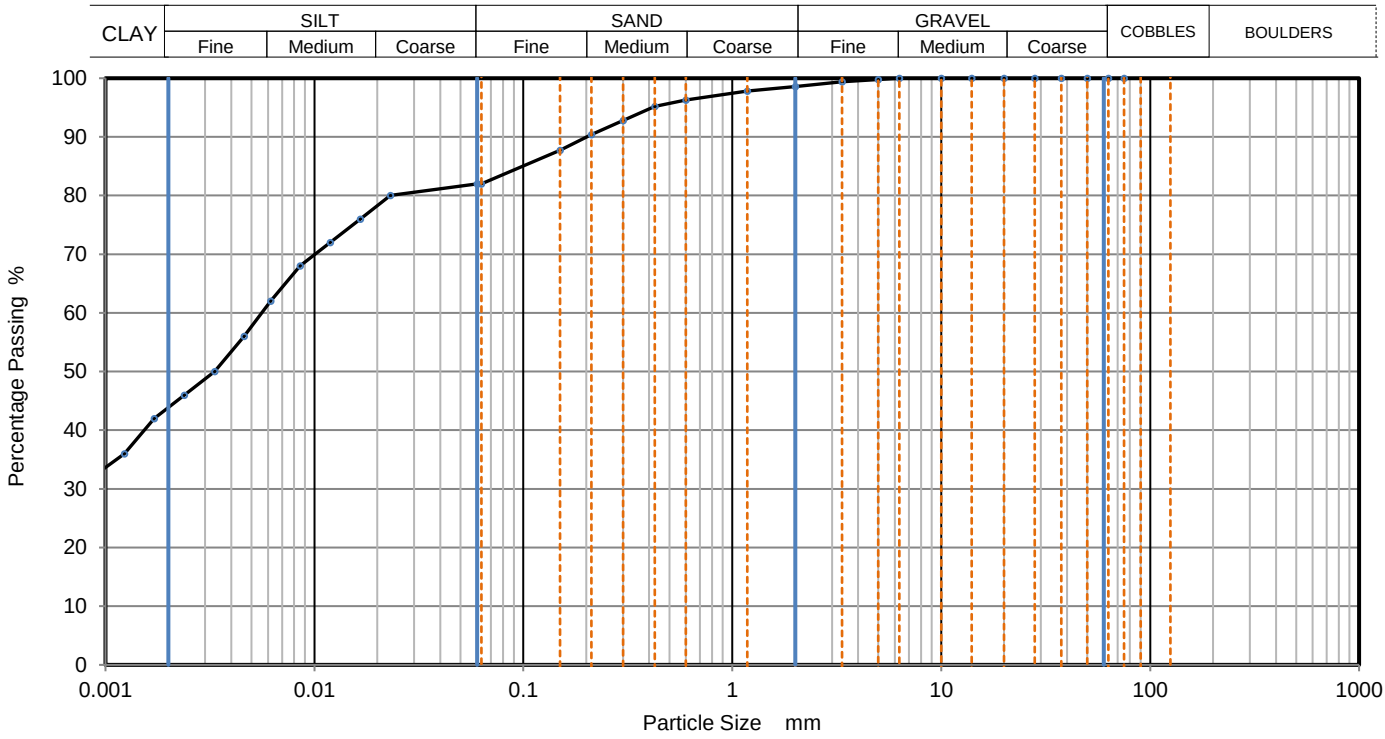
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP07
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly sandy SILT.			Depth, m	1.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103014



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0601	82
		0.0231	80
75	100	0.0166	76
63	100	0.0119	72
50	100	0.0085	68
37.5	100	0.0062	62
28	100	0.0046	56
20	100	0.0033	50
14	100	0.0024	46
10	100	0.0017	42
6.3	100	0.0012	36
5	100	0.0007	30
3.35	99		
2	99		
1.18	98		
0.6	96	Particle density (assumed)	
0.425	95	2.65 Mg/m3	
0.3	93		
0.212	90		
0.15	88		
0.063	82		

Dry Mass of sample, g	397

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	17
Silt	38
Clay	44

Grading Analysis		
D100	mm	
D60	mm	0.0056
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

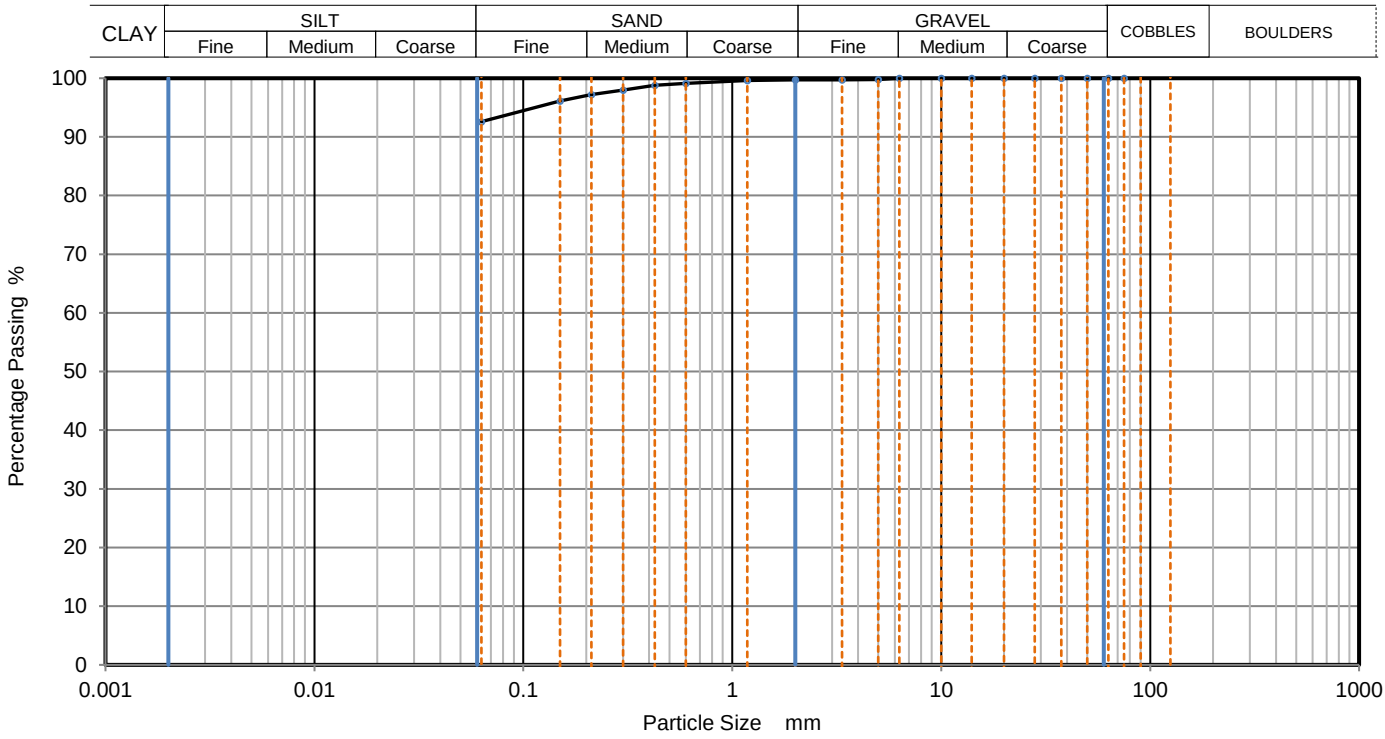
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP07
Site Name	Arklow Bank Windpark			Sample No.	8
Soil Description	Dark brown slightly sandy SILT.			Depth, m	4.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12020103017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	99		
0.3	98		
0.212	97		
0.15	96		
0.063	93		

Dry Mass of sample, g	494

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	7
Fines <0.063mm	93

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

Remarks

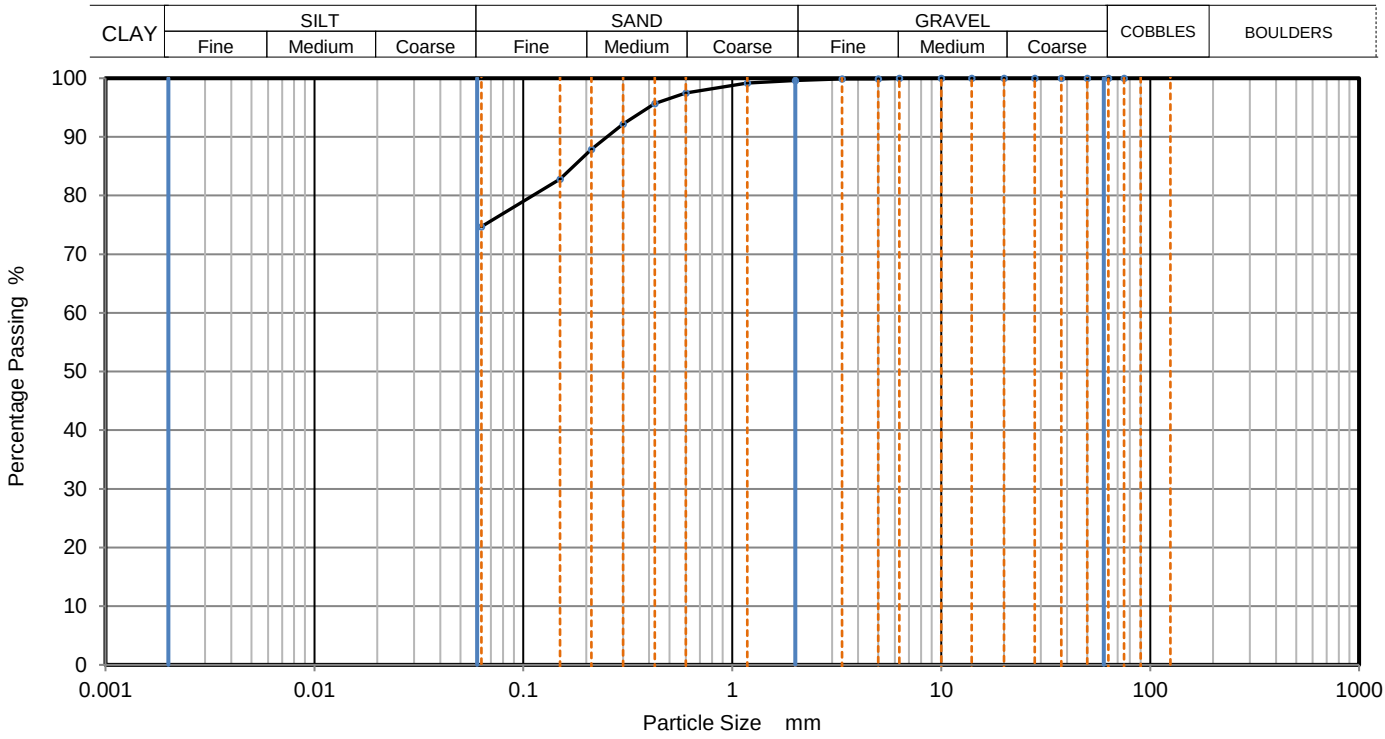
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP08
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12020103019



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	98		
0.425	96		
0.3	92		
0.212	88		
0.15	83		
0.063	75		

Dry Mass of sample, g	387

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	25
Fines <0.063mm	75

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

Remarks

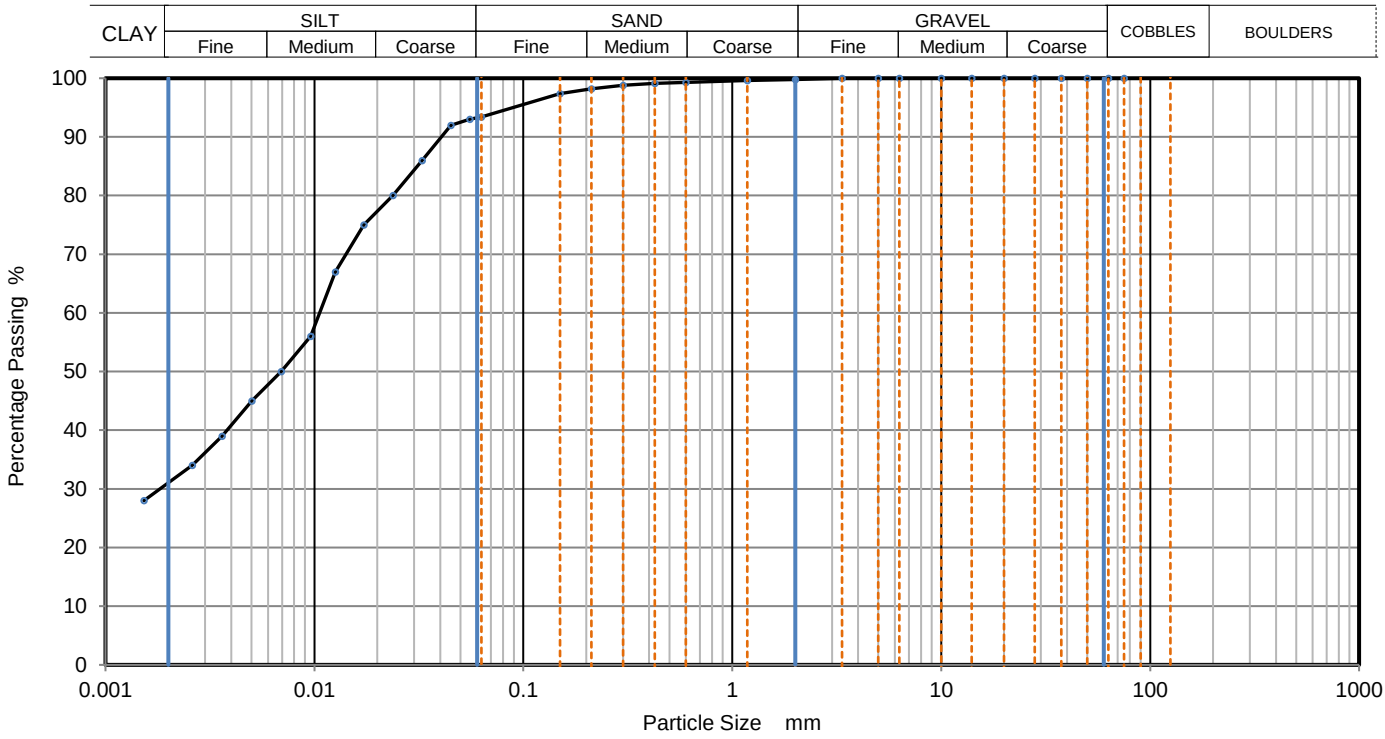
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP08
Site Name	Arklow Bank Windpark			Sample No.	8
Soil Description	Dark brown slightly sandy SILT.			Depth, m	4.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103025



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0553	93
		0.0450	92
75	100	0.0327	86
63	100	0.0238	80
50	100	0.0172	75
37.5	100	0.0126	67
28	100	0.0096	56
20	100	0.0069	50
14	100	0.0050	45
10	100	0.0036	39
6.3	100	0.0026	34
5	100	0.0015	28
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	99		
0.212	98		
0.15	97		
0.063	93		

Dry Mass of sample, g	444

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	6
Silt	63
Clay	31

Grading Analysis		
D100	mm	
D60	mm	0.0106
D30	mm	0.00184
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

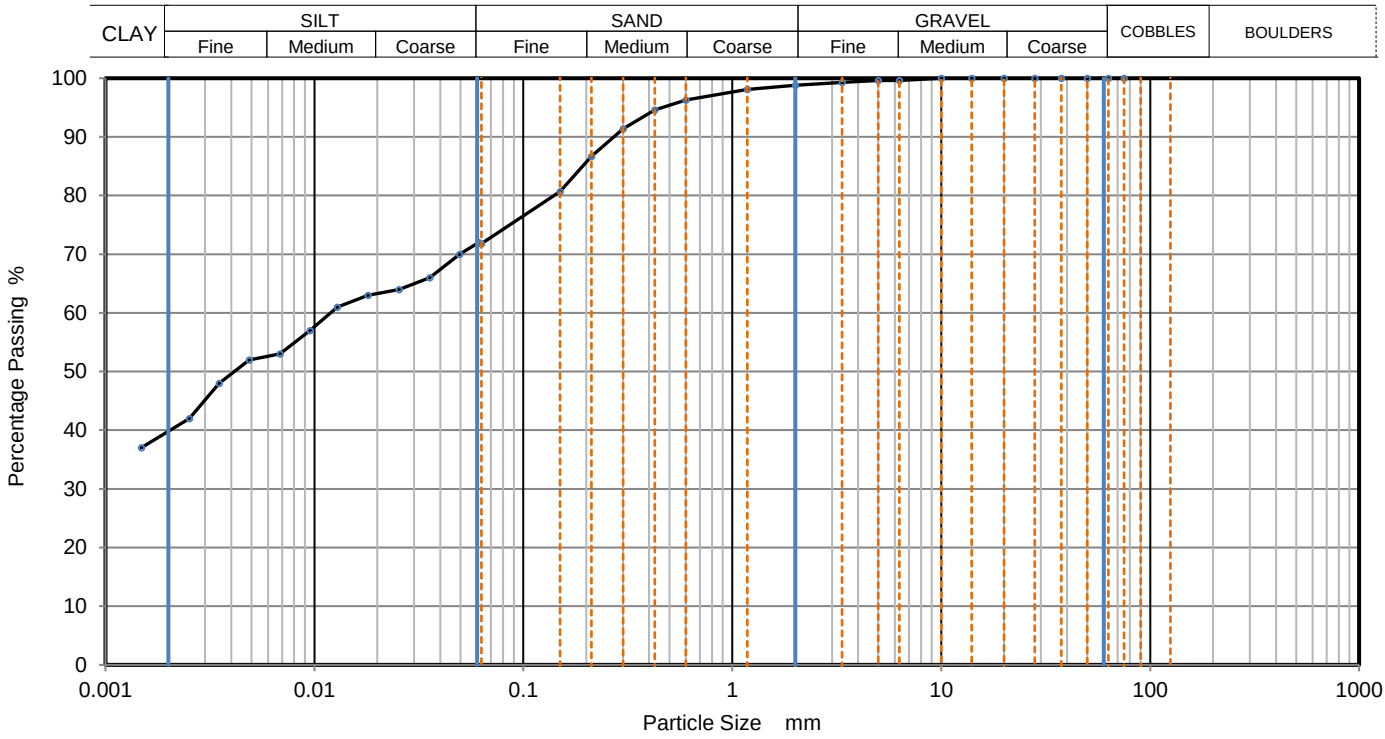
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP09
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly sandy SILT.			Depth, m	1.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103032



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0611	72
		0.0496	70
75	100	0.0356	66
63	100	0.0254	64
50	100	0.0181	63
37.5	100	0.0129	61
28	100	0.0095	57
20	100	0.0068	53
14	100	0.0049	52
10	100	0.0035	48
6.3	100	0.0025	42
5	100	0.0015	37
3.35	99		
2	99		
1.18	98		
0.6	96	Particle density (assumed)	
0.425	95	2.65 Mg/m3	
0.3	91		
0.212	87		
0.15	81		
0.063	72		

Dry Mass of sample, g	492

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	27
Silt	32
Clay	40

Grading Analysis		
D100	mm	
D60	mm	0.0121
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

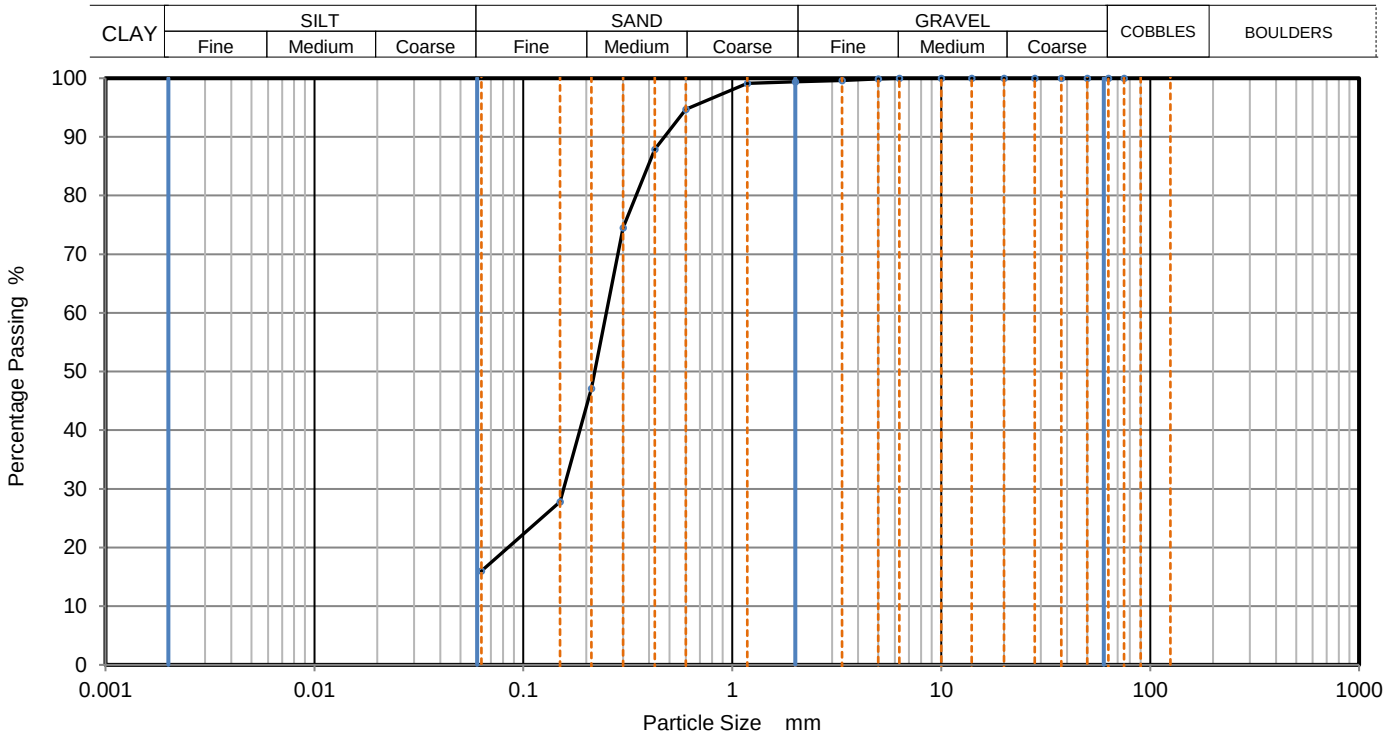
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP10
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown silty medium and fine SAND.			Depth, m	2.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12020103040



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	95		
0.425	88		
0.3	75		
0.212	47		
0.15	28		
0.063	16		

Dry Mass of sample, g	741

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	84
Fines <0.063mm	16

Grading Analysis		
D100	mm	
D60	mm	0.25
D30	mm	0.156
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

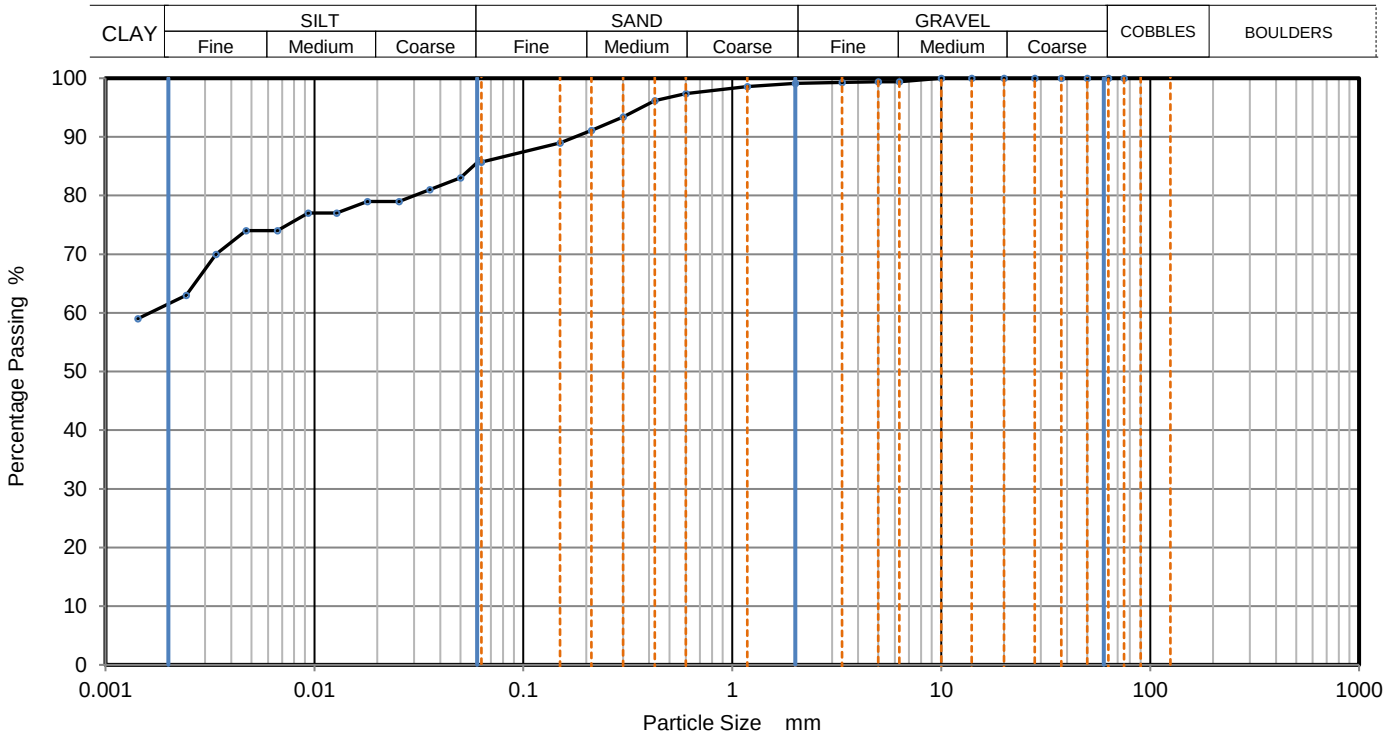
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP11
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly sandy SILT.			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103043



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0616	86
		0.0499	83
75	100	0.0356	81
63	100	0.0254	79
50	100	0.0179	79
37.5	100	0.0128	77
28	100	0.0093	77
20	100	0.0066	74
14	100	0.0047	74
10	100	0.0034	70
6.3	99	0.0024	63
5	99	0.0014	59
3.35	99		
2	99		
1.18	99		
0.6	97	Particle density (assumed)	
0.425	96	2.65 Mg/m3	
0.3	93		
0.212	91		
0.15	89		
0.063	86		

Dry Mass of sample, g	463

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	13
Silt	24
Clay	62

Grading Analysis		
D100	mm	
D60	mm	0.00168
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

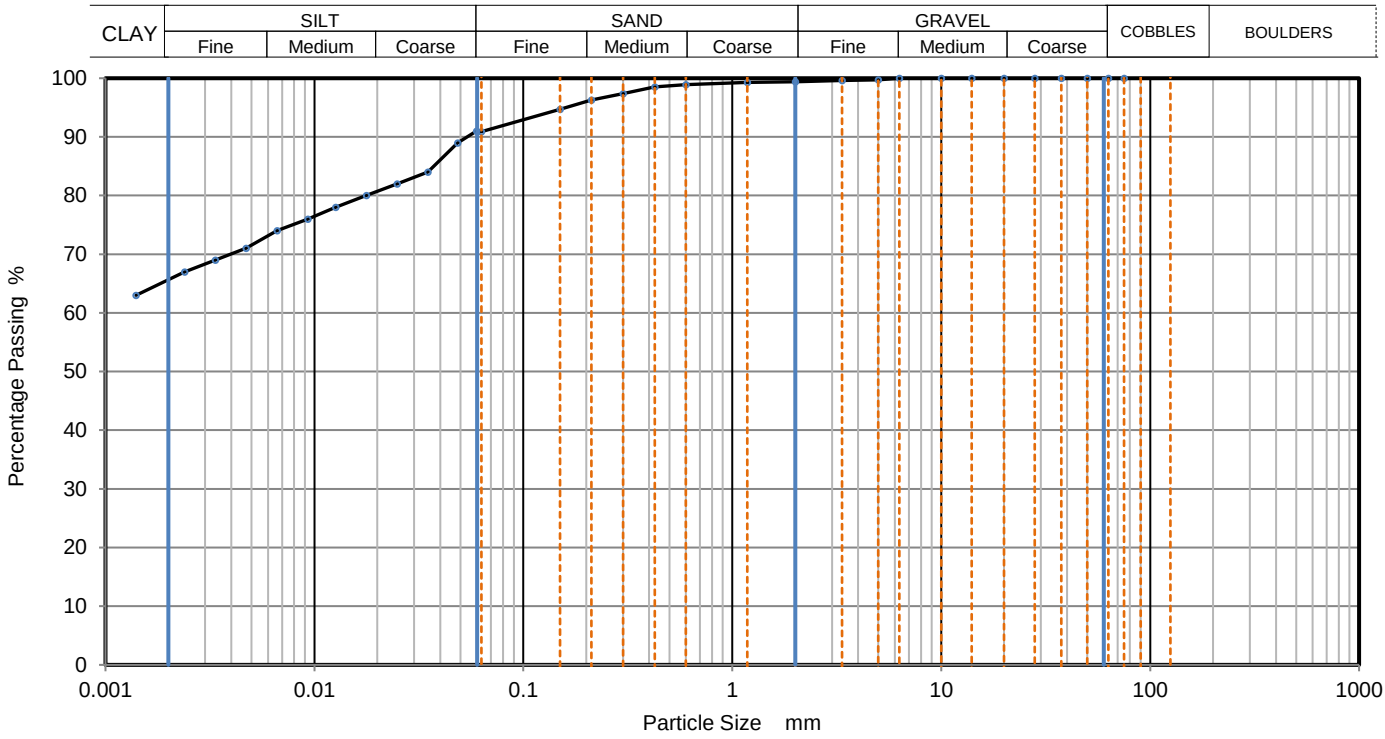
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP11
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Dark brown slightly sandy SILT.			Depth, m	2.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103049



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0596	91
		0.0485	89
75	100	0.0348	84
63	100	0.0248	82
50	100	0.0177	80
37.5	100	0.0126	78
28	100	0.0093	76
20	100	0.0066	74
14	100	0.0047	71
10	100	0.0034	69
6.3	100	0.0024	67
5	100	0.0014	63
3.35	100		
2	99		
1.18	99		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	97		
0.212	96		
0.15	95		
0.063	91		

Dry Mass of sample, g	605

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	9
Silt	25
Clay	66

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

Remarks

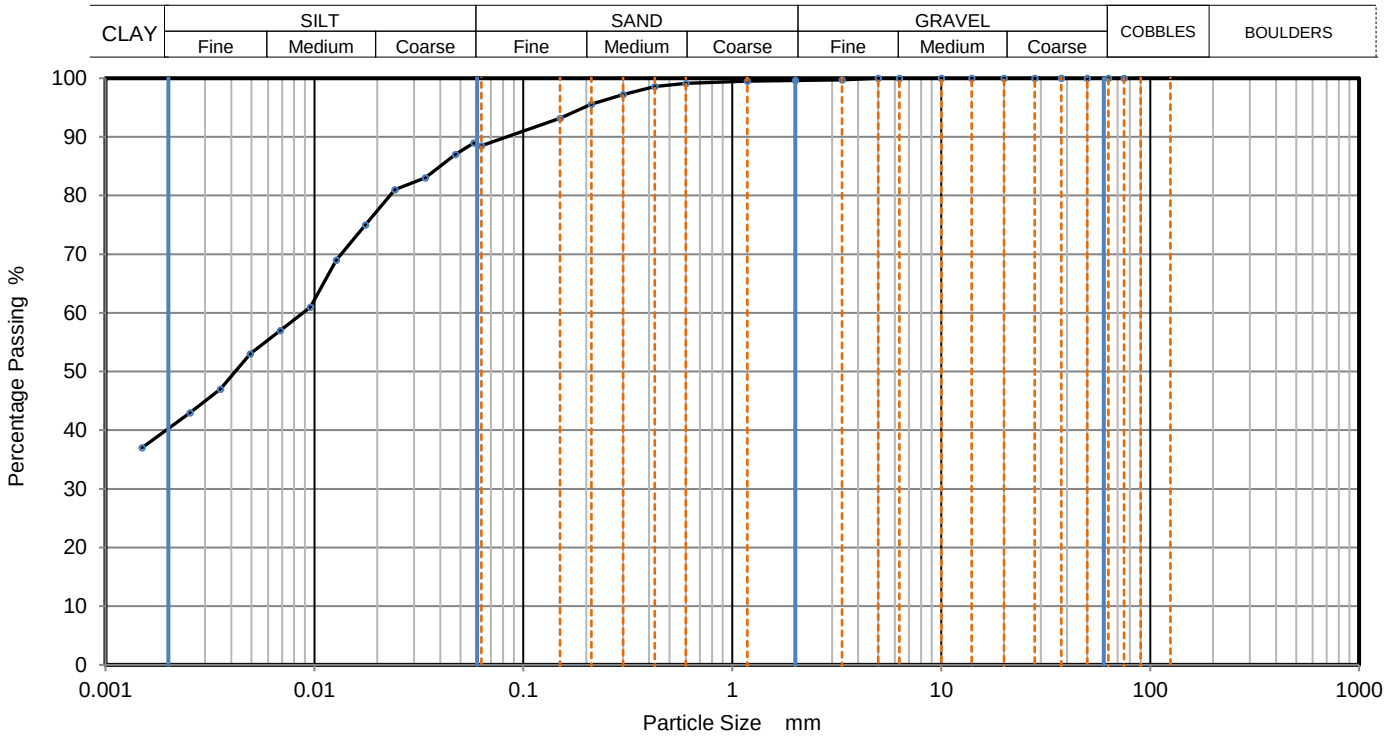
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	1
				QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP11
Site Name	Arklow Bank Windpark			Sample No.	7
Soil Description	Dark brown slightly sandy SILT.			Depth, m	3.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103050



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0580	89
		0.0472	87
75	100	0.0340	83
63	100	0.0242	81
50	100	0.0176	75
37.5	100	0.0127	69
28	100	0.0096	61
20	100	0.0069	57
14	100	0.0049	53
10	100	0.0035	47
6.3	100	0.0025	43
5	100	0.0015	37
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density	(assumed)
0.425	99	2.65	Mg/m3
0.3	97		
0.212	96		
0.15	93		
0.063	89		

Dry Mass of sample, g	545

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	11
Silt	48
Clay	41

Grading Analysis		
D100	mm	
D60	mm	0.00882
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

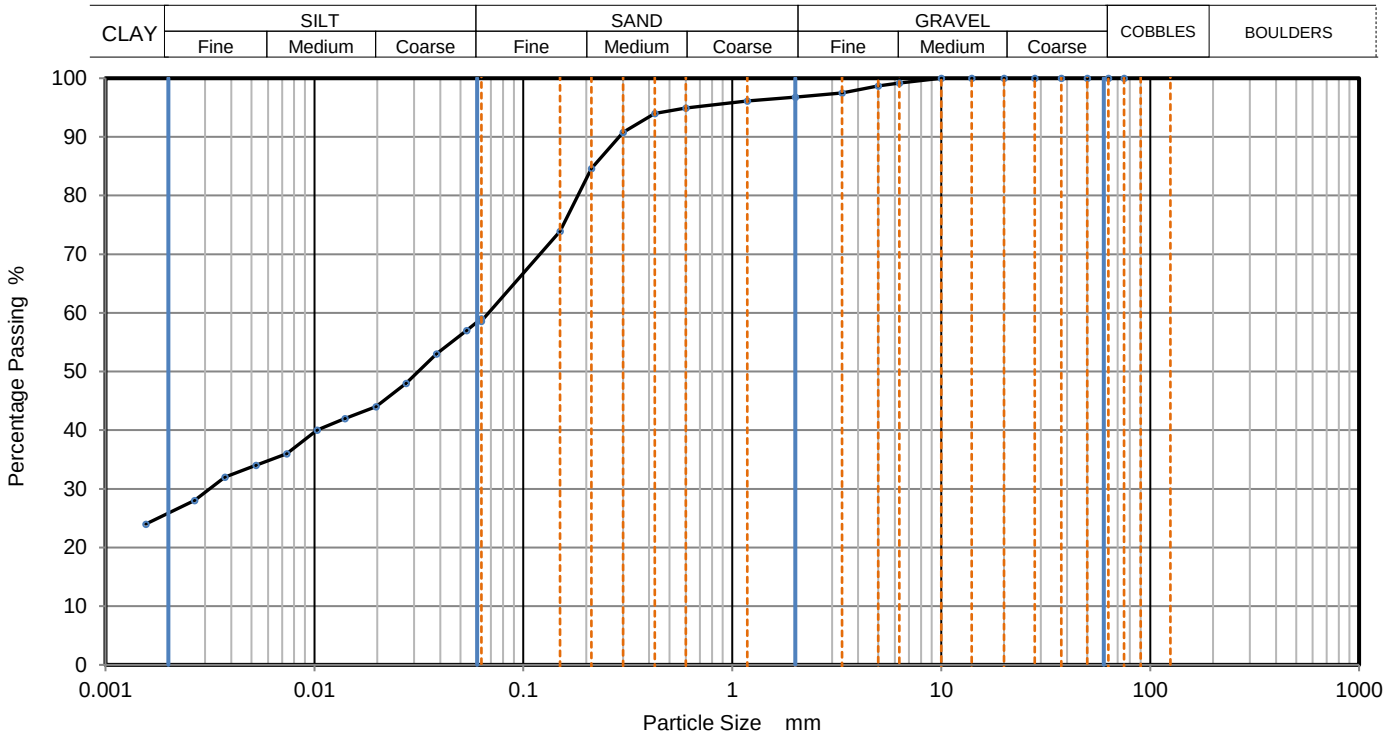
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2020WW102**
				Borehole/Pit No.	TP12
Site Name	Arklow Bank Windpark			Sample No.	6
Soil Description	Brown slightly gravelly sandy SILT. Sand is fine.			Depth, m	2.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	IDL12020103058



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	59
		0.0535	57
75	100	0.0384	53
63	100	0.0275	48
50	100	0.0197	44
37.5	100	0.0140	42
28	100	0.0103	40
20	100	0.0074	36
14	100	0.0052	34
10	100	0.0037	32
6.3	99	0.0027	28
5	99	0.0016	24
3.35	98		
2	97		
1.18	96		
0.6	95	Particle density (assumed)	
0.425	94	2.65	Mg/m3
0.3	91		
0.212	85		
0.15	74		
0.063	59		

Dry Mass of sample, g	549

Sample Proportions	% dry mass
Very coarse	0
Gravel	3
Sand	38
Silt	33
Clay	26

Grading Analysis		
D100	mm	
D60	mm	0.0681
D30	mm	0.00307
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
ED	DCD	Dympna Darcy B.Sc.	07/01/2021 14:17	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

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email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway

Attention: Dympna Darcy

CERTIFICATE OF ANALYSIS

Date of report Generation:	23 December 2020
Customer:	Irish Drilling Limited
Sample Delivery Group (SDG):	201216-121
Your Reference:	2020WW102
Location:	Arklow Bank
Report No:	581370

We received 12 samples on Wednesday December 16, 2020 and 12 of these samples were scheduled for analysis which was completed on Wednesday December 23, 2020. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
23446025	TP01	B4	1.40 - 1.50	15/10/2020
23446038	TP02	B2	0.50 - 0.60	15/10/2020
23446040	TP03	D3	1.10 - 1.20	15/10/2020
23446042	TP04	B7	2.40 - 2.50	15/10/2020
23446046	TP05	D3	1.10 - 1.20	15/10/2020
23446049	TP06	B5	1.40 - 1.50	14/10/2020
23446053	TP07	B6	2.40 - 2.50	13/10/2020
23446056	TP08	B2	0.40 - 0.50	13/10/2020
23446060	TP09	B5	1.50 - 1.60	13/10/2020
23446027	TP10	B2	0.40 - 0.50	14/10/2020
23446030	TP11	B2	0.40 - 0.50	14/10/2020
23446032	TP12	B7	3.50 - 3.60	14/10/2020

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

X **Test**

N **No Determination Possible**

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)	23446025	23446038	23446040	23446042	23446046	23446049	23446053	23446056	23446060	23446027	23446030	23446032
Customer Sample Reference	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10	TP11	TP12
AGS Reference	B4	B2	D3	B7	D3	B5	B6	B2	B5	B2	B2	B7
Depth (m)	1.40 - 1.50	0.50 - 0.60	1.10 - 1.20	2.40 - 2.50	1.10 - 1.20	1.40 - 1.50	2.40 - 2.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	0.40 - 0.50	3.50 - 3.60
Container	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)
Sample Type	S	S	S	S	S	S	S	S	S	S	S	S
Anions by Kone (soil) — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X
pH — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X
Sample description — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X
Total Sulphate — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X
Total Sulphur — All — NDPs: 0 Tests: 12	X	X	X	X	X	X	X	X	X	X	X	X

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
23446025	TP01	1.40 - 1.50	Light Brown	Sandy Loam	None	Stones
23446038	TP02	0.50 - 0.60	Light Brown	Silty Clay	Vegetation	N/A
23446040	TP03	1.10 - 1.20	Dark Brown	Sandy Silt Loam	None	Stones
23446042	TP04	2.40 - 2.50	Light Brown	Silty Clay Loam	None	Stones
23446046	TP05	1.10 - 1.20	Light Brown	Clay	Stones	None
23446049	TP06	1.40 - 1.50	Light Brown	Sandy Silt Loam	None	None
23446053	TP07	2.40 - 2.50	Light Brown	Clay	Stones	None
23446056	TP08	0.40 - 0.50	Light Brown	Clay	Vegetation	None
23446060	TP09	1.50 - 1.60	Dark Brown	Sandy Clay Loam	None	Stones
23446027	TP10	0.40 - 0.50	Dark Brown	Loamy Sand	None	Stones
23446030	TP11	0.40 - 0.50	Light Brown	Clay	Vegetation	None
23446032	TP12	3.50 - 3.60	Light Brown	Clay	None	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Validated

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP01	TP02	TP03	TP04	TP05	TP06
			Depth (m)	1.40 - 1.50	0.50 - 0.60	1.10 - 1.20	2.40 - 2.50	1.10 - 1.20	1.40 - 1.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	15/10/2020	15/10/2020	15/10/2020	15/10/2020	15/10/2020	14/10/2020
			Sample Time	.	.	.	.	.	.
			Date Received	16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020
			SDG Ref	201216-121	201216-121	201216-121	201216-121	201216-121	201216-121
			Lab Sample No.(s)	23446025	23446038	23446040	23446042	23446046	23446049
			AGS Reference	B4	B2	D3	B7	D3	B5
Moisture Content Ratio (% of as received sample)	%	PM024		18	22	16	14	17	20
Sulphur, Total	<0.02 %	TM132		<0.02 @	<0.02 @	<0.02 @	<0.02 @	<0.02 @	<0.02 @
Sulphate, Total potential	<0.06 %	TM132		0.06	0.06	0.06	0.06	0.06	0.06
pH	1 pH Units	TM133		8.59 @ M	7.24 @ M	8.73 @ M	8.82 @ M	7.9 @ M	8.2 @ M
Sulphate, Total	<48 mg/kg	TM221		82.8 M	<48 M	<48 M	<48 M	<48 M	<48 M
Water Soluble Sulphate as SO4 2:1 Extract	<0.004 g/l	TM243		0.0226 @ M	0.0279 @ M	0.0227 @ M	0.0099 @ M	0.0204 @ M	0.0184 @ M

Validated

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	TP07	TP08	TP09	TP10	TP11	TP12
Customer Sample Ref.								
Depth (m)			2.40 - 2.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50	0.40 - 0.50	3.50 - 3.60
Sample Type			Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Date Sampled			13/10/2020	13/10/2020	13/10/2020	14/10/2020	14/10/2020	14/10/2020
Sample Time			.	.	.	.	.	.
Date Received			16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020
SDG Ref			201216-121	201216-121	201216-121	201216-121	201216-121	201216-121
Lab Sample No.(s)			23446053	23446056	23446060	23446027	23446030	23446032
AGS Reference			B6	B2	B5	B2	B2	B7
Moisture Content Ratio (% of as received sample)	%	PM024	16	19	17	19	22	19
Sulphur, Total	<0.02 %	TM132	<0.02 @	<0.02 @	<0.02 @	<0.02 @	<0.02 @	<0.02 @
Sulphate, Total potential	<0.06 %	TM132	0.06	0.06	0.06	0.06	0.06	0.06
pH	1 pH Units	TM133	8.8 @ M	7.77 @ M	8.45 @ M	7.61 @ M	8.06 @ M	8.55 @ M
Sulphate, Total	<48 mg/kg	TM221	68.2 M	<48 M	<48 M	<48 M	<48 M	<48 M
Water Soluble Sulphate as SO4 2:1 Extract	<0.004 g/l	TM243	0.0212 @ M	0.0183 @ M	0.0111 @ M	0.0272 @ M	0.0193 @ M	0.009 @ M

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM132	In - house Method	ELTRA CS800 Operators Guide
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter
TM221	Inductively Coupled Plasma - Atomic Emission Spectroscopy. An Atlas of Spectral Information: Winge, Fassel, Peterson and Floyd	Determination of Acid extractable Sulphate in Soils by IRIS Emission Spectrometer
TM243		Mixed Anions In Soils By Kone

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Validated

CERTIFICATE OF ANALYSIS

SDG:	201216-121	**Client Reference:**	2020WW102	**Report Number:**	581370
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	23446025	23446038	23446040	23446042	23446046	23446049	23446053	23446056	23446060	23446027
Customer Sample Ref.	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10
AGS Ref.	B4	B2	D3	B7	D3	B5	B6	B2	B5	B2
Depth	1.40 - 1.50	0.50 - 0.60	1.10 - 1.20	2.40 - 2.50	1.10 - 1.20	1.40 - 1.50	2.40 - 2.50	0.40 - 0.50	1.50 - 1.60	0.40 - 0.50
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (soil)	23-Dec-2020	23-Dec-2020	22-Dec-2020	23-Dec-2020	23-Dec-2020	23-Dec-2020	22-Dec-2020	22-Dec-2020	23-Dec-2020	23-Dec-2020
pH	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020	18-Dec-2020
Sample description	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020	17-Dec-2020
Total Sulphate	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	22-Dec-2020	22-Dec-2020
Total Sulphur	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020	21-Dec-2020

Lab Sample No(s)	23446030	23446032
Customer Sample Ref.	TP11	TP12
AGS Ref.	B2	B7
Depth	0.40 - 0.50	3.50 - 3.60
Type	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (soil)	23-Dec-2020	23-Dec-2020
pH	18-Dec-2020	18-Dec-2020
Sample description	17-Dec-2020	17-Dec-2020
Total Sulphate	21-Dec-2020	21-Dec-2020
Total Sulphur	21-Dec-2020	21-Dec-2020

Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

18. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

19. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

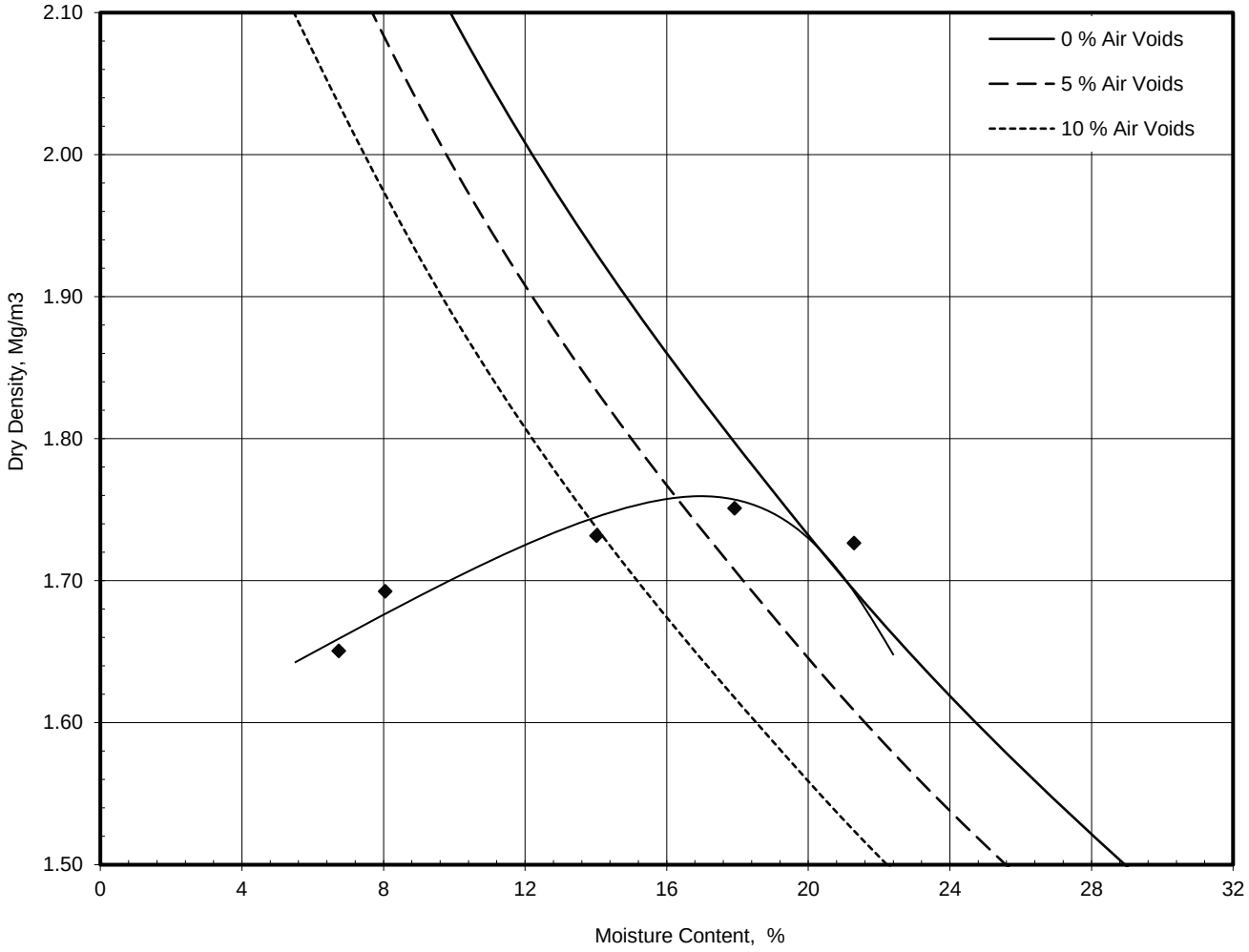
Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2017).*

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP04
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Brown gravelly very silty fine SAND.			Depth	1.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020102928
				Compaction Test Reference/No.	



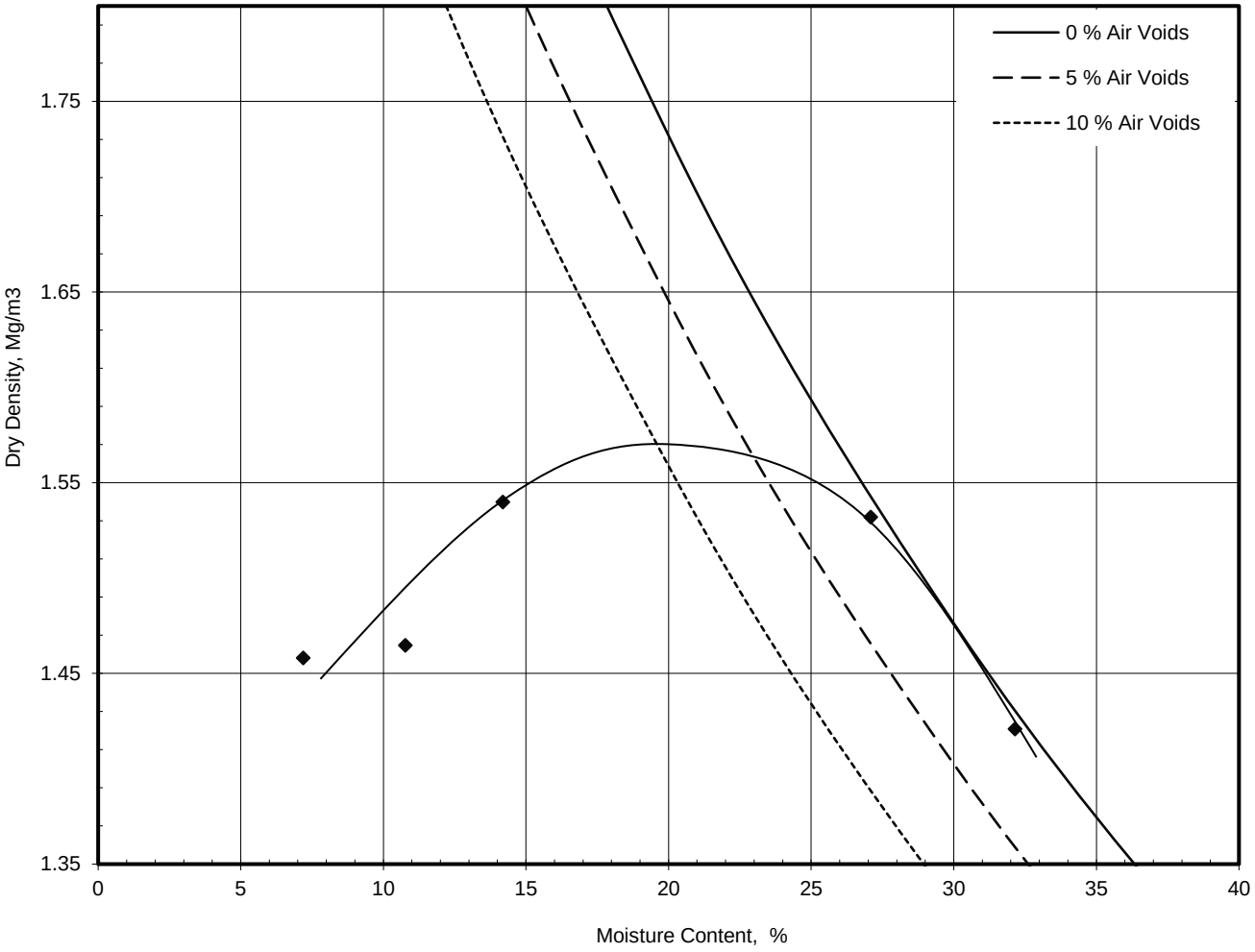
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density -	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.75**
Optimum Moisture Content	%	**18**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP06
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Orange-brown slightly gravelly slightly sandy SILT.			Depth	1.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL1202010306
				Compaction Test Reference/No.	



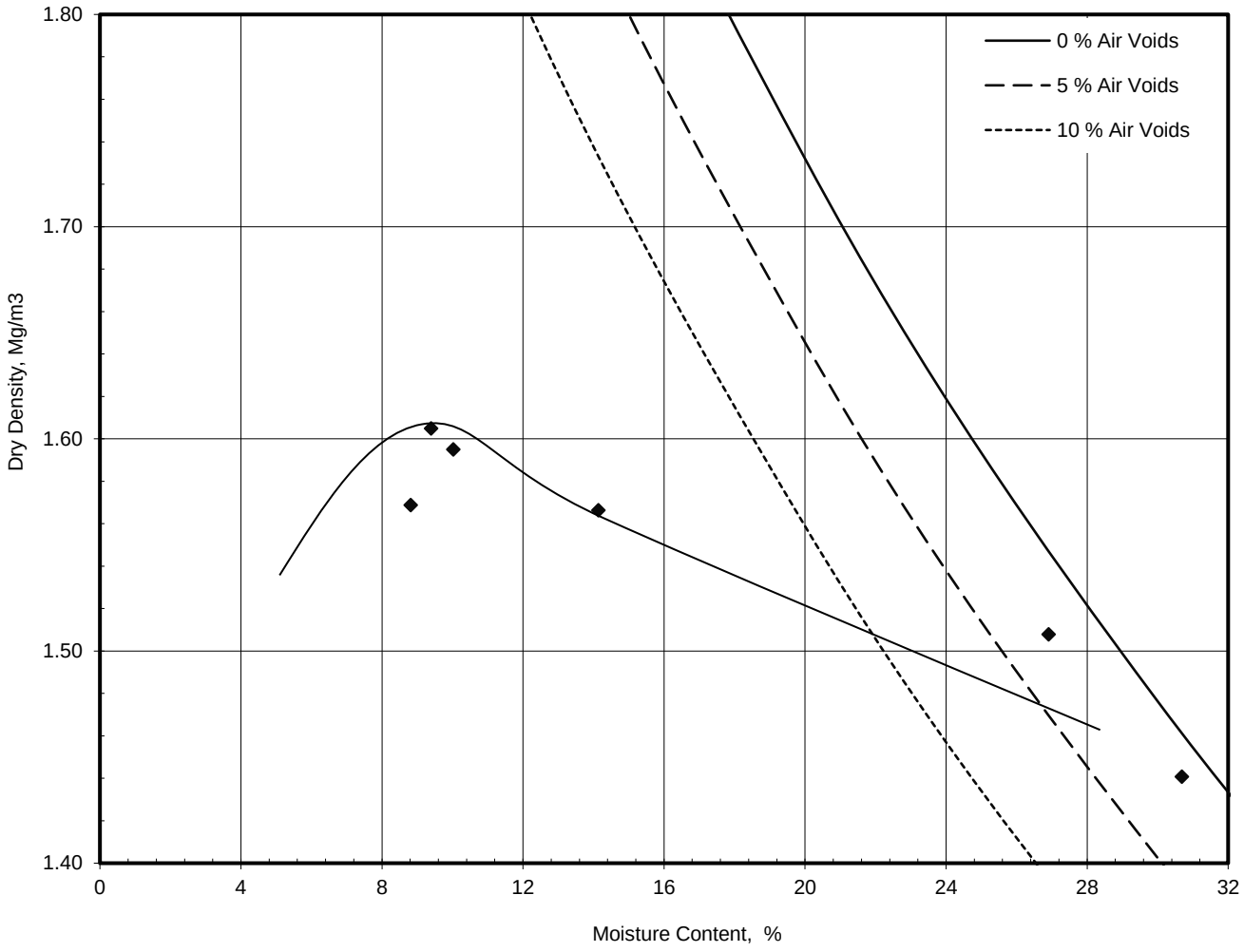
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.56**
Optimum Moisture Content	%	**20**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP07
Site Name	**Arklow Bank Windpark**			Sample No	2
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth	0.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103010
				Compaction Test Reference/No.	



Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

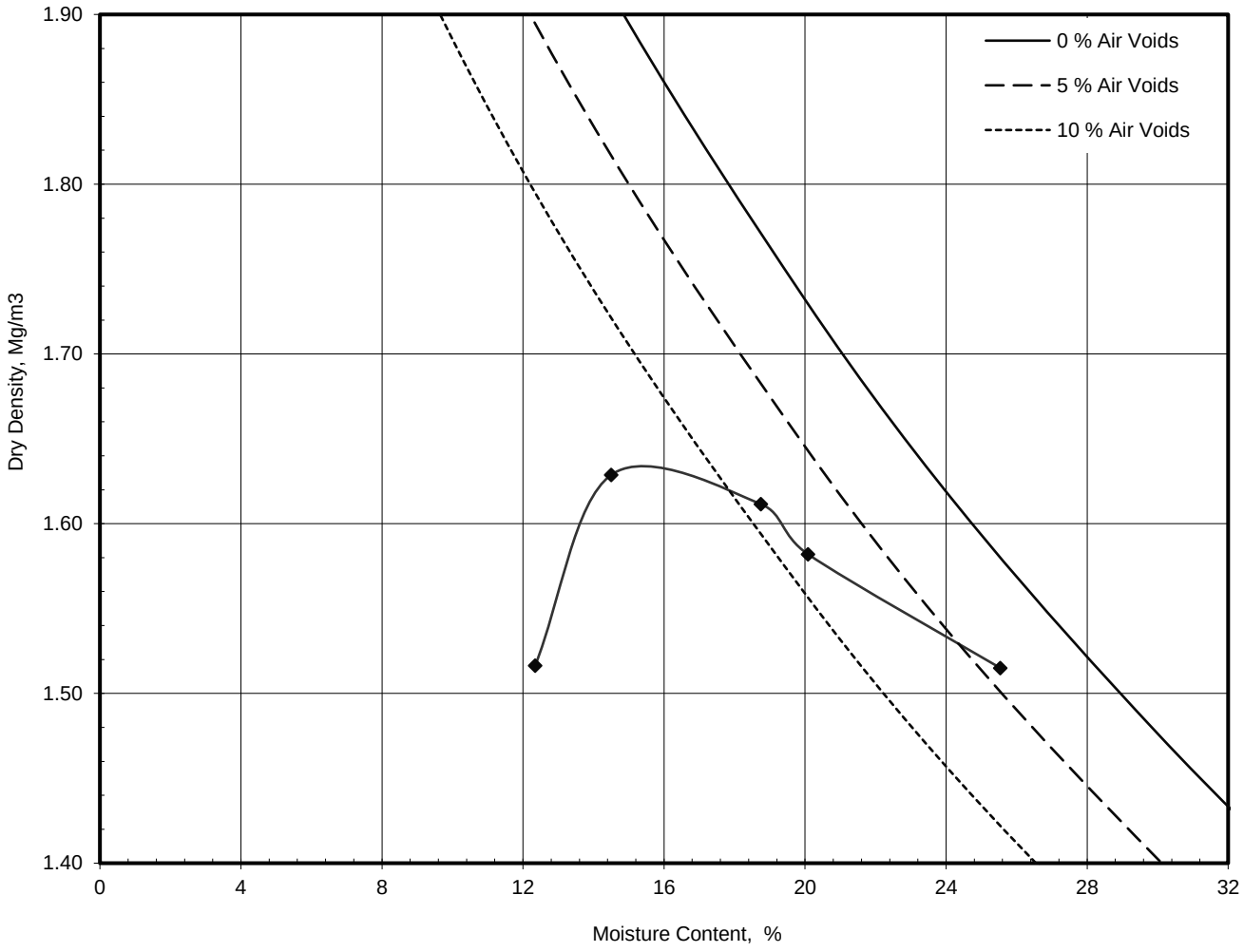
Maximum Dry Density	Mg/m³	**1.60**

Optimum Moisture Content	%	**9.1**

Operator	Checked	Approved	Remarks	**QC Form R4**
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP08
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Greyish-brown slightly gravelly sandy SILT.			Depth	1.50 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103022
				Compaction Test Reference/No.	



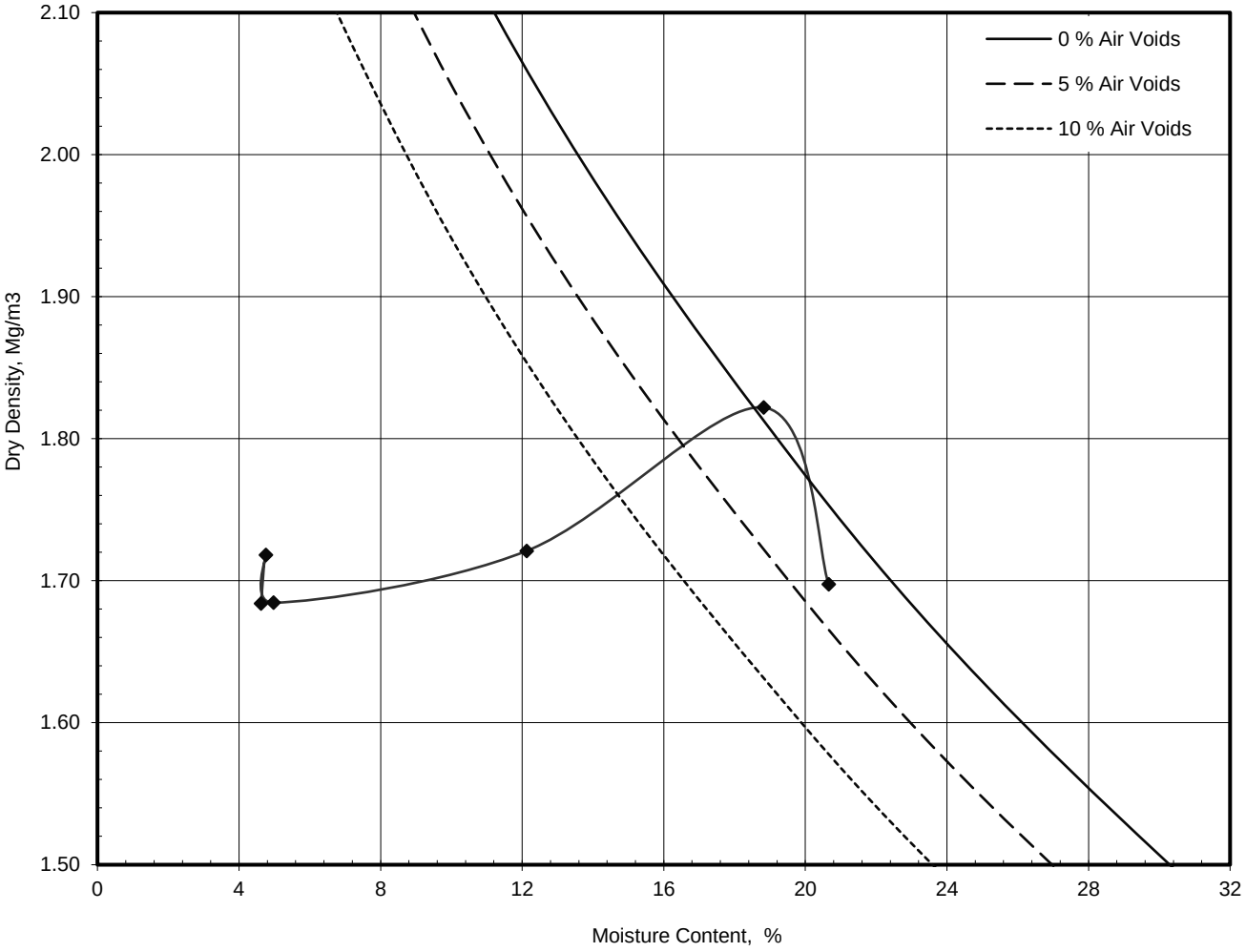
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.64**
Optimum Moisture Content	%	**16**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP09
Site Name	**Arklow Bank Windpark**			Sample No	2
Soil Description	Grey-brown slightly sandy SILT.			Depth	0.50 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103028
				Compaction Test Reference/No.	



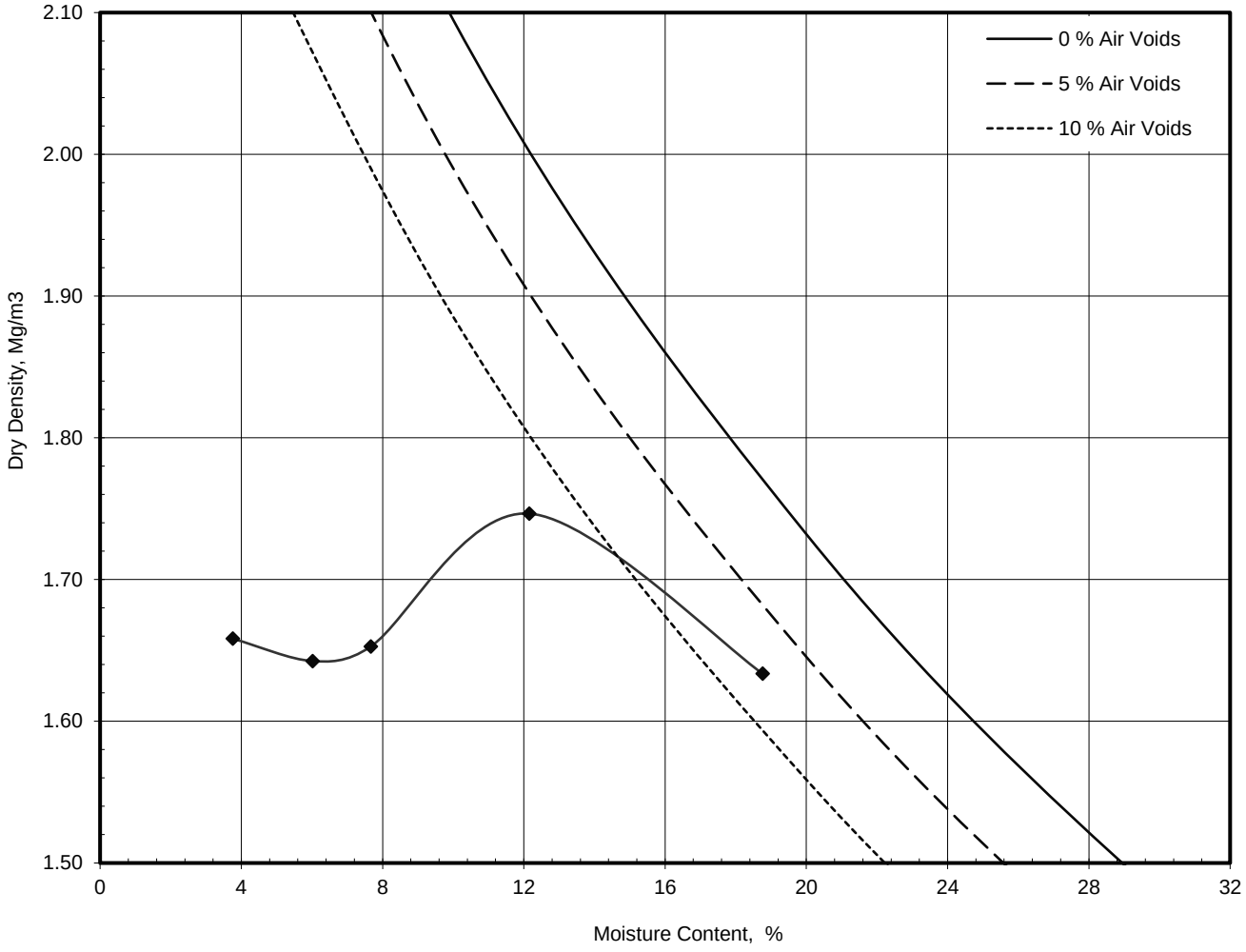
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.75

Maximum Dry Density	Mg/m³	**1.82**
Optimum Moisture Content	%	**19**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP10
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Brown slightly sandy SILT.			Depth	1.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103039
				Compaction Test Reference/No.	



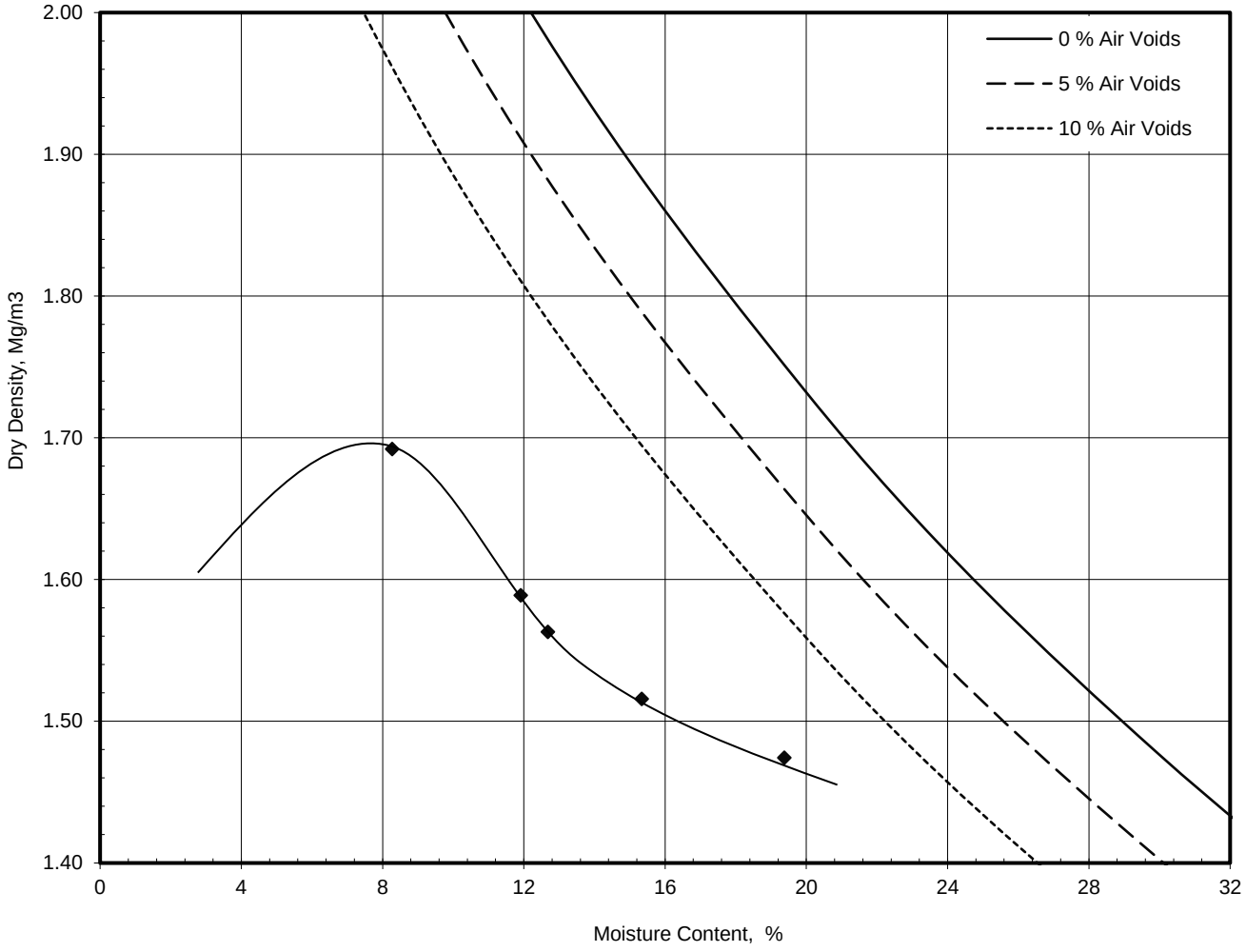
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.75**
Optimum Moisture Content	%	**12**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP11
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth	1.40 m
Specimen Ref.		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103048
				Compaction Test Reference/No.	



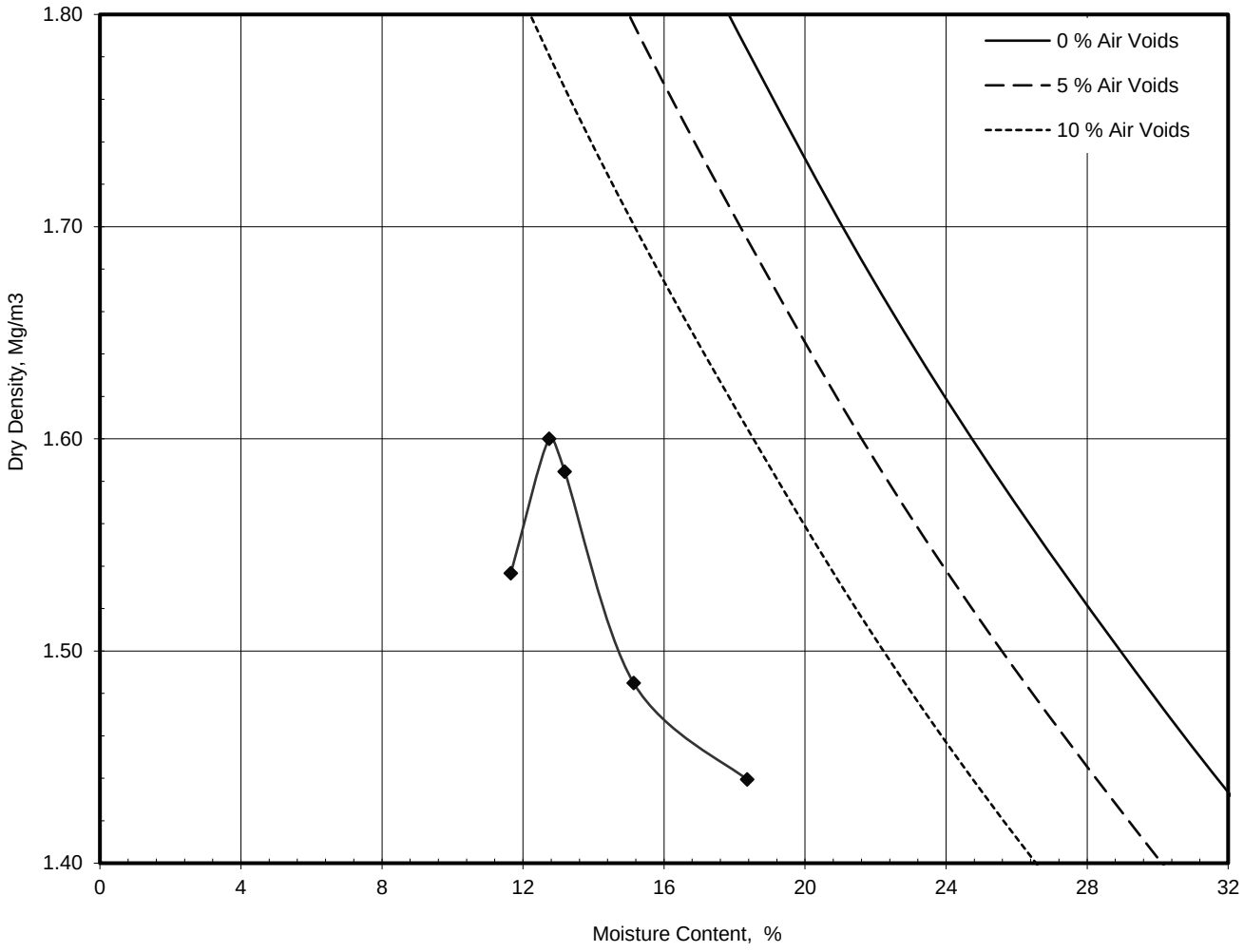
Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.69**
Optimum Moisture Content	%	**8.7**

Operator	Checked	Approved	Remarks	QC Form R4
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Dry Density / Moisture Content Relationship Light Compaction			Job Ref	2020WW102
				Borehole / Pit No	TP12
Site Name	**Arklow Bank Windpark**			Sample No	5
Soil Description	Brown slightly gravelly sandy SILT. Sand is fine.			Depth	1.40 m
Specimen Ref.	1	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer			Keylab ID	IDL12020103057
				Compaction Test Reference/No.	



Preparation		Material used was natural and air dried
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.60**

Optimum Moisture Content	%	**13**

Operator	Checked	Approved	Remarks	**QC Form R4**
RG	DCD	DCD		Sheet 1 of 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP04
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown gravelly very silty fine SAND.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020102928
Test Method	BS1377:Part4:1990:clause 5.5			Date started	25/11/2020

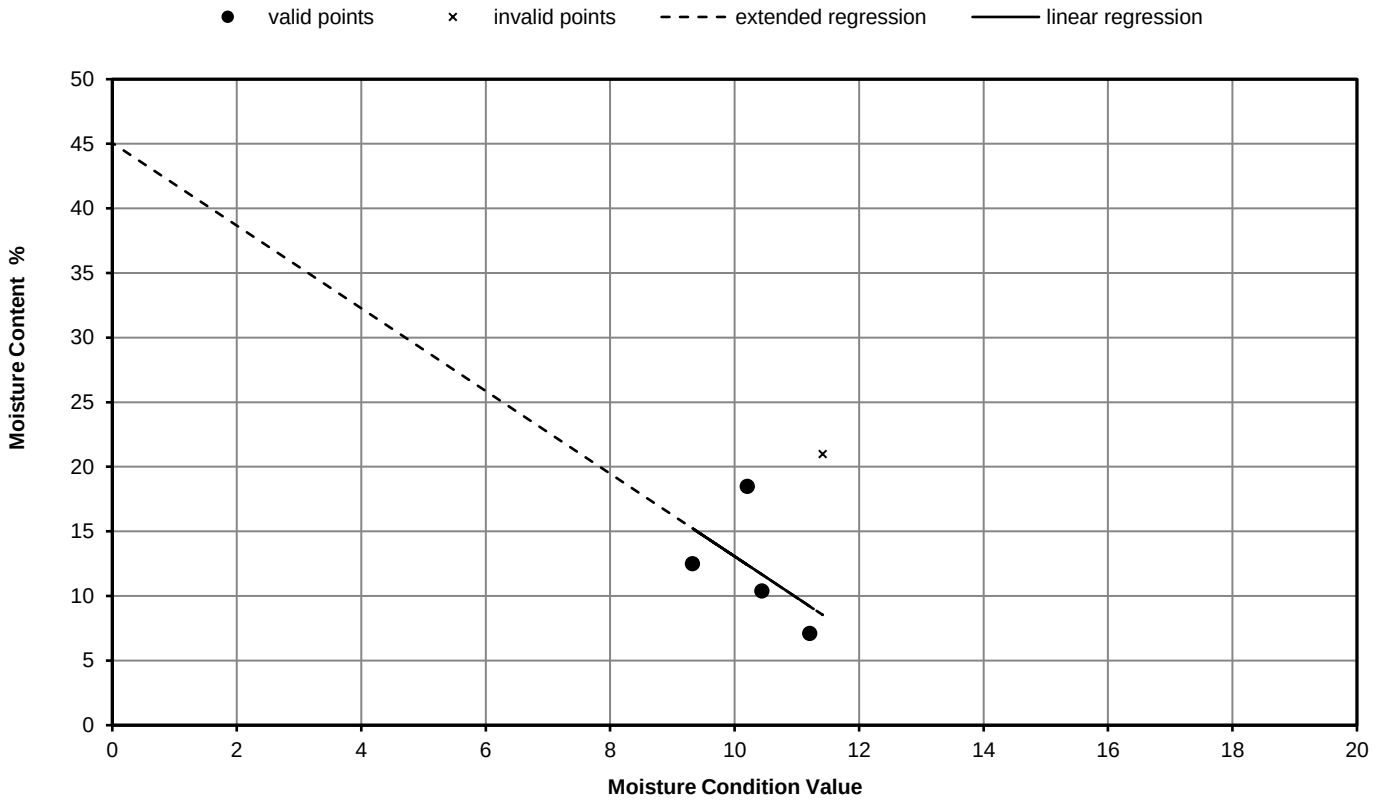
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	13.1	%
Initial Moisture Content of test sample below 20mm	18.5	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	18.5	12.5	10.4	7.1	21.0
Moisture Condition Value	10.2	9.3	10.4	11.2	11.4
MCV report	10.2	9.3	10.4	11.2	11.4
Effective / Valid data point	YES	YES	YES	YES	NO
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP06
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Orange-brown slightly gravelly slightly sandy SILT.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL1202010306
Test Method	BS1377:Part4:1990:clause 5.5			Date started	07/12/2020

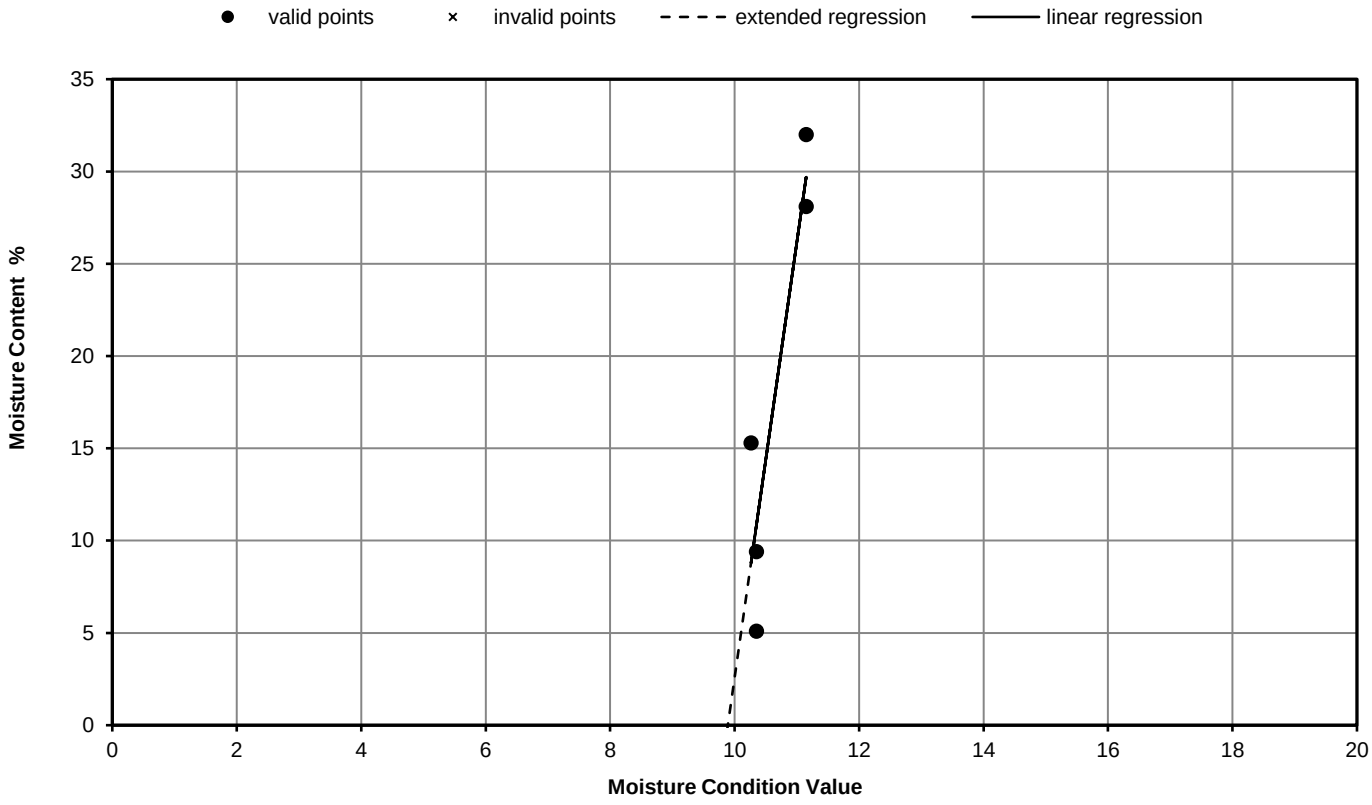
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	23	%
Initial Moisture Content of test sample below 20mm	32	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	32.0	9.4	15.3	28.1	5.1
Moisture Condition Value	11.1	10.4	10.3	11.1	10.4
MCV report	11.1	10.4	10.3	11.1	10.4
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP07
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth	0.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103010
Test Method	BS1377:Part4:1990:clause 5.5			Date started	02/12/2020

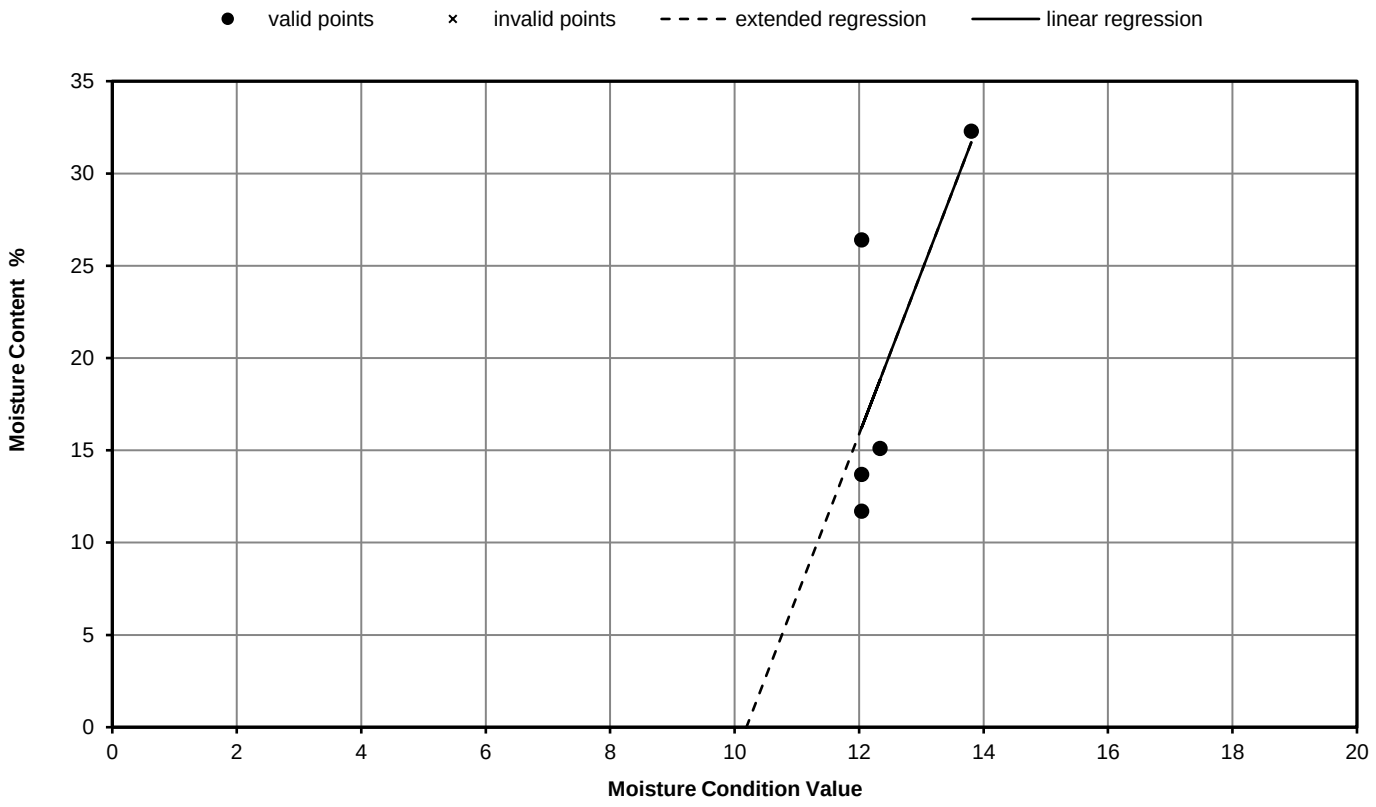
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	27	%
Initial Moisture Content of test sample below 20mm	32.3	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	32.3	11.7	15.1	13.7	26.4
Moisture Condition Value	13.8	12.0	12.3	12.0	12.0
MCV report	13.8	12	12.3	12	12
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP08
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Greyish-brown slightly gravelly sandy SILT.			Depth	1.5
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103022
Test Method	BS1377:Part4:1990:clause 5.5			Date started	26/11/2020

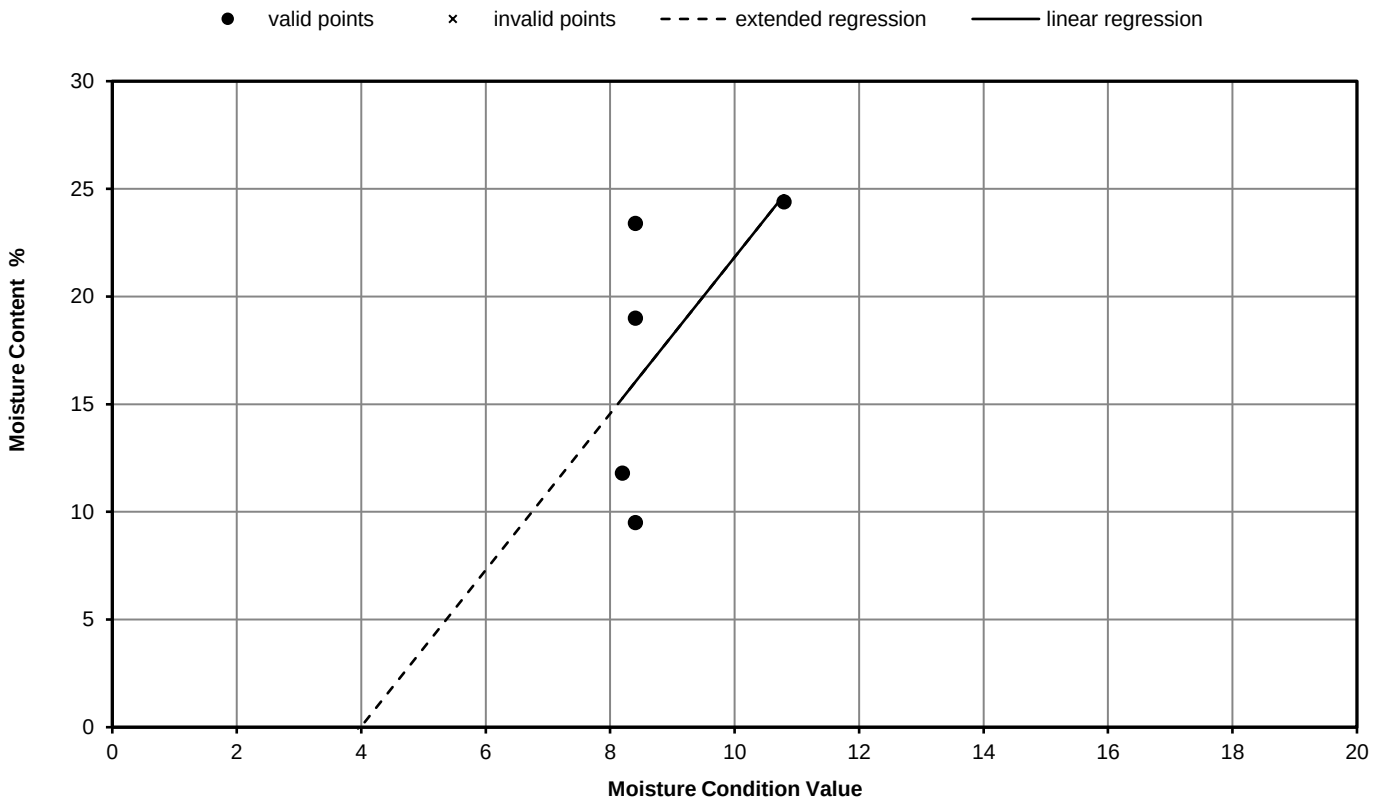
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	27	%
Initial Moisture Content of test sample below 20mm	24.4	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	24.4	23.4	19.0	9.5	11.8
Moisture Condition Value	10.8	8.4	8.4	8.4	8.2
MCV report	10.8	8.4	8.4	8.4	8.2
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP09
Site Name	Arklow Bank Windpark			Sample No.	2
Soil Description	Grey-brown slightly sandy SILT.			Depth	0.5
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103028
Test Method	BS1377:Part4:1990:clause 5.5			Date started	27/11/2020

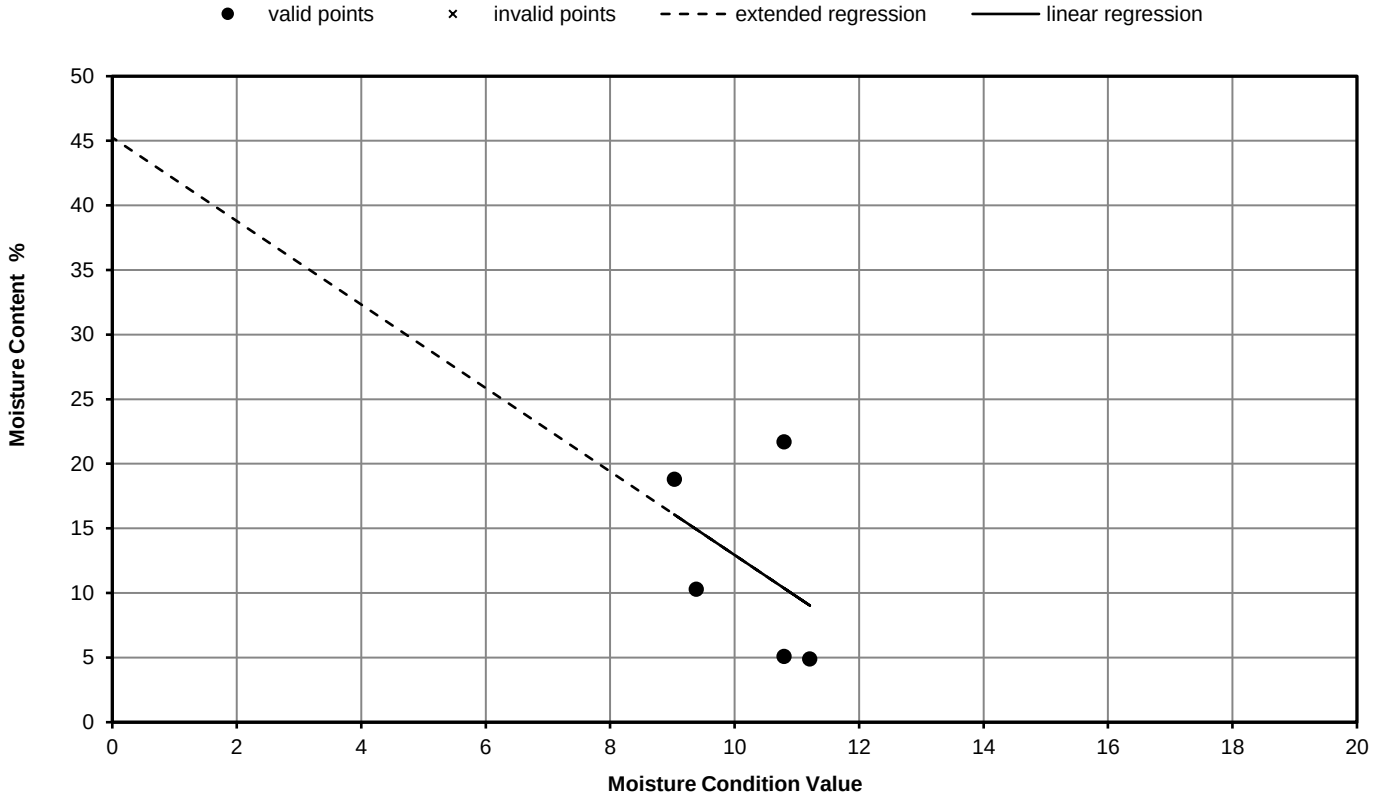
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	18.8	%
Initial Moisture Content of test sample below 20mm	18.8	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	18.8	10.3	5.1	4.9	21.7
Moisture Condition Value	9.0	9.4	10.8	11.2	10.8
MCV report	9	9.4	10.8	11.2	10.8
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP10
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly sandy SILT.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103039
Test Method	BS1377:Part4:1990:clause 5.5			Date started	30/11/2020

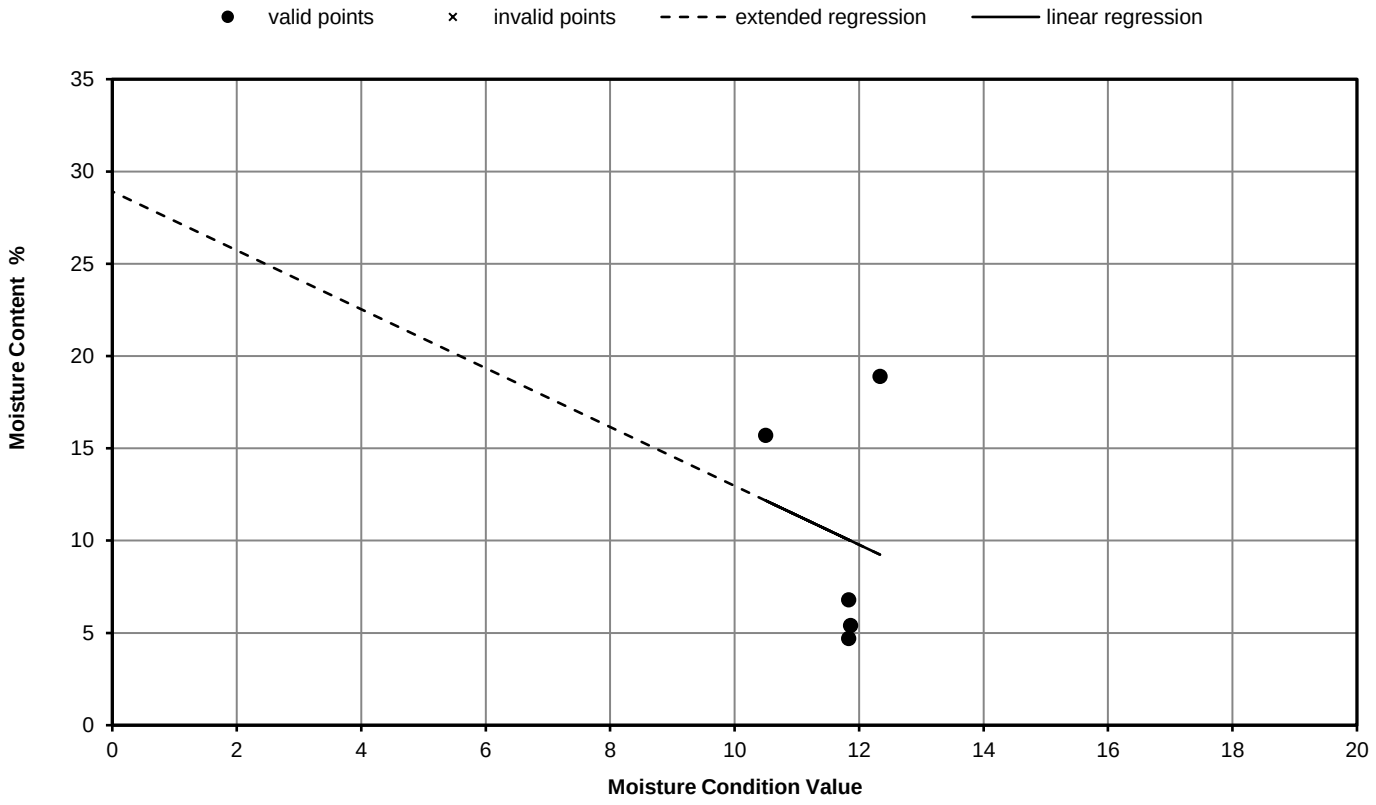
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	20	%
Initial Moisture Content of test sample below 20mm	19	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	18.9	15.7	6.8	5.4	4.7
Moisture Condition Value	12.3	10.5	11.8	11.9	11.8
MCV report	12.3	10.5	11.8	11.9	11.8
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP11
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly gravelly slightly sandy SILT.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103048
Test Method	BS1377:Part4:1990:clause 5.5			Date started	27/11/2020

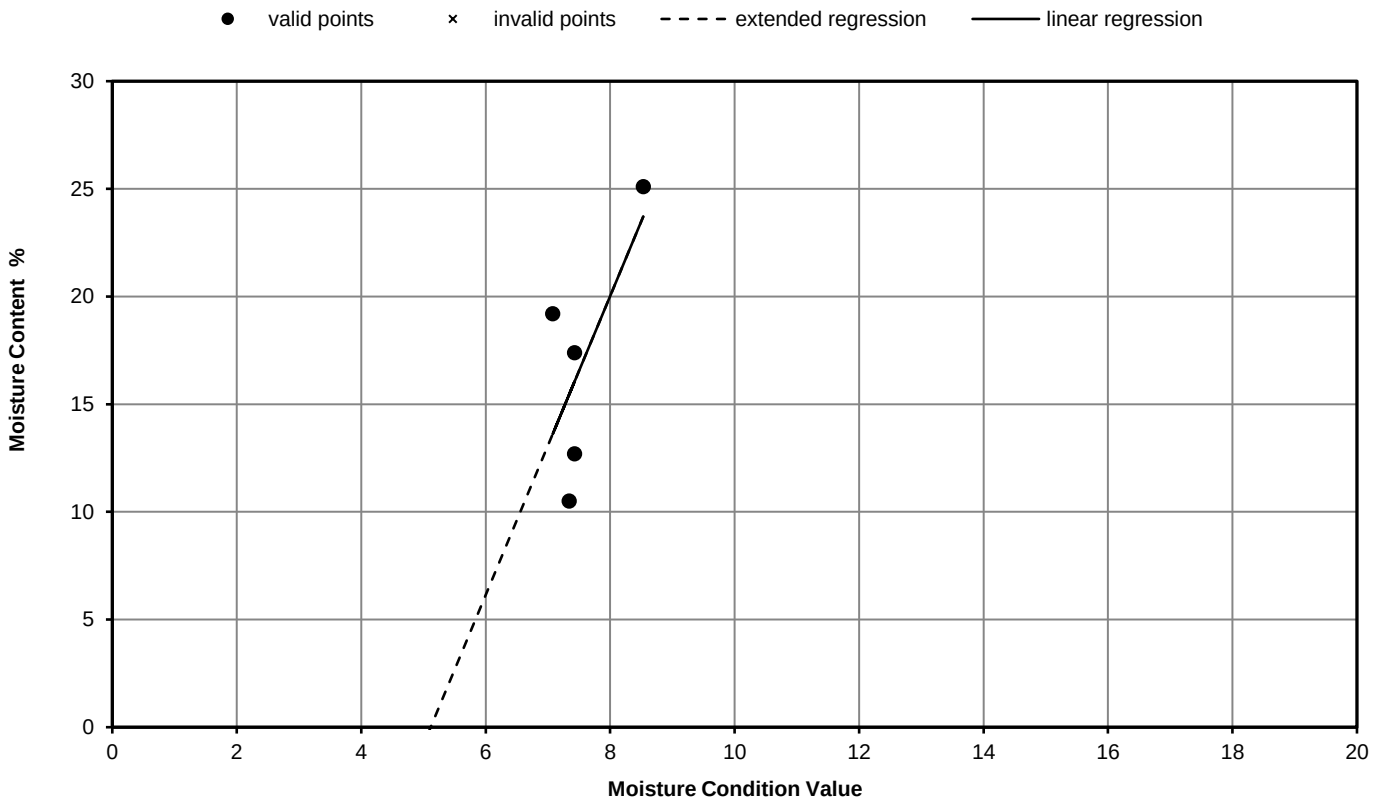
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	26	%
Initial Moisture Content of test sample below 20mm	25	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	25.1	19.2	17.4	12.7	10.5
Moisture Condition Value	8.5	7.1	7.4	7.4	7.3
MCV report	8.5	7.1	7.4	7.4	7.3
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

	Moisture Condition Value / Moisture Content Relationship			Job Ref	2020WW102
				Borehole/Pit No.	TP12
Site Name	Arklow Bank Windpark			Sample No.	5
Soil Description	Brown slightly gravelly sandy SILT. Sand is fine.			Depth	1.4
Specimen Reference	1	Specimen Depth	m	Sample Type	B
Specimen Description				KeyLAB ID	IDL12020103057
Test Method	BS1377:Part4:1990:clause 5.5			Date started	08/12/2020

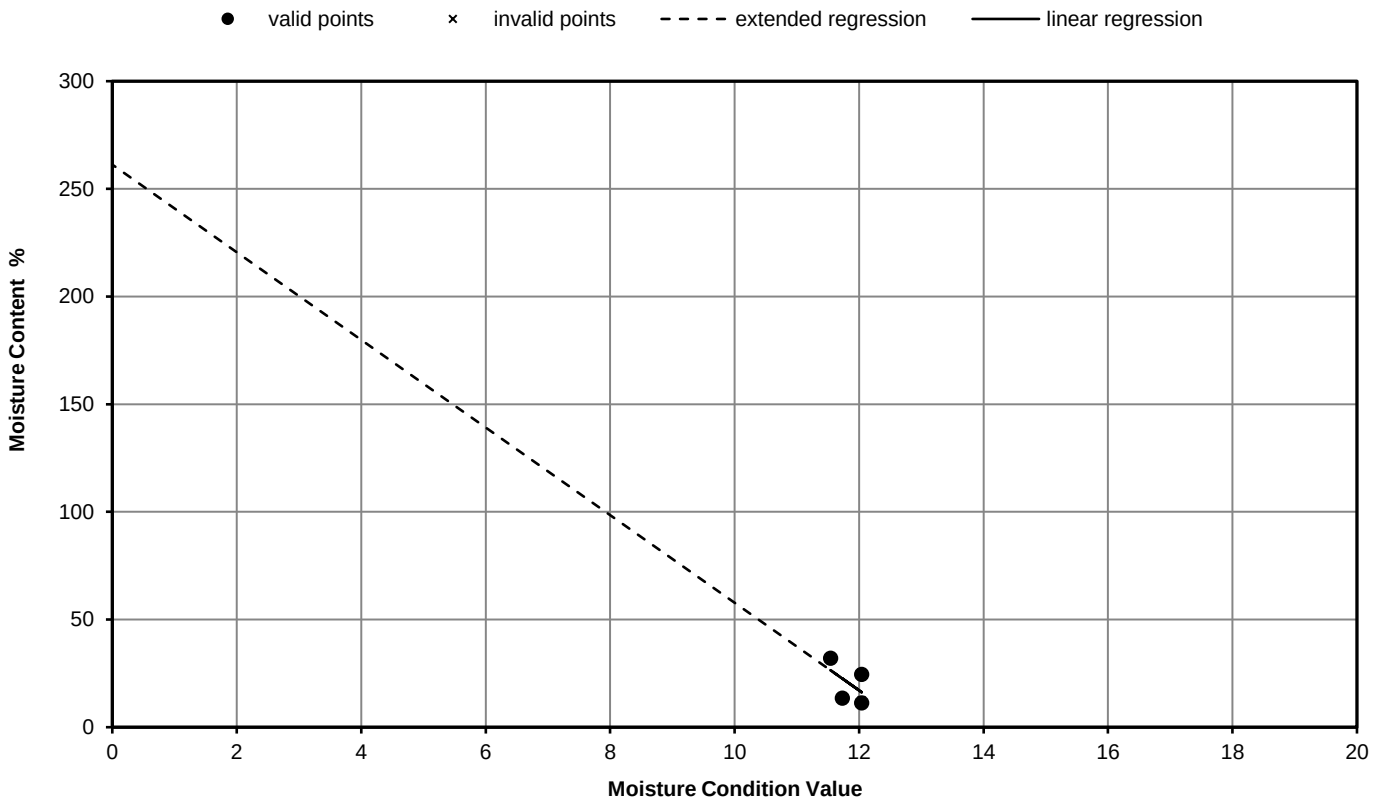
Sample preparation

Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	32	%
Initial Moisture Content of test sample below 20mm	32	%
Composite of fresh and reused material tested		

General remarks

Table of results

MCV Test Number	1	2	3	4	5
Moisture Content, %	32.1	24.6	12.7	13.5	11.3
Moisture Condition Value	11.5	12.0	12.0	11.7	12.0
MCV report	11.5	12	12	11.7	12
Effective / Valid data point	YES	YES	YES	YES	YES
Specimen remarks					



Tested	Checked	Approved
RG	DCD	DCD

Lab Sheet Reference : QC Form R7

National Materials Testing Laboratory Ltd
Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

Determination of Undrained Shear Strength in Triaxial Compression

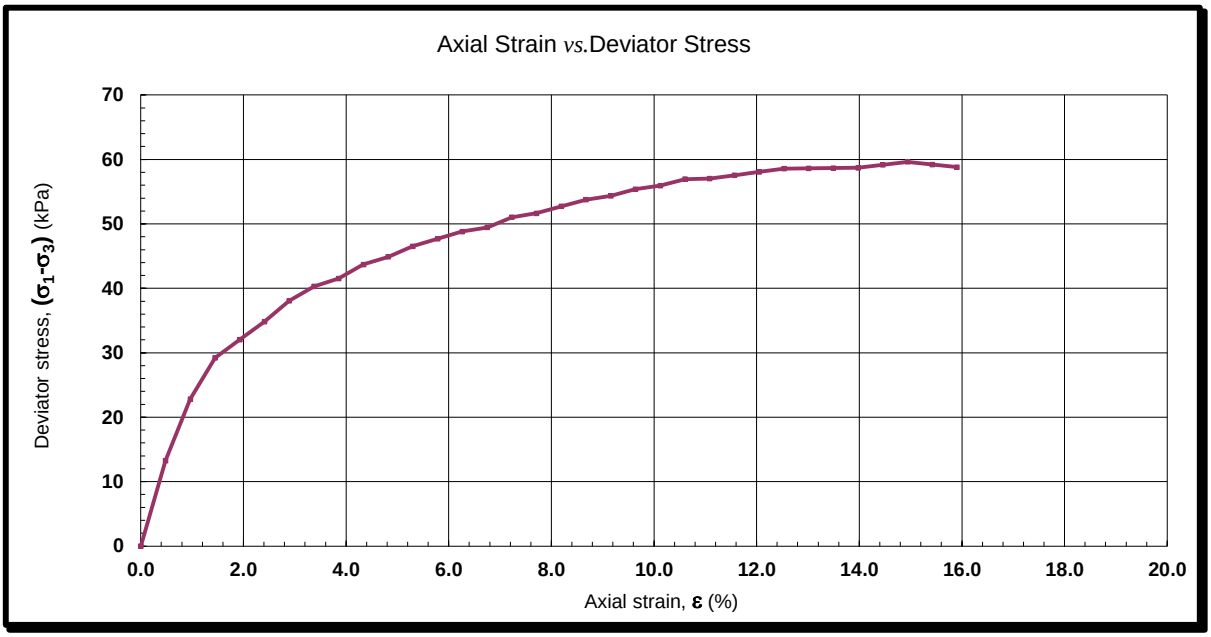
BS 1377 : Part 7 : 1990 Clause 8

Client Name:	**Irish Drilling Ltd**	Contract:	**Arklow Bank**
Address:	**Loughrea**	Site Address:	**N/A**
	Galway	**IDL Project ID:**	**2020WWW102**
	Co. Galway		

Sample No.: **BH01-C- C** Depth: **0.80-1.22m** File Reference: **NMTL 3333**

Sample Description:	**Grey/brown/orange slightly gravelly slightly sandy silty CLAY.**		
Location:	**Arklow Bank**	Date Sampled:	**20 October 2020**
Sample Type:	**C**	Sampled by:	**Irish Drilling Ltd**
Client Sample Ref.:	**BH01-C-0.80-1.22m**	Sampling Cert. Recd.:	**No**
Source / Supplier:	**IDL**	Date Received:	**15 December 2020**
Specification:	**BS 1377: Part 7: 1990 Clause 8**	Date Tested:	**18 December 2020**

Specimen					**Test**		
Length:	**207.5**	mm	Diameter:	**103.5** mm	Membrane type:	**Latex**	
Area:	**8413.4**	mm^2	Volume:	**1745.8** cm^3	Membrane thickness:	**0.3**	mm
Mass:	**3363.6**	g			Membrane correction:	**4.48**	
Moisture content:	**30.3**	%			Sample state:	**Undisturbed**	
Bulk density:	**1.93**	$Mg\ m^{-3}$			Number of stages:	**single**	
Dry density:	**1.48**	$Mg\ m^{-3}$			Rate of strain:	**1.0**	$\%\ min^{-1}$
Preparation Method:	**BS 1377: Part 1: 1990 Clause 8 .3.1**				Cell pressure: σ_3	**50**	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	**59.6**	**kPa**
Strain at Failure:	ε	**14.94**	**%**
Maximum Cohesion / Shear Strength:	C_u	**29.8**	**kPa**
Type of Failure:		**Plastic**	

Signed

Authorised Signatories
☐ N Chana
☐ B Chana

For NMTL Ltd

22 February 2021

Remarks: Undisturbed

Original to: **Client Rep.**
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National Materials Testing Laboratory Ltd
Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

Determination of Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	**Irish Drilling Ltd**	Contract:	**Arklow Bank**
Address:	**Loughrea**	Site Address:	**N/A**
	Galway	**IDL Project ID:**	**2020WWW102**
	Co. Galway		

Sample No.: **BH02-C- C** Depth: **0.80-1.22m** File Reference: **NMTL 3333**

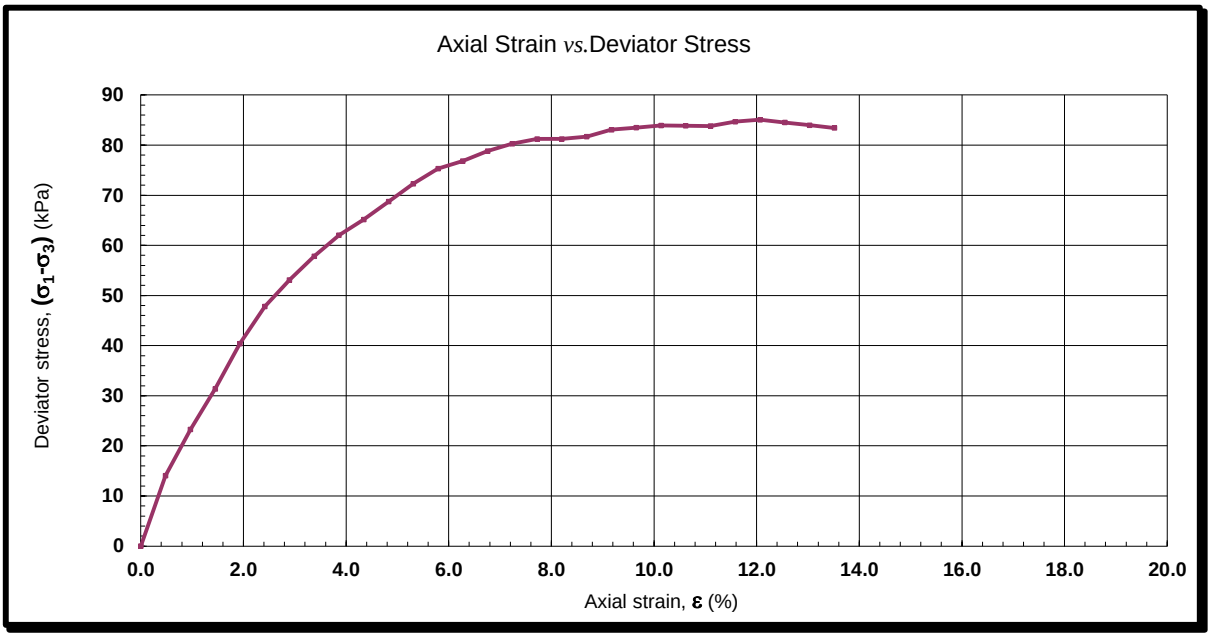
Sample Description:	**Brown/grey slightly gravelly slightly sandy silty CLAY.**		
Location:	**Arklow Bank**	Date Sampled:	**20 October 2020**
Sample Type:	**C**	Sampled by:	**Irish Drilling Ltd**
Client Sample Ref.:	**BH02-C-0.80-1.22m**	Sampling Cert. Recd.:	**No**
Source / Supplier:	**IDL**	Date Received:	**15 December 2020**
Specification:	**BS 1377: Part 7: 1990 Clause 8**	Date Tested:	**18 December 2020**

Specimen

Length:	**207.2**	mm	Diameter:	**102.5**	mm
Area:	**8251.6**	mm^2	Volume:	**1709.7**	cm^3
Mass:	**3403.1**	g			
Moisture content:	**23.4**	%			
Bulk density:	**1.99**	$Mg\ m^{-3}$			
Dry density:	**1.61**	$Mg\ m^{-3}$			
Preparation Method:	**BS 1377: Part 1: 1990 Clause 8 .3.1**				

Test

Membrane type:	**Latex**	
Membrane thickness:	**0.3**	mm
Membrane correction:	**3.62**	
Sample state:	**Undisturbed**	
Number of stages:	**single**	
Rate of strain:	**1.0**	$\%\ min^{-1}$
Cell pressure: σ_3	**50**	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	**85.1**	**kPa**
Strain at Failure:	ε	**12.07**	**%**
Maximum Cohesion / Shear Strength:	C_u	**42.5**	**kPa**
Type of Failure:		**Plastic**	

Signed

Authorised Signatories
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For NMTL Ltd

22 February 2021

Remarks: Undisturbed

Original to: **Client Rep.**
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Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

Determination of Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	**Irish Drilling Ltd**	Contract:	**Arklow Bank**
Address:	**Loughrea**	Site Address:	**N/A**
	Galway	**IDL Project ID:**	**2020WWW102**
	Co. Galway		

Sample No.: **BH02-C- C** Depth: **4.3-4.80m** File Reference: **NMTL 3333**

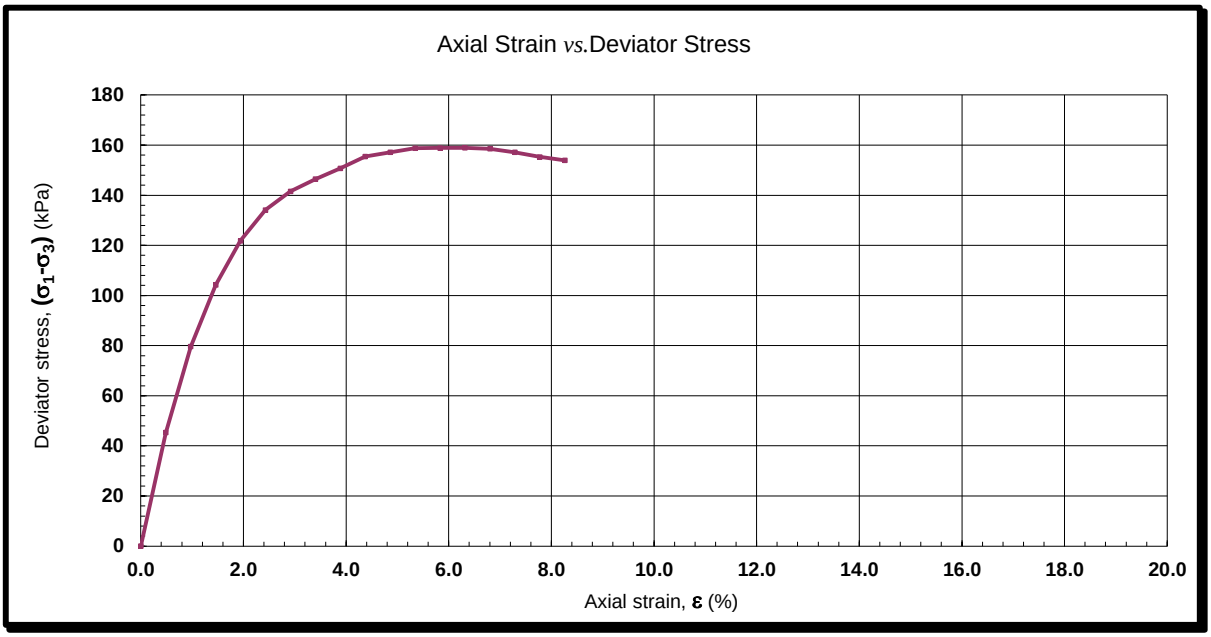
Sample Description:	**Brown/grey slightly sandy silty CLAY.**		
Location:	**Arklow Bank**	Date Sampled:	**21 October 2020**
Sample Type:	**C**	Sampled by:	**Irish Drilling Ltd**
Client Sample Ref.:	**BH02-C-4.3-4.80**	Sampling Cert. Recd.:	**No**
Source / Supplier:	**IDL**	Date Received:	**15 December 2020**
Specification:	**BS 1377: Part 7: 1990 Clause 8**	Date Tested:	**18 December 2020**

Specimen

Length:	**205.8**	mm	Diameter:	**102.0**	mm
Area:	**8171.3**	mm^2	Volume:	**1681.6**	cm^3
Mass:	**3306.7**	g			
Moisture content:	**28.8**	%			
Bulk density:	**1.97**	$Mg\ m^{-3}$			
Dry density:	**1.53**	$Mg\ m^{-3}$			
Preparation Method:	**BS 1377: Part 1: 1990 Clause 8 .3.1**				

Test

Membrane type:	**Latex**	
Membrane thickness:	**0.3**	mm
Membrane correction:	**1.90**	
Sample state:	**Undisturbed**	
Number of stages:	**single**	
Rate of strain:	**1.0**	$\%\ min^{-1}$
Cell pressure: σ_3	**100**	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	**159.0**	**kPa**
Strain at Failure:	ε	**6.32**	**%**
Maximum Cohesion / Shear Strength:	C_u	**79.5**	**kPa**
Type of Failure:		**Brittle**	

Signed

Authorised Signatories
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22 February 2021

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Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

Determination of Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	**Irish Drilling Ltd**	Contract:	**Arklow Bank**
Address:	**Loughrea**	Site Address:	**N/A**
	Galway	**IDL Project ID:**	**2020WWW102**
	Co. Galway		

Sample No.: **BH03-C- C** Depth: **0.7-1.70m** File Reference: **NMTL 3333**

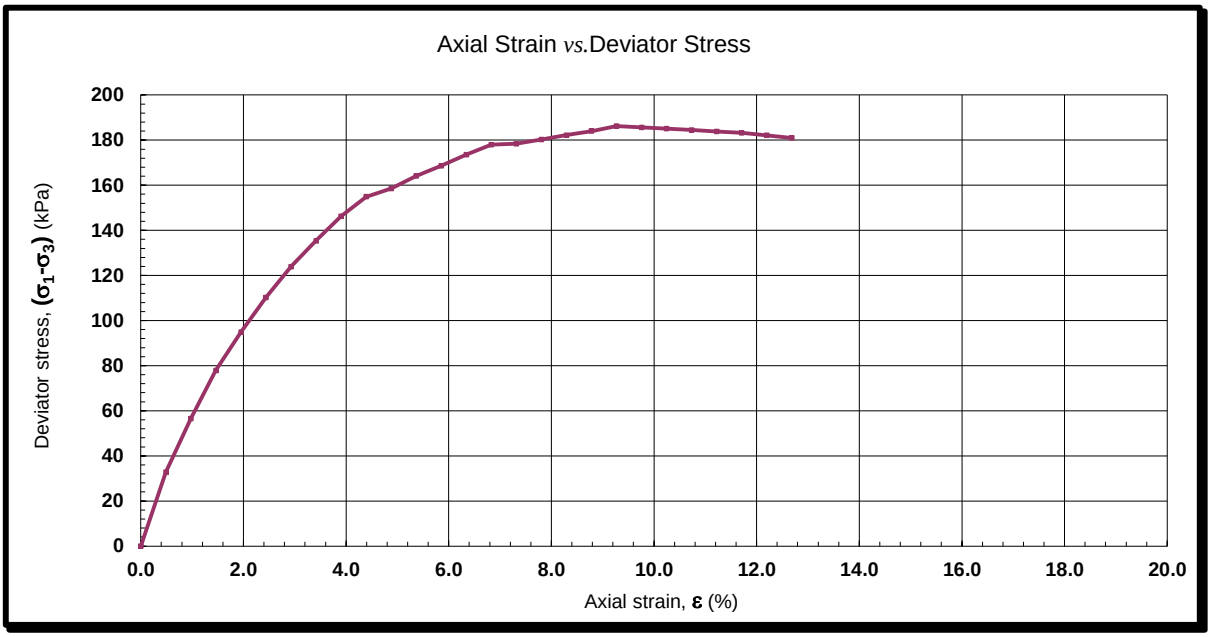
Sample Description:	**Brown clayey silty very sandy GRAVEL.**		
Location:	**Arklow Bank**	Date Sampled:	**22 October 2020**
Sample Type:	**C**	Sampled by:	**Irish Drilling Ltd**
Client Sample Ref.:	**BH03-C-0.7-1.70m**	Sampling Cert. Recd.:	**No**
Source / Supplier:	**IDL**	Date Received:	**15 December 2020**
Specification:	**BS 1377: Part 7: 1990 Clause 8**	Date Tested:	**18 December 2020**

Specimen

Length:	**205.0**	mm	Diameter:	**102.5**	mm
Area:	**8251.6**	mm^2	Volume:	**1691.6**	cm^3
Mass:	**3776.1**	g			
Moisture content:	**12.2**	%			
Bulk density:	**2.23**	$Mg\ m^{-3}$			
Dry density:	**1.99**	$Mg\ m^{-3}$			
Preparation Method:	**BS 1377: Part 1: 1990 Clause 8 .3.1**				

Test

Membrane type:	**Latex**	
Membrane thickness:	**0.3**	mm
Membrane correction:	**2.78**	
Sample state:	**Undisturbed**	
Number of stages:	**single**	
Rate of strain:	**1.0**	$\%\ min^{-1}$
Cell pressure: σ_3	**50**	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	**186.3**	**kPa**
Strain at Failure:	ε	**9.27**	**%**
Maximum Cohesion / Shear Strength:	C_u	**93.1**	**kPa**
Type of Failure:		**Plastic**	

Signed

Remarks: Undisturbed

Authorised Signatories
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22 February 2021

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Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

Determination of Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	**Irish Drilling Ltd**	Contract:	**Arklow Bank**
Address:	**Loughrea**	Site Address:	**N/A**
	Galway	**IDL Project ID:**	**2020WWW102**
	Co. Galway		

Sample No.: **BH04-C- C** Depth: **1.4-1.84m** File Reference: **NMTL 3333**

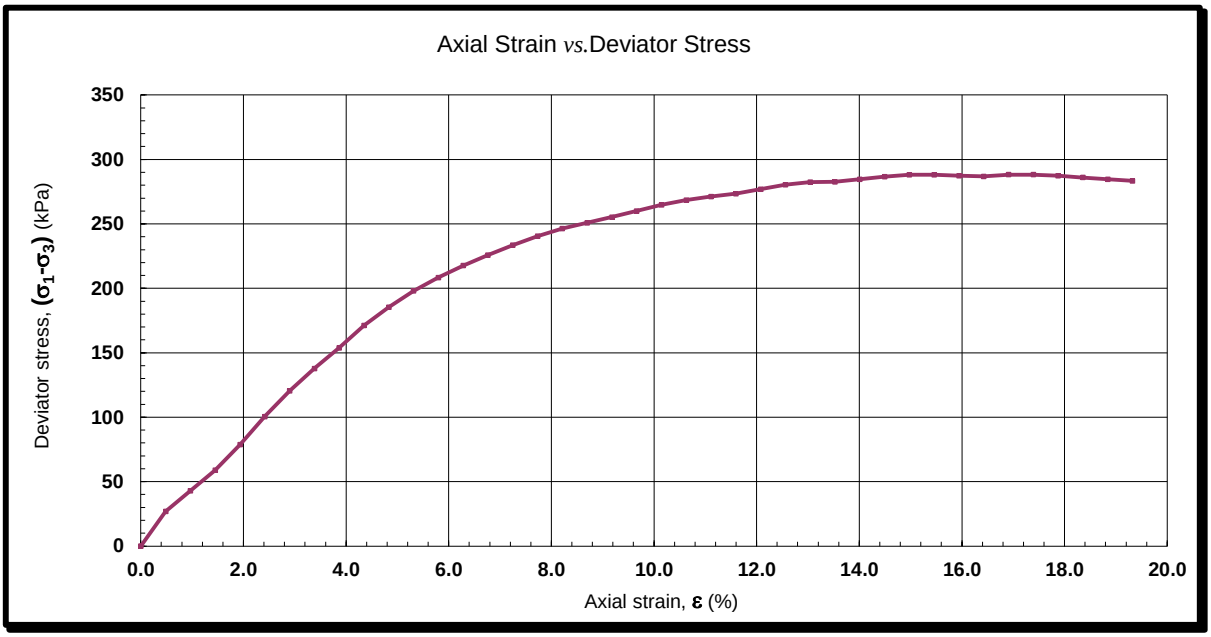
Sample Description:	**Brown slightly gravelly slightly sandy silty CLAY.**		
Location:	**Arklow Bank**	Date Sampled:	**15 October 2020**
Sample Type:	**C**	Sampled by:	**Irish Drilling Ltd**
Client Sample Ref.:	**BH04-C-1.4-1.84m**	Sampling Cert. Recd.:	**No**
Source / Supplier:	**IDL**	Date Received:	**15 December 2020**
Specification:	**BS 1377: Part 7: 1990 Clause 8**	Date Tested:	**18 December 2020**

Specimen

Length:	**207.0**	mm	Diameter:	**102.0**	mm
Area:	**8171.3**	mm^2	Volume:	**1691.5**	cm^3
Mass:	**3731.4**	g			
Moisture content:	**15.6**	%			
Bulk density:	**2.21**	$Mg\ m^{-3}$			
Dry density:	**1.91**	$Mg\ m^{-3}$			
Preparation Method:	**BS 1377: Part 1: 1990 Clause 8 .3.1**				

Test

Membrane type:	**Latex**	
Membrane thickness:	**0.3**	mm
Membrane correction:	**5.07**	
Sample state:	**Undisturbed**	
Number of stages:	**single**	
Rate of strain:	**1.0**	$\%\ min^{-1}$
Cell pressure: σ_3	**50**	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	**288.2**	**kPa**
Strain at Failure:	ε	**16.91**	**%**
Maximum Cohesion / Shear Strength:	C_u	**144.1**	**kPa**
Type of Failure:		**Plastic**	

Signed

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For NMTL Ltd

22 February 2021

Remarks: Undisturbed

Original to: **Client Rep.**
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Unit 18C Tullow Industrial Estate
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Certificate of Test

Determination of Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	**Irish Drilling Ltd**	Contract:	**Arklow Bank**
Address:	**Loughrea**	Site Address:	**N/A**
	Galway	**IDL Project ID:**	**2020WWW102**
	Co. Galway		

Sample No.: **BH04-C- C** Depth: **4.4-4.88m** File Reference: **NMTL 3333**

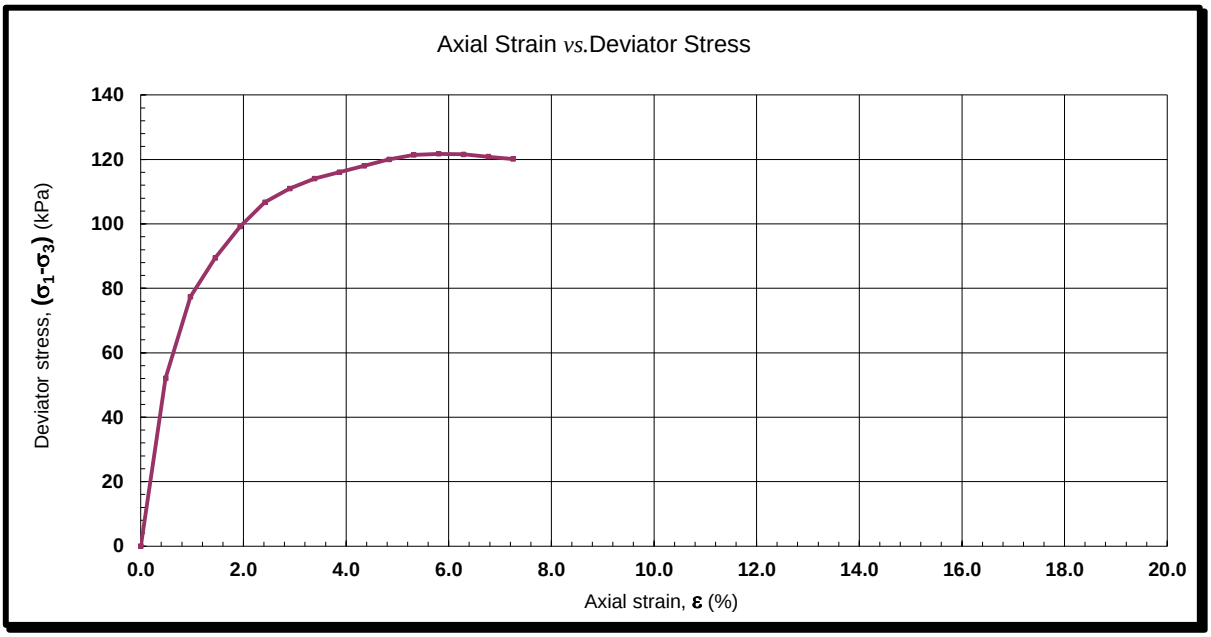
Sample Description:	**Brown/grey slightly sandy silty CLAY.**		
Location:	**Arklow Bank**	Date Sampled:	**15 October 2020**
Sample Type:	**C**	Sampled by:	**Irish Drilling Ltd**
Client Sample Ref.:	**BH04-C-4.4-4.88m**	Sampling Cert. Recd.:	**No**
Source / Supplier:	**IDL**	Date Received:	**15 December 2020**
Specification:	**BS 1377: Part 7: 1990 Clause 8**	Date Tested:	**18 December 2020**

Specimen

Length:	**206.8**	mm	Diameter:	**100.0**	mm
Area:	**7854.0**	mm^2	Volume:	**1624.2**	cm^3
Mass:	**3182.3**	g			
Moisture content:	**28.6**	%			
Bulk density:	**1.96**	$Mg\ m^{-3}$			
Dry density:	**1.52**	$Mg\ m^{-3}$			
Preparation Method:	**BS 1377: Part 1: 1990 Clause 8 .3.1**				

Test

Membrane type:	**Latex**	
Membrane thickness:	**0.3**	mm
Membrane correction:	**1.74**	
Sample state:	**Undisturbed**	
Number of stages:	**single**	
Rate of strain:	**1.0**	$\%\ min^{-1}$
Cell pressure: σ_3	**100**	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	**121.7**	**kPa**
Strain at Failure:	ε	**5.80**	**%**
Maximum Cohesion / Shear Strength:	C_u	**60.9**	**kPa**
Type of Failure:		**Brittle**	

Signed

Remarks: Undisturbed

Authorised Signatories
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For NMTL Ltd

22 February 2021

Original to: **Client Rep.**
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Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

Determination of Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	**Irish Drilling Ltd**	Contract:	**Arklow Bank**
Address:	**Loughrea**	Site Address:	**N/A**
	Galway	**IDL Project ID:**	**2020WWW102**
	Co. Galway		

Sample No.: **BH05-C- C** Depth: **1.30-1.70m** File Reference: **NMTL 3333**

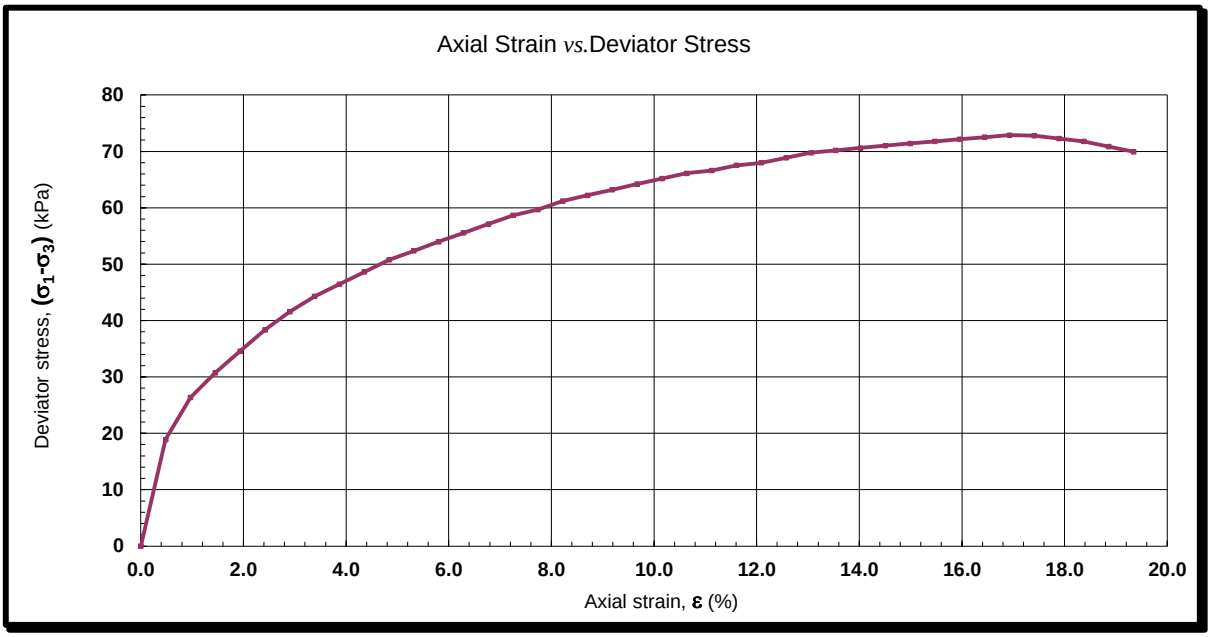
Sample Description:	**Brown/grey slightly sandy silty CLAY.**		
Location:	**Arklow Bank**	Date Sampled:	**19 October 2020**
Sample Type:	**C**	Sampled by:	**Irish Drilling Ltd**
Client Sample Ref.:	**BH05-C-1.3-1.70m**	Sampling Cert. Recd.:	**No**
Source / Supplier:	**IDL**	Date Received:	**15 December 2020**
Specification:	**BS 1377: Part 7: 1990 Clause 8**	Date Tested:	**18 December 2020**

Specimen

Length:	**206.8**	mm	Diameter:	**103.5**	mm
Area:	**8413.4**	mm^2	Volume:	**1739.9**	cm^3
Mass:	**3402.0**	g			
Moisture content:	**27.9**	%			
Bulk density:	**1.96**	$Mg\ m^{-3}$			
Dry density:	**1.53**	$Mg\ m^{-3}$			
Preparation Method:	**BS 1377: Part 1: 1990 Clause 8 .3.1**				

Test

Membrane type:	**Latex**	
Membrane thickness:	**0.3**	mm
Membrane correction:	**5.08**	
Sample state:	**Undisturbed**	
Number of stages:	**single**	
Rate of strain:	**1.0**	$\%\ min^{-1}$
Cell pressure: σ_3	**50**	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	**72.9**	**kPa**
Strain at Failure:	ε	**16.92**	**%**
Maximum Cohesion / Shear Strength:	C_u	**36.4**	**kPa**
Type of Failure:		**Plastic**	

Signed

Authorised Signatories
☐ N Chana
☐ B Chana

For NMTL Ltd

22 February 2021

Remarks: Undisturbed

Original to: **Client Rep.**
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IDL

Point Load Strength Index Tests
Summary of Results

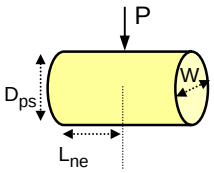
Project No.: 2020WW102

Project Name: Arklow Bank Windpark

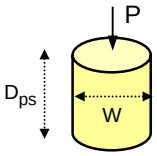
Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Top Depth	Base Depth	Type	Top	Base		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m	m		m	m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH01	3.50	4.7	C	4.2	4.34		A	U	YES		101.5		88.0	7.3	106.6	0.6	0.9	Weak
BH01	5.20	6.7	C	5.7	5.80		D	U	YES		101.5		101.5	3.2	101.5	0.3	0.4	Weak
BH01	6.70	8.2	C	7	7.20		A	U	YES		101.5		101.5	1.3	114.5	0.1	0.1	Very Weak
BH01	6.70	8.2	C	7.8	7.90		D	U	YES		101.5		101.5	2.1	101.5	0.2	0.3	Weak
BH01	8.20	9.7	C	8.52	8.66		D	U	YES		101.5		101.5	4.3	101.5	0.4	0.6	Weak
BH01	9.70	10.2	C	9.9	10.04		D	U	YES		101.5		101.5	3.2	101.5	0.3	0.4	Weak
BH02	9.40	10.1	C	9.68	9.75		D	U	YES		84.5		84.5	2.7	84.5	0.4	0.5	Weak
BH03	1.70	3.2	C	3	3.20		D	U	YES		101.5		101.5	1.2	101.5	0.1	0.2	Weak
BH03	3.20	3.8	C	3.5	3.65		A	U	YES		84.7		73.0	1.1	88.7	0.1	0.2	Weak
BH03	3.80	5.3	C	4.8	4.93		D	U	YES		84.7		84.7	2.2	84.7	0.3	0.4	Weak
BH03	5.30	6.8	C	6.46	6.60		A	U	YES		84.7		80.0	5.0	92.9	0.6	0.8	Weak
BH03	11.20	12.7	C	11.8	12.00		D	U	YES		84.7		84.7	5.6	84.7	0.8	1.0	Weak
BH03	12.70	14.2	C	12.8	13.00		D	U	YES		84.7		84.7	2.9	84.7	0.4	0.5	Weak
BH03	14.20	15.7	C	14.8	15.00		D	U	YES		84.7		84.7	0.8	84.7	0.1	0.1	Very Weak
BH03	15.70	17.2	C	15.8	15.94		D	U	YES		84.7		84.7	4.1	84.7	0.6	0.7	Weak
BH03	17.20	18.7	C	17.95	18.30		D	U	YES		84.7		84.7	8.3	84.7	1.2	1.5	Medium Strong
BH03	18.70	20.2	C	18.7	18.90		D	U	YES		84.7		84.7	3.3	84.7	0.5	0.6	Weak
BH05	4.70	5.3	C	4.5	4.66		D	U	YES		84.7		84.7	5.1	84.7	0.7	0.9	Weak
BH05	5.30	6.8	C	5.5	5.67		D	U	YES		84.7		84.7	3.5	84.7	0.5	0.6	Weak
BH05	6.80	8.3	C	7.5	7.74		D	U	YES		84.7		84.7	3.9	84.7	0.5	0.7	Weak

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P

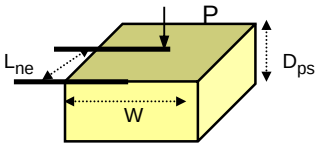
Diametral



Axial



Block/irregular lump



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Date Printed: 13/01/2021

Approved By: APPROVED By DCD at Administrator

Table 1 sheet 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IDL

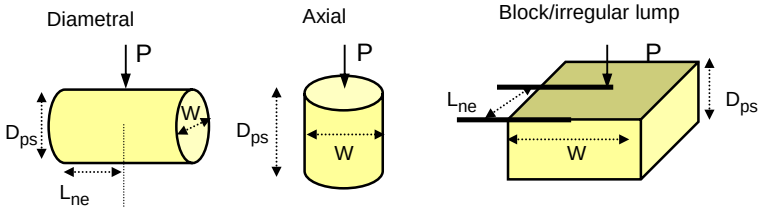
Point Load Strength Index Tests
Summary of Results

Project No.: 2020WW102

Project Name: Arklow Bank Windpark

Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Top Depth	Base Depth	Type	Top	Base		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m	m		m	m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH05	9.70	10.4	C	9.8	10.06		D	U	YES		84.7		84.7	3.8	84.7	0.5	0.7	Weak

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Date Printed: 13/01/2021

Approved By: APPROVED By DCD at Administrator

Table 1 sheet 2

IDL

UNIAXIAL COMPRESSION TEST ON ROCK - SUMMARY OF RESULTS

Project No.: 2020WW102

Project Name: Arklow Bank Windpark

Hole No.	Sample				Specimen Depth (m)	Specimen Dimensions2			Bulk Density2	Water Content 1	Uniaxial Compression3				Remarks
	Ref	Top	Base	Type		Dia. mm	Length mm	H/D	Mg/m3	%	Condition	Stress Rate MPa/s	Mode of failure	UCS MPa	
BH03		12.70	14.20	C	13.0-13.4	84.5	224.7	2.7	2.73		as received	0.0383	MS	6.5	Weak

Notes

1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as tested for UCS

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

Test Specification: International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

Date Printed: 13/01/2021

Approved By: APPROVED By DCD at Administrator

Table 1 sheet 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LTD.
Loughrea Co. Galway
Lab@IrishDrilling.ie
Tel: (091) 841274

Contract:	**Arklow Bank**	2020WW102
Client:	SSE	
Engineer:	**Arup**	
Date:	13.01.2021	
Tested by:	**DCD / RG**	

Thermal Conductivity / Resistivity Test

Using ThermTest TLS-100 Thermal Conductivity / Thermal Resistivity Meter

BS1377:Part 2:1990 and ASTM D5334-08

Location	Depth (m.bgl)	Date	Soil Temperature Before Test °C	Thermal Conductivity W/m.K	Thermal Resistivity K.m/W	Moisture Content Tested %	Bulk Density Mg.m3	Sample Description / preparation
TP03	1.1-1.2	24.11.20	17.28	0.177	5.635	33.6		mct from Tub
TP04	1.1-1.2	24.11.20	17.16	1.41	0.709	13.1		mct from Tub
TP04	1.4-1.5	25.11.20	13.118	2.02	0.495	17.9	2.065	mct from compaction point 1
TP04	1.4-1.5	26.11.20	18.225	1	1	14	1.974	mct from compaction point 2
TP04	1.4-1.5	27.11.20	11.619	1.298	0.77	8	1.829	mct from compaction point 3
TP04	1.4-1.5	30.11.20	12.303	0.945	1.058	6.7	1.762	mct from compaction point 4
TP04	1.4-1.5	01.12.20	12.662	1.783	0.561	21.3	2.094	mct from compaction point 5
TP05	1.1-1.2	24.11.20	10.39	1.145	0.873	21		mct from Tub
TP06	1.1-1.2	27.11.20	15.22	1.203	0.831	22		mct from Tub
TP06	1.4-1.5	7.12.20	13.201	1.322	0.756	32.1	1.878	mct from compaction point 1
TP06	1.4-1.5	8.12.20	18.897	1.115	0.897	11.2	1.846	mct from compaction point 2
TP06	1.4-1.5	9.12.20	16.785	0.783	1.278	14.2	1.758	mct from compaction point 3

Location	Depth (m.bgl)	Date	Soil Temperature Before Test °C	Thermal Conductivity W/m.K	Thermal Resistivity K.m/W	Moisture Content Tested %	Bulk Density Mg.m3	Sample Description / preparation
TP06	1.4-1.5	10.12.20	13.414	1.32	0.758	27.1	1.947	mct from compaction point 4
TP06	1.4-1.5	14.12.20	11.082	0.902	1.108	3.4	1.767	mct from compaction point 5
TP07	1.1-1.2	27.11.20	15.421	1.062	0.942	24		mct from Tub
TP07	0.4-0.5	02.12.20	13.062	1.566	0.638	30.7	1.883	mct from compaction point 1
TP07	0.4-0.5	03.12.20	10.17	1.116	0.896	9.4	1.756	mct from compaction point 2
TP07	0.4-0.5	07.12.20	14.282	1.153	0.867	14.1	1.788	mct from compaction point 3
TP07	0.4-0.5	08.12.20	12.961	1.206	0.829	10	1.755	mct from compaction point 4
TP07	0.4-0.5	09.12.20	13.291	1.527	0.655	26.9	1.914	mct from compaction point 5
TP08	1.1-1.2	27.11.20	15.318	0.702	1.424	26		mct from Tub
TP08	1.5-1.6	26.11.20	13.502	1.353	0.739	25.5	1.902	mct from compaction point 1
TP08	1.5-1.6	27.11.20	17.714	1.201	0.833	20.1	1.9	mct from compaction point 2
TP08	1.5-1.6	30.11.20	15.261	0.836	1.196	17.6	1.831	mct from compaction point 3
TP08	1.5-1.6	02.12.20	11.081	1.092	0.916	14.5	1.865	mct from compaction point 4
TP08	1.5-1.6	03.12.20	18.48	0.727	1.376	12.3	1.704	mct from compaction point 5
TP09	0.5-0.6	27.11.20	12.48	2.155	0.464	18.8	2.165	mct from compaction point 1
TP09	0.5-0.6	30.11.20	13.04	2.099	0.476	12.1	1.843	mct from compaction point 2
TP09	0.5-0.6	01.12.20	15.572	1.125	0.889	4.8	1.8	mct from compaction point 3
TP09	0.5-0.6	02.12.20	16.156	0.801	1.249	5	1.768	mct from compaction point 4
TP09	0.5-0.6	03.12.20	14.117	0.538	1.859	4.6	1.762	mct from compaction point 5
TP09	1.1-1.2	30.11.20	13.354	1.144	0.874	12.1		mct from tub
TP10	1.1-1.2	30.11.20	13.071	0.475	2.107	14		mct from Tub
TP10	1.4-1.5	30.11.20	13.488	1.35	0.741	20.4	2.047	mct from compaction point 1
TP10	1.4-1.5	01.12.20	22.601	0.664	1..507	7.7	1.78	mct from compaction point 2
TP10	1.4-1.5	02.12.20	16.615	0.757	1.321	6	1.741	mct from compaction point 3
TP10	1.4-1.5	03.12.20	19.022	0.347	2.883	3.8	1.721	mct from compaction point 4
TP10	1.4-1.5	04.12.20	21.917	0.501	1.995	4.7	1.762	mct from compaction point 5
TP11	1.1-1.2	30.11.20	13.684	1.37	0.73	25.1		mct from Tub

Location	Depth (m.bgl)	Date	Soil Temperature Before Test °C	Thermal Conductivity W/m.K	Thermal Resistivity K.m/W	Moisture Content Tested %	Bulk Density Mg.m3	Sample Description / preparation
TP11	1.4-1.5	27.11.20	12.022	1.655	0.604	25.6	2.009	mct from compaction point 1
TP11	1.4-1.5	30.11.20	14.687	1.572	0.636	19.4	1.76	mct from compaction point 2
TP11	1.4-1.5	01.12.20	17.155	1.178	0.849	15.3	1.748	mct from compaction point 3
TP11	1.4-1.5	02.12.20	16.934	1.111	0.9	12.7	1.761	mct from compaction point 4
TP11	1.4-1.5	03.12.20	17.57	0.584	1.712	11.9	1.778	mct from compaction point 5
TP12	1.1-1.2	30.11.20	13.413	0.877	1.141			mct from Tub
TP12	1.4-1.5	04.12.20	6.436	1.445	0.692	18.4	2.051	mct from compaction point 1
TP12	1.4-1.5	07.12.20	14.122	1.312	0.762	13.2	1.793	mct from compaction point 2
TP12	1.4-1.5	08.12.20	19.583	1.113	0.898	12.7	1.804	mct from compaction point 3
TP12	1.4-1.5	09.12.20	14.651	0.512	1.955	15.1	1.71	mct from compaction point 4
TP12	1.4-1.5	10.12.20	16.887	0.619	1.614	11.7	1.716	mct from compaction point 5

Schmidt Rebound Hammer Test Sheet - ISRM Blue Book.

Contract:	Arklow Bank				
Description:	Rock core				
Date:	10.02.2021	Tested By:	SS	Calc:	DCD

Borehole	Depth From (m)	Depth To (m)	Diametrical / Axial / Unknown	Hammer Reading	A - side B - down C - Up	N/mm3
BH01	3.5	4.7	D	36	B	40
BH01	5.2	6.7	D	24	B	24
BH01	6.7	8.2	D	34	B	38
BH01	9.7	10.2	D	34	B	38
BH02	6.3	7.7	D	22	B	22
BH02	9.4	10.1	D	26	B	28
BH03	3.8	5.3	D	20	B	20
BH03	11.2	12.7	D	44	B	52
BH03	14.5	15	D	46	B	54
BH03	17.2	18.7	D	20	B	20
BH05	4.7	5.3	D	30	B	32
BH05	6.8	8.3	D	36	B	40
BH05	9.7	10.4	D	26	B	28

Petrographic analysis of borehole samples from Arklow Bank

Contract: 2020WW101

Client Irish Drilling Ltd.

ISSUE 1: 18th January 2021

Prof. Quentin Fisher

PETRIVA Ltd.

E-mail: q.j.fisher@petriva.co.uk

PETRIVA

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Key points

- Four samples were provided to Petriva Ltd. by Irish Drilling Ltd. for petrographic analysis using a scanning electron microscope. The analysis is part of work being conducted on samples from Arklow Bank Wind Park, offshore Ireland.
- Three samples (BH1, BH4, BH5) are phyllites generated by the metamorphism of shale. The mineralogy is consistent with them being metamorphosed to greenschist facies.
- The phyllites have a distinct layering that is probably sedimentary in origin as well as a foliation resulting from the concentration and preferential orientation of chlorite and mica.
- An attempt has been made to provide estimates of volumes of minerals within the samples by incorporating BSE images into image analysis software (ImageJ) and thresholding the images according to the brightness of the minerals present (i.e. mean atomic number). This suggests that the phyllite samples are composed of around 40% quartz, 35% mica, and 25% chlorite. Accessary minerals with present in all samples including: zircon, monazite, rutile and Mn-Fe-Ti oxides.
- The chlorite and mica have precipitated as a result of metamorphic alteration. These usually have a platy texture with a strong orientation creating a distinct foliation. However, they also fill pore space between the quartz; in this case the chlorite and mica do not have a strong orientation.
- Some sand-rich layers are quartz-rich but also contain concentrations of heavy minerals (e.g. zircon) and secondary porosity. The minerals that dissolved to form the secondary porosity could not be identified.
- The Fe-Mn-Ti oxides are secondary alteration products that have precipitated along some of the foliations.
- The forth sample (BH2) is a pliable, silty mud. It had such a low permeability that it was not possible to impregnate it with resin so the polish was very pore. However, it was possible to gain some microstructural information, which suggested the sample is a silty mud composed of quartz and calcite grains in a muddy matrix or randomly orientated quartz, calcite, mica, chlorite and quartz.

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1 Introduction

The following report contains details of a petrographic study of four samples gathered as part of the Arklow Bank Wind Parm project. The samples were provided to Petriva Ltd. by Irish Drilling Limited (IDL) on the 16th December 2020. Polished blocks of the samples were prepared for analysis using a scanning electron microscope (SEM). The samples were examined by Prof. Quentin Fisher on the 12th January 2020 using a TESCAN SEM at the University of Leeds.

The report provides details of the study and is divided into the following four sections and two appendixes:-

- **Section 2** provides an overview of the materials studied and the methodologies used during the current study.
- **Section 3** provides the results obtained during the current study.
- **Section 4** presents conclusions from the study.

2 Samples and methods

2.1 Samples

Four samples were supplied by IDL for petrographic analysis (**Table 2-1**). Three samples were phyllites (BH1,BH4,BH5) created by the metamorphism of siltstones/shales. The forth (BH2) is a poorly consolidated silty mud.

Sample	Depth (m)	Sample type
BH1	4.7-5.2	Phyllite
BH2	2.0-3.5	Silty mud
BH4	9.5-11.3	Phyllite
BH5	5.3-6.8	Phyllite

Table 2-1 *Samples analysed from Arklow Bank.*

2.2 Sample preparation

Around 1.5 x 1.5 x 0.5 cm blocks were cut from the core using a diamond impregnated saw. In several cases, the samples split along the foliations as they were cut. The samples were washed with distilled water and dried at 60 ^{o}C in a vacuum oven. The blocks were then placed in individual moulds and impregnated with a low viscosity resin. The samples were removed from the moulds after the resin had set and around 2 mm of the bottom of the sample was removed with a 40 µm fixed diamond lap. The samples were then polished using a progressively finer sized diamond paste starting at 9 µm size and finishing at 1 µm. The polished samples were then thoroughly cleaned and dried before being coated with a 10 nm thick layer of carbon in preparation of electron microscopy analysis.

2.3 SEM analysis

The polished blocks were examined using a TESCAN VEGA3XN SEM equipped with backscattered electron (BSE) detector as well as an Oxford Instruments INCA 350 EDX system/80mm X-Max SDD detector. The BSE signal is proportional to the mean atomic number of the mineral so it provides a useful tool for distinguishing between mineral phases and identifying their growth relationships. The BSE images can also be imported into image analysis packages and so that mineralogical abundances can be calculated. The main minerals in the phyllite samples have contrasting mean atomic numbers so are easy to distinguish using BSEM (e.g. **Figure 2-1**).

The petrography of the samples were examined in detail, which included assessing the rock type, mineralogy, and grain-size of the samples. Around 10 representative images were collected from each sample as well as energy-dispersive X-ray spectra from key phases present to provide an indication of their chemical composition. Representative BSEM images were also incorporated into the ImageJ software and estimates of their mineralogy were conducted.

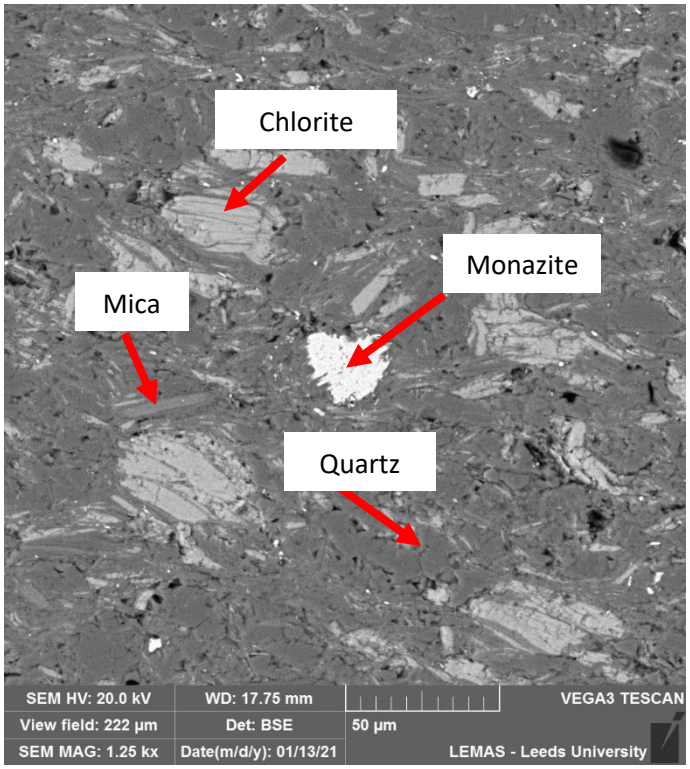


Figure 2-1 *BSE image from sample BH4. Key mineral phases (quartz, chlorite, mica) are marked. Also note that the presence of monazite – this is only present in small amounts but has an interesting chemistry (cerium neodymium phosphate).*

3 Microstructural analysis results

3.1 Introduction

This section presents the results from the microstructural analyses conducted during the study. The results from the samples are summarized in Section 3.2 before more detailed descriptions of individual samples are provided in Section 3.3.

3.2 Summary of petrographic results

3.2.1 Overview

Three of the samples examined (BH1, BH4 and BH5) are metamorphosed siltstones/shales with a very distinct foliation (**Figure 3-1**) and layering (**Figure 3-2**). The foliation is caused by the concentration and alignment of phyllosilicates (mica and chlorite) whereas the layering is caused by differences in grain-size and mineralogy (i.e. alternating layers of metamorphosed shale and siltstone). The main minerals present in the samples are chlorite, mica and quartz. It was beyond the scope of this study to provide quantitative mineralogical analysis. However, image analysis of BSE images indicates that the samples contain roughly: 40% quartz, 35% mica, 25% chlorite as well as small amounts of rutile, zircon, monazite and Fe-Mn oxides were also identified. These samples also contains secondary pores created by the dissolution of an unknown mineral; these are concentrated in the quartz-rich layers within the samples.

The forth sample (BH2) is a pliable silty mud composed of silt-sized quartz and calcite grains supported by a matrix of randomly orientated quartz, calcite, chlorite, mica and clay.

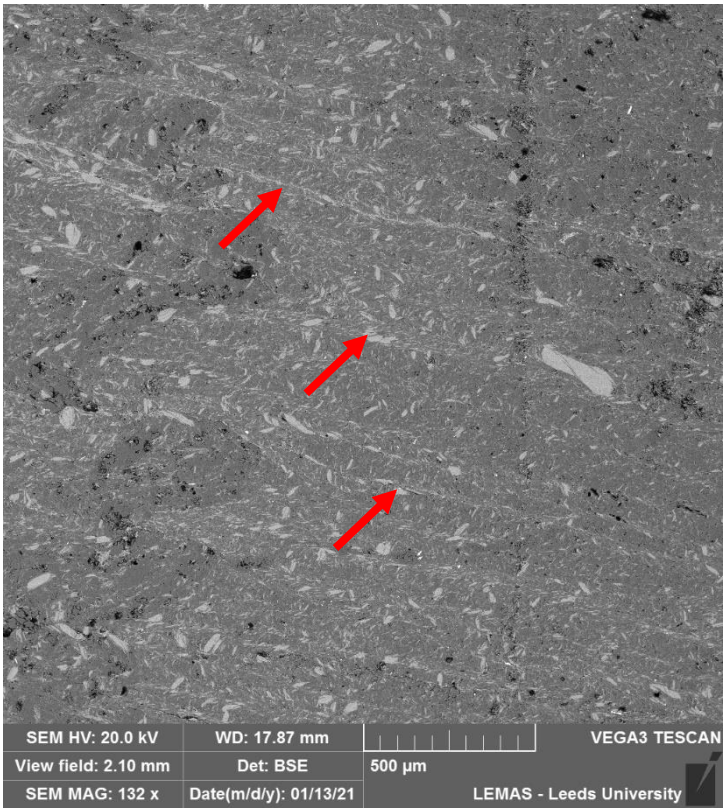


Figure 3-1 *BSEM image showing the lamination in sample BH1 (arrows).*

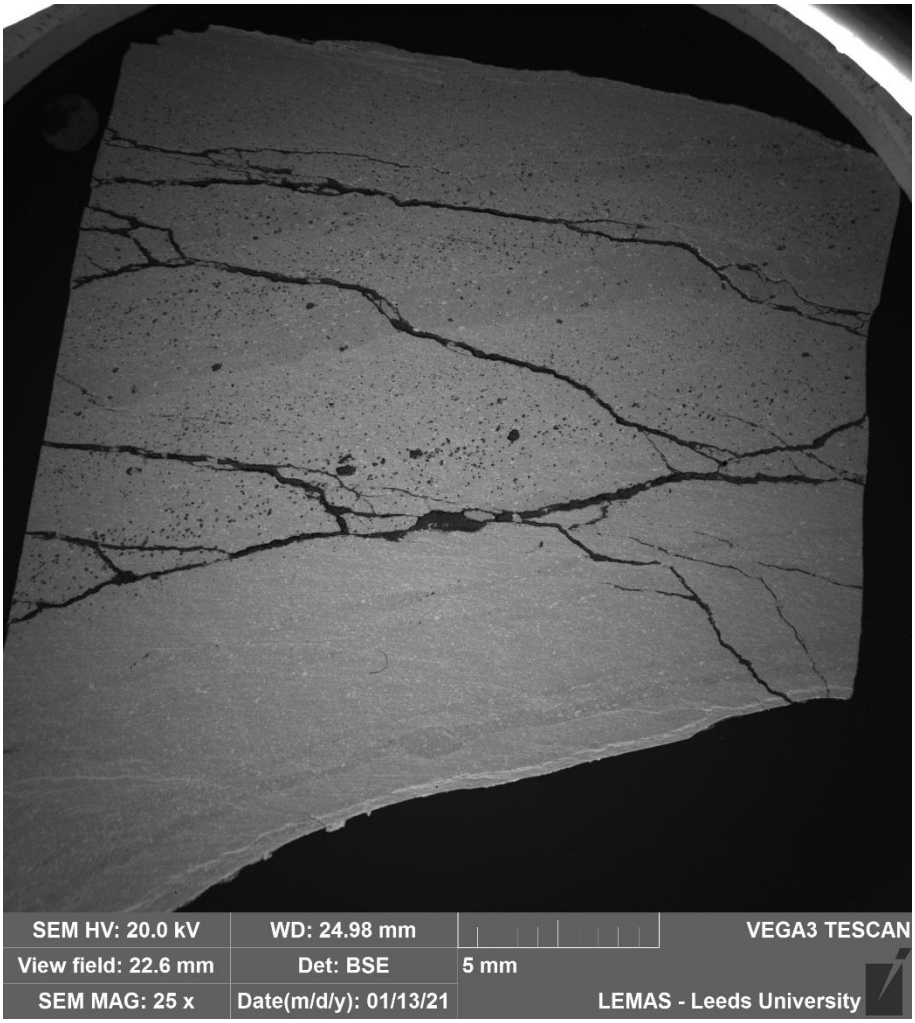


Figure 3-2 *Low magnification BSEM image of sample BH5; note the strong layering.*

3.2.2 Individual minerals present

3.2.2.1 Quartz

Quartz is generally the most abundant mineral present in the samples examined occupying around 40% of the rocks volume; it occurs as silt-sized grains (**Figure 3-3**). It is possible that much of the quartz has a detrital origin. Quartz is concentrated in distinct layers and lenses. It is uncertain whether the lenses reflect the original sedimentary fabric or whether they have been significantly altered as a result of diagenetic and metamorphic processes.

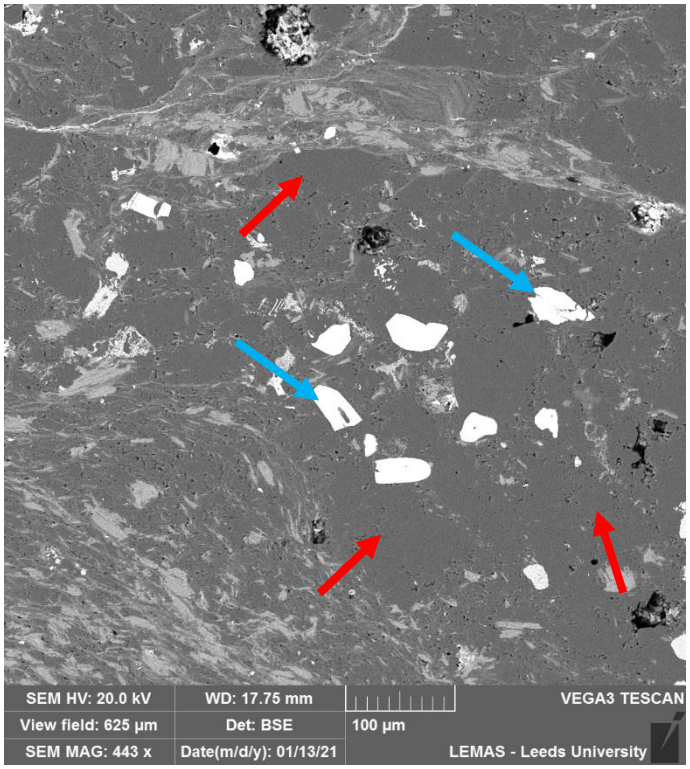


Figure 3-3 *Moderate magnification BSE image of sample BH4. The image shows a quartz-rich lens (red arrows) which also contain zircon (blue arrows).*

3.2.2.2 Mica

Mica is common in the three phyllites examined (BH1, BH4, BH5) in which it occupies around 35% of the rocks volume. It forms and substantial proportion of the matrix of the phyllites and is sometimes intergrown with chlorite (**Figure 3-4**). It is often concentred in distinct zones that are responsible for the foliation present within the three phyllites examples. An EDS spectra from the mica is provided in **Figure 3-5**, which shows that it is composed predominantly of K, Al, Si and O but also contains small amounts of Na.

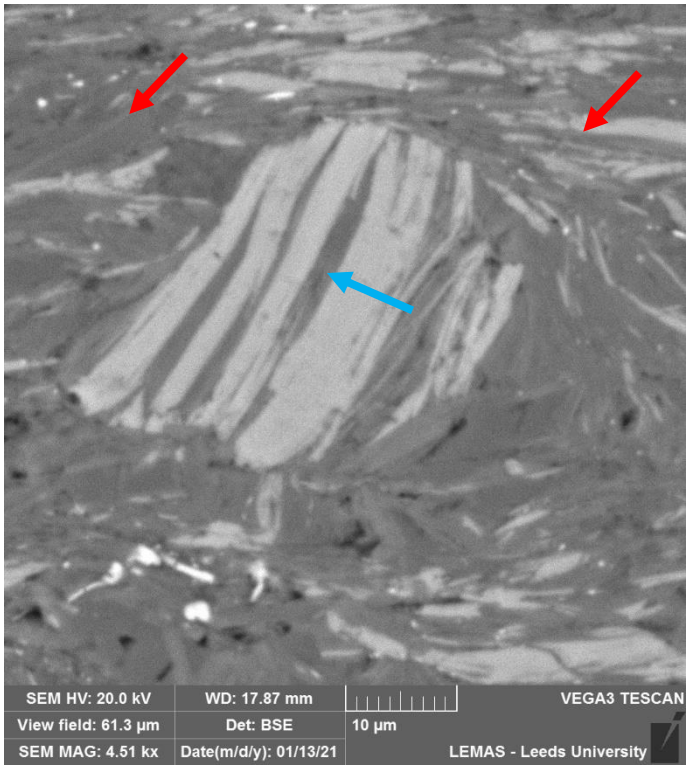


Figure 3-4 *BSE image from sample BH2 showing mica (red arrows) that is orientated parallel to the foliation but also intergrown with chlorite (blue arrows) .*

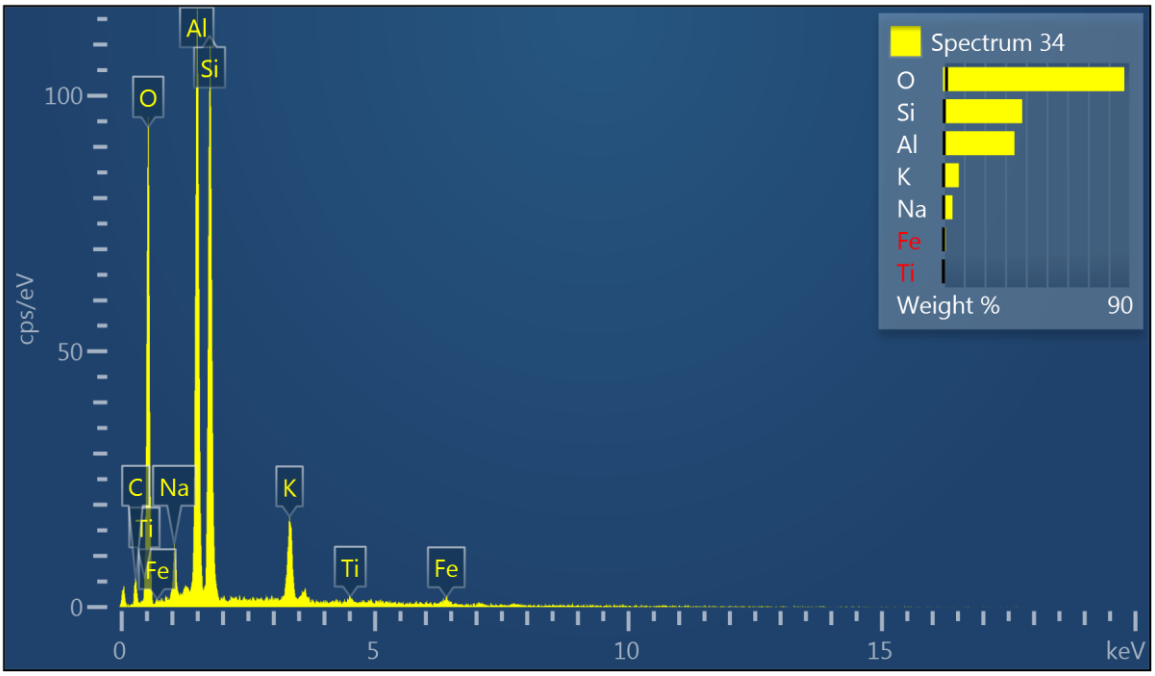


Figure 3-5 *EDS spectrum obtained from white mica; note that its chemistry is dominated by K, Al, Si and O with small amounts of Na.*

3.2.2.3 Chlorite

The three phyllite samples (BH1, BH4, BH5) contain moderate concentrations (25%) of chlorite, which is often concentrated within phyllosilicate-rich lamina that are responsible for the strong foliation. The chlorite occurs as ~10 µm thick, 30 µm long, platy grains, which tend to be orientated

parallel to the foliation (**Figure 3-6**). EDS analysis indicates that the chlorite is a Fe-Mg variety with a Fe:Mg ratio of around 3:1 (**Figure 3-7**).

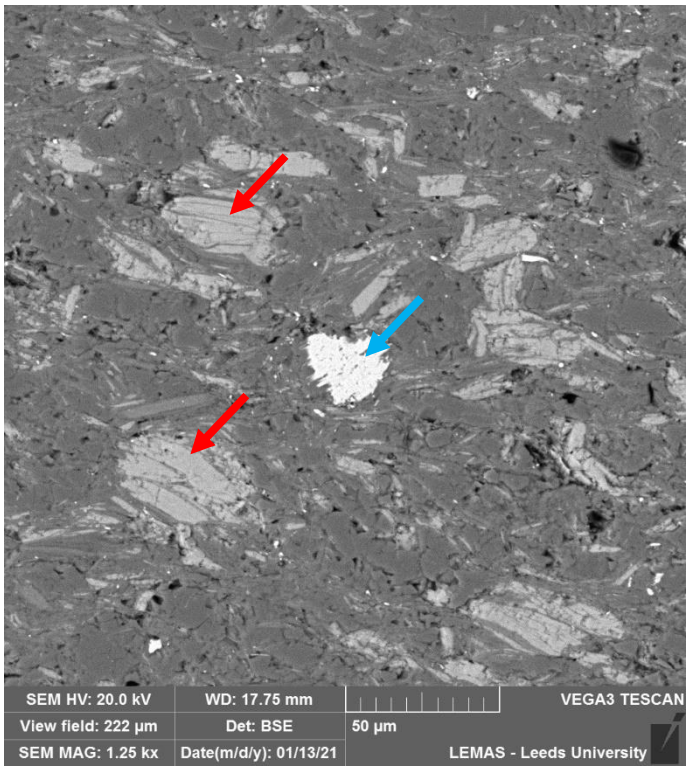


Figure 3-6 *BSE image showing Fe-Mg chlorite (red arrows) in sample BH4. The very bright coloured mineral (blue arrow) is monazite.*

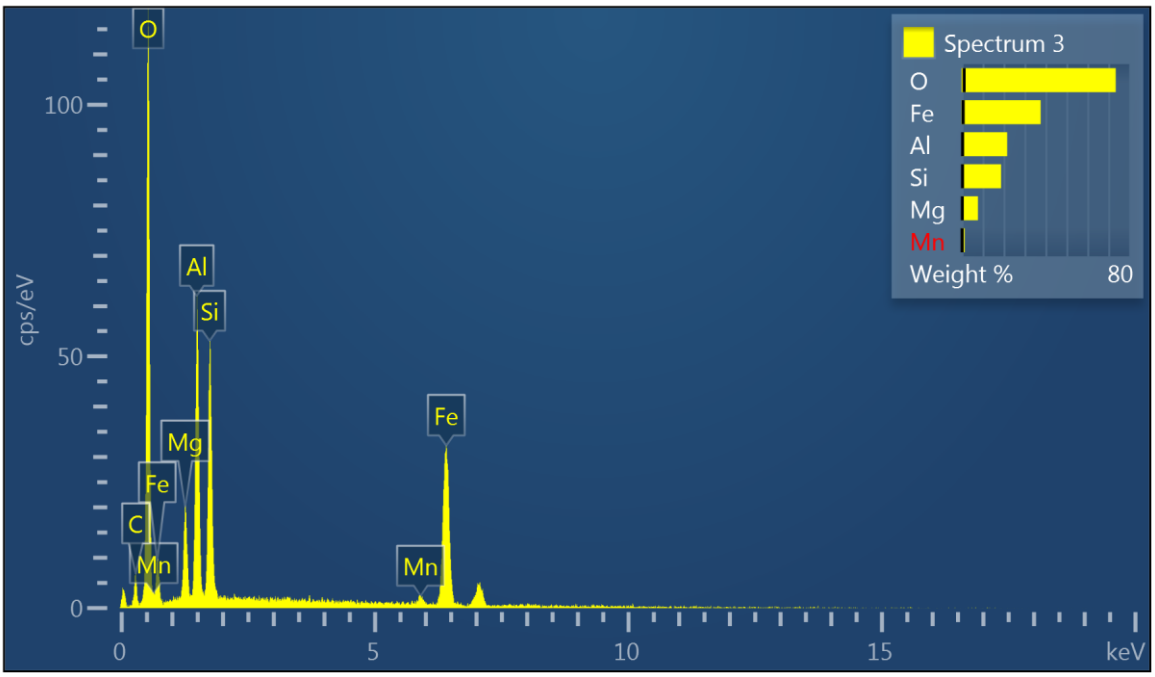


Figure 3-7 *EDS spectrum obtained from Fe-Mg chlorite; note that its chemistry is dominated by Fe, Mg, Al, Si and O.*

3.2.2.4 Secondary pores

Secondary pores were observed within all of the phyllites examined. These are typically concentrated in quartz-rich layers and lenses (**Figure 3-8**). The secondary pores have a similar size to the quartz grains which could suggest that they were formed by the dissolution of a detrital phase (e.g. K-feldspar). However, it is also possible that they formed by the dissolution of a phase that precipitated during the diagenetic or metamorphic alteration of the sample.

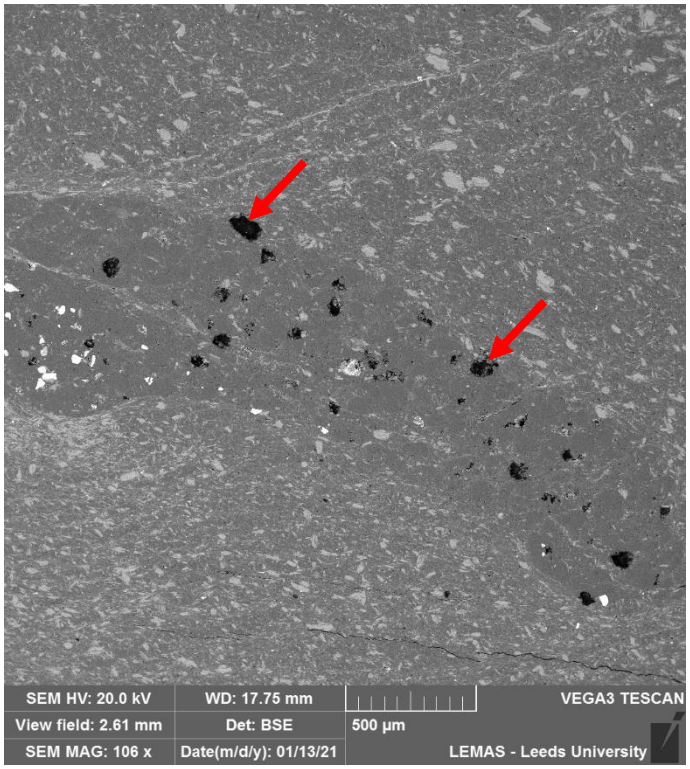


Figure 3-8 *BSE image showing secondary pores (red arrows) within a quartz-rich lens in sample BH4.*

3.2.2.5 Rutile

Rutile (TiO_2) is present in small quantities (<0.5%) in all samples. It occurs as 2 to 5 µm grains that are distributed throughout the sample.

3.2.2.6 Monazite

Monazite (cerium neodymium phosphate) was observed in two of the phyllites examined but is only present in very small quantities (<0.1%). A BSEM image showing the structure of the monazite is given in **Figure 3-5**) and an EDS spectrum showing its composition is provided in **Figure 3-9**.

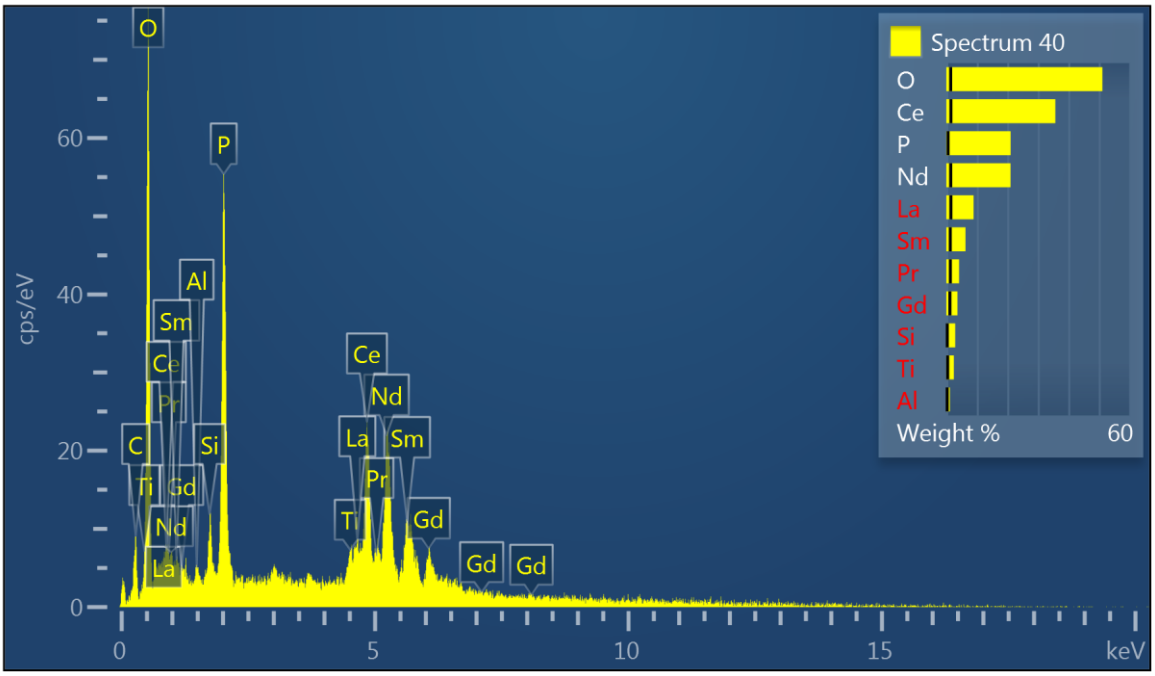


Figure 3-9 *EDS spectrum from monazite in sample BH4.*

3.2.2.7 Zircon

Zircon was observed as an accessary phase in the three phyllite samples analysed but occurs in very small quantities (<0.1%). It tends to be concentrated in the quartz-rich layers and lenses (e.g. **Figure 3-3**). The fact that it has a similar grain-size to the quartz suggests that it could be detrital in origin.

3.2.2.8 Fe, Mn, Ti oxides

Fe, Mn and Ti oxides were observed within discontinuous layers orientated parallel to the foliation in samples BH1 and BH5. It seems likely that these minerals precipitated as a result of fluid flow along the foliation planes that were dilated during uplift.

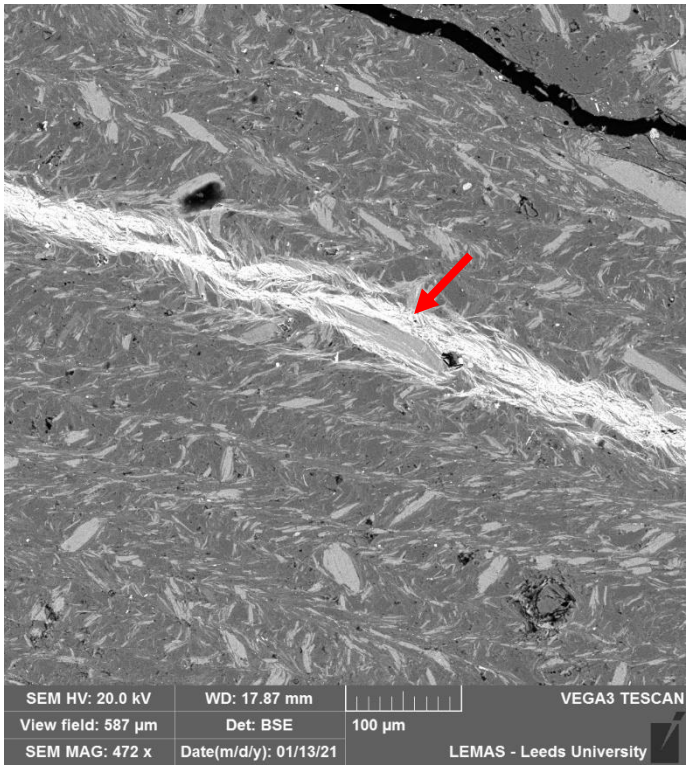


Figure 3-10 *BSE image showing Fe-Mn oxides (bright phase – red arrow) precipitating along a foliation plane in sample BH1.*

3.3 Petrography of individual samples

3.3.1 Sample BH1 (Depth 4.7-5.2 m)

Sample BH1 is a dark grey/green phyllite; a moderately developed foliation may be observed in the hand-specimen (**Figure 3-11**). The sample of BH1 examined using SEM is predominantly composed of metamorphosed rock with fine silt sized grains that contains the occasional folded layering that is possibly sedimentary in nature (**Figure 3-12**, **Figure 3-13**). The rock contains a distinct foliation (**Figure 3-12**, **Figure 3-13**) resulting from the concentration and re-orientation of chlorite and mica (**Figure 3-14**); these have a spacing of 200 to 500 µm. These zones also contain concentrations of accessory minerals such as monazite (cerium neodymium phosphate) and zircon. In places, Fe-Mn oxides have precipitated along the foliation (**Figure 3-15**); these are secondary alteration products that may have formed as a result of weathering. The matrix of the sample (**Figure 3-16**) is composed of around 45% quartz, chlorite, 30% white mica and 25% chlorite with small amounts of accessory minerals such a rutile and zircon. The quartz, mica and chlorite are silt-sized whereas the rutile occurs as 2-5 µm grains. The medium grained metamorphosed silt layers within the sample seem to contain 0.4 to 5 mm wide lenses (e.g. **Figure 3-12**, **Figure 3-13**) that contain far less mica and chlorite than the surrounding sediment but also contain secondary pores; the origin of the secondary pores is unknown.



Figure 3-11 *Photograph of sample BH1. Note the moderately developed foliation.*

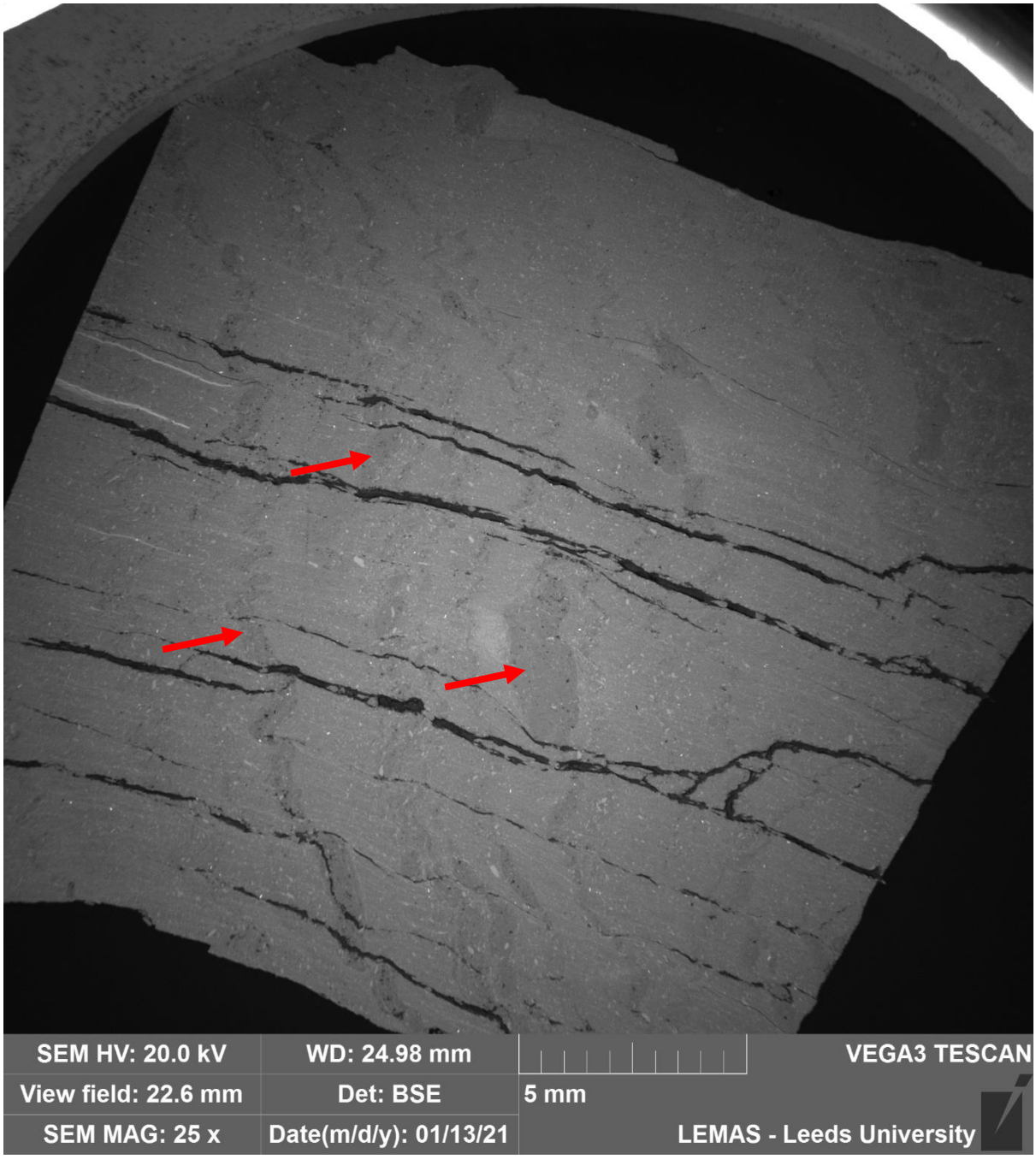


Figure 3-12 *BSE image showing a low magnification image of the general microstructure of sample BH1. Note that the sample has split along a foliation that has developed at around 70^{o} to a folded layering (red arrows).*

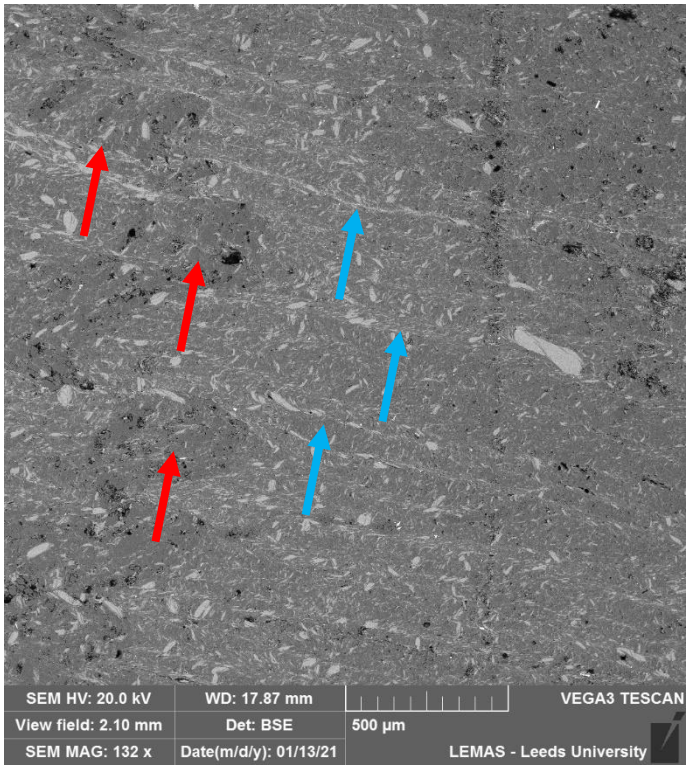


Figure 3-13 *BSE image showing a moderate magnification image of sample BH1. Note the 400 µm nodules that have lower concentrations of mica (red arrows) and the foliation (blue arrows)*

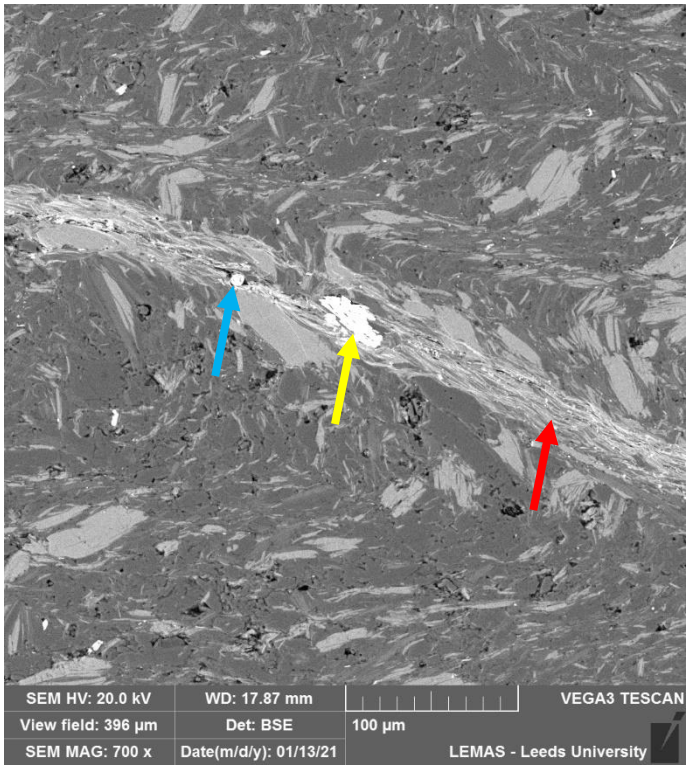


Figure 3-14 *BSE image showing a moderate magnification of a chlorite-mica rich zone in sample BH1, which forms the foliation in this sample (red arrow). This zone contains zircon (blue arrow) and monazite (yellow arrow).*

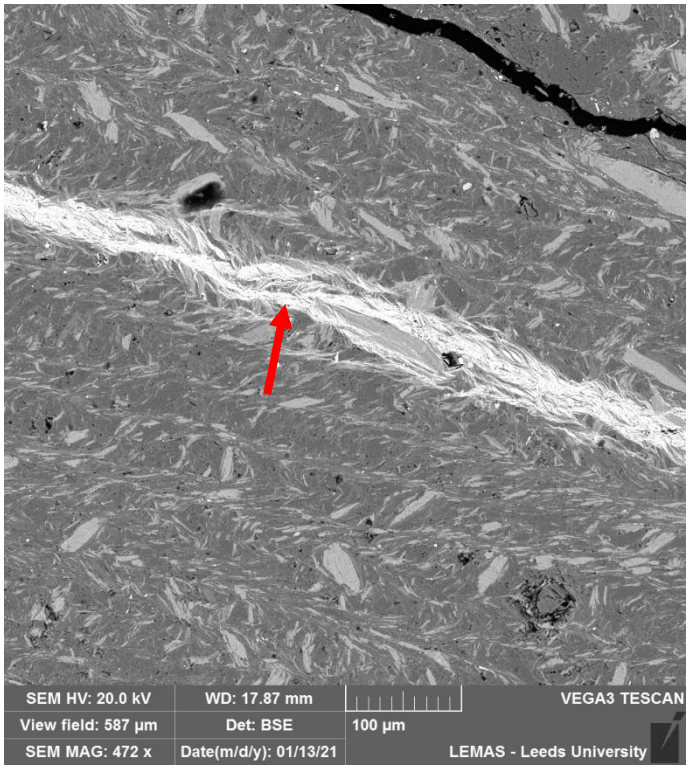


Figure 3-15 *BSE image showing a layer within sample BH1 containing Fe-Mn oxides (arrow).*

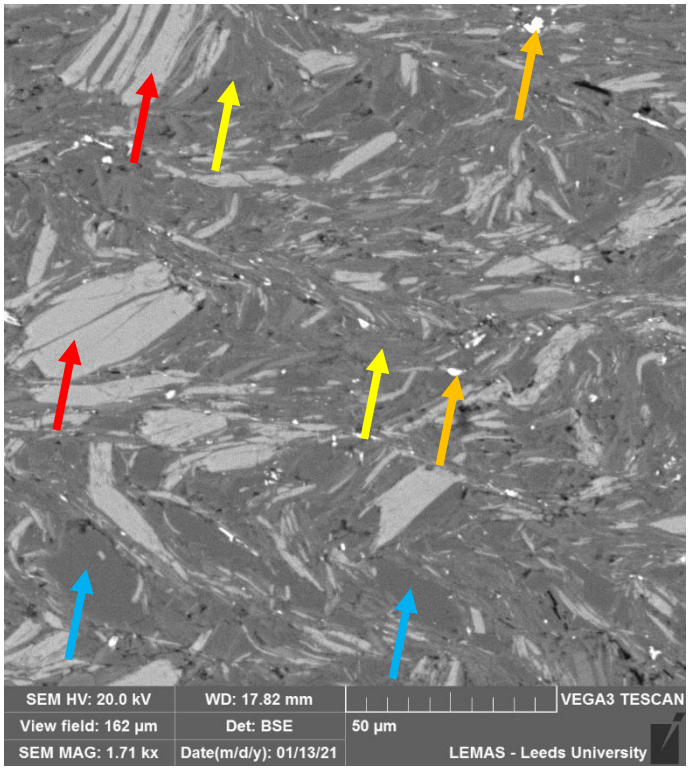


Figure 3-16 *BSE image showing a high magnification image of the matrix in sample BH1. It contains chlorite (red arrow), quartz (blue arrow), mica (yellow arrow) and very fine grained rutile (orange arrow).*

3.3.2 Sample BH2 (Depth 2-3.5 m)

Sample BH02 is a very soft, pliable mud (**Figure 3-17**). The sample had such a low permeability it was not possible to effectively impregnate it with resin, which meant that it was fell apart during polishing. However, small parts of the sample were preserved that could be imaged in the SEM. The sample is composed a small proportion of silt-sized grains (mainly quartz with a small amount of calcite), supported by randomly oriented clay and fine grained mica with small fragments of quartz.



Figure 3-17 *Photograph of the sample of BH2; note that it is composed of lumps of soft mud.*

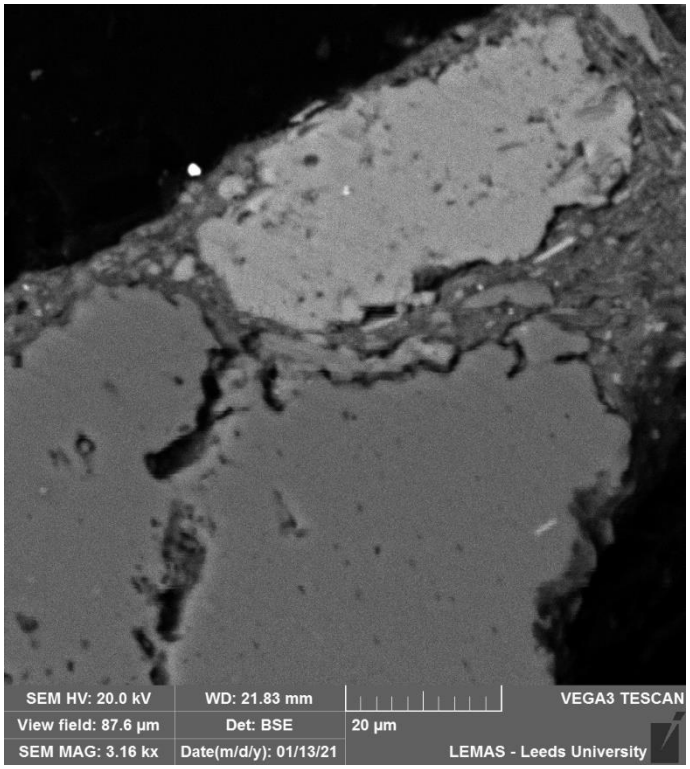


Figure 3-18 *BSE image showing the silt-sized grains within sample BH2. The lighter grains are quartz (red arrows) and the bright grain is calcite (blue arrow)*

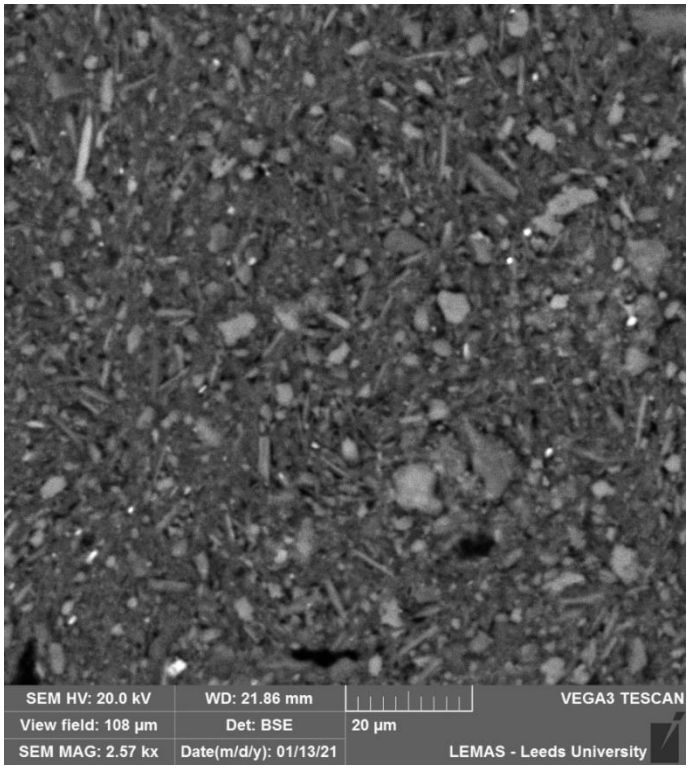


Figure 3-19 *BSE image showing a high magnification view of the muddy matrix.*

3.3.3 Sample BH4 (Depth 6.5-8 m)

Sample BH4 is a dark grey/green coloured phyllite with a moderately developed foliation (**Figure 3-20**). The sample of BH4 examined using SEM has a folded layering that is possibly sedimentary in nature and a distinct foliation along which the sample has split (**Figure 3-21**). Image analysis indicates that the matrix of the sample (e.g. **Figure 3-22**) is composed of 40% mica, 40% quartz, 20% chlorite with small amounts of accessory minerals such a rutile, zircon, monazite as well as Fe-Mn oxides. The quartz, mica and chlorite are silt-sized whereas the rutile occurs as 2-5 µm grains. The The mica appears to have a composition close to muscovite but does contain some Na. The chlorite is a Fe-Mg variety; EDS analysis suggests that the Fe to Mg ratio is around 3:1. The quartz-rich layers within the sample seem to contain 0.4 to 5 mm wide nodules (**Figure 3-23**) that contain far less mica and chlorite than the surrounding rock. These also contain secondary pores of a similar size to the quartz grains and concentrations of heavy minerals such as zircon (**Figure 3-24**); the origin (i.e. mineral which was dissolved) of the secondary pores could not be determined. The foliation is caused by the preferential orientation, and concentration, of mica and chlorite within zones that have a spacing of 200 to 500 µm. These zones also contain concentrations of accessory minerals such as monazite (Cerium neodymium phosphate) and zircon. In places these layers have undergone and contain concentrations of Fe-Mn oxides.



Figure 3-20 *Photograph of sample BH4. Note moderately developed foliation.*

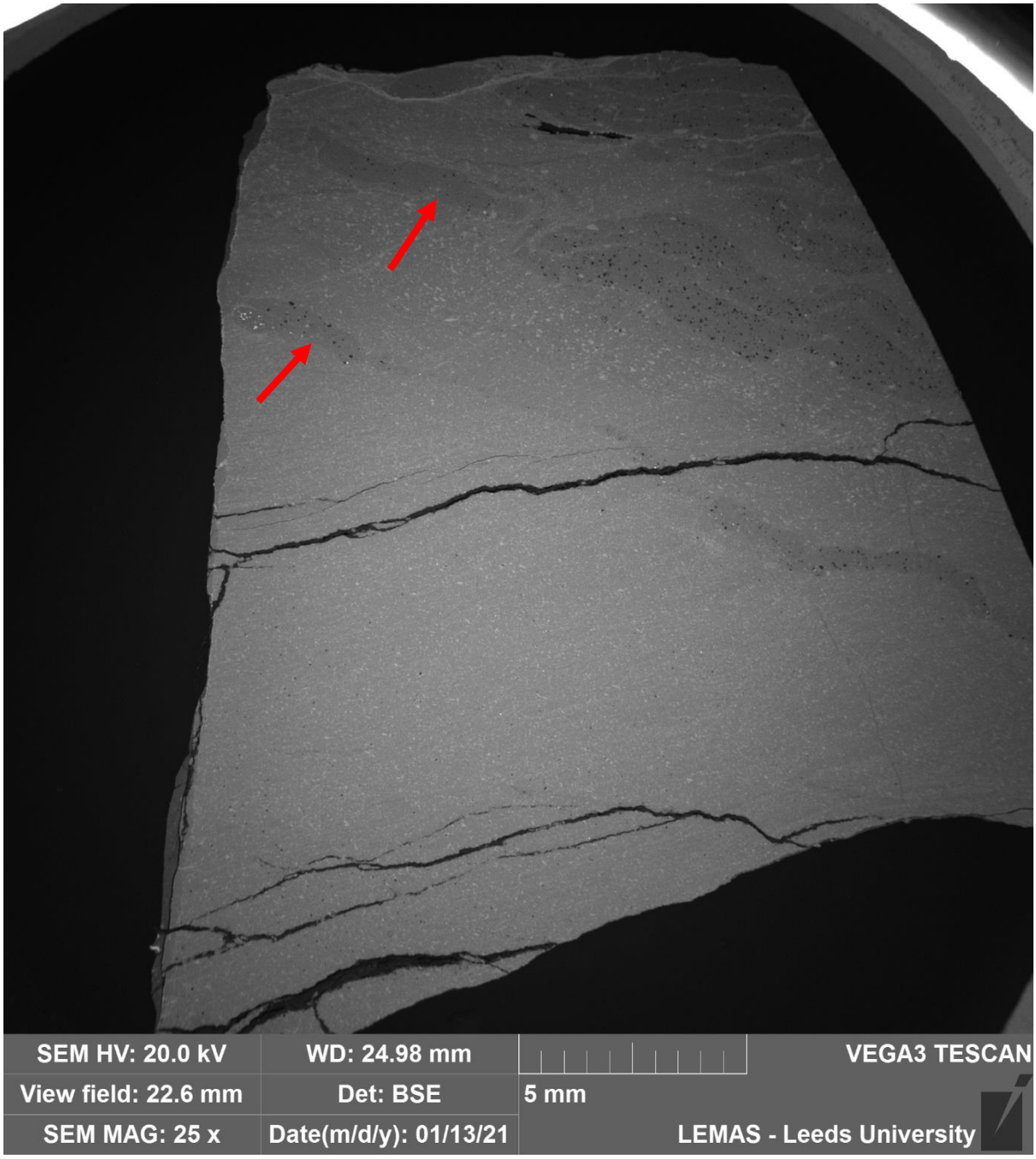


Figure 3-21 *BSE image showing a low magnification image of the general microstructure of sample BN4. Note that the sample has split along a foliation that has developed at around 70^{o} to a folded quartz-rich layers (red arrows).*

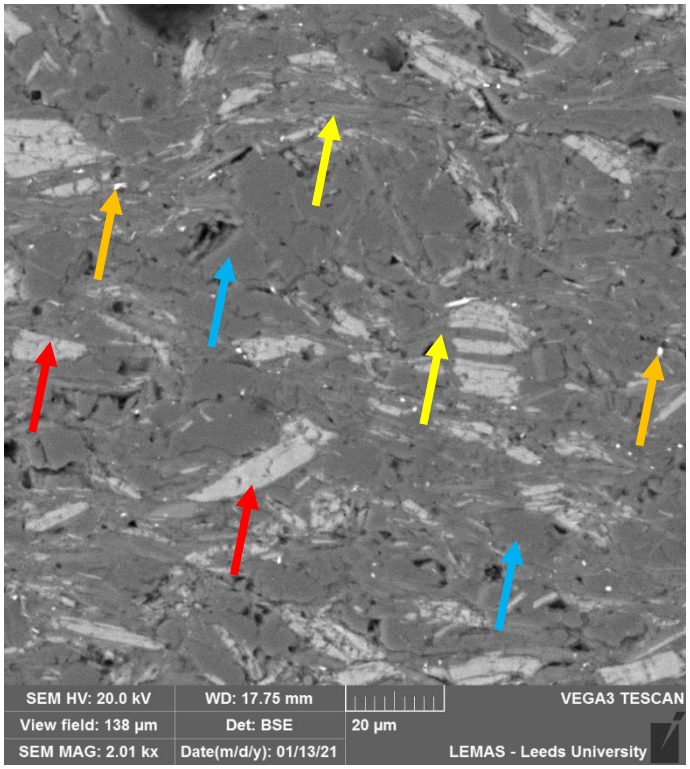


Figure 3-22 *BSE image showing a high magnification image sample BH4. It contains chlorite (red arrow), quartz (blue arrow), mica (yellow arrow) and very fine-grained rutile (orange arrow).*

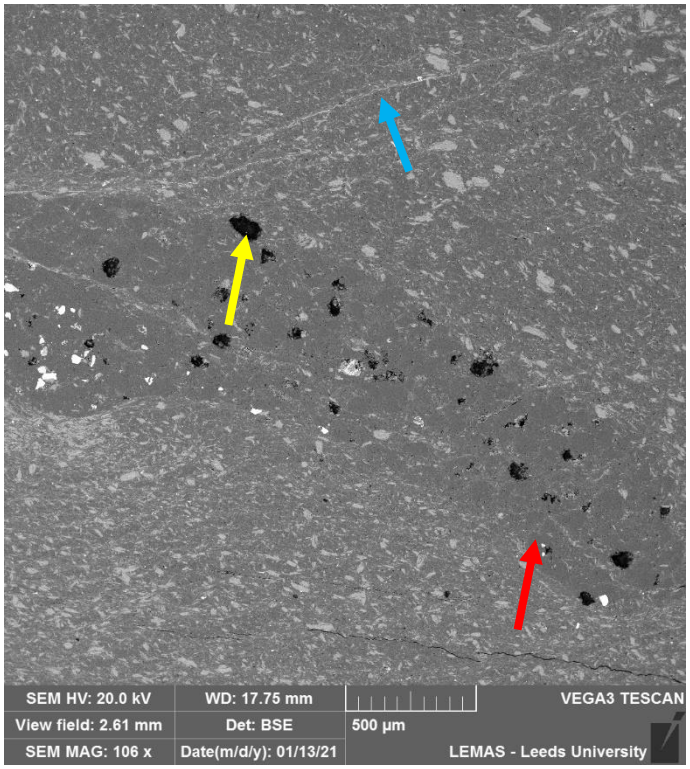


Figure 3-23 *BSE image showing a moderate magnification image of sample BH4 Note the 400 µm quartz-rich lenses mica (red arrows) and the foliation (blue arrows). Note that the nodule contains secondary pores (yellow arrow).*

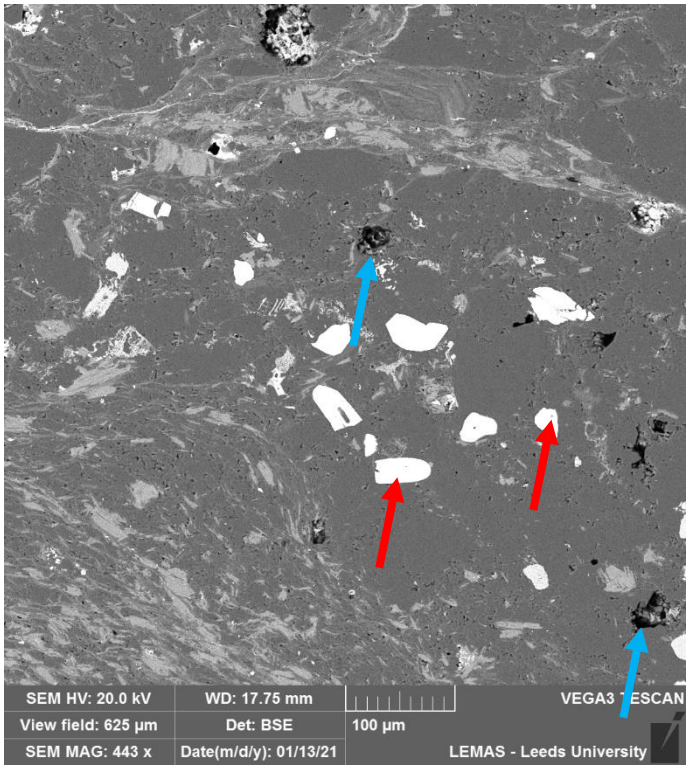


Figure 3-24 *BSE image showing a moderate magnification of one of the layers with lower concentrations of mica/chlorite in sample BH4. These are composed mainly of quartz but also contain zircon (red arrows) and secondary pores (blue arrows).*

3.3.4 Sample BH5 (Depth 5.30-6.80 m)

BH5 is a dark coloured phyllite (**Figure 3-25**). The sample of BH5 examined using the SEM contains a 0.5 cm thick layer of metamorphosed fine siltstone overlain by a 1cm layer of medium siltstone (**Figure 3-26**). The sample contains a distinct foliation orientated at around 30° to the layering. The metamorphosed fine siltstone layers (e.g. **Figure 3-27**) are composed of ~40% quartz, 35% mica, 25% chlorite with subordinate quantities of rutile, zircon and Fe-Ti oxides. The chlorite is a Mg-Fe variety (Fe to Mg ratio is around 3:1) whereas the mica is composed of K-Al-Si-O with small amounts of Na. The fine silt layers have a distinct foliation (**Figure 3-28**) resulting in the concentration and preferential orientation within zones that have a spacing of 200 to 500 µm that are orientated at around 30° to the layering. Occasionally, Fe and Ti oxides have precipitated along the foliation (**Figure 3-29**).

The metamorphosed medium grained siltstone layers (e.g. **Figure 3-31**, **Figure 3-32**) are composed of ~55% quartz, 25% mica, 13% chlorite, and have around 7% secondary porosity. The origins of the secondary porosity could not be determined. The pores have a similar size to the overall grain-size indicating that they may have resulted from the dissolution of a detrital grain (e.g. K-feldspar). However, it is also possible that they formed as a result of the dissolution of a mineral that precipitated during diagenesis or metamorphism.



Figure 3-25 *Photograph of sample BH5. The sample has split along the foliation*

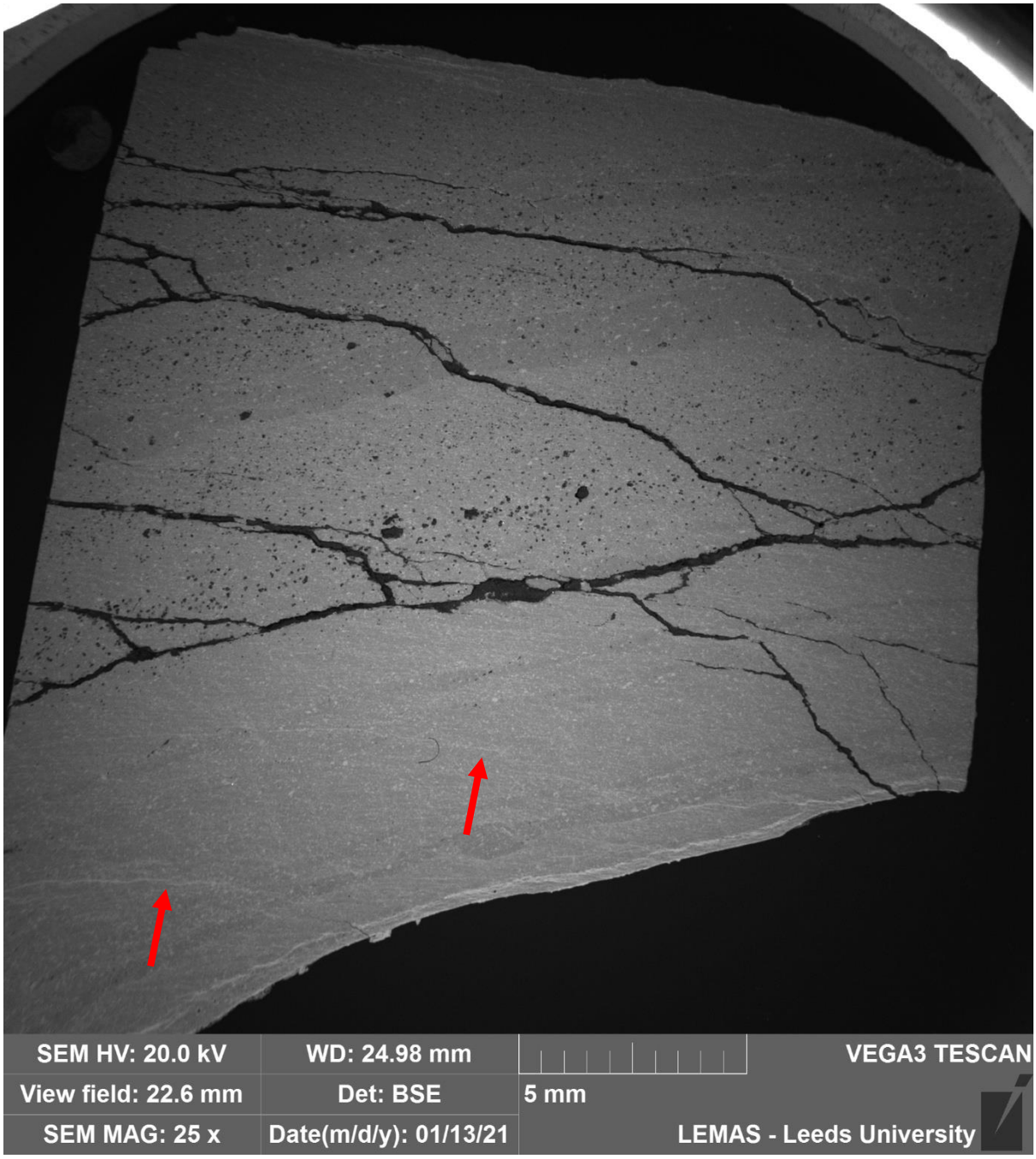


Figure 3-26 *BSE image showing a low magnification image of the general microstructure of sample BH5. Note the distinct layering and the foliation that is orientated around 30° to the bedding (arrows).*

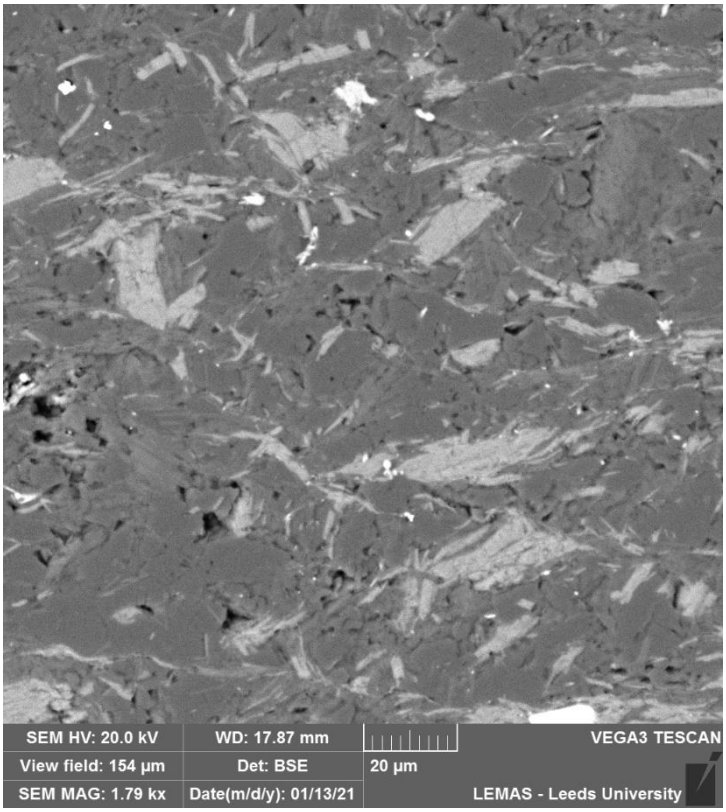


Figure 3-27 *BSE image showing a high magnification image of layer containing fine silt-sized grains in sample BH5.*

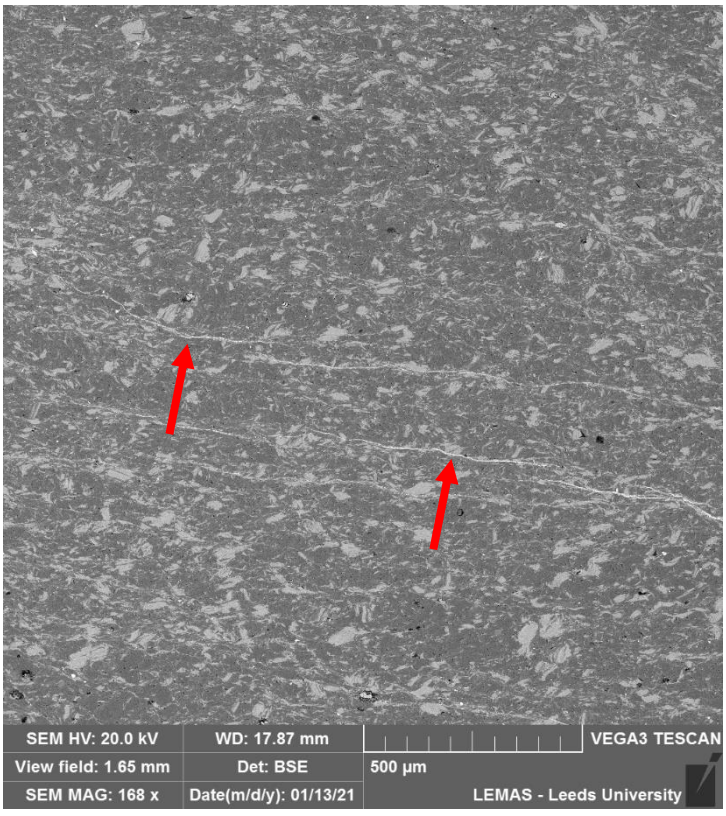


Figure 3-28 *BSE image showing a moderate magnification image of layer containing fine silt-sized grains in sample BH5.*

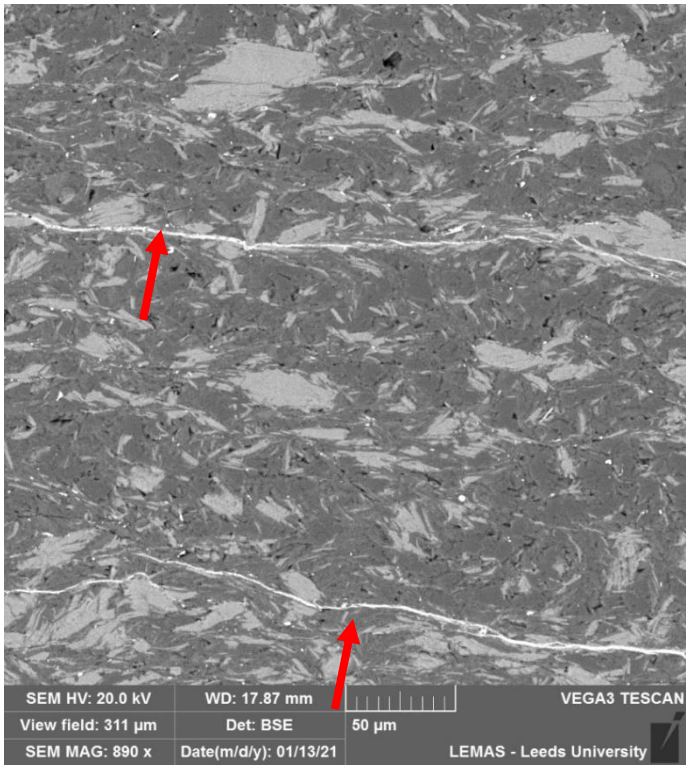


Figure 3-29 *BSE image showing the layers containing Fe and Ti oxides (arrows) within sample BH5.*

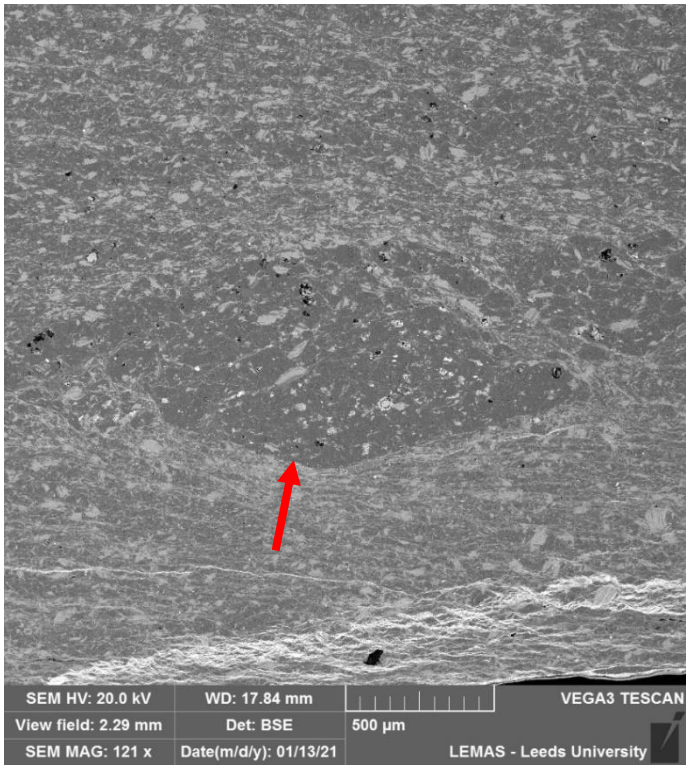


Figure 3-30 *BSE image showing small quartz-rich lens within the sample that contain lower concentrations of chlorite and mica than the surrounding matrix.*

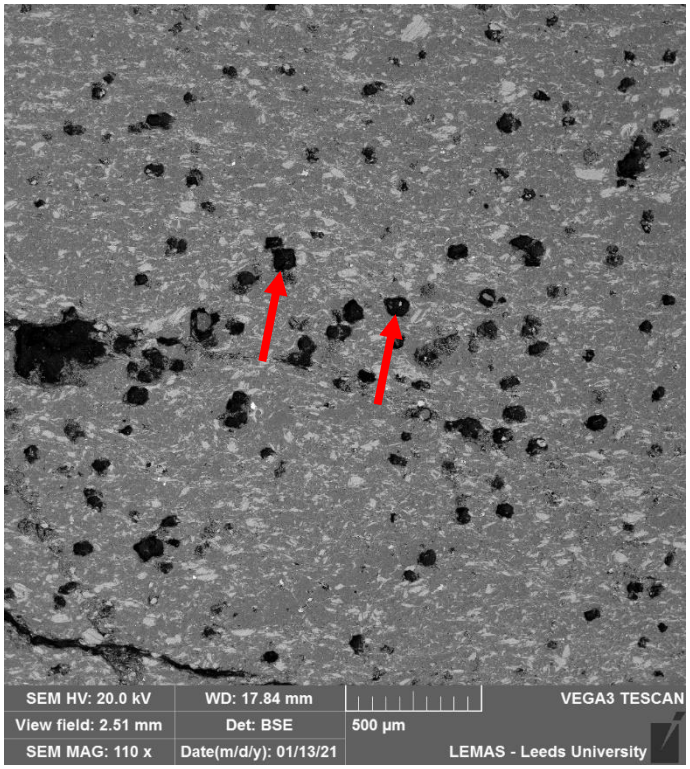


Figure 3-31 *BSE image showing a moderate magnification image of the layer containing medium silt-sized grains from sample BH5. Note also the secondary porosity (black areas – arrows).*

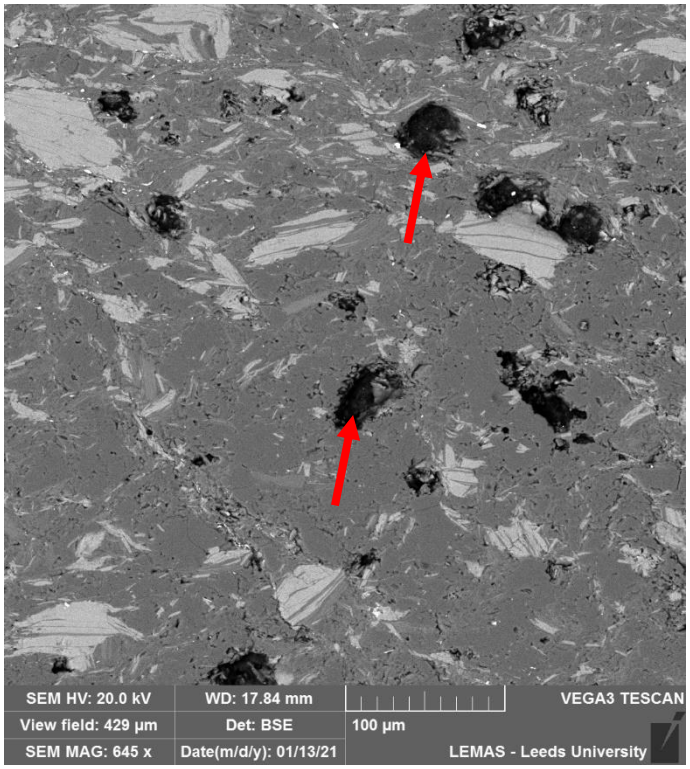


Figure 3-32 *BSE image showing a moderate magnification image of the layer containing medium silt-sized grains from sample BH5. Note also the secondary porosity (black areas – arrows).*

4 Conclusions

The petrography of four samples were analysed using scanning electron microscopy for Irish Drilling Limited as part of the Arklow Banks Wind Farm project. Three samples (BH1, BH4, BH5) are phyllites (metamorphosed siltstone/shales) with a moderately developed foliation. These samples are composed predominantly of quartz, mica, and chlorite. This mineralogy indicates the samples have been metamorphosed to greenschist facies. The samples also contain subordinate quantities of heavy minerals such as zircon, monazite and rutile as well as secondary alteration products such as Fe-Mn-Ti oxides that have precipitated along the foliation.

The forth sample (BH2) is a pliable, silty mud composed of quartz and calcite grains in a muddy matrix of randomly orientated quartz, calcite, mica, chlorite and quartz.

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 18 January 2021
Test Report Ref: TR 771631

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Oxidisable sulphides (OS) content of an Sample by calculation of **TRL Report 447 Test No. 2 and Test No. 4**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH01 4.7-5.2**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH01 4.7-5.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**<0.5 % SO_4 - If deposited within 500mm of Cementitious Materials** **<0.06 % SO_4 - If deposited within 500mm of Metallic Structural Elements**

RESULTS:

Oxidisable Sulphides (OS) (%) = 0.02 SO_4

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 18 January 2021
Test Report Ref: TR 771630

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Soluble Sulphur Content of a sample in accordance with
BS 1377 : 1990 : ICP-AES Method 2 (TRL Report 447 Method 1)

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH01 4.7-5.2**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH01 4.7-5.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Soluble Sulphate Content (mg/l) = 117.00 (SO4)

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 18 January 2021
Test Report Ref: TR 771629

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Total Sulphur Content of a sample in accordance **BS 1377 : 1990 : ICP-AES Method 17 (TRL Report 447 Test No.4)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH01 4.7-5.2**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH01 4.7-5.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Total Sulphur Content (%) =	**0.01**	
Total Potential Sulphate Content (%) =	**0.04**	**(SO4)**

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These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 18 January 2021
Test Report Ref: TR 771628

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Acid Soluble Sulphur Content of a sample in accordance with **TRL Report 447 and BS 1377 : 1990 : ICP-AES Method 4 (Test No.2)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH01 4.7-5.2**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH01 4.7-5.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Acid Soluble Sulphate Content (%) = <0.02 (SO4)

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These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 27 January 2021
Test Report Ref: TR 771627

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Resistance to Freezing and Thawing of an aggregate sample in accordance with **BS EN 1367-1 : 2007**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH01 4.7-5.2**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**11/01/2021**
Sampling Location:	**BH01 4.7-5.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**DW**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

% Loss in mass after Freeze Thaw test (F) = 0.4 (nearest 0.1%)

Visual Observation of sample after testing: No cracking or splitting observed

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments / Departure from specified Procedure	Report checked and approved by:
No departure from specified procedure	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 22 February 2021
Test Report Ref: TR 771623

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Frost Heave of Unbound Aggregate in accordance with **BS 812: Part 124: 2009 - Annex B (Use of Comparator Specimens)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH01 4.7-5.2**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**10/02/2021**
Sampling Location:	**BH01 4.7-5.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**MW**
Material Description:	**Cores**
Target Specification	**SHW Series 800: clause 801.8**

RESULTS:

Were any unrepresentative lumps present? No

Frost Heave Test Result:

Comparator Specimen - Maximum Heave Observed in 96 hours (mm)		
Comparator Specimen 1	12.0	*(nearest 0.5mm)*
Comparator Specimen 2	12.5	*(nearest 0.5mm)*
Comparator Specimen 3	12.0	*(nearest 0.5mm)*
Mean	**12.2**	*(nearest 0.1mm)* *(limits: 13.6 +/- 4mm)*
Test Specimen - Maximum Heave Observed in 96 hours (mm)		
Test Specimen 1	12.0	*(nearest 0.5mm)*
Test Specimen 2	14.0	*(nearest 0.5mm)*
Test Specimen 3	12.0	*(nearest 0.5mm)*
Range of Test Specimens Maximum Heave	2.0	*(should not exceed 6mm)*
Mean Frost Heave	**12.7**	*(nearest 0.1mm)*

In accordance with SHW Series 800: clause 801.8 the sample is classified as being
Non Frost Susceptible (mean frost heave ≤ 15mm)

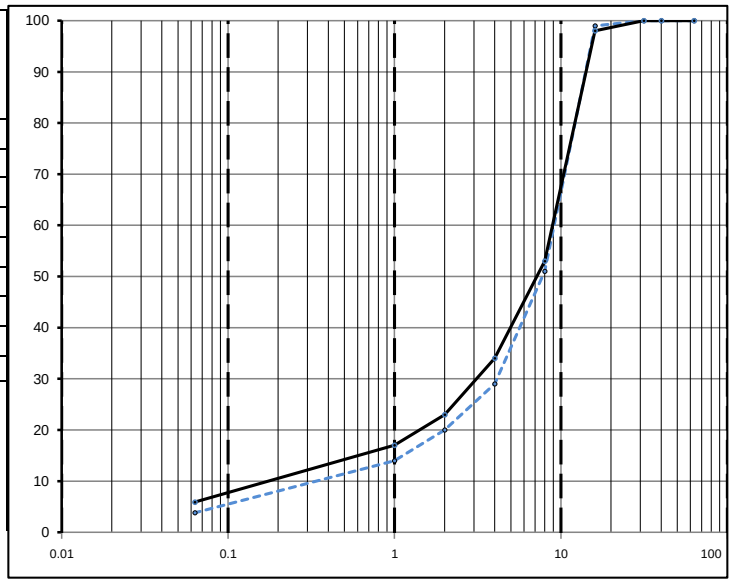
RESULTS CONTINUED:

Laboratory Dry Density & Water Content Test Result

Maximum Dry Density	**2.04 Mg/m3**
Optimum Water Content	**7.5 %**
Actual Dry Density	**2.04 Mg/m3**
Actual Water Content	**7.3 %**

Particle Size Distribution Test Result

BS Test Sieve Nominal Aperture	As Received Test Portion % Passing	Stable Test Portion % Passing
63.0 mm	100	100
40.0 mm	100	100
31.5 mm	100	100
16.0 mm	99	98
8.0 mm	51	53
4.0 mm	29	34
2.0 mm	20	23
1.0 mm	14	17
0.063 mm	3.8	5.9



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These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Dyfed Jones
Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 03 February 2021
Test Report Ref: TR 771620

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine Flakiness Index of Aggregate Sample in accordance with **BS EN 933-3: 2012**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH01 5.2-6.7**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH01 5.2-6.7**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**MD**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Mass of Test Portion =	**3772 g**
Flakiness Index (FI) =	**39**

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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 02 February 2021
Test Report Ref: TR 771619

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Content of a rock sample (oven-drying method) in accordance with the **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH01 5.2-6.7**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**20/01/2021**
Sampling Location:	**BH01 5.2-6.7**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**LT**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Content (%) = **3.7**

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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 03 February 2021
Test Report Ref: TR 771622

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine Flakiness Index of Aggregate Sample in accordance with **BS EN 933-3: 2012**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH01 9.7-10.2**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH01 9.7-10.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**MD**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Mass of Test Portion =	**3631 g**
Flakiness Index (FI) =	**30**

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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 02 February 2021
Test Report Ref: TR 771621

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Content of a rock sample (oven-drying method) in accordance with the **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH01 9.7-10.2**
Date and Time of Sampling:	**21/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**20/01/2021**
Sampling Location:	**BH01 9.7-10.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**LT**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Content (%) = **2.3**

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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 03 February 2021
Test Report Ref: TR 771633

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine Flakiness Index of Aggregate Sample in accordance with **BS EN 933-3: 2012**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH03 3.2-3.8**
Date and Time of Sampling:	**22/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH03 3.2-3.8**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**MD**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Mass of Test Portion =	**3588 g**
Flakiness Index (FI) =	**59**

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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 02 February 2021
Test Report Ref: TR 771632

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Content of a rock sample (oven-drying method) in accordance with the **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH03 3.2-3.8**
Date and Time of Sampling:	**22/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**20/01/2021**
Sampling Location:	**BH03 3.2-3.8**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**LT**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Content (%) = **3.8**

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These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Dyfed Jones
Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 27 January 2021
Test Report Ref: TR 771638

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Resistance to Freezing and Thawing of an aggregate sample in accordance with **BS EN 1367-1 : 2007**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH03 6.8-8.2**
Date and Time of Sampling:	**23/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**11/01/2021**
Sampling Location:	**BH03 6.8-8.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**DW**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

% Loss in mass after Freeze Thaw test (F) = 0.6 (nearest 0.1%)

Visual Observation of sample after testing: No cracking or splitting observed

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These results relate only to the items tested.

Comments / Departure from specified Procedure	Report checked and approved by:
No departure from specified procedure	DWJones Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 22 February 2021
Test Report Ref: TR 771634

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Frost Heave of Unbound Aggregate in accordance with **BS 812: Part 124: 2009 - Annex B (Use of Comparator Specimens)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH03 6.8-8.2**
Date and Time of Sampling:	**23/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**12/02/2021**
Sampling Location:	**BH03 6.8-8.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**MW**
Material Description:	**Cores**
Target Specification	**SHW Series 800: clause 801.8**

RESULTS:

Were any unrepresentative lumps present? No

Frost Heave Test Result:

Comparator Specimen - Maximum Heave Observed in 96 hours (mm)		
Comparator Specimen 1	12.0	*(nearest 0.5mm)*
Comparator Specimen 2	11.0	*(nearest 0.5mm)*
Comparator Specimen 3	11.5	*(nearest 0.5mm)*
Mean	**11.5**	*(nearest 0.1mm)* *(limits: 13.6 +/- 4mm)*
Test Specimen - Maximum Heave Observed in 96 hours (mm)		
Test Specimen 1	7.5	*(nearest 0.5mm)*
Test Specimen 2	9.0	*(nearest 0.5mm)*
Test Specimen 3	8.5	*(nearest 0.5mm)*
Range of Test Specimens Maximum Heave	1.5	*(should not exceed 6mm)*
Mean Frost Heave	**8.3**	*(nearest 0.1mm)*

In accordance with SHW Series 800: clause 801.8 the sample is classified as being
Non Frost Susceptible (mean frost heave ≤ 15mm)

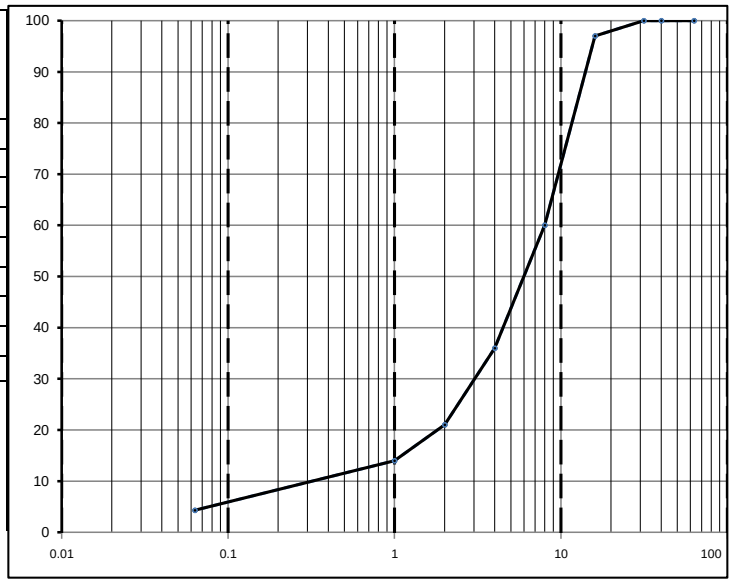
RESULTS CONTINUED:

Laboratory Dry Density & Water Content Test Result

Maximum Dry Density	**2.03 Mg/m3**
Optimum Water Content	**6 %**
Actual Dry Density	**2.03 Mg/m3**
Actual Water Content	**5.8 %**

Particle Size Distribution Test Result

BS Test Sieve Nominal Aperture	As Received Test Portion % Passing	Stable Test Portion % Passing
63.0 mm	100	100
40.0 mm	100	100
31.5 mm	100	100
16.0 mm	97	97
8.0 mm	60	60
4.0 mm	36	36
2.0 mm	21	21
1.0 mm	14	14
0.063 mm	4.3	4.3



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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 03 February 2021
Test Report Ref: TR 771640

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine Flakiness Index of Aggregate Sample in accordance with **BS EN 933-3: 2012**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH03 12.7-14.2**
Date and Time of Sampling:	**23/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH03 12.7-14.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**MD**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Mass of Test Portion =	**3520 g**
Flakiness Index (FI) =	**53**

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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 02 February 2021
Test Report Ref: TR 771639

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Content of a rock sample (oven-drying method) in accordance with the **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH03 12.7-14.2**
Date and Time of Sampling:	**23/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**20/01/2021**
Sampling Location:	**BH03 12.7-14.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**LT**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Content (%) = **2**

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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

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Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 03 February 2021
Test Report Ref: TR 771642

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine Flakiness Index of Aggregate Sample in accordance with **BS EN 933-3: 2012**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH03 18.7-20.2**
Date and Time of Sampling:	**27/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH03 18.7-20.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**MD**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Mass of Test Portion =	**4255 g**
Flakiness Index (FI) =	**72**

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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 02 February 2021
Test Report Ref: TR 771641

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Content of a rock sample (oven-drying method) in accordance with the **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH03 18.7-20.2**
Date and Time of Sampling:	**27/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**20/01/2021**
Sampling Location:	**BH03 18.7-20.2**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**LT**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Content (%) =	**2.5**

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These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Contract: SSE
Arklow Bank
2020WW102
2020WW102

Date: 18 January 2021
Test Report Ref: TR 771648

Order No: 9246

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Soluble Sulphur Content of a sample in accordance with
BS 1377 : 1990 : ICP-AES Method 2 (TRL Report 447 Method 1)

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH05 5.3-6.8**
Date and Time of Sampling:	**20/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH05 5.3-6.8**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Soluble Sulphate Content (mg/l) = <0.20 (SO4)

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.
These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	DWJones Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 18 January 2021
Test Report Ref: TR 771647

Order No: 9246

Contract: SSE
Arklow Bank
2020WW102
2020WW102

2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Oxidisable sulphides (OS) content of an Sample by calculation of **TRL Report 447 Test No. 2 and Test No. 4**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH05 5.3-6.8**
Date and Time of Sampling:	**20/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH05 5.3-6.8**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**<0.5 % SO_4 - If deposited within 500mm of Cementitious Materials** **<0.06 % SO_4 - If deposited within 500mm of Metallic Structural Elements**

RESULTS:

Oxidisable Sulphides (OS) (%) = 0.02 SO_4

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments
The work was carried out by our accredited, competent, sub contracted laboratory.

Report checked and approved by:

Dyfed Jones
Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 18 January 2021
Test Report Ref: TR 771646

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Total Sulphur Content of a sample in accordance **BS 1377 : 1990 : ICP-AES Method 17 (TRL Report 447 Test No.4)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH05 5.3-6.8**
Date and Time of Sampling:	**20/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH05 5.3-6.8**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Total Sulphur Content (%) =	**0.01**	
Total Potential Sulphate Content (%) =	**0.04**	**(SO4)**

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 18 January 2021
Test Report Ref: TR 771645
Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Acid Soluble Sulphur Content of a sample in accordance with **TRL Report 447 and BS 1377 : 1990 : ICP-AES Method 4 (Test No.2)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH05 5.3-6.8**
Date and Time of Sampling:	**20/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH05 5.3-6.8**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Acid Soluble Sulphate Content (%) = <0.02 (SO4)

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.
These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 03 February 2021
Test Report Ref: TR 771644

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine Flakiness Index of Aggregate Sample in accordance with **BS EN 933-3: 2012**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH05 5.3-6.8**
Date and Time of Sampling:	**20/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**14/01/2021**
Sampling Location:	**BH05 5.3-6.8**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**MD**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Mass of Test Portion =	**3521 g**
Flakiness Index (FI) =	**17**

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 02 February 2021
Test Report Ref: TR 771643

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Content of a rock sample (oven-drying method) in accordance with the **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. No:	**BH05 5.3-6.8**
Date and Time of Sampling:	**20/10/2020**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**20/01/2021**
Sampling Location:	**BH05 5.3-6.8**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**LT**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Content (%) = **4.9**

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 04 March 2021
Test Report Ref: TR 785732

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Oxidisable sulphides (OS) content of an Sample by calculation of **TRL Report 447 Test No. 2 and Test No. 4**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH4@ 6.5-8.0m**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**01/03/2021**
Sampling Location:	**BH4@ 6.5-8.0m**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**<0.5 % SO_4 - If deposited within 500mm of Cementitious Materials** **<0.06 % SO_4 - If deposited within 500mm of Metallic Structural Elements**

RESULTS:

Oxidisable Sulphides (OS) (%) = 0.04 SO_4

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 04 March 2021
Test Report Ref: TR 785731

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Total Sulphur Content of a sample in accordance **BS 1377 : 1990 : ICP-AES Method 17 (TRL Report 447 Test No.4)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH4@ 6.5-8.0m**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**01/03/2021**
Sampling Location:	**BH4@ 6.5-8.0m**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Total Sulphur Content (%) =	**0.02**	
Total Potential Sulphate Content (%) =	**0.07**	**(SO4)**

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments
The work was carried out by our accredited, competent, sub contracted laboratory.

Report checked and approved by:

Dyfed Jones
Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 04 March 2021
Test Report Ref: TR 785730

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Acid Soluble Sulphur Content of a sample in accordance with **TRL Report 447 and BS 1377 : 1990 : ICP-AES Method 4 (Test No.2)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH4@ 6.5-8.0m**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**01/03/2021**
Sampling Location:	**BH4@ 6.5-8.0m**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Acid Soluble Sulphate Content (%) = 0.03 (SO4)

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 04 March 2021
Test Report Ref: TR 785729

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Soluble Sulphur Content of a sample in accordance with
BS 1377 : 1990 : ICP-AES Method 2 (TRL Report 447 Method 1)

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH4@ 6.5-8.0m**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**01/03/2021**
Sampling Location:	**BH4@ 6.5-8.0m**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Soluble Sulphate Content (mg/l) = 27.00 (SO4)

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 04 March 2021
Test Report Ref: TR 785728

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Soluble Sulphur Content of a sample in accordance with
BS 1377 : 1990 : ICP-AES Method 2 (TRL Report 447 Method 1)

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH2@ 2.0-3.5m**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**01/03/2021**
Sampling Location:	**BH2@ 2.0-3.5m**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Water Soluble Sulphate Content (mg/l) = 30.00 (SO4)

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 04 March 2021
Test Report Ref: TR 785727

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Acid Soluble Sulphur Content of a sample in accordance with **TRL Report 447 and BS 1377 : 1990 : ICP-AES Method 4 (Test No.2)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH2@ 2.0-3.5m**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**01/03/2021**
Sampling Location:	**BH2@ 2.0-3.5m**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Acid Soluble Sulphate Content (%) = 0.04 (SO4)

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments
The work was carried out by our accredited, competent, sub contracted laboratory.

Report checked and approved by:

Dyfed Jones
Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 04 March 2021
Test Report Ref: TR 785726

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Total Sulphur Content of a sample in accordance **BS 1377 : 1990 : ICP-AES Method 17 (TRL Report 447 Test No.4)**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH2@ 2.0-3.5m**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**01/03/2021**
Sampling Location:	**BH2@ 2.0-3.5m**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**N/A**

RESULTS:

Total Sulphur Content (%) =	**0.01**	
Total Potential Sulphate Content (%) =	**0.04**	**(SO4)**

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments
The work was carried out by our accredited, competent, sub contracted laboratory.

Report checked and approved by:

Dyfed Jones
Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 04 March 2021
Test Report Ref: TR 785725

Order No: 9246

Contract: SSE Arklow Bank 2020WW102

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Oxidisable sulphides (OS) content of an Sample by calculation of **TRL Report 447 Test No. 2 and Test No. 4**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S91851**
Client Ref. :	**BH2@ 2.0-3.5m**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**03/12/2020**
Date of Start of Test:	**01/03/2021**
Sampling Location:	**BH2@ 2.0-3.5m**
Name of Source:	**Arlow Bank**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Tested By:	**Subcontracted Laboratory**
Material Description:	**Cores**
Target Specification:	**<0.5 % SO_4 - If deposited within 500mm of Cementitious Materials** **<0.06 % SO_4 - If deposited within 500mm of Metallic Structural Elements**

RESULTS:

Oxidisable Sulphides (OS) (%) = <0.01 SO_4

This test report shall not be reproduced, except in full, without the written approval of Celtest Company Limited.

These results relate only to the items tested.

Comments	Report checked and approved by:
The work was carried out by our accredited, competent, sub contracted laboratory.	Dyfed Jones Aggregate Team Coordinator

Appendix 1a Environmental Test Results (Water)

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Irish Drilling Limited
Old Galway Road
Loughrea
Co. Galway

Attention: Dympna Darcy

CERTIFICATE OF ANALYSIS

Date of report Generation:	20 May 2021
Customer:	Irish Drilling Limited
Sample Delivery Group (SDG):	210510-73
Your Reference:	2020WW102
Location:	Arklow Bank
Report No:	598689

This report has been revised and directly supersedes 598190 in its entirety.

We received 3 samples on Monday May 10, 2021 and 3 of these samples were scheduled for analysis which was completed on Thursday May 20, 2021. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:



Sonia McWhan
Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
24240226	BH01	EW1	3.22 - 3.22	05/05/2021
24240246	BH03	EW1	1.52 - 1.52	05/05/2021
24240235	BH04	EW1	7.99 - 7.99	05/05/2021

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

| | | | | |

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Results Legend

X **Test**

N **No Determination Possible**

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			24240226					24240246					24240235						
Customer Sample Reference			BH01					BH03					BH04						
AGS Reference			EW1					EW1					EW1						
Depth (m)			3.22 - 3.22					1.52 - 1.52					7.99 - 7.99						
Container			0.5l glass bottle (ALE227)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)	Vial (ALE297)	0.5l glass bottle (ALE227)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)	Vial (ALE297)	0.5l glass bottle (ALE227)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)	Vial (ALE297)		
Sample Type			GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW		
Total Metals by ICP-MS	All	NDPs: 0 Tests: 3	X					X					X						
TPH by IR Oils and Greases	All	NDPs: 0 Tests: 3					X	X					X						
VOC MS (W)	All	NDPs: 0 Tests: 3					X					X					X		

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	3.22 - 3.22	1.52 - 1.52	7.99 - 7.99			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	05/05/2021	05/05/2021	05/05/2021			
			Sampled Time	.	.	.			
			Date Received	10/05/2021	10/05/2021	10/05/2021			
			SDG Ref	210510-73	210510-73	210510-73			
			Lab Sample No.(s)	24240226	24240246	24240235			
			AGS Reference	EW1	EW1	EW1			
Dissolved solids, Total (gravimetric)	<40 mg/l	TM021		440 #	391 #	353 #			
Carbon, Organic (diss.filt)	<3 mg/l	TM090		<3	<3	20.7			
Sulphide	<0.01 mg/l	TM101		<0.01 2 #	<0.01 2 #	<0.01 2 #			
Fluoride	<0.5 mg/l	TM104		<0.5 #	<0.5 #	<0.5 #			
Arsenic (tot.unfilt)	<2 µg/l	TM152		8.59 2 #	2.26 2 #	11.1 2 #			
Boron (tot.unfilt)	<20 µg/l	TM152		26.9 2 #	40.6 2 #	27 2 #			
Cadmium (tot.unfilt)	<0.5 µg/l	TM152		<0.5 2 #	<0.5 2 #	<0.5 2 #			
Chromium (diss.filt)	<1 µg/l	TM152		<1 #	<1 #	<1 #			
Copper (tot.unfilt)	<1 µg/l	TM152		53.8 2 #	2.41 2 #	13 2 #			
Lead (tot.unfilt)	<1 µg/l	TM152		43.6 2 #	<1 2 #	3.43 2 #			
Molybdenum (tot.unfilt)	<9 µg/l	TM152		<9 2 #	33.7 2 #	10.6 2 #			
Nickel (tot.unfilt)	<1 µg/l	TM152		71 2 #	9.84 2 #	21.3 2 #			
Selenium (tot.unfilt)	<1 µg/l	TM152		<1 2 #	2 2 #	3.17 2 #			
Zinc (tot.unfilt)	<5 µg/l	TM152		179 2 #	6.33 2 #	29.6 2 #			
Hardness, Total as CaCO3 unfiltered	<0.35 mg/l	TM152		273 2	49.8 2	147 2			
EPH Range >C10 - C40 (aq)	<100 µg/l	TM172		180 #	112 #	177 #			
Total EPH (C6-C40) (aq)	<100 µg/l	TM172		180	112	177			
Mercury (tot.unfilt)	<0.02 µg/l	TM183		<0.02 2 #	<0.02 2 #	<0.02 2 #			
Sulphate	<2 mg/l	TM184		22.7 #	17.3 #	46.8 #			
Chloride	<2 mg/l	TM184		90.6 #	83.6 #	45.8 #			
Chloride	<0.08 mg/l	TM226		95.9 #	88.9 #	50.3 #			
Mineral Oil	<1 mg/l	TM235		<10	<5	<2			
pH	<1 pH Units	TM256		7.38 #	9.72 #	8.03 #			
Phenol	<0.002 mg/l	TM259		<0.002 #	<0.002 #	<0.002 #			
Cyanide, Total (low level)	<5 µg/l	TM279		<5 #	<5 #	<5 #			

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

GRO by GC-FID (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Customer Sample Ref.	BH01	BH03	BH04			
Depth (m)	3.22 - 3.22	1.52 - 1.52	7.99 - 7.99			
Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
Date Sampled	05/05/2021	05/05/2021	05/05/2021			
Sampled Time	.	.	.			
Date Received	10/05/2021	10/05/2021	10/05/2021			
SDG Ref	210510-73	210510-73	210510-73			
Lab Sample No.(s)	24240226	24240246	24240235			
AGS Reference	EW1	EW1	EW1			

Component	LOD/Units	Method						
Methyl tertiary butyl ether (MTBE)	<3 µg/l	TM245	<3 #	<3 #	<3 #			
Benzene	<7 µg/l	TM245	<7 #	<7 #	<7 #			
Toluene	<4 µg/l	TM245	<4 #	<4 #	<4 #			
Ethylbenzene	<5 µg/l	TM245	<5 #	<5 #	<5 #			
m,p-Xylene	<8 µg/l	TM245	<8 #	<8 #	<8 #			
o-Xylene	<3 µg/l	TM245	<3 #	<3 #	<3 #			
Sum of detected BTEX	<28 µg/l	TM245	<28	<28	<28			
GRO >C5-C10	<10 µg/l	TM245	<10	<10	<10			
EPH (C6-C10)	<100 µg/l	TM245	<100	<100	<100			

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

PAH Spec MS - Aqueous (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Customer Sample Ref.	BH01	BH03	BH04			
Depth (m)	3.22 - 3.22	1.52 - 1.52	7.99 - 7.99			
Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
Date Sampled	05/05/2021	05/05/2021	05/05/2021			
Sampled Time	.	.	.			
Date Received	10/05/2021	10/05/2021	10/05/2021			
SDG Ref	210510-73	210510-73	210510-73			
Lab Sample No.(s)	24240226	24240246	24240235			
AGS Reference	EW1	EW1	EW1			

Component	LOD/Units	Method						
Naphthalene (aq)	<0.01 µg/l	TM178	<0.01 #	<0.01 #	<0.01 #			
Acenaphthene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Acenaphthylene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Fluoranthene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Anthracene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Phenanthrene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Fluorene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Chrysene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Pyrene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Benzo(a)anthracene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Benzo(b)fluoranthene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Benzo(k)fluoranthene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Benzo(a)pyrene (aq)	<0.002 µg/l	TM178	<0.002 #	<0.002 #	<0.002 #			
Dibenzo(a,h)anthracene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Benzo(g,h,i)perylene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
Indeno(1,2,3-cd)pyrene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #			
PAH, Total Detected USEPA 16 (aq)	<0.082 µg/l	TM178	<0.082 #	<0.082 #	<0.082 #			

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

VOC MS (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	3.22 - 3.22	1.52 - 1.52	7.99 - 7.99			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	05/05/2021	05/05/2021	05/05/2021			
			Sampled Time	.	.	.			
			Date Received	10/05/2021	10/05/2021	10/05/2021			
			SDG Ref	210510-73	210510-73	210510-73			
			Lab Sample No.(s)	24240226	24240246	24240235			
			AGS Reference	EW1	EW1	EW1			
Dibromofluoromethane**	%	TM208		117	101	111			
Toluene-d8**	%	TM208		98.2	96.9	96			
4-Bromofluorobenzene**	%	TM208		91	92.1	91.4			
Dichlorodifluoromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Chloromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Vinyl chloride	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Bromomethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Chloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Trichlorofluoromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1-Dichloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Carbon disulphide	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Dichloromethane	<3 µg/l	TM208		<3 #	<3 #	<3 #			
Methyl tertiary butyl ether (MTBE)	<1 µg/l	TM208		<1 #	<1 #	<1 #			
trans-1,2-Dichloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1-Dichloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
cis-1,2-Dichloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
2,2-Dichloropropane	<1 µg/l	TM208		<1	<1	<1			
Bromochloromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Chloroform	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1,1-Trichloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1-Dichloropropene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Carbontetrachloride	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dichloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Benzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Trichloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dichloropropane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Dibromomethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Bromodichloromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
cis-1,3-Dichloropropene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Toluene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
trans-1,3-Dichloropropene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1,2-Trichloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

VOC MS (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	3.22 - 3.22	1.52 - 1.52	7.99 - 7.99			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	05/05/2021	05/05/2021	05/05/2021			
			Sampled Time	.	.	.			
			Date Received	10/05/2021	10/05/2021	10/05/2021			
			SDG Ref	210510-73	210510-73	210510-73			
			Lab Sample No.(s)	24240226	24240246	24240235			
			AGS Reference	EW1	EW1	EW1			
1,3-Dichloropropane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Tetrachloroethene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Dibromochloromethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dibromoethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Chlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1,1,2-Tetrachloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Ethylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
m,p-Xylene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
o-Xylene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Styrene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Bromoform	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Isopropylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,1,2,2-Tetrachloroethane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2,3-Trichloropropane	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Bromobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Propylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
2-Chlorotoluene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,3,5-Trimethylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
4-Chlorotoluene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
tert-Butylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2,4-Trimethylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
sec-Butylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
4-iso-Propyltoluene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,3-Dichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,4-Dichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
n-Butylbenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,2-Dibromo-3-chloropropane	<1 µg/l	TM208		<1	<1	<1			
1,2,4-Trichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Hexachlorobutadiene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
tert-Amyl methyl ether (TAME)	<1 µg/l	TM208		<1 #	<1 #	<1 #			
Naphthalene	<1 µg/l	TM208		<1 #	<1 #	<1 #			

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

VOC MS (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH01	BH03	BH04			
			Depth (m)	3.22 - 3.22	1.52 - 1.52	7.99 - 7.99			
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)			
			Date Sampled	05/05/2021	05/05/2021	05/05/2021			
			Sampled Time	.	.	.			
			Date Received	10/05/2021	10/05/2021	10/05/2021			
			SDG Ref	210510-73	210510-73	210510-73			
			Lab Sample No.(s)	24240226	24240246	24240235			
			AGS Reference	EW1	EW1	EW1			
1,2,3-Trichlorobenzene	<1 µg/l	TM208		<1 #	<1 #	<1 #			
1,3,5-Trichlorobenzene	<1 µg/l	TM208		<1	<1	<1			
VOC TIC		TM208		Not Detected	Not Detected	Not Detected			
Sum of detected Xylenes	<2 µg/l	TM208		<2	<2	<2			
Sum of BTEX	<5 µg/l	TM208		<5	<5	<5			
Total VOC TIC	<10 µg/l	TM208		<10	<10	<10			

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Table of Results - Appendix

Method No	Reference	Description
TM021	Method 2540C, AWWA/APHA, 20th Ed., 1999	Determination of total dissolved solids in waters by gravimetry.
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water
TM101	Method 4500B & C, AWWA/APHA, 20th Ed., 1999	Determination of Sulphide in soil and water samples using the Kone Analyser
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM172	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	EPH in Waters
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters
TM226	In-House Method	Determination of Anions in Waters using Ion Chromatography
TM235	The Determination of Hydrocarbon Oils in Waters by Solvent Extraction, Infra red Absorption and Gravimetry 1983, HMSO, London	Determination of Total Petroleum Hydrocarbons (TPH) in Waters By Infra-Red Spectroscopy
TM245	By GC-FID	Determination of GRO by Headspace in waters
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter
TM259	by HPLC	Determination of Phenols in Waters and Leachates by HPLC
TM279		Determination of Low Level Easily Liberatable (Free) Cyanides and Total Cyanides in Waters using the Skalar SANS+ System Segmented Flow Analyser

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Test Completion Dates

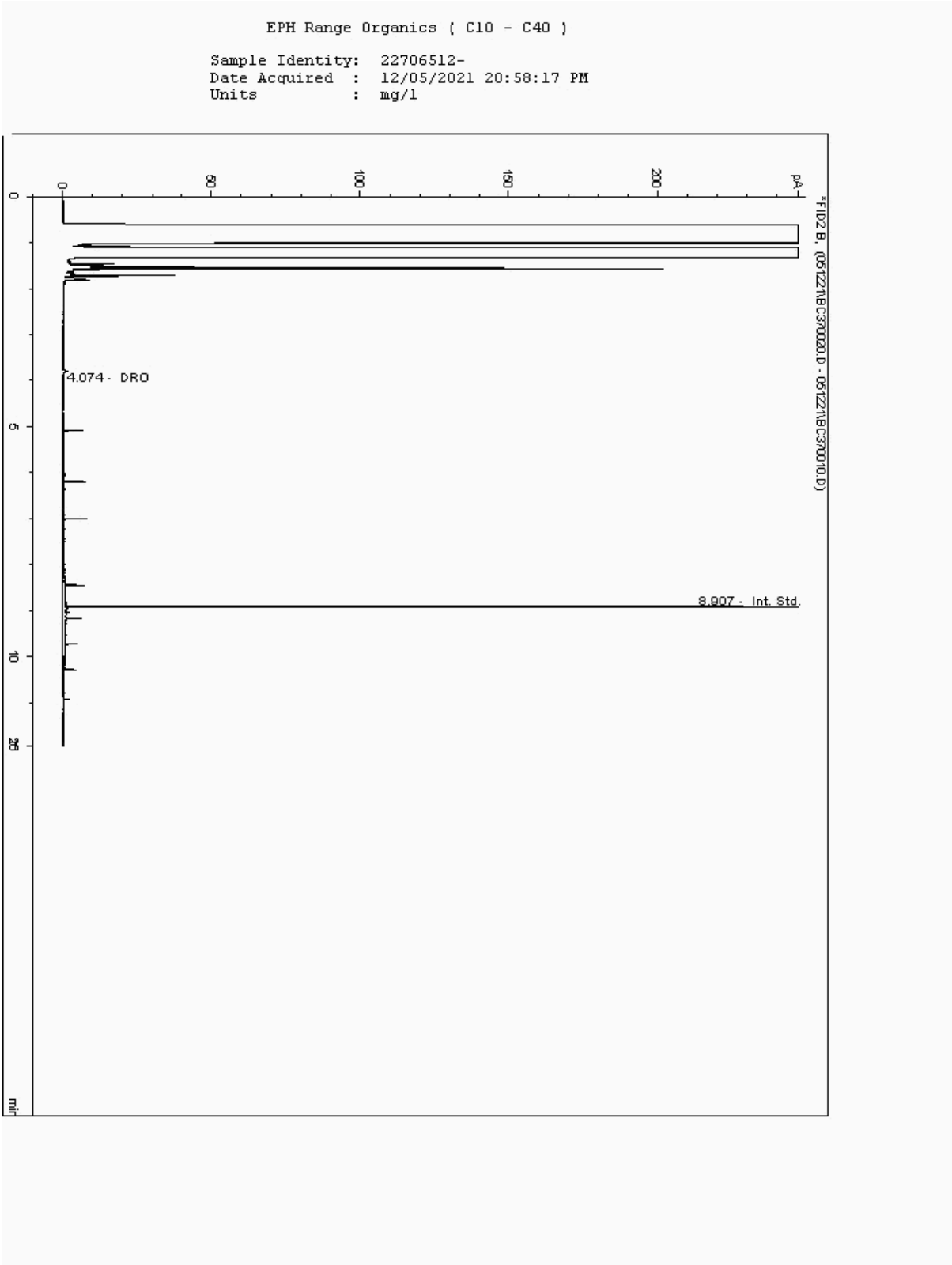
Lab Sample No(s)	24240226	24240246	24240235
Customer Sample Ref.	BH01	BH03	BH04
AGS Ref.	EW1	EW1	EW1
Depth	3.22 - 3.22	1.52 - 1.52	7.99 - 7.99
Type	Ground Water	Ground Water	Ground Water
Anions by ion Chromatography	17-May-2021	17-May-2021	17-May-2021
Anions by Kone (w)	13-May-2021	13-May-2021	13-May-2021
Dissolved Metals by ICP-MS	13-May-2021	13-May-2021	13-May-2021
Dissolved Organic/Inorganic Carbon	20-May-2021	20-May-2021	20-May-2021
EPH (DRO) (C10-C40) Aqueous (W)	13-May-2021	13-May-2021	13-May-2021
Fluoride	14-May-2021	14-May-2021	14-May-2021
GRO by GC-FID (W)	13-May-2021	13-May-2021	14-May-2021
Low Level Cyanide (W)	12-May-2021	12-May-2021	12-May-2021
Mercury Unfiltered	12-May-2021	12-May-2021	12-May-2021
PAH Spec MS - Aqueous (W)	12-May-2021	12-May-2021	12-May-2021
pH Value	12-May-2021	12-May-2021	12-May-2021
Phenols by HPLC (W)	12-May-2021	12-May-2021	12-May-2021
Sulphide	17-May-2021	17-May-2021	17-May-2021
Total Dissolved Solids (Grav)	14-May-2021	14-May-2021	14-May-2021
Total EPH (aq)	13-May-2021	13-May-2021	14-May-2021
Total Metals by ICP-MS	13-May-2021	13-May-2021	13-May-2021
TPH by IR Oils and Greases	17-May-2021	17-May-2021	17-May-2021
VOC MS (W)	12-May-2021	13-May-2021	12-May-2021

CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Chromatogram

Analysis: EPH (DRO) (C10-C40) Aqueous (W) **Sample No :** 24244797 **Sample ID :** BH01 **Depth :** 3.22 - 3.22

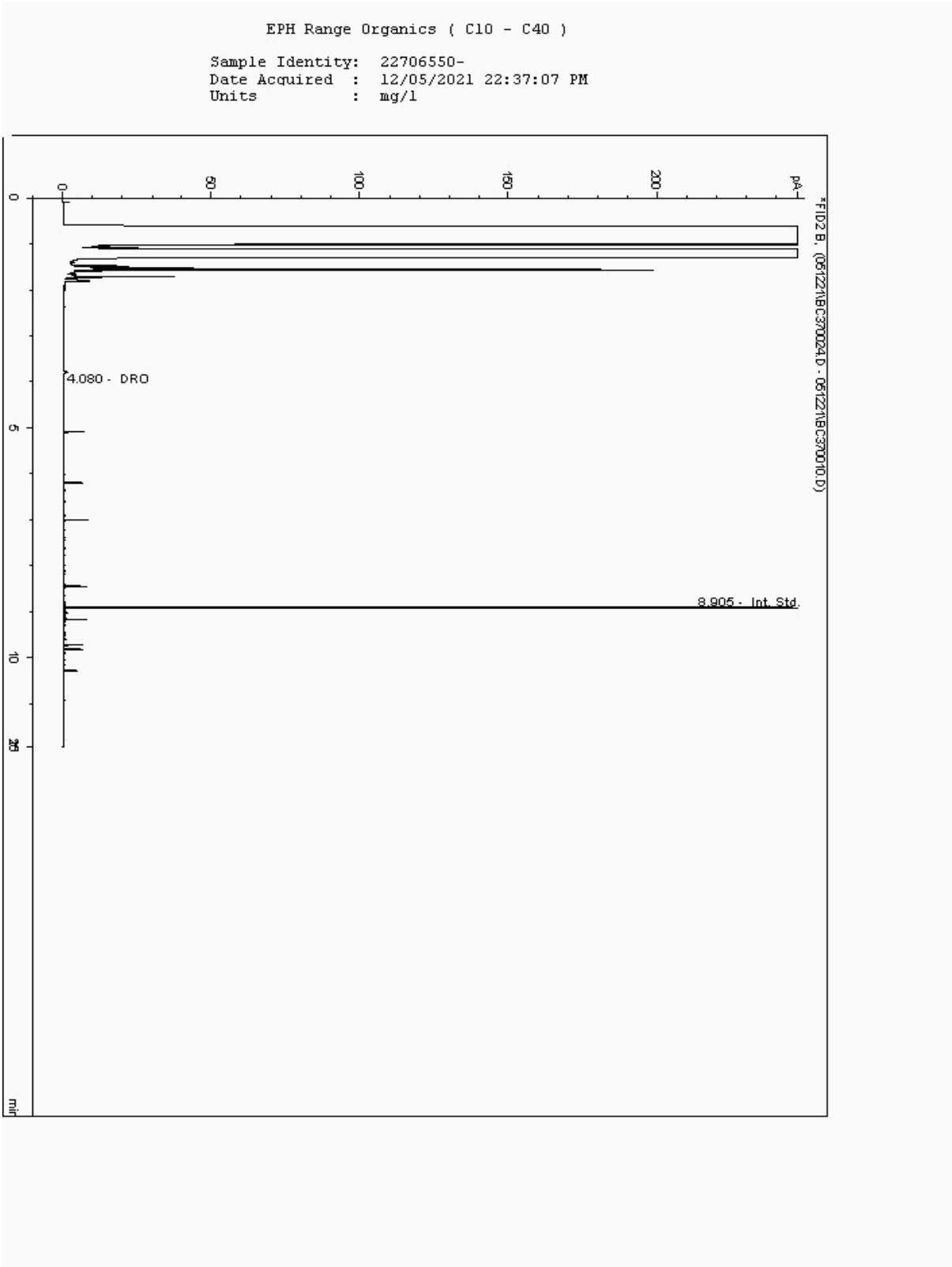


CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Chromatogram

Analysis: EPH (DRO) (C10-C40) Aqueous (W) **Sample No :** 24245128 **Sample ID :** BH03 **Depth :** 1.52 - 1.52

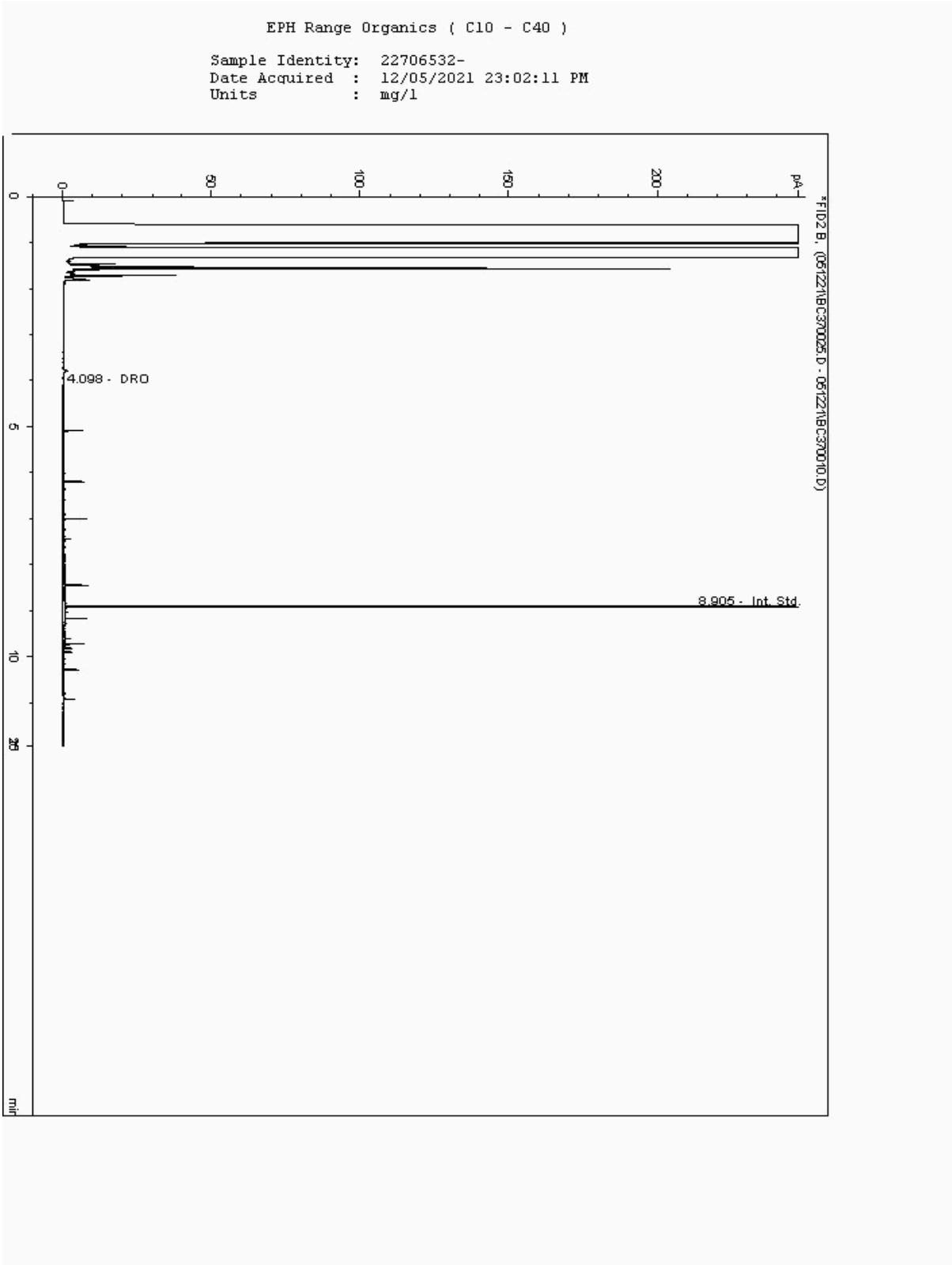


CERTIFICATE OF ANALYSIS

SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Chromatogram

Analysis: EPH (DRO) (C10-C40) Aqueous (W) **Sample No :** 24245240 **Sample ID :** BH04 **Depth :** 7.99 - 7.99



CERTIFICATE OF ANALYSIS

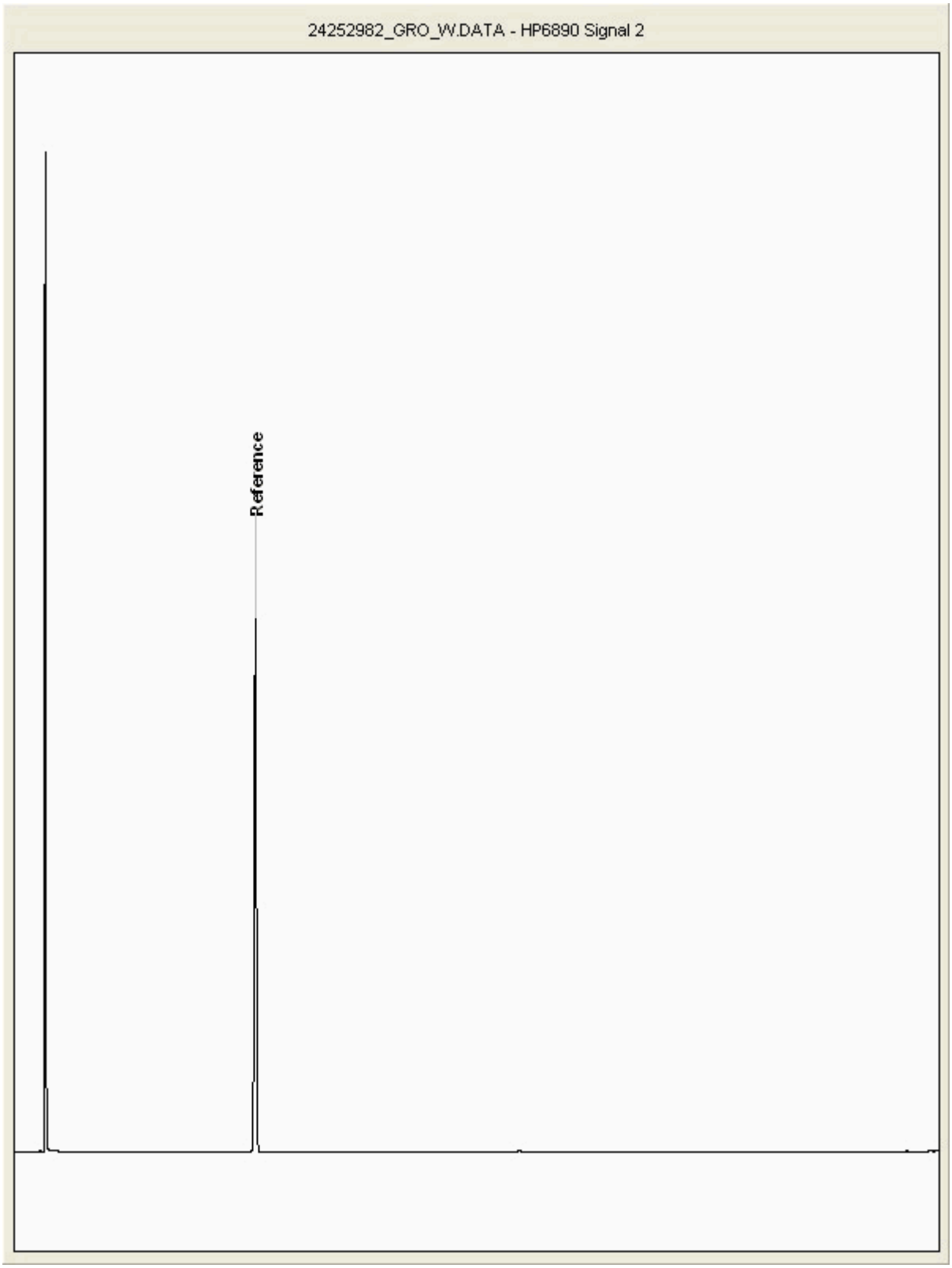
SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 24252982
Sample ID : BH01

Depth : 3.22 - 3.22



CERTIFICATE OF ANALYSIS

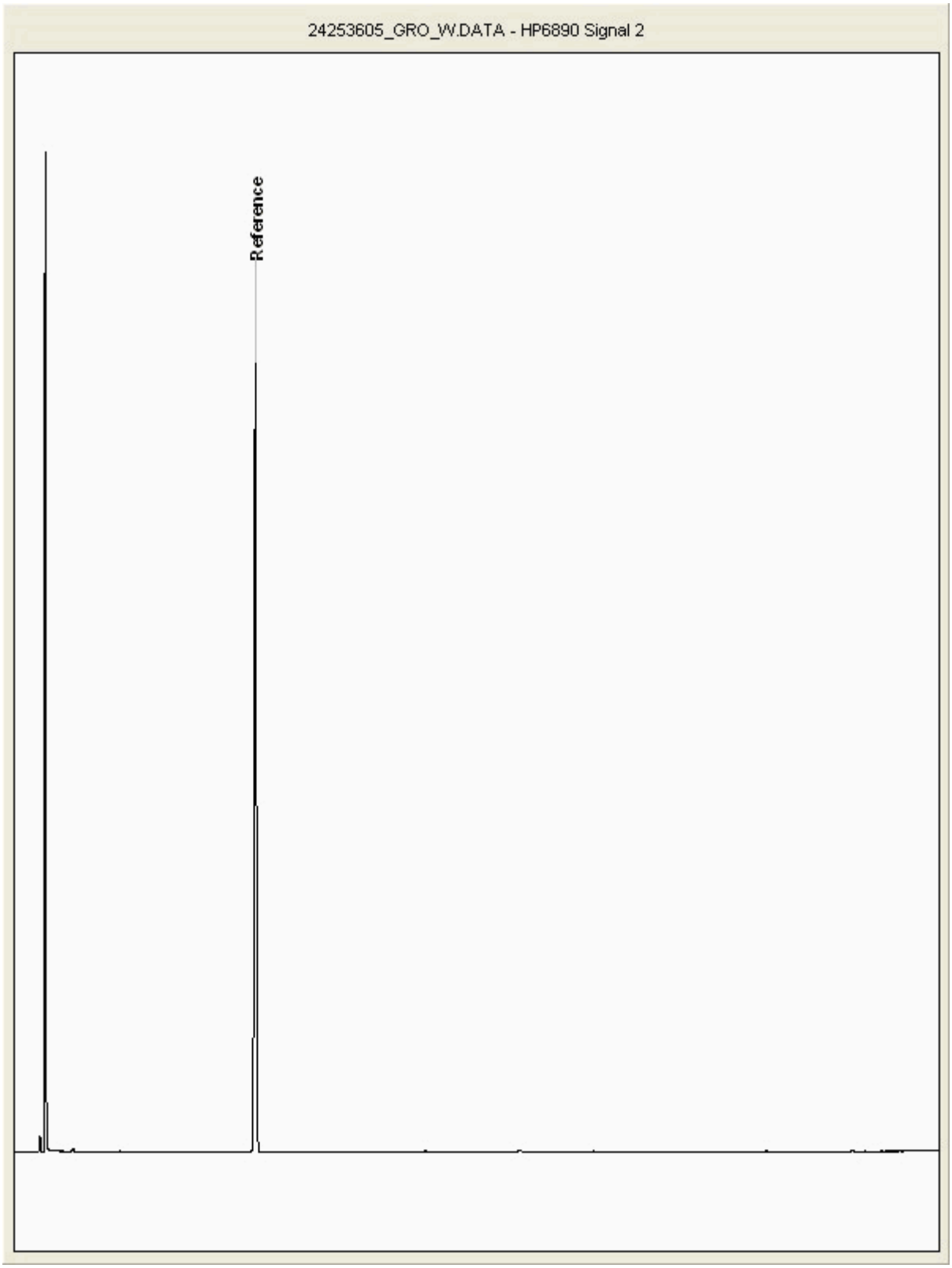
SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 24253605
Sample ID : BH03

Depth : 1.52 - 1.52



CERTIFICATE OF ANALYSIS

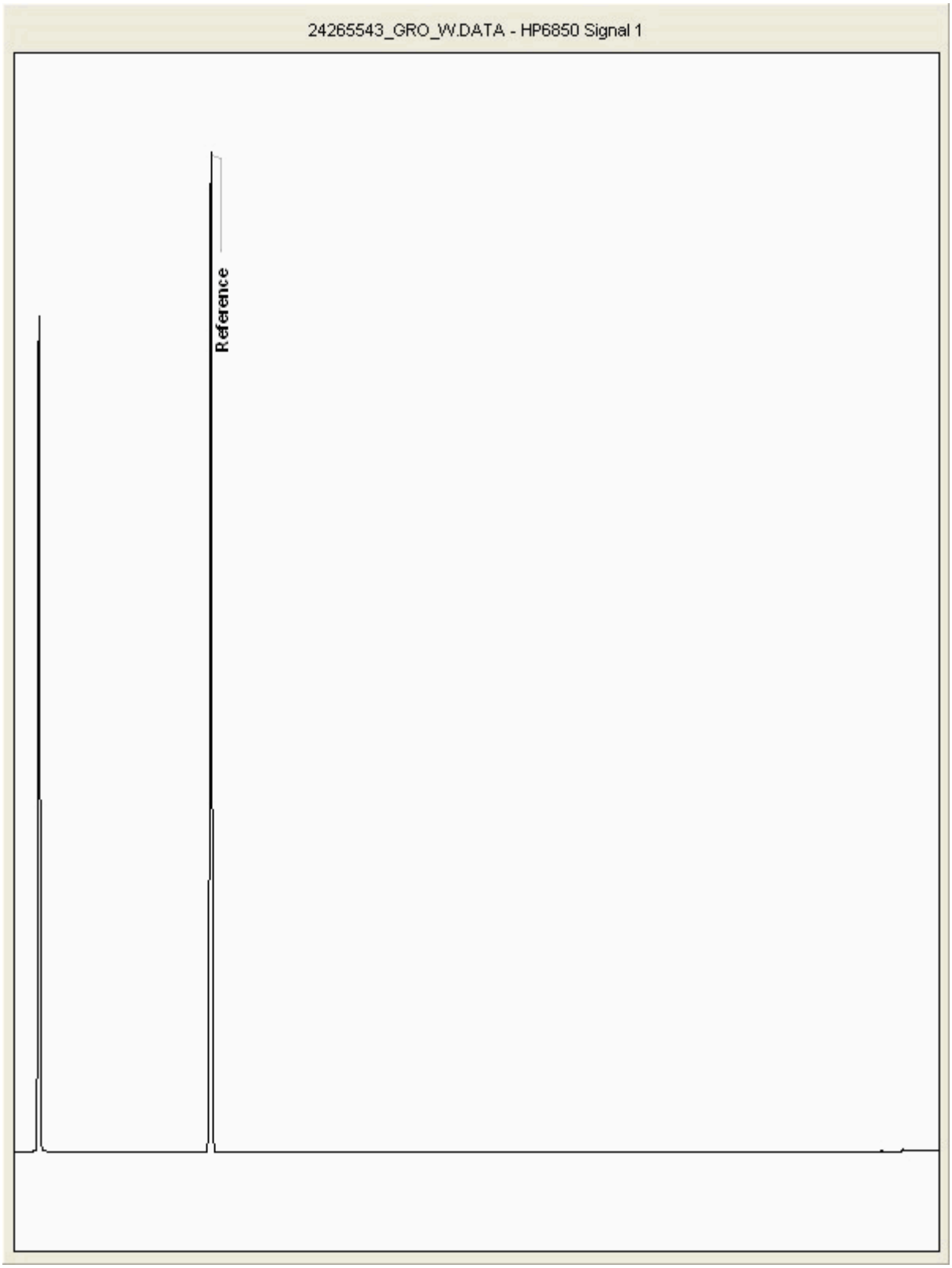
SDG:	210510-73	**Client Reference:**	2020WW102	**Report Number:**	598689
Location:	Arklow Bank	**Order Number:**	9028	**Superseded Report:**	598190

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 24265543
Sample ID : BH04

Depth : 7.99 - 7.99



Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

18. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

19. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2017).*

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix 2 Groundwater Readings (Data Logger)

Logger ID	C31228
Reading Stored	337
Unit of Measurement	M
Job Number	A2020
Calibration Factor 1	5730
Calibration Factor 2	20969
Sampling interval	1 Hour
Start Date	25 November 2020 at 11:32:00
Well Number	BH01
Transducer depth	5.0Meter

No	Date	Time	Temperature(°C)	Pressure(Meter)	Head of Water(M)	Depth to Water(M)
1	25/11/2020	11:32:00	12.438	12.168	1.86	3.14
2	25/11/2020	12:00:00	12.062	12.172	1.86	3.14
3	25/11/2020	13:00:00	12.062	12.17	1.858	3.142
4	25/11/2020	14:00:00	12.062	12.176	1.856	3.144
5	25/11/2020	15:00:00	12.062	12.179	1.839	3.161
6	25/11/2020	16:00:00	12.062	12.187	1.834	3.166
7	25/11/2020	17:00:00	12.062	12.189	1.821	3.179
8	25/11/2020	18:00:00	12.062	12.198	1.819	3.181
9	25/11/2020	19:00:00	12.062	12.204	1.814	3.186
10	25/11/2020	20:00:00	12	12.206	1.81	3.19
11	25/11/2020	21:00:00	12.062	12.208	1.81	3.19
12	25/11/2020	22:00:00	12	12.214	1.818	3.182
13	25/11/2020	23:00:00	12	12.217	1.818	3.182
14	26/11/2020	00:00:00	12	12.217	1.814	3.186
15	26/11/2020	01:00:00	12.062	12.225	1.815	3.185
16	26/11/2020	02:00:00	12	12.227	1.819	3.181
17	26/11/2020	03:00:00	12	12.229	1.824	3.176
18	26/11/2020	04:00:00	12.062	12.233	1.828	3.172
19	26/11/2020	05:00:00	12	12.235	1.833	3.167
20	26/11/2020	06:00:00	12	12.24	1.83	3.17
21	26/11/2020	07:00:00	12	12.246	1.838	3.162
22	26/11/2020	08:00:00	12	12.248	1.834	3.166
23	26/11/2020	09:00:00	12	12.25	1.848	3.152
24	26/11/2020	10:00:00	12	12.252	1.859	3.141
25	26/11/2020	11:00:00	12	12.254	1.858	3.142
26	26/11/2020	12:00:00	12	12.254	1.862	3.138
27	26/11/2020	13:00:00	12	12.255	1.863	3.137
28	26/11/2020	14:00:00	12	12.257	1.858	3.142
29	26/11/2020	15:00:00	12	12.255	1.857	3.143
30	26/11/2020	16:00:00	12	12.259	1.853	3.147
31	26/11/2020	17:00:00	12	12.259	1.847	3.153
32	26/11/2020	18:00:00	12	12.261	1.842	3.158
33	26/11/2020	19:00:00	12	12.263	1.838	3.162
34	26/11/2020	20:00:00	12	12.265	1.848	3.152
35	26/11/2020	21:00:00	12	12.265	1.851	3.149
36	26/11/2020	22:00:00	12	12.265	1.851	3.149
37	26/11/2020	23:00:00	12	12.265	1.855	3.145
38	27/11/2020	00:00:00	12	12.263	1.852	3.148
39	27/11/2020	01:00:00	12	12.267	1.859	3.141
40	27/11/2020	02:00:00	12	12.269	1.857	3.143
41	27/11/2020	03:00:00	12	12.265	1.847	3.153
42	27/11/2020	04:00:00	12	12.267	1.85	3.15
43	27/11/2020	05:00:00	12	12.265	1.849	3.151
44	27/11/2020	06:00:00	12	12.269	1.853	3.147
45	27/11/2020	07:00:00	12	12.265	1.851	3.149
46	27/11/2020	08:00:00	12	12.267	1.859	3.141
47	27/11/2020	09:00:00	12	12.267	1.874	3.126
48	27/11/2020	10:00:00	12	12.265	1.901	3.099
49	27/11/2020	11:00:00	12	12.259	1.899	3.101
50	27/11/2020	12:00:00	12	12.259	1.905	3.095
51	27/11/2020	13:00:00	12	12.255	1.903	3.097
52	27/11/2020	14:00:00	12	12.248	1.901	3.099

53	27/11/2020	15:00:00	12	12.248	1.9	3.1
54	27/11/2020	16:00:00	12	12.244	1.897	3.103
55	27/11/2020	17:00:00	12	12.246	1.903	3.097
56	27/11/2020	18:00:00	12	12.246	1.902	3.098
57	27/11/2020	19:00:00	12	12.24	1.898	3.102
58	27/11/2020	20:00:00	12	12.236	1.896	3.104
59	27/11/2020	21:00:00	12	12.236	1.904	3.096
60	27/11/2020	22:00:00	12	12.233	1.899	3.101
61	27/11/2020	23:00:00	12	12.231	1.898	3.102
62	28/11/2020	00:00:00	12	12.223	1.894	3.106
63	28/11/2020	01:00:00	12	12.223	1.899	3.101
64	28/11/2020	02:00:00	12	12.221	1.898	3.102
65	28/11/2020	03:00:00	12	12.219	1.896	3.104
66	28/11/2020	04:00:00	12	12.215	1.893	3.107
67	28/11/2020	05:00:00	12	12.217	1.899	3.101
68	28/11/2020	06:00:00	12	12.219	1.901	3.099
69	28/11/2020	07:00:00	12	12.219	1.897	3.103
70	28/11/2020	08:00:00	12	12.217	1.893	3.107
71	28/11/2020	09:00:00	12	12.217	1.885	3.115
72	28/11/2020	10:00:00	12	12.219	1.883	3.117
73	28/11/2020	11:00:00	12	12.219	1.879	3.121
74	28/11/2020	12:00:00	12	12.225	1.883	3.117
75	28/11/2020	13:00:00	12	12.219	1.874	3.126
76	28/11/2020	14:00:00	12	12.217	1.87	3.13
77	28/11/2020	15:00:00	12	12.219	1.862	3.138
78	28/11/2020	16:00:00	12	12.219	1.861	3.139
79	28/11/2020	17:00:00	12	12.225	1.857	3.143
80	28/11/2020	18:00:00	12	12.225	1.851	3.149
81	28/11/2020	19:00:00	12	12.233	1.852	3.148
82	28/11/2020	20:00:00	12	12.236	1.849	3.151
83	28/11/2020	21:00:00	12	12.238	1.845	3.155
84	28/11/2020	22:00:00	12	12.242	1.84	3.16
85	28/11/2020	23:00:00	12	12.248	1.843	3.157
86	29/11/2020	00:00:00	12	12.252	1.839	3.161
87	29/11/2020	01:00:00	12	12.254	1.843	3.157
88	29/11/2020	02:00:00	12	12.254	1.841	3.159
89	29/11/2020	03:00:00	12	12.255	1.84	3.16
90	29/11/2020	04:00:00	12	12.259	1.844	3.156
91	29/11/2020	05:00:00	12	12.267	1.849	3.151
92	29/11/2020	06:00:00	12	12.271	1.847	3.153
93	29/11/2020	07:00:00	12	12.273	1.846	3.154
94	29/11/2020	08:00:00	12	12.278	1.844	3.156
95	29/11/2020	09:00:00	12	12.282	1.844	3.156
96	29/11/2020	10:00:00	12	12.284	1.843	3.157
97	29/11/2020	11:00:00	12	12.288	1.846	3.154
98	29/11/2020	12:00:00	12	12.29	1.853	3.147
99	29/11/2020	13:00:00	12	12.288	1.85	3.15
100	29/11/2020	14:00:00	12	12.292	1.855	3.145
101	29/11/2020	15:00:00	12	12.295	1.856	3.144
102	29/11/2020	16:00:00	12	12.292	1.846	3.154
103	29/11/2020	17:00:00	12	12.295	1.844	3.156
104	29/11/2020	18:00:00	12	12.297	1.846	3.154
105	29/11/2020	19:00:00	12	12.299	1.845	3.155
106	29/11/2020	20:00:00	12	12.307	1.849	3.151
107	29/11/2020	21:00:00	12	12.303	1.844	3.156
108	29/11/2020	22:00:00	12	12.309	1.851	3.149
109	29/11/2020	23:00:00	12	12.311	1.854	3.146
110	30/11/2020	00:00:00	12	12.309	1.852	3.148
111	30/11/2020	01:00:00	12	12.313	1.861	3.139
112	30/11/2020	02:00:00	12	12.309	1.856	3.144
113	30/11/2020	03:00:00	12	12.307	1.855	3.145
114	30/11/2020	04:00:00	12	12.311	1.865	3.135
115	30/11/2020	05:00:00	12	12.309	1.866	3.134
116	30/11/2020	06:00:00	12	12.309	1.878	3.122

117	30/11/2020	07:00:00	12	12.311	1.883	3.117
118	30/11/2020	08:00:00	12	12.313	1.879	3.121
119	30/11/2020	09:00:00	12	12.309	1.872	3.128
120	30/11/2020	10:00:00	12	12.313	1.883	3.117
121	30/11/2020	11:00:00	12	12.309	1.885	3.115
122	30/11/2020	12:00:00	12	12.307	1.885	3.115
123	30/11/2020	13:00:00	12	12.305	1.886	3.114
124	30/11/2020	14:00:00	12	12.303	1.887	3.113
125	30/11/2020	15:00:00	12	12.299	1.883	3.117
126	30/11/2020	16:00:00	12	12.299	1.881	3.119
127	30/11/2020	17:00:00	12	12.299	1.874	3.126
128	30/11/2020	18:00:00	12	12.299	1.87	3.13
129	30/11/2020	19:00:00	12	12.301	1.861	3.139
130	30/11/2020	20:00:00	12	12.301	1.852	3.148
131	30/11/2020	21:00:00	12	12.305	1.846	3.154
132	30/11/2020	22:00:00	12	12.305	1.835	3.165
133	30/11/2020	23:00:00	12	12.311	1.839	3.161
134	01/12/2020	00:00:00	12	12.311	1.835	3.165
135	01/12/2020	01:00:00	12	12.314	1.84	3.16
136	01/12/2020	02:00:00	12	12.314	1.836	3.164
137	01/12/2020	03:00:00	12	12.316	1.838	3.162
138	01/12/2020	04:00:00	12	12.318	1.841	3.159
139	01/12/2020	05:00:00	12	12.318	1.837	3.163
140	01/12/2020	06:00:00	12	12.324	1.843	3.157
141	01/12/2020	07:00:00	12	12.33	1.841	3.159
142	01/12/2020	08:00:00	12	12.332	1.841	3.159
143	01/12/2020	09:00:00	12	12.337	1.847	3.153
144	01/12/2020	10:00:00	12	12.339	1.854	3.146
145	01/12/2020	11:00:00	12	12.335	1.856	3.144
146	01/12/2020	12:00:00	12	12.339	1.864	3.136
147	01/12/2020	13:00:00	12	12.337	1.872	3.128
148	01/12/2020	14:00:00	12	12.337	1.879	3.121
149	01/12/2020	15:00:00	12	12.333	1.873	3.127
150	01/12/2020	16:00:00	12	12.332	1.868	3.132
151	01/12/2020	17:00:00	12	12.326	1.864	3.136
152	01/12/2020	18:00:00	12	12.33	1.873	3.127
153	01/12/2020	19:00:00	12	12.328	1.87	3.13
154	01/12/2020	20:00:00	12	12.33	1.877	3.123
155	01/12/2020	21:00:00	12	12.328	1.876	3.124
156	01/12/2020	22:00:00	12	12.324	1.874	3.126
157	01/12/2020	23:00:00	12	12.324	1.883	3.117
158	02/12/2020	00:00:00	11.938	12.32	1.885	3.115
159	02/12/2020	01:00:00	12	12.318	1.891	3.109
160	02/12/2020	02:00:00	11.938	12.314	1.891	3.109
161	02/12/2020	03:00:00	12	12.313	1.889	3.111
162	02/12/2020	04:00:00	11.938	12.307	1.896	3.104
163	02/12/2020	05:00:00	11.938	12.303	1.902	3.098
164	02/12/2020	06:00:00	11.938	12.301	1.903	3.097
165	02/12/2020	07:00:00	12	12.303	1.91	3.09
166	02/12/2020	08:00:00	11.938	12.299	1.895	3.105
167	02/12/2020	09:00:00	12	12.299	1.904	3.096
168	02/12/2020	10:00:00	12	12.294	1.92	3.08
169	02/12/2020	11:00:00	11.938	12.294	1.922	3.078
170	02/12/2020	12:00:00	12	12.286	1.928	3.072
171	02/12/2020	13:00:00	11.938	12.28	1.933	3.067
172	02/12/2020	14:00:00	12	12.274	1.921	3.079
173	02/12/2020	15:00:00	11.938	12.265	1.919	3.081
174	02/12/2020	16:00:00	11.938	12.259	1.92	3.08
175	02/12/2020	17:00:00	11.938	12.252	1.917	3.083
176	02/12/2020	18:00:00	11.938	12.248	1.921	3.079
177	02/12/2020	19:00:00	11.938	12.236	1.92	3.08
178	02/12/2020	20:00:00	11.938	12.235	1.94	3.06
179	02/12/2020	21:00:00	12	12.229	1.947	3.053
180	02/12/2020	22:00:00	11.938	12.219	1.955	3.045

181	02/12/2020	23:00:00	11.938	12.208	1.96	3.04
182	03/12/2020	00:00:00	12	12.198	1.965	3.035
183	03/12/2020	01:00:00	11.938	12.191	1.974	3.026
184	03/12/2020	02:00:00	11.938	12.177	1.978	3.022
185	03/12/2020	03:00:00	11.938	12.164	1.985	3.015
186	03/12/2020	04:00:00	11.938	12.151	1.991	3.009
187	03/12/2020	05:00:00	11.938	12.139	1.998	3.002
188	03/12/2020	06:00:00	11.938	12.124	1.997	3.003
189	03/12/2020	07:00:00	11.938	12.109	2.004	2.996
190	03/12/2020	08:00:00	11.938	12.103	2.012	2.988
191	03/12/2020	09:00:00	11.938	12.09	2.013	2.987
192	03/12/2020	10:00:00	11.938	12.078	2.022	2.978
193	03/12/2020	11:00:00	11.938	12.065	2.027	2.973
194	03/12/2020	12:00:00	11.938	12.052	2.029	2.971
195	03/12/2020	13:00:00	11.938	12.042	2.024	2.976
196	03/12/2020	14:00:00	11.938	12.027	2.011	2.989
197	03/12/2020	15:00:00	11.938	12.016	2.001	2.999
198	03/12/2020	16:00:00	11.938	12.004	1.986	3.014
199	03/12/2020	17:00:00	11.938	11.993	1.974	3.026
200	03/12/2020	18:00:00	11.938	11.985	1.969	3.031
201	03/12/2020	19:00:00	11.938	11.974	1.96	3.04
202	03/12/2020	20:00:00	11.938	11.966	1.952	3.048
203	03/12/2020	21:00:00	11.938	11.962	1.948	3.052
204	03/12/2020	22:00:00	11.938	11.96	1.941	3.059
205	03/12/2020	23:00:00	11.938	11.957	1.944	3.056
206	04/12/2020	00:00:00	11.938	11.949	1.93	3.07
207	04/12/2020	01:00:00	11.938	11.945	1.929	3.071
208	04/12/2020	02:00:00	11.938	11.943	1.928	3.072
209	04/12/2020	03:00:00	11.938	11.94	1.919	3.081
210	04/12/2020	04:00:00	11.938	11.934	1.916	3.084
211	04/12/2020	05:00:00	11.938	11.93	1.914	3.086
212	04/12/2020	06:00:00	11.938	11.926	1.911	3.089
213	04/12/2020	07:00:00	11.938	11.928	1.906	3.094
214	04/12/2020	08:00:00	11.938	11.928	1.903	3.097
215	04/12/2020	09:00:00	11.938	11.928	1.908	3.092
216	04/12/2020	10:00:00	11.938	11.926	1.926	3.074
217	04/12/2020	11:00:00	11.938	11.924	1.932	3.068
218	04/12/2020	12:00:00	11.938	11.924	1.939	3.061
219	04/12/2020	13:00:00	11.938	11.919	1.947	3.053
220	04/12/2020	14:00:00	11.938	11.915	1.935	3.065
221	04/12/2020	15:00:00	11.938	11.911	1.93	3.07
222	04/12/2020	16:00:00	11.938	11.905	1.928	3.072
223	04/12/2020	17:00:00	11.938	11.9	1.919	3.081
224	04/12/2020	18:00:00	11.938	11.898	1.908	3.092
225	04/12/2020	19:00:00	11.938	11.898	1.904	3.096
226	04/12/2020	20:00:00	11.938	11.894	1.899	3.101
227	04/12/2020	21:00:00	11.938	11.898	1.897	3.103
228	04/12/2020	22:00:00	11.938	11.898	1.89	3.11
229	04/12/2020	23:00:00	11.938	11.896	1.883	3.117
230	05/12/2020	00:00:00	11.938	11.9	1.875	3.125
231	05/12/2020	01:00:00	11.938	11.901	1.868	3.132
232	05/12/2020	02:00:00	11.938	11.903	1.863	3.137
233	05/12/2020	03:00:00	11.938	11.905	1.858	3.142
234	05/12/2020	04:00:00	11.938	11.909	1.855	3.145
235	05/12/2020	05:00:00	11.938	11.909	1.849	3.151
236	05/12/2020	06:00:00	11.938	11.913	1.835	3.165
237	05/12/2020	07:00:00	11.938	11.919	1.836	3.164
238	05/12/2020	08:00:00	11.938	11.921	1.825	3.175
239	05/12/2020	09:00:00	11.938	11.928	1.818	3.182
240	05/12/2020	10:00:00	11.938	11.94	1.821	3.179
241	05/12/2020	11:00:00	11.938	11.945	1.815	3.185
242	05/12/2020	12:00:00	11.938	11.955	1.821	3.179
243	05/12/2020	13:00:00	11.938	11.959	1.828	3.172
244	05/12/2020	14:00:00	11.938	11.964	1.813	3.187

245	05/12/2020	15:00:00	11.938	11.966	1.81	3.19
246	05/12/2020	16:00:00	11.938	11.974	1.798	3.202
247	05/12/2020	17:00:00	11.938	11.98	1.792	3.208
248	05/12/2020	18:00:00	11.938	11.981	1.787	3.213
249	05/12/2020	19:00:00	11.938	11.987	1.785	3.215
250	05/12/2020	20:00:00	11.938	11.995	1.784	3.216
251	05/12/2020	21:00:00	11.938	11.999	1.783	3.217
252	05/12/2020	22:00:00	11.938	12.006	1.786	3.214
253	05/12/2020	23:00:00	11.938	12.012	1.791	3.209
254	06/12/2020	00:00:00	11.938	12.019	1.796	3.204
255	06/12/2020	01:00:00	11.938	12.025	1.805	3.195
256	06/12/2020	02:00:00	11.938	12.031	1.806	3.194
257	06/12/2020	03:00:00	11.938	12.033	1.804	3.196
258	06/12/2020	04:00:00	11.938	12.037	1.809	3.191
259	06/12/2020	05:00:00	11.938	12.039	1.814	3.186
260	06/12/2020	06:00:00	11.938	12.042	1.813	3.187
261	06/12/2020	07:00:00	11.938	12.042	1.813	3.187
262	06/12/2020	08:00:00	11.938	12.048	1.815	3.185
263	06/12/2020	09:00:00	11.938	12.052	1.822	3.178
264	06/12/2020	10:00:00	11.938	12.054	1.843	3.157
265	06/12/2020	11:00:00	11.938	12.059	1.845	3.155
266	06/12/2020	12:00:00	11.938	12.067	1.853	3.147
267	06/12/2020	13:00:00	11.938	12.061	1.859	3.141
268	06/12/2020	14:00:00	11.938	12.065	1.862	3.138
269	06/12/2020	15:00:00	11.938	12.067	1.846	3.154
270	06/12/2020	16:00:00	11.938	12.069	1.836	3.164
271	06/12/2020	17:00:00	11.938	12.069	1.828	3.172
272	06/12/2020	18:00:00	11.938	12.067	1.83	3.17
273	06/12/2020	19:00:00	11.938	12.069	1.831	3.169
274	06/12/2020	20:00:00	11.938	12.065	1.837	3.163
275	06/12/2020	21:00:00	11.938	12.063	1.842	3.158
276	06/12/2020	22:00:00	11.938	12.065	1.851	3.149
277	06/12/2020	23:00:00	11.938	12.061	1.863	3.137
278	07/12/2020	00:00:00	11.938	12.067	1.873	3.127
279	07/12/2020	01:00:00	11.938	12.061	1.873	3.127
280	07/12/2020	02:00:00	11.938	12.061	1.879	3.121
281	07/12/2020	03:00:00	11.938	12.059	1.877	3.123
282	07/12/2020	04:00:00	11.938	12.058	1.882	3.118
283	07/12/2020	05:00:00	11.938	12.059	1.883	3.117
284	07/12/2020	06:00:00	11.938	12.058	1.885	3.115
285	07/12/2020	07:00:00	11.938	12.052	1.878	3.122
286	07/12/2020	08:00:00	11.938	12.052	1.872	3.128
287	07/12/2020	09:00:00	11.938	12.05	1.87	3.13
288	07/12/2020	10:00:00	11.938	12.05	1.883	3.117
289	07/12/2020	11:00:00	11.938	12.05	1.873	3.127
290	07/12/2020	12:00:00	11.938	12.052	1.867	3.133
291	07/12/2020	13:00:00	11.938	12.052	1.877	3.123
292	07/12/2020	14:00:00	11.938	12.052	1.89	3.11
293	07/12/2020	15:00:00	11.938	12.054	1.874	3.126
294	07/12/2020	16:00:00	11.938	12.058	1.87	3.13
295	07/12/2020	17:00:00	11.938	12.052	1.86	3.14
296	07/12/2020	18:00:00	11.938	12.058	1.86	3.14
297	07/12/2020	19:00:00	11.938	12.052	1.85	3.15
298	07/12/2020	20:00:00	11.938	12.052	1.849	3.151
299	07/12/2020	21:00:00	11.938	12.05	1.847	3.153
300	07/12/2020	22:00:00	11.938	12.052	1.848	3.152
301	07/12/2020	23:00:00	11.938	12.052	1.84	3.16
302	08/12/2020	00:00:00	11.938	12.056	1.846	3.154
303	08/12/2020	01:00:00	11.938	12.056	1.845	3.155
304	08/12/2020	02:00:00	11.938	12.059	1.844	3.156
305	08/12/2020	03:00:00	11.875	12.059	1.848	3.152
306	08/12/2020	04:00:00	11.938	12.063	1.85	3.15
307	08/12/2020	05:00:00	11.938	12.065	1.855	3.145
308	08/12/2020	06:00:00	11.875	12.061	1.853	3.147

309	08/12/2020	07:00:00	11.875	12.065	1.85	3.15
310	08/12/2020	08:00:00	11.875	12.065	1.853	3.147
311	08/12/2020	09:00:00	11.875	12.065	1.849	3.151
312	08/12/2020	10:00:00	11.875	12.069	1.863	3.137
313	08/12/2020	11:00:00	11.875	12.067	1.846	3.154
314	08/12/2020	12:00:00	11.875	12.073	1.851	3.149
315	08/12/2020	13:00:00	11.938	12.077	1.856	3.144
316	08/12/2020	14:00:00	11.875	12.077	1.862	3.138
317	08/12/2020	15:00:00	11.875	12.084	1.854	3.146
318	08/12/2020	16:00:00	11.875	12.084	1.845	3.155
319	08/12/2020	17:00:00	11.875	12.088	1.836	3.164
320	08/12/2020	18:00:00	11.875	12.09	1.828	3.172
321	08/12/2020	19:00:00	11.875	12.09	1.814	3.186
322	08/12/2020	20:00:00	11.938	12.094	1.825	3.175
323	08/12/2020	21:00:00	11.875	12.096	1.82	3.18
324	08/12/2020	22:00:00	11.875	12.092	1.806	3.194
325	08/12/2020	23:00:00	11.875	12.101	1.817	3.183
326	09/12/2020	00:00:00	11.875	12.101	1.807	3.193
327	09/12/2020	01:00:00	11.875	12.103	1.808	3.192
328	09/12/2020	02:00:00	11.875	12.111	1.819	3.181
329	09/12/2020	03:00:00	11.875	12.113	1.831	3.169
330	09/12/2020	04:00:00	11.875	12.115	1.822	3.178
331	09/12/2020	05:00:00	11.875	12.115	1.826	3.174
332	09/12/2020	06:00:00	11.875	12.12	1.836	3.164
333	09/12/2020	07:00:00	11.875	12.118	1.847	3.153
334	09/12/2020	08:00:00	11.875	12.117	1.854	3.146
335	09/12/2020	09:00:00	11.875	12.118	1.861	3.139
336	09/12/2020	10:00:00	11.875	12.113	1.867	3.133
337	09/12/2020	11:00:00	5.312	10.303	0	0

Logger ID	C31226
Reading Stored	335
Unit of Measurement	M
Job Number	A2020
Calibration Factor 1	5929
Calibration Factor 2	21773
Sampling interval	1 Hour
Start Date	25 November 2020 at 11:40:00
Well Number	0BH03
Transducer depth	15Meter

No	Date	Time	Temperature(°C)	Pressure(Meter)	Head of Water(M)	Depth to Water(M)
1	25/11/2020	11:40:00	11.188	24.781	14.473	0.527
2	25/11/2020	12:00:00	11.188	24.779	14.467	0.533
3	25/11/2020	13:00:00	11.188	24.776	14.464	0.536
4	25/11/2020	14:00:00	11.188	24.783	14.463	0.537
5	25/11/2020	15:00:00	11.188	24.787	14.447	0.553
6	25/11/2020	16:00:00	11.188	24.792	14.439	0.561
7	25/11/2020	17:00:00	11.188	24.799	14.431	0.569
8	25/11/2020	18:00:00	11.188	24.805	14.426	0.574
9	25/11/2020	19:00:00	11.188	24.81	14.42	0.58
10	25/11/2020	20:00:00	11.188	24.814	14.418	0.582
11	25/11/2020	21:00:00	11.188	24.816	14.418	0.582
12	25/11/2020	22:00:00	11.188	24.821	14.425	0.575
13	25/11/2020	23:00:00	11.188	24.82	14.421	0.579
14	26/11/2020	00:00:00	11.188	24.818	14.415	0.585
15	26/11/2020	01:00:00	11.188	24.82	14.41	0.59
16	26/11/2020	02:00:00	11.188	24.814	14.406	0.594
17	26/11/2020	03:00:00	11.188	24.814	14.409	0.591
18	26/11/2020	04:00:00	11.188	24.816	14.411	0.589
19	26/11/2020	05:00:00	11.188	24.82	14.418	0.582
20	26/11/2020	06:00:00	11.188	24.821	14.411	0.589
21	26/11/2020	07:00:00	11.188	24.829	14.421	0.579
22	26/11/2020	08:00:00	11.188	24.831	14.417	0.583
23	26/11/2020	09:00:00	11.188	24.834	14.432	0.568
24	26/11/2020	10:00:00	11.188	24.836	14.443	0.557
25	26/11/2020	11:00:00	11.188	24.832	14.436	0.564
26	26/11/2020	12:00:00	11.188	24.831	14.439	0.561
27	26/11/2020	13:00:00	11.188	24.829	14.437	0.563
28	26/11/2020	14:00:00	11.188	24.827	14.428	0.572
29	26/11/2020	15:00:00	11.188	24.823	14.425	0.575
30	26/11/2020	16:00:00	11.188	24.823	14.417	0.583
31	26/11/2020	17:00:00	11.188	24.829	14.417	0.583
32	26/11/2020	18:00:00	11.188	24.829	14.41	0.59
33	26/11/2020	19:00:00	11.188	24.832	14.407	0.593
34	26/11/2020	20:00:00	11.188	24.832	14.415	0.585
35	26/11/2020	21:00:00	11.188	24.832	14.418	0.582
36	26/11/2020	22:00:00	11.188	24.832	14.418	0.582
37	26/11/2020	23:00:00	11.188	24.832	14.422	0.578
38	27/11/2020	00:00:00	11.188	24.827	14.416	0.584
39	27/11/2020	01:00:00	11.188	24.816	14.408	0.592
40	27/11/2020	02:00:00	11.188	24.81	14.398	0.602
41	27/11/2020	03:00:00	11.188	24.807	14.389	0.611
42	27/11/2020	04:00:00	11.188	24.807	14.39	0.61
43	27/11/2020	05:00:00	11.188	24.805	14.389	0.611
44	27/11/2020	06:00:00	11.188	24.805	14.389	0.611
45	27/11/2020	07:00:00	11.188	24.807	14.393	0.607
46	27/11/2020	08:00:00	11.188	24.803	14.395	0.605
47	27/11/2020	09:00:00	11.188	24.803	14.41	0.59
48	27/11/2020	10:00:00	11.188	24.801	14.437	0.563
49	27/11/2020	11:00:00	11.188	24.801	14.441	0.559
50	27/11/2020	12:00:00	11.188	24.787	14.433	0.567
51	27/11/2020	13:00:00	11.188	24.783	14.431	0.569

52	27/11/2020	14:00:00	11.188	24.774	14.427	0.573
53	27/11/2020	15:00:00	11.188	24.768	14.42	0.58
54	27/11/2020	16:00:00	11.188	24.766	14.419	0.581
55	27/11/2020	17:00:00	11.188	24.765	14.422	0.578
56	27/11/2020	18:00:00	11.188	24.768	14.424	0.576
57	27/11/2020	19:00:00	11.188	24.77	14.428	0.572
58	27/11/2020	20:00:00	11.188	24.761	14.421	0.579
59	27/11/2020	21:00:00	11.188	24.755	14.423	0.577
60	27/11/2020	22:00:00	11.188	24.757	14.423	0.577
61	27/11/2020	23:00:00	11.188	24.755	14.422	0.578
62	28/11/2020	00:00:00	11.188	24.748	14.419	0.581
63	28/11/2020	01:00:00	11.188	24.739	14.415	0.585
64	28/11/2020	02:00:00	11.188	24.735	14.412	0.588
65	28/11/2020	03:00:00	11.188	24.732	14.409	0.591
66	28/11/2020	04:00:00	11.188	24.726	14.404	0.596
67	28/11/2020	05:00:00	11.188	24.73	14.412	0.588
68	28/11/2020	06:00:00	11.188	24.735	14.417	0.583
69	28/11/2020	07:00:00	11.188	24.735	14.413	0.587
70	28/11/2020	08:00:00	11.188	24.741	14.417	0.583
71	28/11/2020	09:00:00	11.188	24.746	14.414	0.586
72	28/11/2020	10:00:00	11.188	24.75	14.414	0.586
73	28/11/2020	11:00:00	11.188	24.75	14.41	0.59
74	28/11/2020	12:00:00	11.188	24.75	14.408	0.592
75	28/11/2020	13:00:00	11.188	24.752	14.407	0.593
76	28/11/2020	14:00:00	11.188	24.75	14.403	0.597
77	28/11/2020	15:00:00	11.188	24.752	14.395	0.605
78	28/11/2020	16:00:00	11.188	24.746	14.388	0.612
79	28/11/2020	17:00:00	11.188	24.757	14.389	0.611
80	28/11/2020	18:00:00	11.188	24.765	14.391	0.609
81	28/11/2020	19:00:00	11.188	24.772	14.391	0.609
82	28/11/2020	20:00:00	11.188	24.776	14.389	0.611
83	28/11/2020	21:00:00	11.188	24.779	14.386	0.614
84	28/11/2020	22:00:00	11.188	24.788	14.386	0.614
85	28/11/2020	23:00:00	11.188	24.79	14.385	0.615
86	29/11/2020	00:00:00	11.188	24.792	14.379	0.621
87	29/11/2020	01:00:00	11.188	24.788	14.377	0.623
88	29/11/2020	02:00:00	11.188	24.787	14.374	0.626
89	29/11/2020	03:00:00	11.188	24.785	14.37	0.63
90	29/11/2020	04:00:00	11.188	24.781	14.366	0.634
91	29/11/2020	05:00:00	11.188	24.788	14.37	0.63
92	29/11/2020	06:00:00	11.188	24.792	14.368	0.632
93	29/11/2020	07:00:00	11.188	24.799	14.372	0.628
94	29/11/2020	08:00:00	11.188	24.809	14.375	0.625
95	29/11/2020	09:00:00	11.188	24.81	14.372	0.628
96	29/11/2020	10:00:00	11.188	24.816	14.375	0.625
97	29/11/2020	11:00:00	11.188	24.816	14.374	0.626
98	29/11/2020	12:00:00	11.188	24.814	14.377	0.623
99	29/11/2020	13:00:00	11.188	24.818	14.38	0.62
100	29/11/2020	14:00:00	11.188	24.81	14.373	0.627
101	29/11/2020	15:00:00	11.188	24.805	14.366	0.634
102	29/11/2020	16:00:00	11.188	24.803	14.357	0.643
103	29/11/2020	17:00:00	11.188	24.805	14.354	0.646
104	29/11/2020	18:00:00	11.188	24.809	14.358	0.642
105	29/11/2020	19:00:00	11.188	24.818	14.364	0.636
106	29/11/2020	20:00:00	11.188	24.823	14.365	0.635
107	29/11/2020	21:00:00	11.188	24.823	14.364	0.636
108	29/11/2020	22:00:00	11.188	24.82	14.362	0.638
109	29/11/2020	23:00:00	11.188	24.818	14.361	0.639
110	30/11/2020	00:00:00	11.188	24.818	14.361	0.639
111	30/11/2020	01:00:00	11.188	24.81	14.358	0.642
112	30/11/2020	02:00:00	11.188	24.812	14.359	0.641
113	30/11/2020	03:00:00	11.188	24.805	14.353	0.647
114	30/11/2020	04:00:00	11.188	24.792	14.346	0.654

115	30/11/2020	05:00:00	11.188	24.796	14.353	0.647
116	30/11/2020	06:00:00	11.188	24.794	14.363	0.637
117	30/11/2020	07:00:00	11.188	24.792	14.364	0.636
118	30/11/2020	08:00:00	11.188	24.801	14.367	0.633
119	30/11/2020	09:00:00	11.188	24.801	14.364	0.636
120	30/11/2020	10:00:00	11.188	24.798	14.368	0.632
121	30/11/2020	11:00:00	11.188	24.798	14.374	0.626
122	30/11/2020	12:00:00	11.188	24.794	14.372	0.628
123	30/11/2020	13:00:00	11.188	24.788	14.369	0.631
124	30/11/2020	14:00:00	11.188	24.783	14.367	0.633
125	30/11/2020	15:00:00	11.188	24.779	14.363	0.637
126	30/11/2020	16:00:00	11.188	24.779	14.361	0.639
127	30/11/2020	17:00:00	11.188	24.777	14.352	0.648
128	30/11/2020	18:00:00	11.188	24.781	14.352	0.648
129	30/11/2020	19:00:00	11.188	24.796	14.356	0.644
130	30/11/2020	20:00:00	11.188	24.798	14.349	0.651
131	30/11/2020	21:00:00	11.188	24.807	14.348	0.652
132	30/11/2020	22:00:00	11.188	24.809	14.339	0.661
133	30/11/2020	23:00:00	11.188	24.81	14.338	0.662
134	01/12/2020	00:00:00	11.188	24.81	14.334	0.666
135	01/12/2020	01:00:00	11.188	24.81	14.336	0.664
136	01/12/2020	02:00:00	11.188	24.81	14.332	0.668
137	01/12/2020	03:00:00	11.188	24.805	14.327	0.673
138	01/12/2020	04:00:00	11.188	24.805	14.328	0.672
139	01/12/2020	05:00:00	11.188	24.805	14.324	0.676
140	01/12/2020	06:00:00	11.188	24.805	14.324	0.676
141	01/12/2020	07:00:00	11.188	24.814	14.325	0.675
142	01/12/2020	08:00:00	11.188	24.825	14.334	0.666
143	01/12/2020	09:00:00	11.188	24.827	14.337	0.663
144	01/12/2020	10:00:00	11.188	24.831	14.346	0.654
145	01/12/2020	11:00:00	11.188	24.825	14.346	0.654
146	01/12/2020	12:00:00	11.188	24.821	14.346	0.654
147	01/12/2020	13:00:00	11.188	24.818	14.353	0.647
148	01/12/2020	14:00:00	11.188	24.81	14.352	0.648
149	01/12/2020	15:00:00	11.188	24.805	14.345	0.655
150	01/12/2020	16:00:00	11.188	24.798	14.334	0.666
151	01/12/2020	17:00:00	11.188	24.79	14.328	0.672
152	01/12/2020	18:00:00	11.188	24.787	14.33	0.67
153	01/12/2020	19:00:00	11.188	24.787	14.329	0.671
154	01/12/2020	20:00:00	11.188	24.787	14.334	0.666
155	01/12/2020	21:00:00	11.188	24.792	14.34	0.66
156	01/12/2020	22:00:00	11.188	24.788	14.338	0.662
157	01/12/2020	23:00:00	11.188	24.781	14.34	0.66
158	02/12/2020	00:00:00	11.188	24.776	14.341	0.659
159	02/12/2020	01:00:00	11.188	24.772	14.345	0.655
160	02/12/2020	02:00:00	11.188	24.766	14.343	0.657
161	02/12/2020	03:00:00	11.188	24.761	14.337	0.663
162	02/12/2020	04:00:00	11.188	24.746	14.335	0.665
163	02/12/2020	05:00:00	11.188	24.739	14.338	0.662
164	02/12/2020	06:00:00	11.188	24.734	14.336	0.664
165	02/12/2020	07:00:00	11.188	24.735	14.342	0.658
166	02/12/2020	08:00:00	11.188	24.737	14.333	0.667
167	02/12/2020	09:00:00	11.188	24.737	14.342	0.658
168	02/12/2020	10:00:00	11.188	24.735	14.361	0.639
169	02/12/2020	11:00:00	11.188	24.724	14.352	0.648
170	02/12/2020	12:00:00	11.188	24.723	14.365	0.635
171	02/12/2020	13:00:00	11.188	24.712	14.365	0.635
172	02/12/2020	14:00:00	11.188	24.708	14.355	0.645
173	02/12/2020	15:00:00	11.188	24.693	14.347	0.653
174	02/12/2020	16:00:00	11.188	24.682	14.343	0.657
175	02/12/2020	17:00:00	11.188	24.666	14.331	0.669
176	02/12/2020	18:00:00	11.188	24.66	14.333	0.667
177	02/12/2020	19:00:00	11.188	24.653	14.337	0.663

178	02/12/2020	20:00:00	11.188	24.64	14.345	0.655
179	02/12/2020	21:00:00	11.188	24.637	14.355	0.645
180	02/12/2020	22:00:00	11.188	24.624	14.36	0.64
181	02/12/2020	23:00:00	11.188	24.613	14.365	0.635
182	03/12/2020	00:00:00	11.188	24.6	14.367	0.633
183	03/12/2020	01:00:00	11.188	24.587	14.37	0.63
184	03/12/2020	02:00:00	11.188	24.571	14.372	0.628
185	03/12/2020	03:00:00	11.188	24.55	14.371	0.629
186	03/12/2020	04:00:00	11.188	24.53	14.37	0.63
187	03/12/2020	05:00:00	11.188	24.514	14.373	0.627
188	03/12/2020	06:00:00	11.188	24.496	14.369	0.631
189	03/12/2020	07:00:00	11.188	24.485	14.38	0.62
190	03/12/2020	08:00:00	11.188	24.475	14.384	0.616
191	03/12/2020	09:00:00	11.188	24.468	14.391	0.609
192	03/12/2020	10:00:00	11.188	24.455	14.399	0.601
193	03/12/2020	11:00:00	11.188	24.448	14.41	0.59
194	03/12/2020	12:00:00	11.188	24.439	14.416	0.584
195	03/12/2020	13:00:00	11.188	24.426	14.408	0.592
196	03/12/2020	14:00:00	11.188	24.422	14.406	0.594
197	03/12/2020	15:00:00	11.188	24.411	14.396	0.604
198	03/12/2020	16:00:00	11.188	24.402	14.384	0.616
199	03/12/2020	17:00:00	11.188	24.393	14.374	0.626
200	03/12/2020	18:00:00	11.188	24.389	14.373	0.627
201	03/12/2020	19:00:00	11.188	24.382	14.368	0.632
202	03/12/2020	20:00:00	11.188	24.377	14.363	0.637
203	03/12/2020	21:00:00	11.188	24.378	14.364	0.636
204	03/12/2020	22:00:00	11.188	24.382	14.363	0.637
205	03/12/2020	23:00:00	11.188	24.375	14.362	0.638
206	04/12/2020	00:00:00	11.188	24.377	14.358	0.642
207	04/12/2020	01:00:00	11.188	24.371	14.355	0.645
208	04/12/2020	02:00:00	11.188	24.371	14.356	0.644
209	04/12/2020	03:00:00	11.188	24.367	14.346	0.654
210	04/12/2020	04:00:00	11.188	24.36	14.342	0.658
211	04/12/2020	05:00:00	11.188	24.356	14.34	0.66
212	04/12/2020	06:00:00	11.188	24.353	14.338	0.662
213	04/12/2020	07:00:00	11.188	24.355	14.333	0.667
214	04/12/2020	08:00:00	11.188	24.358	14.333	0.667
215	04/12/2020	09:00:00	11.188	24.358	14.338	0.662
216	04/12/2020	10:00:00	11.188	24.355	14.355	0.645
217	04/12/2020	11:00:00	11.188	24.358	14.366	0.634
218	04/12/2020	12:00:00	11.188	24.351	14.366	0.634
219	04/12/2020	13:00:00	11.188	24.342	14.37	0.63
220	04/12/2020	14:00:00	11.188	24.336	14.356	0.644
221	04/12/2020	15:00:00	11.188	24.333	14.352	0.648
222	04/12/2020	16:00:00	11.188	24.329	14.352	0.648
223	04/12/2020	17:00:00	11.188	24.327	14.346	0.654
224	04/12/2020	18:00:00	11.188	24.324	14.334	0.666
225	04/12/2020	19:00:00	11.188	24.324	14.33	0.67
226	04/12/2020	20:00:00	11.188	24.325	14.33	0.67
227	04/12/2020	21:00:00	11.188	24.333	14.332	0.668
228	04/12/2020	22:00:00	11.188	24.338	14.33	0.67
229	04/12/2020	23:00:00	11.188	24.342	14.329	0.671
230	05/12/2020	00:00:00	11.188	24.351	14.326	0.674
231	05/12/2020	01:00:00	11.188	24.355	14.322	0.678
232	05/12/2020	02:00:00	11.188	24.355	14.315	0.685
233	05/12/2020	03:00:00	11.188	24.364	14.317	0.683
234	05/12/2020	04:00:00	11.188	24.366	14.312	0.688
235	05/12/2020	05:00:00	11.188	24.367	14.307	0.693
236	05/12/2020	06:00:00	11.188	24.371	14.293	0.707
237	05/12/2020	07:00:00	11.188	24.378	14.295	0.705
238	05/12/2020	08:00:00	11.188	24.384	14.288	0.712
239	05/12/2020	09:00:00	11.188	24.399	14.289	0.711
240	05/12/2020	10:00:00	11.188	24.41	14.291	0.709

241	05/12/2020	11:00:00	11.188	24.421	14.291	0.709
242	05/12/2020	12:00:00	11.188	24.43	14.296	0.704
243	05/12/2020	13:00:00	11.188	24.442	14.311	0.689
244	05/12/2020	14:00:00	11.188	24.452	14.301	0.699
245	05/12/2020	15:00:00	11.188	24.457	14.301	0.699
246	05/12/2020	16:00:00	11.188	24.468	14.292	0.708
247	05/12/2020	17:00:00	11.188	24.479	14.291	0.709
248	05/12/2020	18:00:00	11.188	24.481	14.287	0.713
249	05/12/2020	19:00:00	11.188	24.483	14.281	0.719
250	05/12/2020	20:00:00	11.188	24.492	14.281	0.719
251	05/12/2020	21:00:00	11.188	24.497	14.281	0.719
252	05/12/2020	22:00:00	11.188	24.508	14.288	0.712
253	05/12/2020	23:00:00	11.188	24.514	14.293	0.707
254	06/12/2020	00:00:00	11.188	24.529	14.306	0.694
255	06/12/2020	01:00:00	11.188	24.529	14.309	0.691
256	06/12/2020	02:00:00	11.188	24.538	14.313	0.687
257	06/12/2020	03:00:00	11.188	24.547	14.318	0.682
258	06/12/2020	04:00:00	11.188	24.556	14.328	0.672
259	06/12/2020	05:00:00	11.188	24.563	14.338	0.662
260	06/12/2020	06:00:00	11.188	24.563	14.334	0.666
261	06/12/2020	07:00:00	11.188	24.565	14.336	0.664
262	06/12/2020	08:00:00	11.188	24.569	14.336	0.664
263	06/12/2020	09:00:00	11.188	24.578	14.348	0.652
264	06/12/2020	10:00:00	11.188	24.582	14.371	0.629
265	06/12/2020	11:00:00	11.188	24.587	14.373	0.627
266	06/12/2020	12:00:00	11.188	24.593	14.379	0.621
267	06/12/2020	13:00:00	11.188	24.593	14.391	0.609
268	06/12/2020	14:00:00	11.188	24.591	14.388	0.612
269	06/12/2020	15:00:00	11.188	24.596	14.375	0.625
270	06/12/2020	16:00:00	11.188	24.598	14.365	0.635
271	06/12/2020	17:00:00	11.188	24.598	14.357	0.643
272	06/12/2020	18:00:00	11.188	24.594	14.357	0.643
273	06/12/2020	19:00:00	11.188	24.589	14.351	0.649
274	06/12/2020	20:00:00	11.188	24.583	14.355	0.645
275	06/12/2020	21:00:00	11.188	24.578	14.357	0.643
276	06/12/2020	22:00:00	11.188	24.576	14.362	0.638
277	06/12/2020	23:00:00	11.188	24.572	14.374	0.626
278	07/12/2020	00:00:00	11.188	24.572	14.378	0.622
279	07/12/2020	01:00:00	11.188	24.571	14.383	0.617
280	07/12/2020	02:00:00	11.188	24.567	14.385	0.615
281	07/12/2020	03:00:00	11.188	24.567	14.385	0.615
282	07/12/2020	04:00:00	11.188	24.563	14.387	0.613
283	07/12/2020	05:00:00	11.188	24.567	14.391	0.609
284	07/12/2020	06:00:00	11.188	24.569	14.396	0.604
285	07/12/2020	07:00:00	11.188	24.565	14.391	0.609
286	07/12/2020	08:00:00	11.188	24.565	14.385	0.615
287	07/12/2020	09:00:00	11.188	24.565	14.385	0.615
288	07/12/2020	10:00:00	11.188	24.567	14.4	0.6
289	07/12/2020	11:00:00	11.188	24.569	14.392	0.608
290	07/12/2020	12:00:00	11.188	24.574	14.389	0.611
291	07/12/2020	13:00:00	11.188	24.572	14.397	0.603
292	07/12/2020	14:00:00	11.188	24.574	14.412	0.588
293	07/12/2020	15:00:00	11.188	24.58	14.4	0.6
294	07/12/2020	16:00:00	11.188	24.585	14.397	0.603
295	07/12/2020	17:00:00	11.188	24.587	14.395	0.605
296	07/12/2020	18:00:00	11.188	24.593	14.395	0.605
297	07/12/2020	19:00:00	11.188	24.594	14.392	0.608
298	07/12/2020	20:00:00	11.188	24.591	14.388	0.612
299	07/12/2020	21:00:00	11.188	24.587	14.384	0.616
300	07/12/2020	22:00:00	11.188	24.582	14.378	0.622
301	07/12/2020	23:00:00	11.188	24.582	14.37	0.63
302	08/12/2020	00:00:00	11.188	24.585	14.375	0.625
303	08/12/2020	01:00:00	11.188	24.583	14.372	0.628

304	08/12/2020	02:00:00	11.188	24.587	14.372	0.628
305	08/12/2020	03:00:00	11.188	24.593	14.382	0.618
306	08/12/2020	04:00:00	11.188	24.596	14.383	0.617
307	08/12/2020	05:00:00	11.188	24.6	14.39	0.61
308	08/12/2020	06:00:00	11.188	24.602	14.394	0.606
309	08/12/2020	07:00:00	11.125	24.607	14.392	0.608
310	08/12/2020	08:00:00	11.188	24.605	14.393	0.607
311	08/12/2020	09:00:00	11.188	24.605	14.389	0.611
312	08/12/2020	10:00:00	11.188	24.605	14.399	0.601
313	08/12/2020	11:00:00	11.188	24.609	14.388	0.612
314	08/12/2020	12:00:00	11.188	24.611	14.389	0.611
315	08/12/2020	13:00:00	11.188	24.616	14.395	0.605
316	08/12/2020	14:00:00	11.188	24.622	14.407	0.593
317	08/12/2020	15:00:00	11.188	24.622	14.392	0.608
318	08/12/2020	16:00:00	11.188	24.627	14.388	0.612
319	08/12/2020	17:00:00	11.188	24.637	14.385	0.615
320	08/12/2020	18:00:00	11.188	24.64	14.378	0.622
321	08/12/2020	19:00:00	11.188	24.646	14.37	0.63
322	08/12/2020	20:00:00	11.188	24.64	14.371	0.629
323	08/12/2020	21:00:00	11.188	24.642	14.366	0.634
324	08/12/2020	22:00:00	11.188	24.638	14.352	0.648
325	08/12/2020	23:00:00	11.188	24.633	14.349	0.651
326	09/12/2020	00:00:00	11.188	24.637	14.343	0.657
327	09/12/2020	01:00:00	11.188	24.635	14.34	0.66
328	09/12/2020	02:00:00	11.188	24.638	14.346	0.654
329	09/12/2020	03:00:00	11.188	24.637	14.355	0.645
330	09/12/2020	04:00:00	11.188	24.638	14.345	0.655
331	09/12/2020	05:00:00	11.188	24.642	14.353	0.647
332	09/12/2020	06:00:00	11.188	24.64	14.356	0.644
333	09/12/2020	07:00:00	11.188	24.642	14.371	0.629
334	09/12/2020	08:00:00	11.188	24.637	14.374	0.626
335	09/12/2020	09:00:00	11.188	24.633	14.376	0.624

Logger ID	C31227
Reading Stored	336
Unit of Measurement	M
Job Number	A2020
Calibration Factor 1	5882
Calibration Factor 2	21420
Sampling interval	1 Hour
Start Date	25 November 2020 at 11:00:00
Well Number	BH04
Transducer depth	10.5Meter

No	Date	Time	Temperature(°C)	Pressure(Meter)	Head of Water(M)	Depth to Water(M)
1	25/11/2020	11:00:00	11	13.037	2.729	7.771
2	25/11/2020	12:00:00	11.062	13.044	2.732	7.768
3	25/11/2020	13:00:00	11.062	13.048	2.736	7.764
4	25/11/2020	14:00:00	11.062	13.052	2.732	7.768
5	25/11/2020	15:00:00	11.062	13.055	2.715	7.785
6	25/11/2020	16:00:00	11.062	13.065	2.712	7.788
7	25/11/2020	17:00:00	11.062	13.07	2.702	7.798
8	25/11/2020	18:00:00	11.062	13.072	2.693	7.807
9	25/11/2020	19:00:00	11.062	13.085	2.695	7.805
10	25/11/2020	20:00:00	11.062	13.093	2.697	7.803
11	25/11/2020	21:00:00	11.062	13.097	2.699	7.801
12	25/11/2020	22:00:00	11.062	13.1	2.704	7.796
13	25/11/2020	23:00:00	11.062	13.102	2.703	7.797
14	26/11/2020	00:00:00	11.062	13.106	2.703	7.797
15	26/11/2020	01:00:00	11.062	13.111	2.701	7.799
16	26/11/2020	02:00:00	11.062	13.115	2.707	7.793
17	26/11/2020	03:00:00	11.062	13.119	2.714	7.786
18	26/11/2020	04:00:00	11.062	13.117	2.712	7.788
19	26/11/2020	05:00:00	11.062	13.115	2.713	7.787
20	26/11/2020	06:00:00	11.062	13.117	2.707	7.793
21	26/11/2020	07:00:00	11.062	13.123	2.715	7.785
22	26/11/2020	08:00:00	11.062	13.125	2.711	7.789
23	26/11/2020	09:00:00	11.062	13.13	2.728	7.772
24	26/11/2020	10:00:00	11.062	13.128	2.735	7.765
25	26/11/2020	11:00:00	11.062	13.134	2.738	7.762
26	26/11/2020	12:00:00	11.062	13.134	2.742	7.758
27	26/11/2020	13:00:00	11.062	13.132	2.74	7.76
28	26/11/2020	14:00:00	11.062	13.13	2.731	7.769
29	26/11/2020	15:00:00	11.062	13.13	2.732	7.768
30	26/11/2020	16:00:00	11.062	13.132	2.726	7.774
31	26/11/2020	17:00:00	11.062	13.128	2.716	7.784
32	26/11/2020	18:00:00	11.062	13.132	2.713	7.787
33	26/11/2020	19:00:00	11.062	13.134	2.709	7.791
34	26/11/2020	20:00:00	11.062	13.13	2.713	7.787
35	26/11/2020	21:00:00	11.062	13.134	2.72	7.78
36	26/11/2020	22:00:00	11.062	13.136	2.722	7.778
37	26/11/2020	23:00:00	11.062	13.139	2.729	7.771
38	27/11/2020	00:00:00	11.062	13.139	2.728	7.772
39	27/11/2020	01:00:00	11.062	13.136	2.728	7.772
40	27/11/2020	02:00:00	11.062	13.132	2.72	7.78
41	27/11/2020	03:00:00	11.062	13.132	2.714	7.786
42	27/11/2020	04:00:00	11.062	13.13	2.713	7.787
43	27/11/2020	05:00:00	11.062	13.123	2.707	7.793
44	27/11/2020	06:00:00	11.062	13.125	2.709	7.791
45	27/11/2020	07:00:00	11.062	13.119	2.705	7.795
46	27/11/2020	08:00:00	11.062	13.119	2.711	7.789
47	27/11/2020	09:00:00	11.062	13.117	2.724	7.776
48	27/11/2020	10:00:00	11.062	13.115	2.751	7.749
49	27/11/2020	11:00:00	11.062	13.111	2.751	7.749
50	27/11/2020	12:00:00	11.062	13.104	2.75	7.75
51	27/11/2020	13:00:00	11.062	13.102	2.75	7.75

52	27/11/2020	14:00:00	11.062	13.098	2.751	7.749
53	27/11/2020	15:00:00	11.062	13.089	2.741	7.759
54	27/11/2020	16:00:00	11.062	13.089	2.742	7.758
55	27/11/2020	17:00:00	11.062	13.083	2.74	7.76
56	27/11/2020	18:00:00	11.062	13.08	2.736	7.764
57	27/11/2020	19:00:00	11.062	13.08	2.738	7.762
58	27/11/2020	20:00:00	11.062	13.076	2.736	7.764
59	27/11/2020	21:00:00	11.062	13.074	2.742	7.758
60	27/11/2020	22:00:00	11.062	13.074	2.74	7.76
61	27/11/2020	23:00:00	11.062	13.074	2.741	7.759
62	28/11/2020	00:00:00	11.062	13.07	2.741	7.759
63	28/11/2020	01:00:00	11.062	13.067	2.743	7.757
64	28/11/2020	02:00:00	11.062	13.063	2.74	7.76
65	28/11/2020	03:00:00	11.062	13.061	2.738	7.762
66	28/11/2020	04:00:00	11.062	13.057	2.735	7.765
67	28/11/2020	05:00:00	11.062	13.059	2.741	7.759
68	28/11/2020	06:00:00	11.062	13.055	2.737	7.763
69	28/11/2020	07:00:00	11.062	13.059	2.737	7.763
70	28/11/2020	08:00:00	11.062	13.061	2.737	7.763
71	28/11/2020	09:00:00	11.062	13.063	2.731	7.769
72	28/11/2020	10:00:00	11.062	13.07	2.734	7.766
73	28/11/2020	11:00:00	11.062	13.072	2.732	7.768
74	28/11/2020	12:00:00	11.062	13.08	2.738	7.762
75	28/11/2020	13:00:00	11.062	13.085	2.74	7.76
76	28/11/2020	14:00:00	11.062	13.087	2.74	7.76
77	28/11/2020	15:00:00	11.062	13.085	2.728	7.772
78	28/11/2020	16:00:00	11.062	13.093	2.735	7.765
79	28/11/2020	17:00:00	11.062	13.097	2.729	7.771
80	28/11/2020	18:00:00	11.062	13.102	2.728	7.772
81	28/11/2020	19:00:00	11.062	13.111	2.73	7.77
82	28/11/2020	20:00:00	11.062	13.119	2.732	7.768
83	28/11/2020	21:00:00	11.062	13.119	2.726	7.774
84	28/11/2020	22:00:00	11.062	13.126	2.724	7.776
85	28/11/2020	23:00:00	11.062	13.132	2.727	7.773
86	29/11/2020	00:00:00	11.062	13.139	2.726	7.774
87	29/11/2020	01:00:00	11.062	13.145	2.734	7.766
88	29/11/2020	02:00:00	11.062	13.147	2.734	7.766
89	29/11/2020	03:00:00	11.062	13.151	2.736	7.764
90	29/11/2020	04:00:00	11.062	13.153	2.738	7.762
91	29/11/2020	05:00:00	11.062	13.153	2.735	7.765
92	29/11/2020	06:00:00	11.062	13.156	2.732	7.768
93	29/11/2020	07:00:00	11.062	13.16	2.733	7.767
94	29/11/2020	08:00:00	11.062	13.164	2.73	7.77
95	29/11/2020	09:00:00	11.062	13.171	2.733	7.767
96	29/11/2020	10:00:00	11.062	13.171	2.73	7.77
97	29/11/2020	11:00:00	11.062	13.173	2.731	7.769
98	29/11/2020	12:00:00	11.062	13.181	2.744	7.756
99	29/11/2020	13:00:00	11.062	13.181	2.743	7.757
100	29/11/2020	14:00:00	11.062	13.182	2.745	7.755
101	29/11/2020	15:00:00	11.062	13.181	2.742	7.758
102	29/11/2020	16:00:00	11.062	13.181	2.735	7.765
103	29/11/2020	17:00:00	11.062	13.181	2.73	7.77
104	29/11/2020	18:00:00	11.062	13.182	2.731	7.769
105	29/11/2020	19:00:00	11.062	13.186	2.732	7.768
106	29/11/2020	20:00:00	11.062	13.186	2.728	7.772
107	29/11/2020	21:00:00	11.062	13.19	2.731	7.769
108	29/11/2020	22:00:00	11.062	13.194	2.736	7.764
109	29/11/2020	23:00:00	11.062	13.19	2.733	7.767
110	30/11/2020	00:00:00	11.062	13.192	2.735	7.765
111	30/11/2020	01:00:00	11.062	13.192	2.74	7.76
112	30/11/2020	02:00:00	11.062	13.19	2.737	7.763
113	30/11/2020	03:00:00	11.062	13.192	2.74	7.76
114	30/11/2020	04:00:00	11.062	13.181	2.735	7.765

115	30/11/2020	05:00:00	11.062	13.182	2.739	7.761
116	30/11/2020	06:00:00	11.062	13.179	2.748	7.752
117	30/11/2020	07:00:00	11.062	13.173	2.745	7.755
118	30/11/2020	08:00:00	11.062	13.171	2.737	7.763
119	30/11/2020	09:00:00	11.062	13.171	2.734	7.766
120	30/11/2020	10:00:00	11.062	13.171	2.741	7.759
121	30/11/2020	11:00:00	11.062	13.171	2.747	7.753
122	30/11/2020	12:00:00	11.062	13.166	2.744	7.756
123	30/11/2020	13:00:00	11.062	13.166	2.747	7.753
124	30/11/2020	14:00:00	11.062	13.164	2.748	7.752
125	30/11/2020	15:00:00	11.062	13.164	2.748	7.752
126	30/11/2020	16:00:00	11.062	13.16	2.742	7.758
127	30/11/2020	17:00:00	11.062	13.16	2.735	7.765
128	30/11/2020	18:00:00	11.062	13.162	2.733	7.767
129	30/11/2020	19:00:00	11.062	13.169	2.729	7.771
130	30/11/2020	20:00:00	11.062	13.173	2.724	7.776
131	30/11/2020	21:00:00	11.062	13.182	2.723	7.777
132	30/11/2020	22:00:00	11.062	13.182	2.712	7.788
133	30/11/2020	23:00:00	11.062	13.192	2.72	7.78
134	01/12/2020	00:00:00	11.062	13.195	2.719	7.781
135	01/12/2020	01:00:00	11.062	13.197	2.723	7.777
136	01/12/2020	02:00:00	11.062	13.205	2.727	7.773
137	01/12/2020	03:00:00	11.062	13.205	2.727	7.773
138	01/12/2020	04:00:00	11.062	13.203	2.726	7.774
139	01/12/2020	05:00:00	11.062	13.207	2.726	7.774
140	01/12/2020	06:00:00	11.062	13.209	2.728	7.772
141	01/12/2020	07:00:00	11.062	13.212	2.723	7.777
142	01/12/2020	08:00:00	11.062	13.212	2.721	7.779
143	01/12/2020	09:00:00	11.062	13.216	2.726	7.774
144	01/12/2020	10:00:00	11.062	13.218	2.733	7.767
145	01/12/2020	11:00:00	11.062	13.218	2.739	7.761
146	01/12/2020	12:00:00	11.062	13.218	2.743	7.757
147	01/12/2020	13:00:00	11.062	13.214	2.749	7.751
148	01/12/2020	14:00:00	11.062	13.212	2.754	7.746
149	01/12/2020	15:00:00	11.062	13.207	2.747	7.753
150	01/12/2020	16:00:00	11.062	13.203	2.739	7.761
151	01/12/2020	17:00:00	11.062	13.201	2.739	7.761
152	01/12/2020	18:00:00	11.062	13.199	2.742	7.758
153	01/12/2020	19:00:00	11.062	13.197	2.739	7.761
154	01/12/2020	20:00:00	11.062	13.192	2.739	7.761
155	01/12/2020	21:00:00	11.062	13.19	2.738	7.762
156	01/12/2020	22:00:00	11.062	13.186	2.736	7.764
157	01/12/2020	23:00:00	11.062	13.186	2.745	7.755
158	02/12/2020	00:00:00	11.062	13.182	2.747	7.753
159	02/12/2020	01:00:00	11.062	13.175	2.748	7.752
160	02/12/2020	02:00:00	11.062	13.173	2.75	7.75
161	02/12/2020	03:00:00	11.062	13.169	2.745	7.755
162	02/12/2020	04:00:00	11.062	13.166	2.755	7.745
163	02/12/2020	05:00:00	11.062	13.154	2.753	7.747
164	02/12/2020	06:00:00	11.062	13.147	2.749	7.751
165	02/12/2020	07:00:00	11.062	13.145	2.752	7.748
166	02/12/2020	08:00:00	11.062	13.138	2.734	7.766
167	02/12/2020	09:00:00	11.062	13.141	2.746	7.754
168	02/12/2020	10:00:00	11.062	13.139	2.765	7.735
169	02/12/2020	11:00:00	11.062	13.134	2.762	7.738
170	02/12/2020	12:00:00	11.062	13.125	2.767	7.733
171	02/12/2020	13:00:00	11.062	13.113	2.766	7.734
172	02/12/2020	14:00:00	11.062	13.11	2.757	7.743
173	02/12/2020	15:00:00	11.062	13.104	2.758	7.742
174	02/12/2020	16:00:00	11.062	13.097	2.758	7.742
175	02/12/2020	17:00:00	11.062	13.085	2.75	7.75
176	02/12/2020	18:00:00	11.062	13.074	2.747	7.753
177	02/12/2020	19:00:00	11.062	13.067	2.751	7.749

178	02/12/2020	20:00:00	11.062	13.057	2.762	7.738
179	02/12/2020	21:00:00	11.062	13.044	2.762	7.738
180	02/12/2020	22:00:00	11.062	13.033	2.769	7.731
181	02/12/2020	23:00:00	11.062	13.018	2.77	7.73
182	03/12/2020	00:00:00	11.062	12.999	2.766	7.734
183	03/12/2020	01:00:00	11.062	12.988	2.771	7.729
184	03/12/2020	02:00:00	11.062	12.971	2.772	7.728
185	03/12/2020	03:00:00	11.062	12.955	2.776	7.724
186	03/12/2020	04:00:00	11.062	12.934	2.774	7.726
187	03/12/2020	05:00:00	11.062	12.915	2.774	7.726
188	03/12/2020	06:00:00	11.062	12.893	2.766	7.734
189	03/12/2020	07:00:00	11.062	12.88	2.775	7.725
190	03/12/2020	08:00:00	11.062	12.865	2.774	7.726
191	03/12/2020	09:00:00	11.062	12.846	2.769	7.731
192	03/12/2020	10:00:00	11.062	12.83	2.774	7.726
193	03/12/2020	11:00:00	11.062	12.815	2.777	7.723
194	03/12/2020	12:00:00	11.062	12.803	2.78	7.72
195	03/12/2020	13:00:00	11.062	12.796	2.778	7.722
196	03/12/2020	14:00:00	11.062	12.785	2.769	7.731
197	03/12/2020	15:00:00	11.062	12.774	2.759	7.741
198	03/12/2020	16:00:00	11.062	12.77	2.752	7.748
199	03/12/2020	17:00:00	11.062	12.764	2.745	7.755
200	03/12/2020	18:00:00	11.062	12.762	2.746	7.754
201	03/12/2020	19:00:00	11.062	12.755	2.741	7.759
202	03/12/2020	20:00:00	11.062	12.753	2.739	7.761
203	03/12/2020	21:00:00	11.062	12.753	2.739	7.761
204	03/12/2020	22:00:00	11.062	12.751	2.732	7.768
205	03/12/2020	23:00:00	11.062	12.753	2.74	7.76
206	04/12/2020	00:00:00	11.062	12.751	2.732	7.768
207	04/12/2020	01:00:00	11.062	12.753	2.737	7.763
208	04/12/2020	02:00:00	11.062	12.753	2.738	7.762
209	04/12/2020	03:00:00	11.062	12.751	2.73	7.77
210	04/12/2020	04:00:00	11.062	12.753	2.735	7.765
211	04/12/2020	05:00:00	11.062	12.753	2.737	7.763
212	04/12/2020	06:00:00	11.062	12.751	2.736	7.764
213	04/12/2020	07:00:00	11.062	12.751	2.729	7.771
214	04/12/2020	08:00:00	11.062	12.753	2.728	7.772
215	04/12/2020	09:00:00	11.062	12.755	2.735	7.765
216	04/12/2020	10:00:00	11.062	12.757	2.757	7.743
217	04/12/2020	11:00:00	11.062	12.759	2.767	7.733
218	04/12/2020	12:00:00	11.062	12.751	2.766	7.734
219	04/12/2020	13:00:00	11.062	12.749	2.777	7.723
220	04/12/2020	14:00:00	11.062	12.744	2.764	7.736
221	04/12/2020	15:00:00	11.062	12.736	2.755	7.745
222	04/12/2020	16:00:00	11.062	12.731	2.754	7.746
223	04/12/2020	17:00:00	11.062	12.731	2.75	7.75
224	04/12/2020	18:00:00	11.062	12.734	2.744	7.756
225	04/12/2020	19:00:00	11.062	12.738	2.744	7.756
226	04/12/2020	20:00:00	11.062	12.738	2.743	7.757
227	04/12/2020	21:00:00	11.062	12.742	2.741	7.759
228	04/12/2020	22:00:00	11.062	12.751	2.743	7.757
229	04/12/2020	23:00:00	11.062	12.755	2.742	7.758
230	05/12/2020	00:00:00	11.062	12.759	2.734	7.766
231	05/12/2020	01:00:00	11.062	12.768	2.735	7.765
232	05/12/2020	02:00:00	11.062	12.777	2.737	7.763
233	05/12/2020	03:00:00	11.062	12.781	2.734	7.766
234	05/12/2020	04:00:00	11.062	12.789	2.735	7.765
235	05/12/2020	05:00:00	11.062	12.798	2.738	7.762
236	05/12/2020	06:00:00	11.062	12.802	2.724	7.776
237	05/12/2020	07:00:00	11.062	12.809	2.726	7.774
238	05/12/2020	08:00:00	11.062	12.818	2.722	7.778
239	05/12/2020	09:00:00	11.062	12.828	2.718	7.782
240	05/12/2020	10:00:00	11.062	12.839	2.72	7.78

241	05/12/2020	11:00:00	11.062	12.852	2.722	7.778
242	05/12/2020	12:00:00	11.062	12.859	2.725	7.775
243	05/12/2020	13:00:00	11.062	12.869	2.738	7.762
244	05/12/2020	14:00:00	11.062	12.878	2.727	7.773
245	05/12/2020	15:00:00	11.062	12.886	2.73	7.77
246	05/12/2020	16:00:00	11.062	12.893	2.717	7.783
247	05/12/2020	17:00:00	11.062	12.906	2.718	7.782
248	05/12/2020	18:00:00	11.062	12.912	2.718	7.782
249	05/12/2020	19:00:00	11.062	12.921	2.719	7.781
250	05/12/2020	20:00:00	11.062	12.929	2.718	7.782
251	05/12/2020	21:00:00	11.062	12.934	2.718	7.782
252	05/12/2020	22:00:00	11.062	12.94	2.72	7.78
253	05/12/2020	23:00:00	11.062	12.942	2.721	7.779
254	06/12/2020	00:00:00	11.062	12.943	2.72	7.78
255	06/12/2020	01:00:00	11.062	12.945	2.725	7.775
256	06/12/2020	02:00:00	11.062	12.945	2.72	7.78
257	06/12/2020	03:00:00	11.062	12.949	2.72	7.78
258	06/12/2020	04:00:00	11.062	12.951	2.723	7.777
259	06/12/2020	05:00:00	11.062	12.951	2.726	7.774
260	06/12/2020	06:00:00	11.062	12.953	2.724	7.776
261	06/12/2020	07:00:00	11.062	12.957	2.728	7.772
262	06/12/2020	08:00:00	11.062	12.957	2.724	7.776
263	06/12/2020	09:00:00	11.062	12.962	2.732	7.768
264	06/12/2020	10:00:00	11.062	12.964	2.753	7.747
265	06/12/2020	11:00:00	11.062	12.964	2.75	7.75
266	06/12/2020	12:00:00	11.062	12.964	2.75	7.75
267	06/12/2020	13:00:00	11.062	12.962	2.76	7.74
268	06/12/2020	14:00:00	11.062	12.96	2.757	7.743
269	06/12/2020	15:00:00	11.062	12.96	2.739	7.761
270	06/12/2020	16:00:00	11.062	12.96	2.727	7.773
271	06/12/2020	17:00:00	11.062	12.96	2.719	7.781
272	06/12/2020	18:00:00	11.062	12.957	2.72	7.78
273	06/12/2020	19:00:00	11.062	12.953	2.715	7.785
274	06/12/2020	20:00:00	11.062	12.949	2.721	7.779
275	06/12/2020	21:00:00	11.062	12.947	2.726	7.774
276	06/12/2020	22:00:00	11.062	12.945	2.731	7.769
277	06/12/2020	23:00:00	11.062	12.942	2.744	7.756
278	07/12/2020	00:00:00	11.062	12.934	2.74	7.76
279	07/12/2020	01:00:00	11.062	12.932	2.744	7.756
280	07/12/2020	02:00:00	11.062	12.929	2.747	7.753
281	07/12/2020	03:00:00	11.062	12.923	2.741	7.759
282	07/12/2020	04:00:00	11.062	12.921	2.745	7.755
283	07/12/2020	05:00:00	11.062	12.917	2.741	7.759
284	07/12/2020	06:00:00	11.062	12.915	2.742	7.758
285	07/12/2020	07:00:00	11.062	12.915	2.741	7.759
286	07/12/2020	08:00:00	11.062	12.914	2.734	7.766
287	07/12/2020	09:00:00	11.062	12.914	2.734	7.766
288	07/12/2020	10:00:00	11.062	12.914	2.747	7.753
289	07/12/2020	11:00:00	11.062	12.919	2.742	7.758
290	07/12/2020	12:00:00	11.062	12.923	2.738	7.762
291	07/12/2020	13:00:00	11.062	12.921	2.746	7.754
292	07/12/2020	14:00:00	11.062	12.919	2.757	7.743
293	07/12/2020	15:00:00	11.062	12.917	2.737	7.763
294	07/12/2020	16:00:00	11.062	12.921	2.733	7.767
295	07/12/2020	17:00:00	11.062	12.919	2.727	7.773
296	07/12/2020	18:00:00	11.062	12.927	2.729	7.771
297	07/12/2020	19:00:00	11.062	12.927	2.725	7.775
298	07/12/2020	20:00:00	11.062	12.93	2.727	7.773
299	07/12/2020	21:00:00	11.062	12.932	2.729	7.771
300	07/12/2020	22:00:00	11.062	12.93	2.726	7.774
301	07/12/2020	23:00:00	11.062	12.932	2.72	7.78
302	08/12/2020	00:00:00	11.062	12.934	2.724	7.776
303	08/12/2020	01:00:00	11.062	12.938	2.727	7.773

304	08/12/2020	02:00:00	11.062	12.934	2.719	7.781
305	08/12/2020	03:00:00	11.062	12.936	2.725	7.775
306	08/12/2020	04:00:00	11.062	12.932	2.719	7.781
307	08/12/2020	05:00:00	11.062	12.938	2.728	7.772
308	08/12/2020	06:00:00	11.062	12.938	2.73	7.77
309	08/12/2020	07:00:00	11.062	12.94	2.725	7.775
310	08/12/2020	08:00:00	11.062	12.942	2.73	7.77
311	08/12/2020	09:00:00	11.062	12.945	2.729	7.771
312	08/12/2020	10:00:00	11.062	12.947	2.741	7.759
313	08/12/2020	11:00:00	11.062	12.953	2.732	7.768
314	08/12/2020	12:00:00	11.062	12.955	2.733	7.767
315	08/12/2020	13:00:00	11.062	12.958	2.737	7.763
316	08/12/2020	14:00:00	11.062	12.96	2.745	7.755
317	08/12/2020	15:00:00	11.062	12.964	2.734	7.766
318	08/12/2020	16:00:00	11.062	12.971	2.732	7.768
319	08/12/2020	17:00:00	11.062	12.975	2.723	7.777
320	08/12/2020	18:00:00	11.062	12.981	2.719	7.781
321	08/12/2020	19:00:00	11.062	12.988	2.712	7.788
322	08/12/2020	20:00:00	11.062	12.992	2.723	7.777
323	08/12/2020	21:00:00	11.062	12.996	2.72	7.78
324	08/12/2020	22:00:00	11.062	12.998	2.712	7.788
325	08/12/2020	23:00:00	11.062	13.005	2.721	7.779
326	09/12/2020	00:00:00	11.062	13.009	2.715	7.785
327	09/12/2020	01:00:00	11.062	13.007	2.712	7.788
328	09/12/2020	02:00:00	11.062	13.009	2.717	7.783
329	09/12/2020	03:00:00	11.062	13.007	2.725	7.775
330	09/12/2020	04:00:00	11.062	13.009	2.716	7.784
331	09/12/2020	05:00:00	11.062	13.005	2.716	7.784
332	09/12/2020	06:00:00	11.062	13.007	2.723	7.777
333	09/12/2020	07:00:00	11.062	13.005	2.734	7.766
334	09/12/2020	08:00:00	11.062	13.001	2.738	7.762
335	09/12/2020	09:00:00	11.062	12.999	2.742	7.758
336	09/12/2020	10:00:00	11.062	12.99	2.744	7.756

Appendix 2a Groundwater Readings (Dipmeter)

IRISH DRILLING LTD.
Loughrea Co. Galway

Tel: (091) 841274 Fax: (091) 880861

Project: Arklow Bank Wind Park - Onshore Grid Infrastructure
Client: SSE
Location: County Wicklow
Date: 19/03/2021 Sheet No. 1
Checked: RK

Water Levels in Standpipes

Date	Location	Depth	Comments	Remarks
17.11.2020	BH01	3.10m	before purge	
		2.43m	after purge	50mm standpipe, Rotary Core Borehole
	BH03	0.94m	before purge	
		5.86m	after purge	50mm standpipe, Rotary Core Borehole
	BH04	7.92m	before purge	
		7.01m	after purge	50mm standpipe, Rotary Core Borehole
25.11.2020	BH01	3.10m	Data Logger installed at 5.00m bgl (Logger No. 31228).	
	BH03	1.00m	Data Logger installed at 15.00m bgl (Logger No. 31226).	
	BH04	7.94m	Data Logger installed at 10.50m bgl (Logger No. 31227).	
24.02.2021				
	BH01	3.03m		50mm standpipe, Rotary Core Borehole
	BH03	0.65m		50mm standpipe, Rotary Core Borehole
	BH04	8.83m		50mm standpipe, Rotary Core Borehole
05.05.2021				
	BH01	3.22m		50mm standpipe, Rotary Core Borehole
	BH03	1.52m		50mm standpipe, Rotary Core Borehole
	BH04	7.99m		50mm standpipe, Rotary Core Borehole

Remarks:
All readings record depth from ground level to top of water level.
Standpipes in boreholes decommissioned on May 6th 2021.

Appendix 2b Water Quality Readings

Landfall Water Quality Readings

Date	Bh No.	Water Level	Dissolved Oxygen (mg/L)	Dissovled Oxygen (%L)	Ph	Temp (C°)
09.12.2020	BH03	1.16m	7.61	0.1	9.42	8.9
09.12.2020	BH04	8.01m	0.6	8.1	9.51	7.8
09.12.2020	BH01	3.10m	0.58	8	7.3	9.3

Appendix 3 Digital Data

D. Scantech Ltd PAS128 Utility Survey (2021)

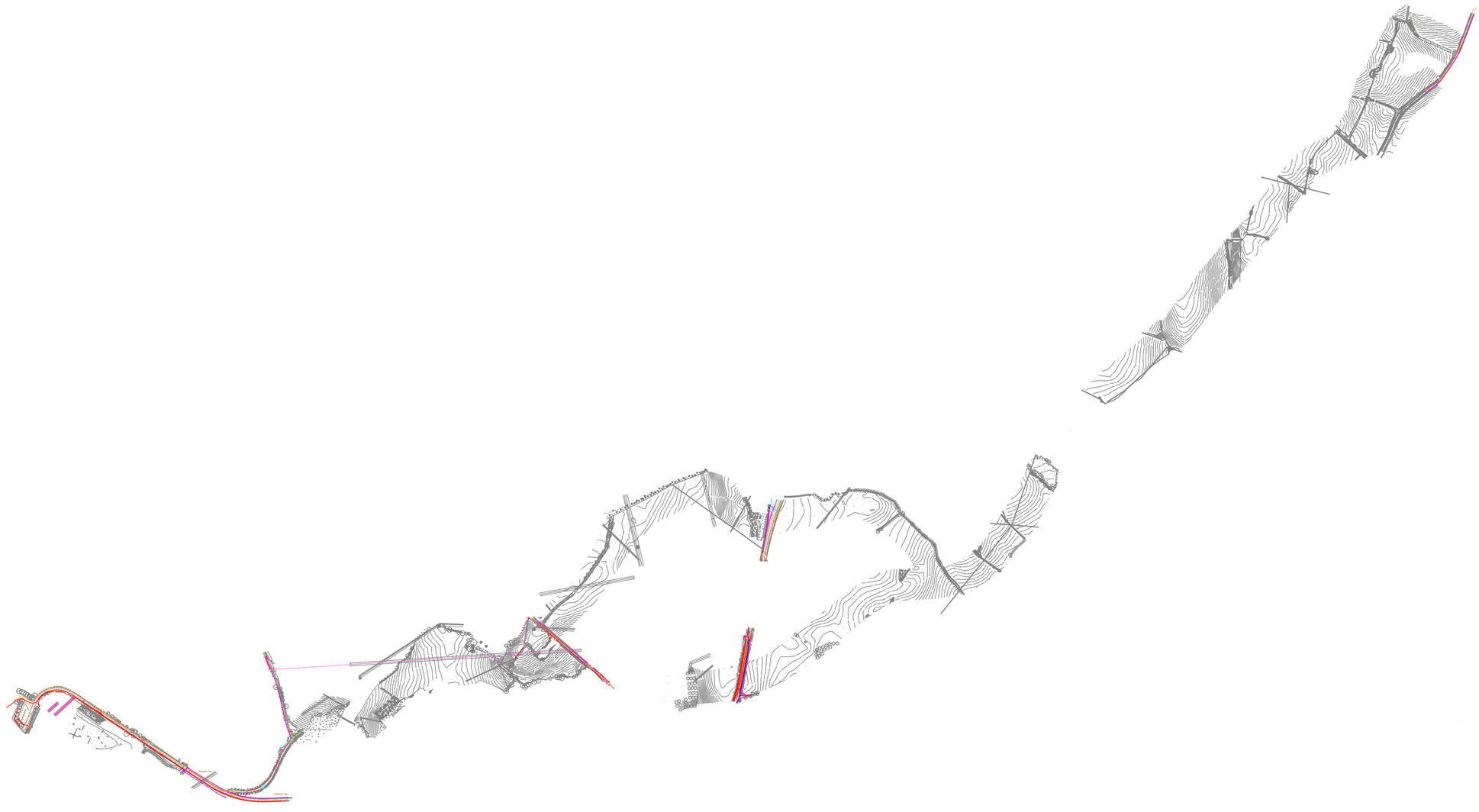
Project Title	Arklow Bank Wind Park Phase 2
Document Reference Number	LF100034-ENG-GP-ONX-SUR-0001

Onshore Ground Investigations: Cable Route – Utility Survey

DATASET

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Rev	Date	Reason for Issue	Originator	Checker	Approver
01	22/03/2021	Approved for Use	Scantech Geoscience	Irish Drilling Limited	



LEGEND

DESCRIPTION	COLOUR	TRACED SERVICES	INFERRED SERVICES
Foul Water Sewer	GREEN		
Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH 00	
Surface/Storm Water Manhole	CYAN	MH 00	
Power Manhole	RED	MH 00	
Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH 00	
Foul Sewer/Water Gully	GREEN	G	
Surface/Storm Water Gully	CYAN	G	

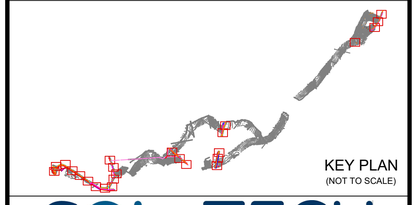
NOTES:

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5. 300mm denotes the diameter of the pipe.
6. 0.5 denotes (mBGL) depth in metres below ground level to top of pipe.
7. Survey carried out in November 2020.
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9. UTT denotes unable to Trace, UTO denotes unable to Open
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N

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Client: Sure Partners Limited

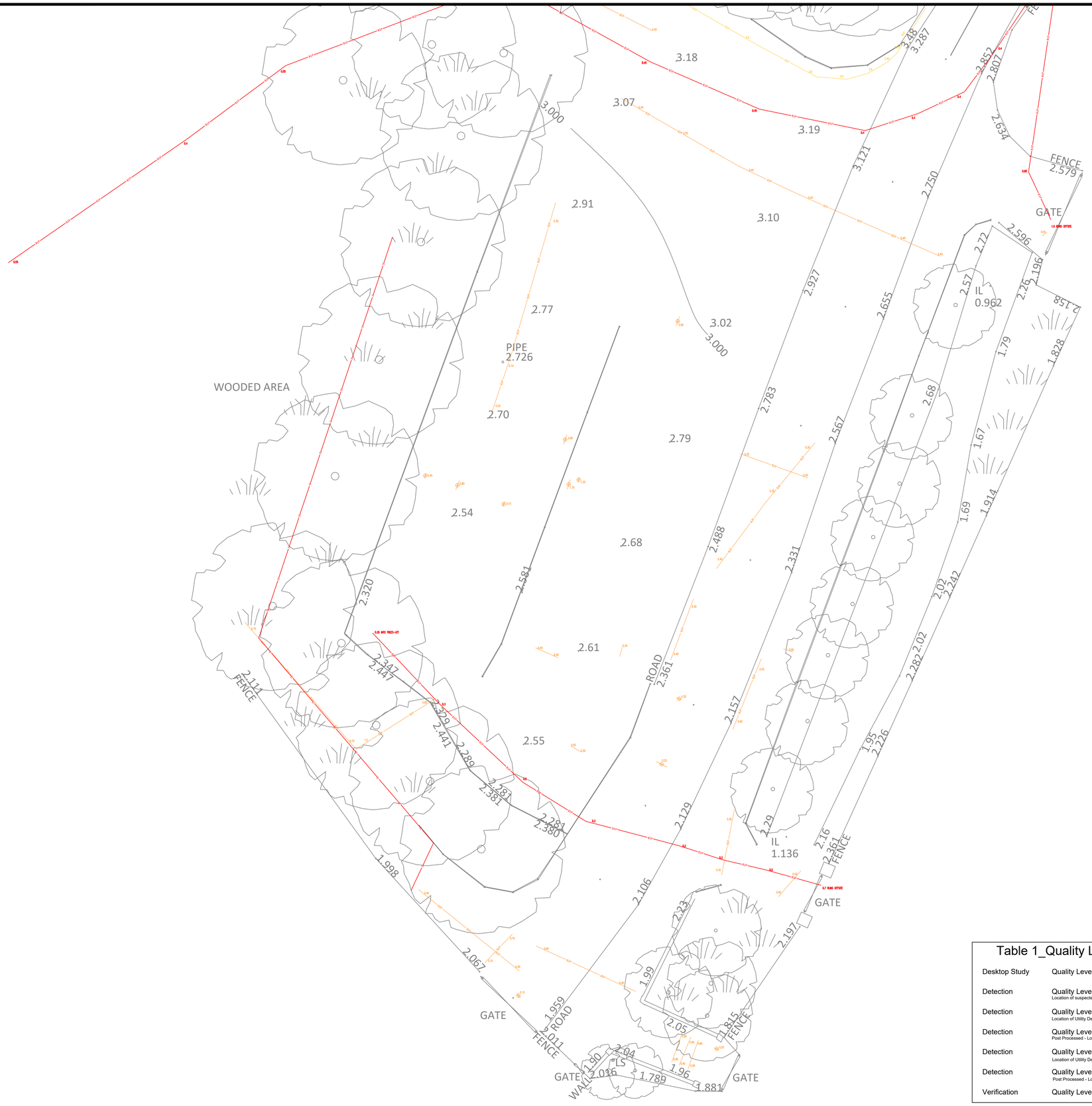
Project Title: Arklow Avoca River Park

Drawing Title: Underground Services Layout

Date: 16th December 2020 | Drawn By: JC

Scale: Not to Scale | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Overview | Revision:



LEGEND

DESCRIPTION	COLOUR	TRACED SERVICES	INFERRED SERVICES
Foul Water Sewer	GREEN		
Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH 00	
Surface/Storm Water Manhole	CYAN	MH 00	
Power Manhole	RED	MH 00	
Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH 00	
Foul Sewer/Water Gully	GREEN	G	
Surface/Storm Water Gully	CYAN	G	

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Table 1_Quality Level_PAS 128

Desktop Study	Quality Level - D	D
Detection	Quality Level - B4 Location of suspected Utility segment not detected - assumed route	B4
Detection	Quality Level - B2 Location of Utility Detected with One Technique	B2
Detection	Quality Level - B2P Post Processed - Location of Utility Detected with One Technique	B2P
Detection	Quality Level - B1 Location of Utility Detected with Two Techniques	B1
Detection	Quality Level - B1P Post Processed - Location of Utility Detected with Two Techniques	B1P
Verification	Quality Level - A	

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www.scantech.ie

Client: Sure Partners Limited

Project Title: Arklow Avoca River Park

Drawing Title: Underground Services Layout

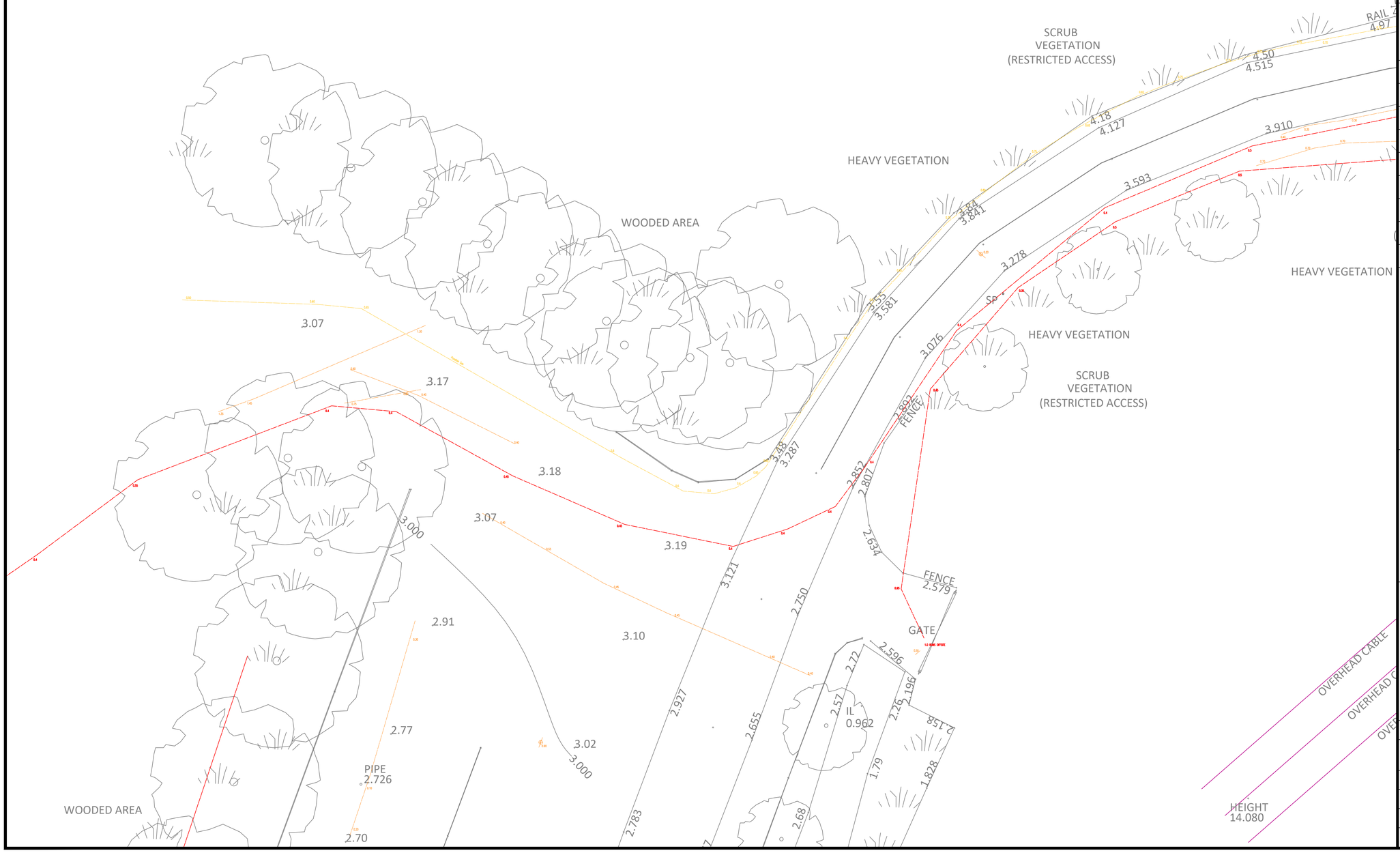
Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 1 | Revision:

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Verification	Quality Level - A	



LEGEND

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Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH FW	
Surface/Storm Water Manhole	CYAN	MH SW	
Power Manhole	RED	MH P	
Telecom Manhole	MAGENTA	MH T	
Watermain Manhole	BLUE	MH W	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH G	
Foul Sewer/Water Gully	GREEN	G	
Surface/Storm Water Gully	CYAN	G	

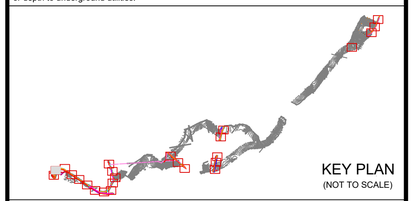
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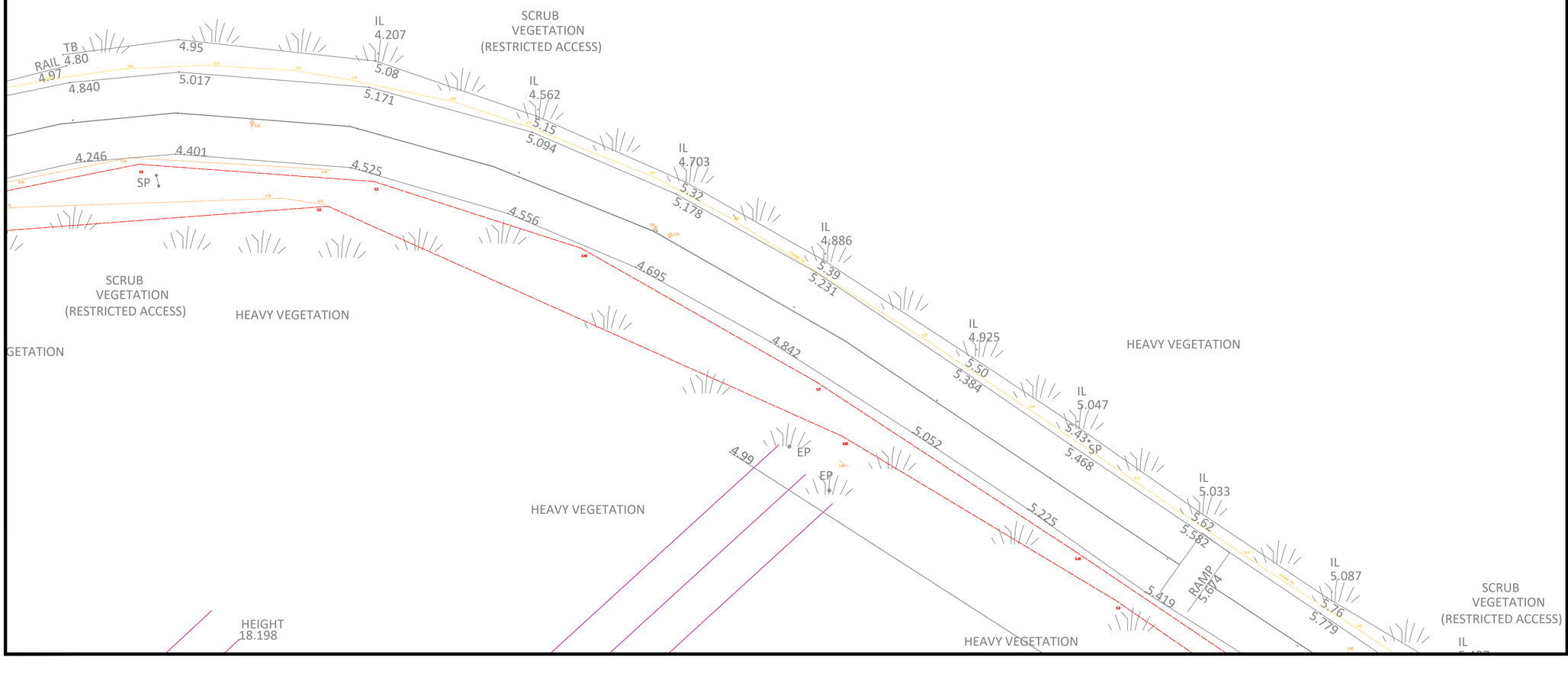
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Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 2 | Revision:

Table 1_Quality Level_PAS 128

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Verification	Quality Level - A	



LEGEND

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Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
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Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH 00	
Surface/Storm Water Manhole	CYAN	MH 00	
Power Manhole	RED	MH 00	
Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH 00	
Foul Sewer/Water Gully	GREEN	G	
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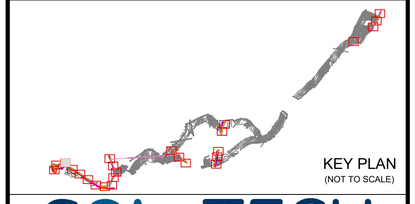
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Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 3 | Revision:

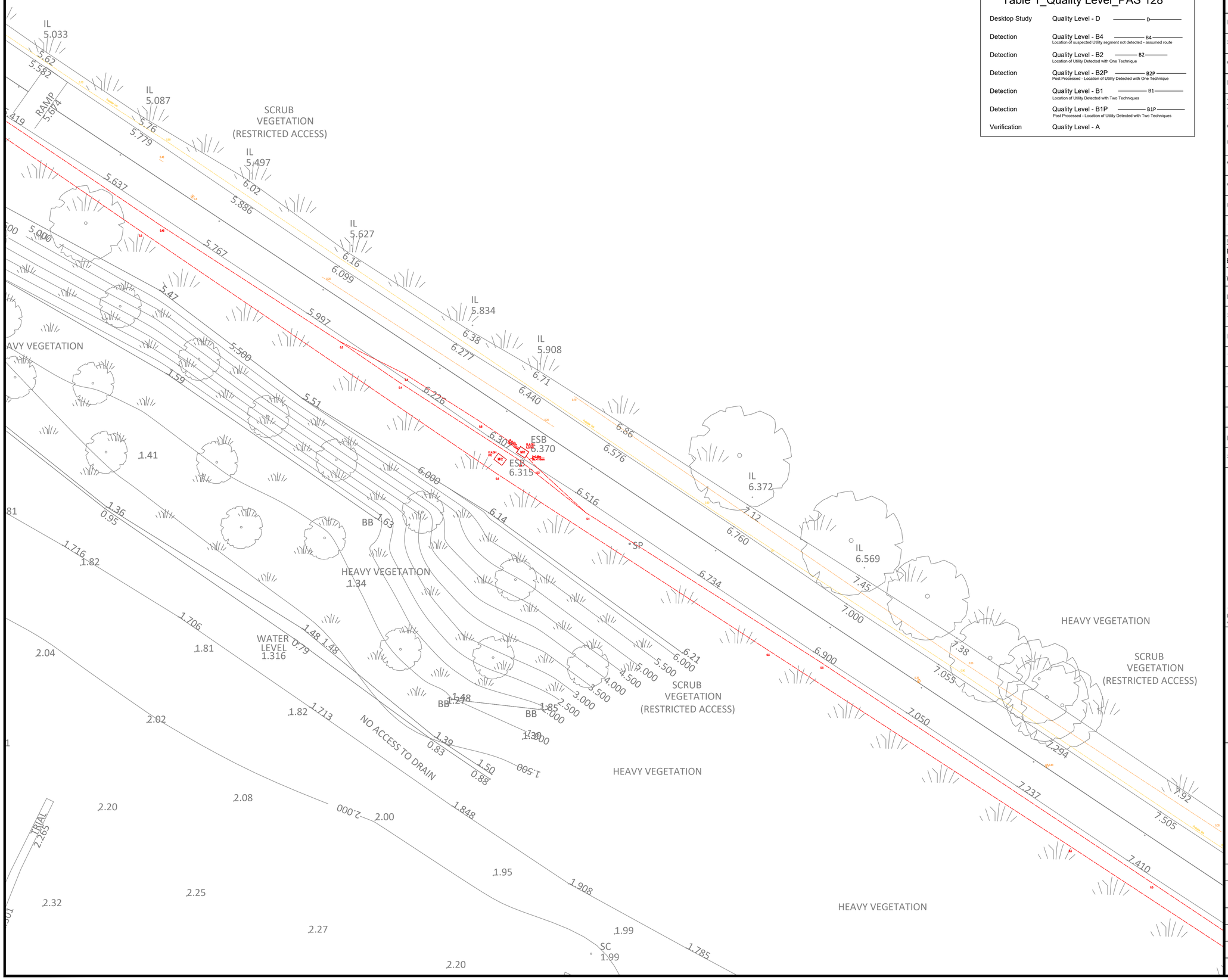


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Verification	Quality Level - A	

LEGEND

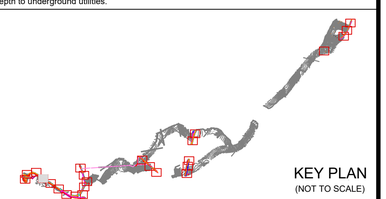
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Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH 00	
Surface/Storm Water Manhole	CYAN	MH 00	
Power Manhole	RED	MH 00	
Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH 00	
Foul Sewer/Water Gully	GREEN	G	
Surface/Storm Water Gully	CYAN	G	

NOTES:

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3. GPR = Ground Penetrating Radar - Mala 100 Mhz, 250 Mhz & 500 Mhz.
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www.scantech.ie

Client: Sure Partners Limited

Project Title: Arklow Avoca River Park

Drawing Title: Underground Services Layout

Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 4 | Revision:

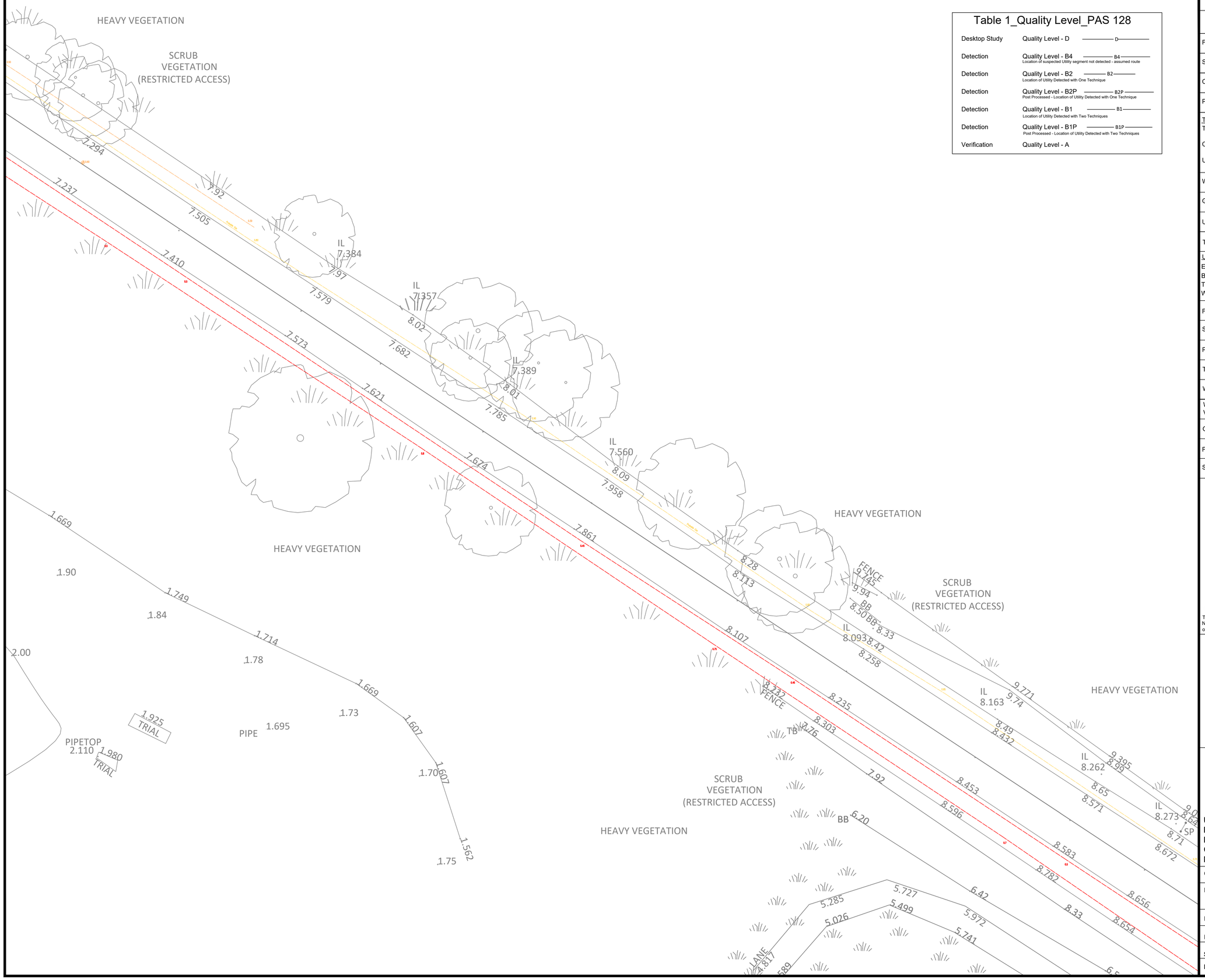


Table 1_Quality Level_PAS 128

Desktop Study	Quality Level - D	D
Detection	Quality Level - B4 Location of suspected Utility segment not detected - assumed route	B4
Detection	Quality Level - B2 Location of Utility Detected with One Technique	B2
Detection	Quality Level - B2P Post Processed - Location of Utility Detected with One Technique	B2P
Detection	Quality Level - B1 Location of Utility Detected with Two Techniques	B1
Detection	Quality Level - B1P Post Processed - Location of Utility Detected with Two Techniques	B1P
Verification	Quality Level - A	

LEGEND

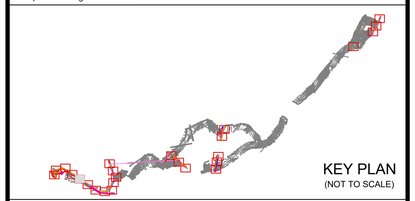
DESCRIPTION	COLOUR	TRACED SERVICES	INFERRED SERVICES
Foul Water Sewer	GREEN		
Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms Telecom Cable TV Unknown Cable	 MAGENTA PURPLE PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records ESB Records Bord Gais Records Telecom Records Water Records	 RED YELLOW MAGENTA BLUE		
Foul Sewer/Water Manhole	GREEN	MH 00	
Surface/Storm Water Manhole	CYAN	MH 00	
Power Manhole	RED	MH 00	
Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH 00	
Foul Sewer/Water Gully	GREEN	G	
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Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 5 | Revision:

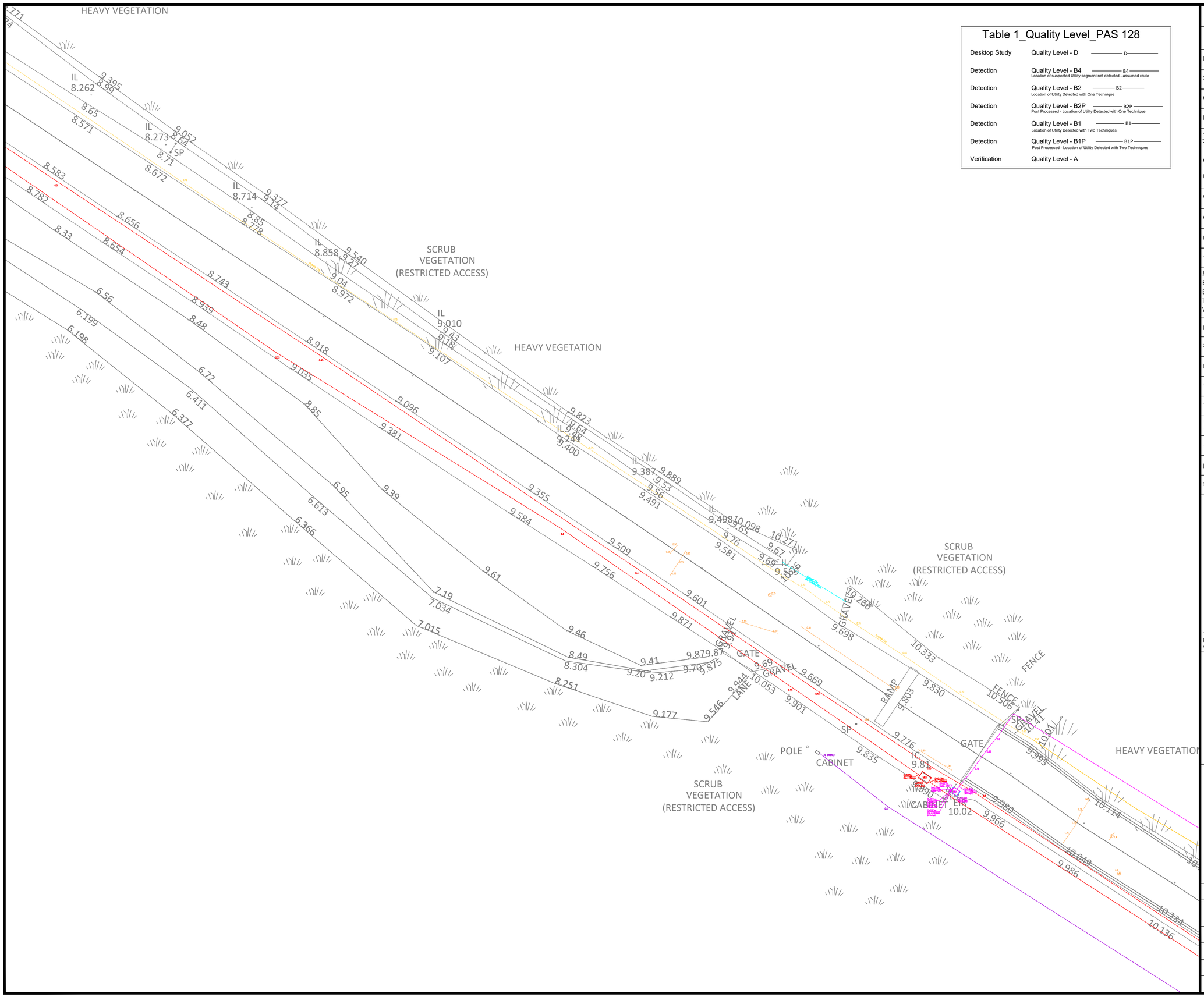


Table 1_Quality Level_PAS 128

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Detection	Quality Level - B1P Post Processed - Location of Utility Detected with Two Techniques	B1P
Verification	Quality Level - A	

LEGEND

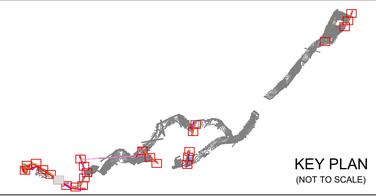
DESCRIPTION	COLOUR	TRACED SERVICES	INFERRED SERVICES
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Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
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Telecom Records	MAGENTA		
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Power Manhole	RED	MH P	
Telecom Manhole	MAGENTA	MH T	
Watermain Manhole	BLUE	MH W	
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Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 6 | Revision:

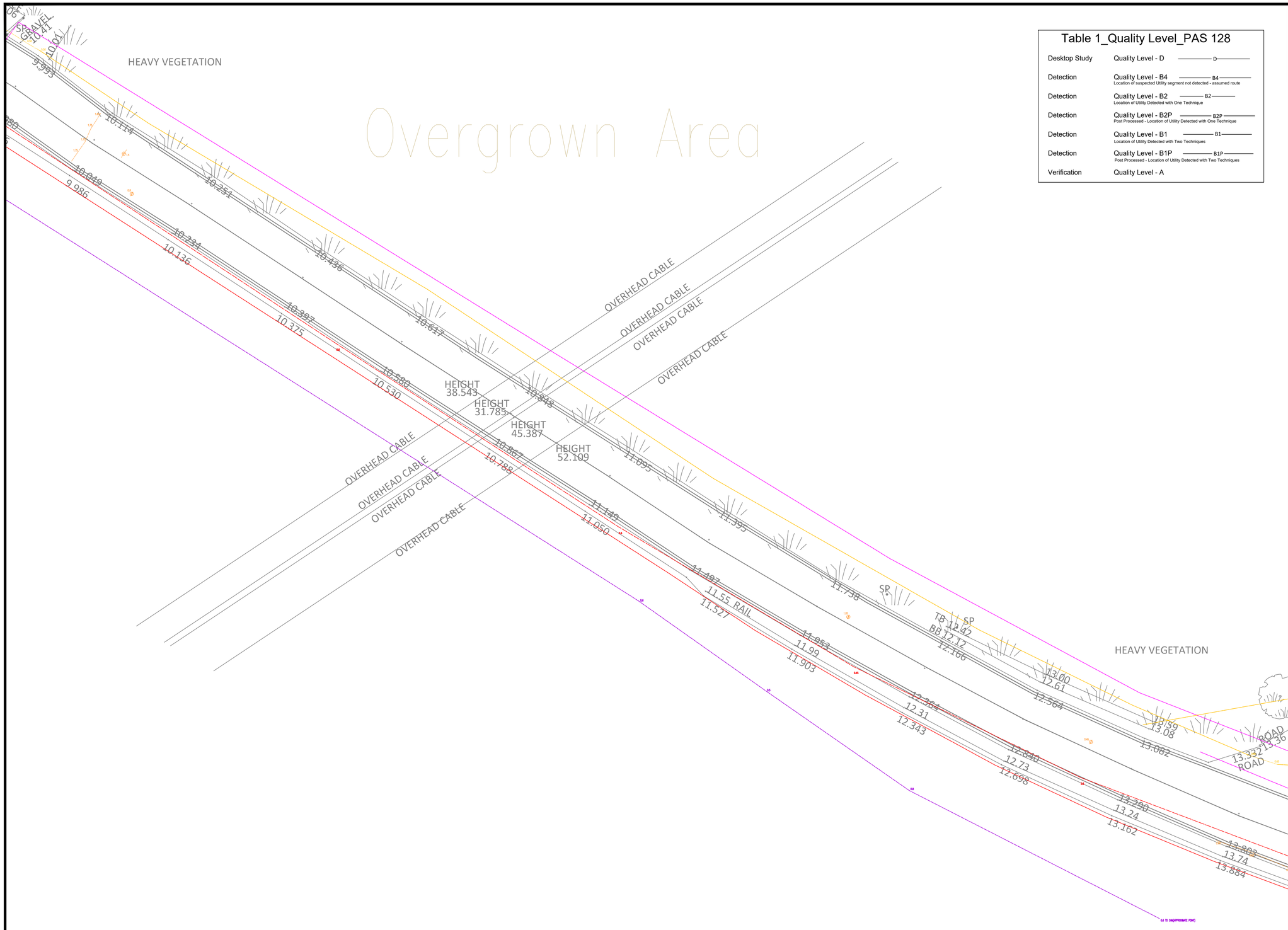


Table 1_Quality Level_PAS 128

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Detection	Quality Level - B4 Location of suspected Utility segment not detected - assumed route	B4
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Detection	Quality Level - B1 Location of Utility Detected with Two Techniques	B1
Detection	Quality Level - B1P Post Processed - Location of Utility Detected with Two Techniques	B1P
Verification	Quality Level - A	

LEGEND

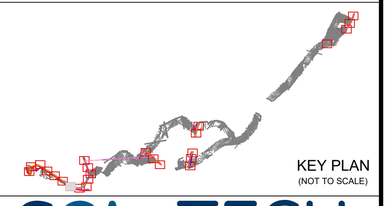
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Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH 00	
Surface/Storm Water Manhole	CYAN	MH 00	
Power Manhole	RED	MH 00	
Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH 00	
Foul Sewer/Water Gully	GREEN	G	
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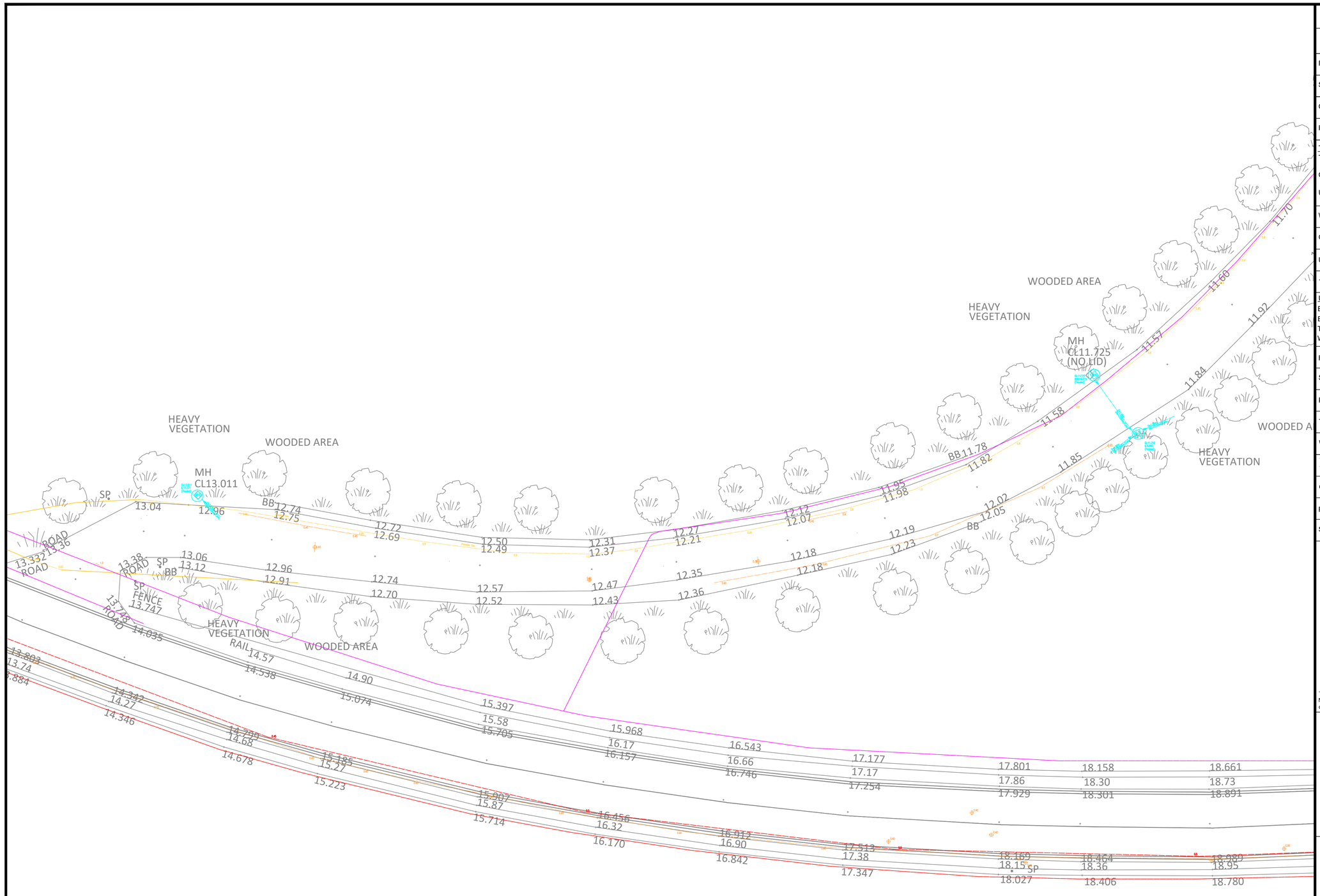
Project Title: Arklow Avoca River Park

Drawing Title: Underground Services Layout

Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 7 | Revision:



LEGEND

DESCRIPTION	COLOUR	TRACED SERVICES	INFERRED SERVICES
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Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
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Surface/Storm Water Manhole	CYAN	MH 00	
Power Manhole	RED	MH 00	
Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH 00	
Foul Sewer/Water Gully	GREEN	G	
Surface/Storm Water Gully	CYAN	G	

NOTES:

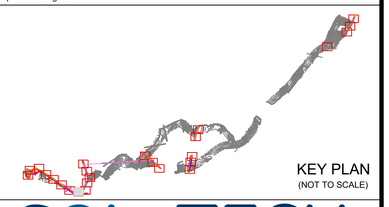
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Table 1_Quality Level_PAS 128

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Detection	Quality Level - B4 Location of suspected Utility segment not detected - assumed route	B4
Detection	Quality Level - B2 Location of Utility Detected with One Technique	B2
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Verification	Quality Level - A	



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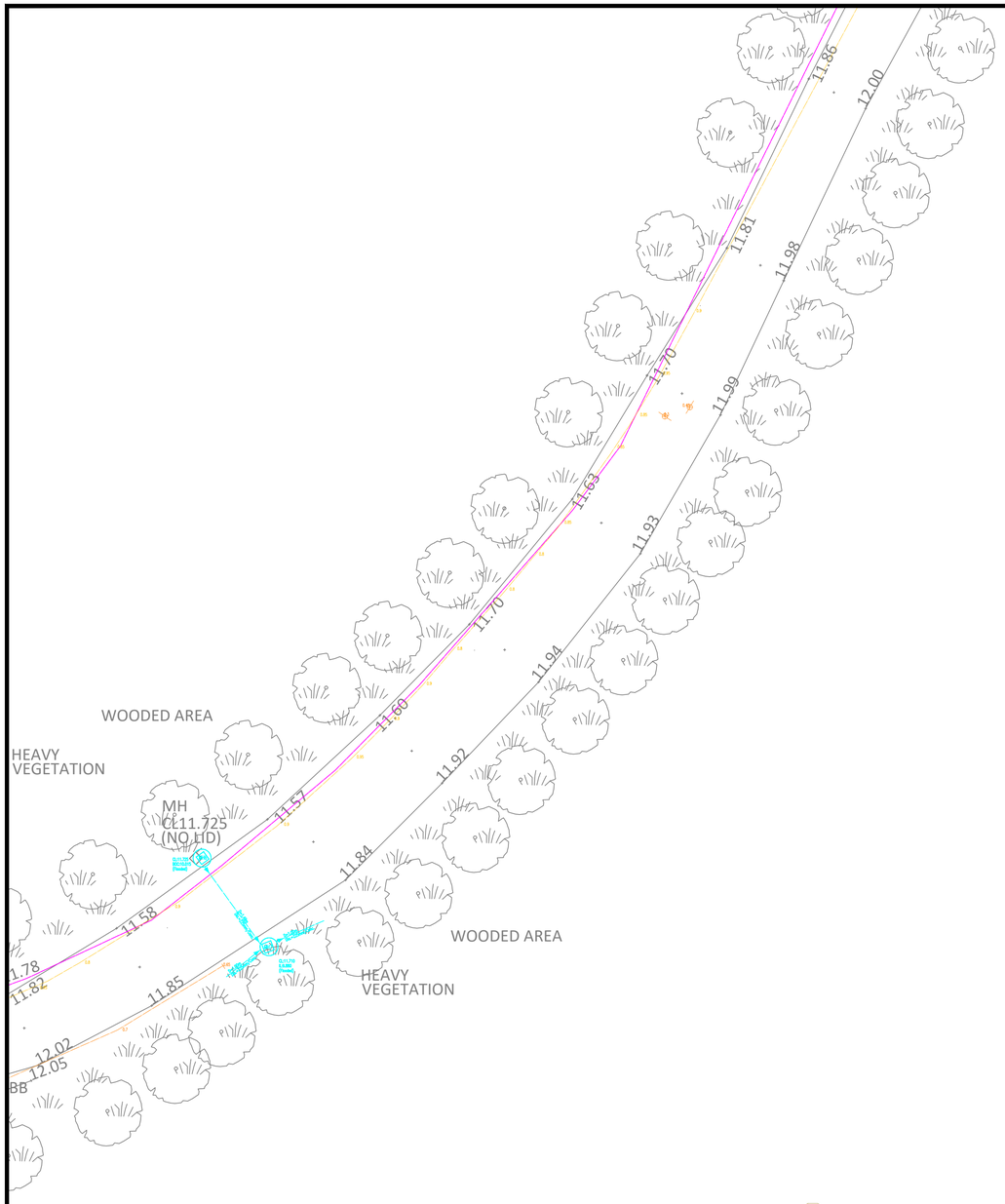
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Date: 16th December 2020 | Drawn By: JC

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Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 8 | Revision:



Overgrown Area

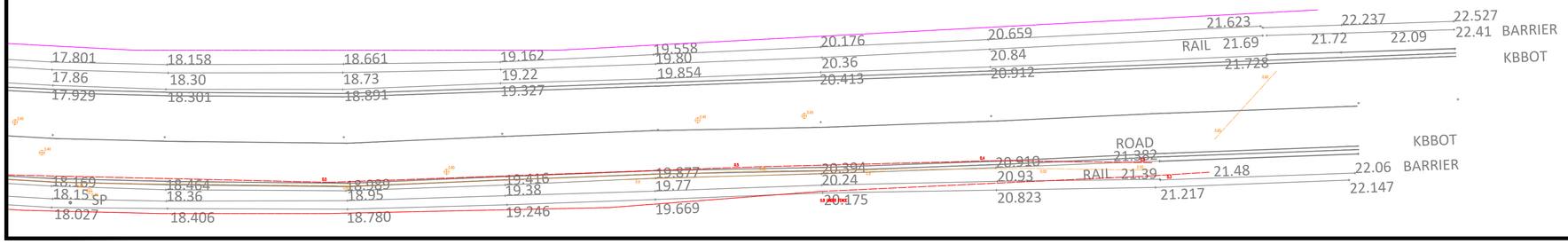


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Verification	Quality Level - A	

LEGEND

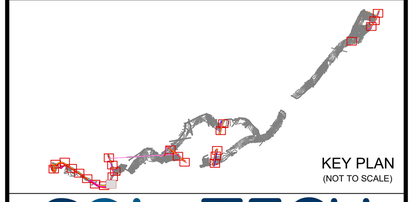
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Foul Water Sewer	GREEN		
Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH FW	
Surface/Storm Water Manhole	CYAN	MH SW	
Power Manhole	RED	MH PO	
Telecom Manhole	MAGENTA	MH TC	
Watermain Manhole	BLUE	MH WM	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH GS	
Foul Sewer/Water Gully	GREEN	G	
Surface/Storm Water Gully	CYAN	G	

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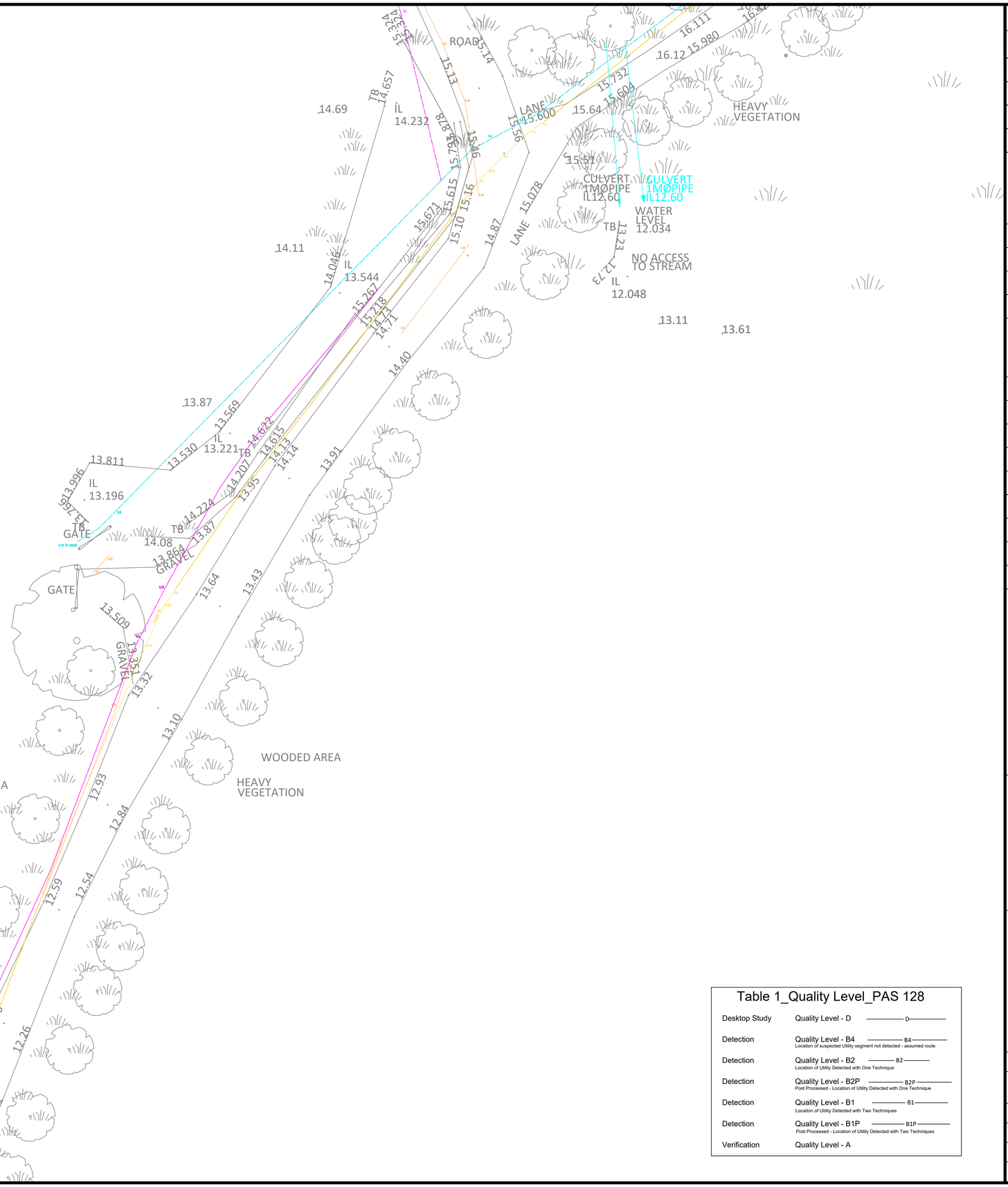
Project Title: Arklow Avoca River Park

Drawing Title: Underground Services Layout

Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 9 | Revision:



LEGEND

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Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
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NOTES:

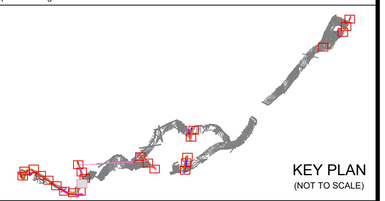
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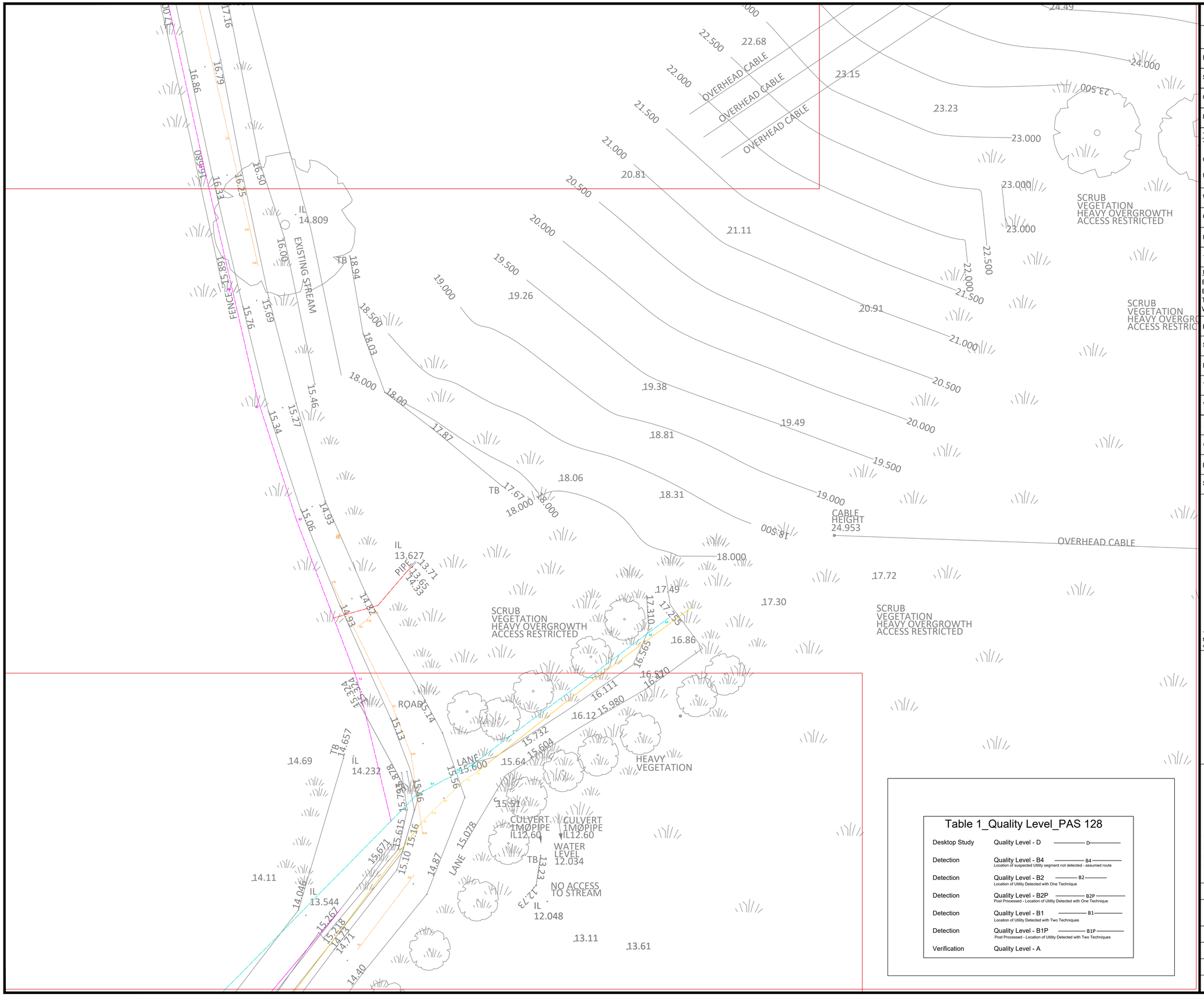
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Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 10 | Revision:



LEGEND

DESCRIPTION	COLOUR	TRACED SERVICES	INFERRED SERVICES
Foul Water Sewer	GREEN		
Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH 00	
Surface/Storm Water Manhole	CYAN	MH 00	
Power Manhole	RED	MH 00	
Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH 00	
Foul Sewer/Water Gully	GREEN	G	
Surface/Storm Water Gully	CYAN	G	

NOTES:

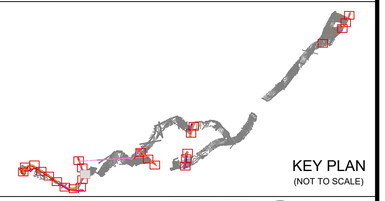
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Table 1_Quality Level_PAS 128

Desktop Study	Quality Level - D	D
Detection	Quality Level - B4 Location of suspected Utility segment not detected - assumed route	B4
Detection	Quality Level - B2 Location of Utility Detected with One Technique	B2
Detection	Quality Level - B2P Post Processed - Location of Utility Detected with One Technique	B2P
Detection	Quality Level - B1 Location of Utility Detected with Two Techniques	B1
Detection	Quality Level - B1P Post Processed - Location of Utility Detected with Two Techniques	B1P
Verification	Quality Level - A	



KEY PLAN
(NOT TO SCALE)

SCANTECH GEOSCIENCE
GPR - Utility Survey
Unit 1
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T: 01 2542680
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www.scantech.ie

Client: Sure Partners Limited

Project Title: Arklow Avoca River Park

Drawing Title: Underground Services Layout

Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 11 | Revision:

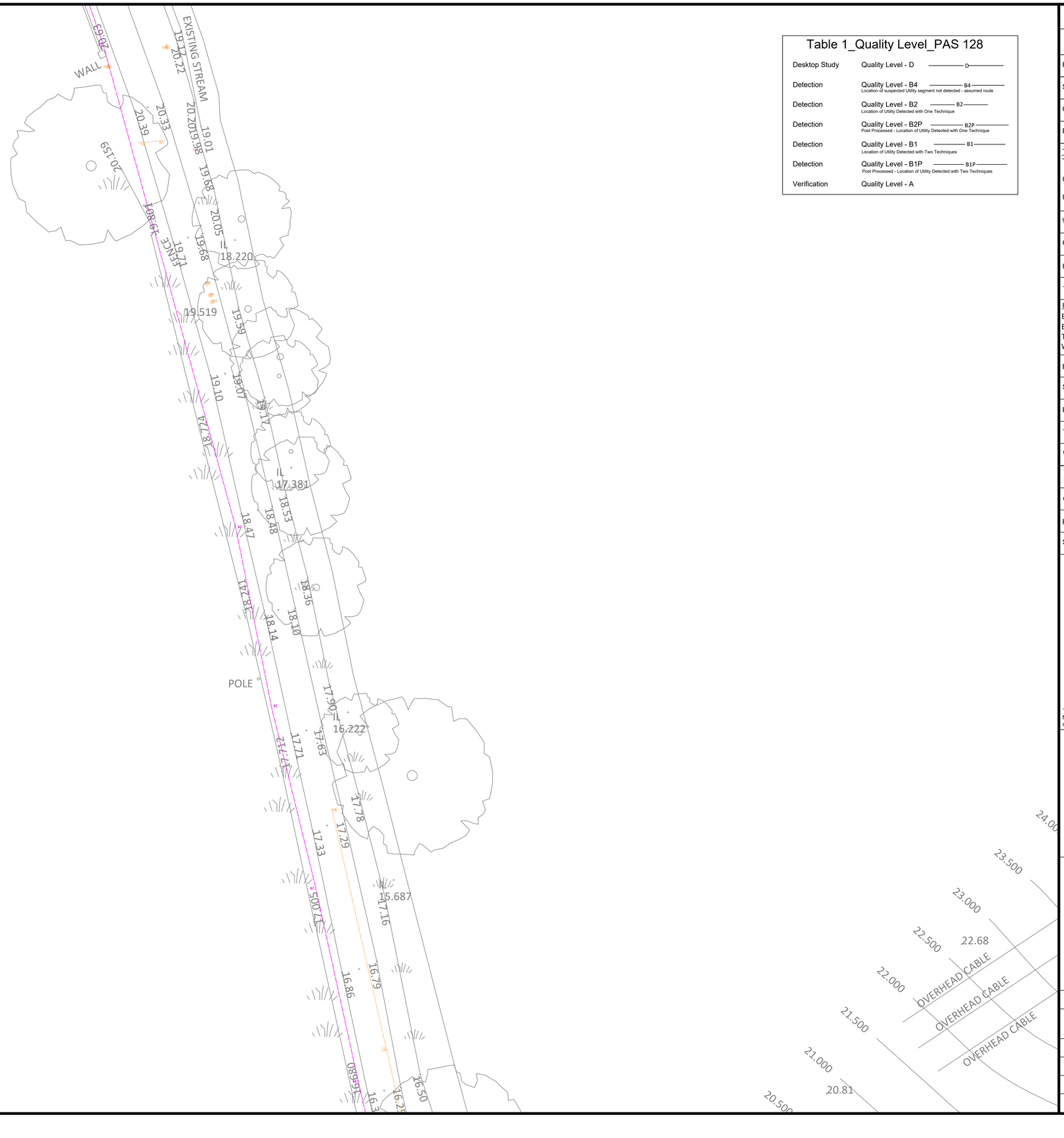


Table 1_Quality Level_PAS 128

Desktop Study	Quality Level - D — D —
Detection	Quality Level - B4 — B4 — Location of suspected Utility segment not detected - assumed route
Detection	Quality Level - B2 — B2 — Location of Utility Detected with One Technique
Detection	Quality Level - B2P — B2P — Post Processed - Location of Utility Detected with One Technique
Detection	Quality Level - B1 — B1 — Location of Utility Detected with Two Techniques
Detection	Quality Level - B1P — B1P — Post Processed - Location of Utility Detected with Two Techniques
Verification	Quality Level - A

LEGEND

DESCRIPTION	COLOUR	TRACED SERVICES	INFERRED SERVICES
Foul Water Sewer	GREEN		
Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH 00	
Surface/Storm Water Manhole	CYAN	MH 00	
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Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
Water Hydrant, Meter, Sluice Valve, Air Valve, Stop Cock	BLUE	HY WM SV AV SC	
Gas Line Manhole	YELLOW	MH 00	
Foul Sewer/Water Gully	GREEN	G	
Surface/Storm Water Gully	CYAN	G	

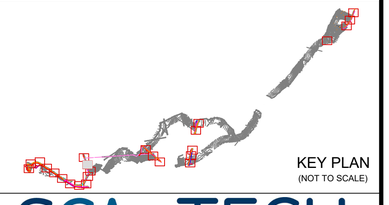
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N

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Date: 16th December 2020 | Drawn By: JC

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Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 12 | Revision:

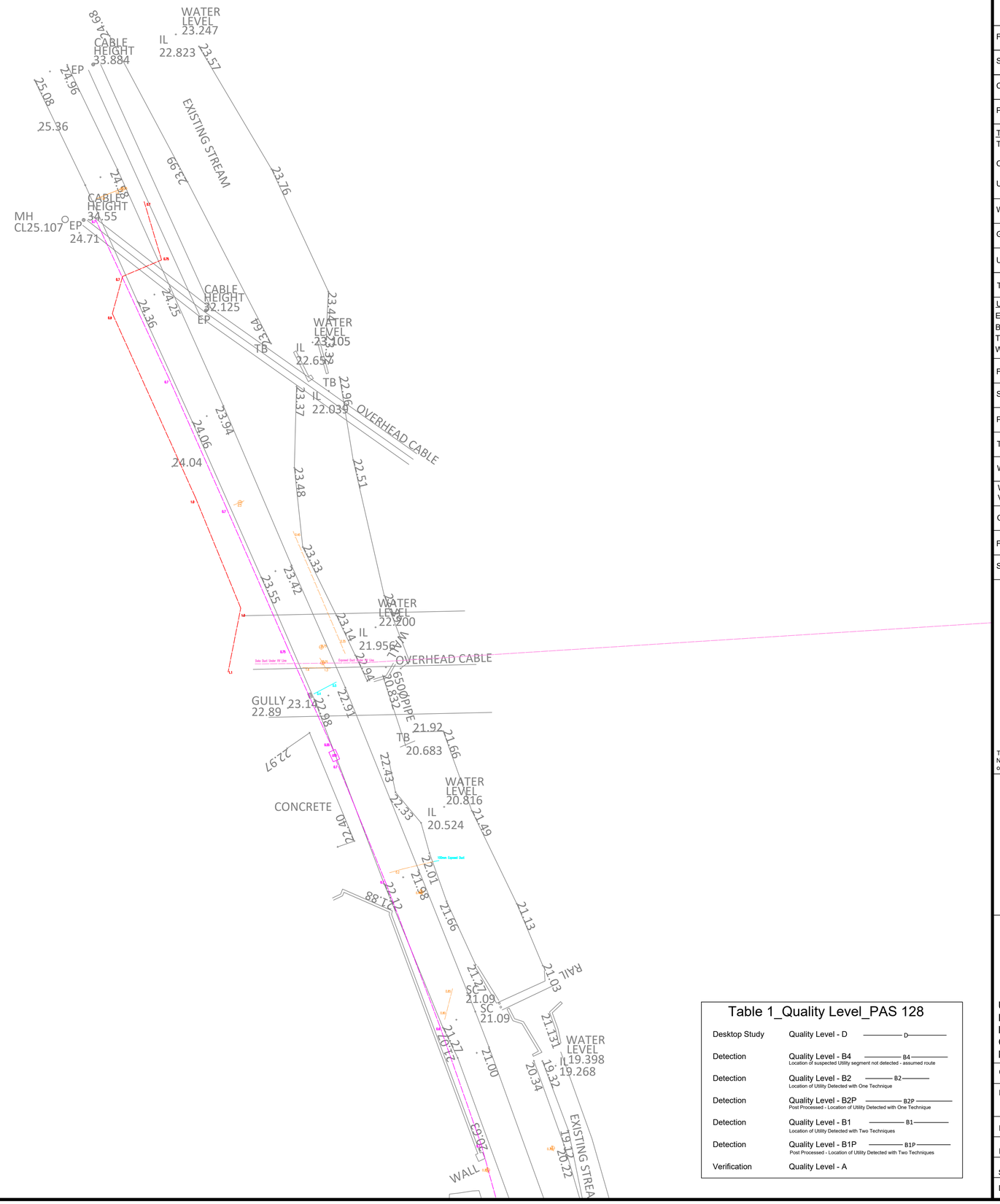


Table 1_Quality Level_PAS 128

Desktop Study	Quality Level - D	D
Detection	Quality Level - B4 Location of suspected Utility segment not detected - assumed route	B4
Detection	Quality Level - B2 Location of Utility Detected with One Technique	B2
Detection	Quality Level - B2P Post Processed - Location of Utility Detected with One Technique	B2P
Detection	Quality Level - B1 Location of Utility Detected with Two Techniques	B1
Detection	Quality Level - B1P Post Processed - Location of Utility Detected with Two Techniques	B1P
Verification	Quality Level - A	

LEGEND

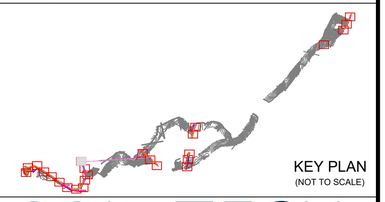
DESCRIPTION	COLOUR	TRACED SERVICES	INFERRED SERVICES
Foul Water Sewer	GREEN		
Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
Bord Gais Records	YELLOW		
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Water Records	BLUE		
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Drawing Title: Underground Services Layout

Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 13 | Revision:

PRIVATE PROPERTY
NO ACCESS

BUILDING

GATE

SCRUB
VEGETATION
(RESTRICTED ACCESS)

CABLE HEIGHT 43.164 EP

CABLE HEIGHT 44.495 EP

3 PHASE 20MK POLE

OVERHEAD CABLE

ROAD 37.06

ROAD 37.08

CABLE HEIGHT 47.034

EIR 37.63

FENCE 40.048

HEIGHT 66.802

HEIGHT 59.817

HEIGHT 73.810

HEIGHT 80.008

PYLON 38.27 38.27

HEIGHT 59.479

HEIGHT 65.945

HEIGHT 73.322

CABLE HEIGHT 45.644 EP 36.78

CABLE HEIGHT 43.981 EP 37.50

OVERHEAD CABLE

SCRUB

TB

BB

SCRUB
VEGETATION
(RESTRICTED ACCESS)

WALL 35.11

WALL 36.30

WALL 34.46

GULLY 33.85

EAVES 38.23

FENCE 36.29

BUILDING

RIDGE 41.515

BUILDING

BUILDING

GATE

WALL 36.50 36.562

WALL 36.19 WALL 36.05

Table 1_Quality Level_PAS 128

Desktop Study	Quality Level - D	D
Detection	Quality Level - B4 Location of suspected Utility segment not detected - assumed route	B4
Detection	Quality Level - B2 Location of Utility Detected with One Technique	B2
Detection	Quality Level - B2P Post Processed - Location of Utility Detected with One Technique	B2P
Detection	Quality Level - B1 Location of Utility Detected with Two Techniques	B1
Detection	Quality Level - B1P Post Processed - Location of Utility Detected with Two Techniques	B1P
Verification	Quality Level - A	

LEGEND

DESCRIPTION	COLOUR	TRACED SERVICES	INFERRED SERVICES
Foul Water Sewer	GREEN		
Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms			
Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records			
ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
Water Records	BLUE		
Foul Sewer/Water Manhole	GREEN	MH 00	
Surface/Storm Water Manhole	CYAN	MH 00	
Power Manhole	RED	MH 00	
Telecom Manhole	MAGENTA	MH 00	
Watermain Manhole	BLUE	MH 00	
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Drawing Title: Underground Services Layout

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Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 14 | Revision:

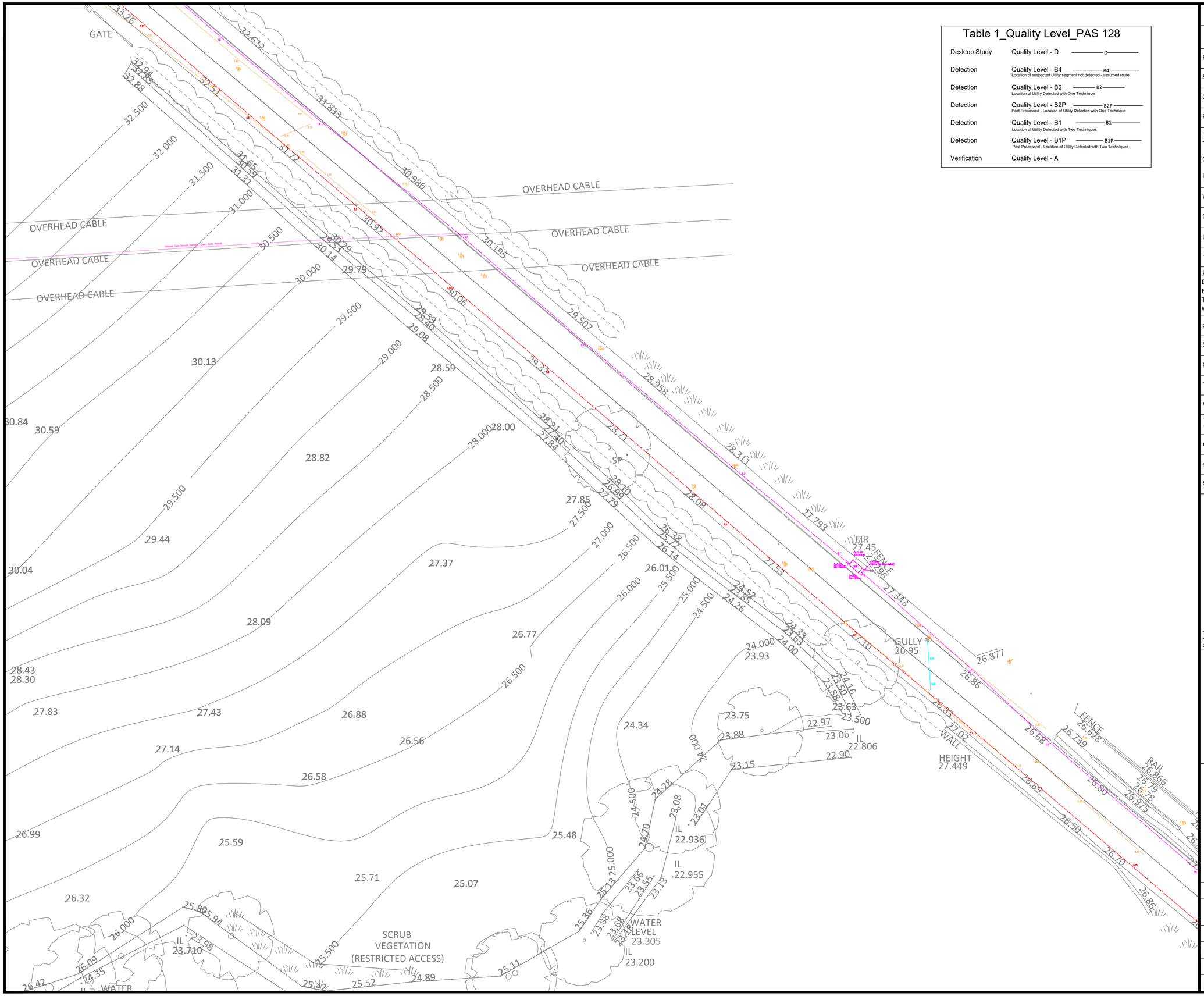


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Detection	Quality Level - B1 Location of Utility Detected with Two Techniques	B1
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Verification	Quality Level - A	

LEGEND

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Surface/Storm Water Sewer	CYAN		
Combined Sewer	BROWN		
Power	RED		
Telecoms Telecom	MAGENTA		
Cable TV	PURPLE		
Unknown Cable	PINK		
Watermain	BLUE		
Gas	YELLOW		
Unknown Service/Anomaly	ORANGE	0.5	
Trench Scar	LIGHT GREEN		
Utility Providers Records ESB Records	RED		
Bord Gais Records	YELLOW		
Telecom Records	MAGENTA		
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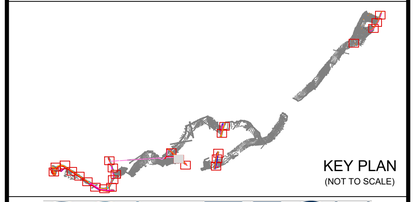
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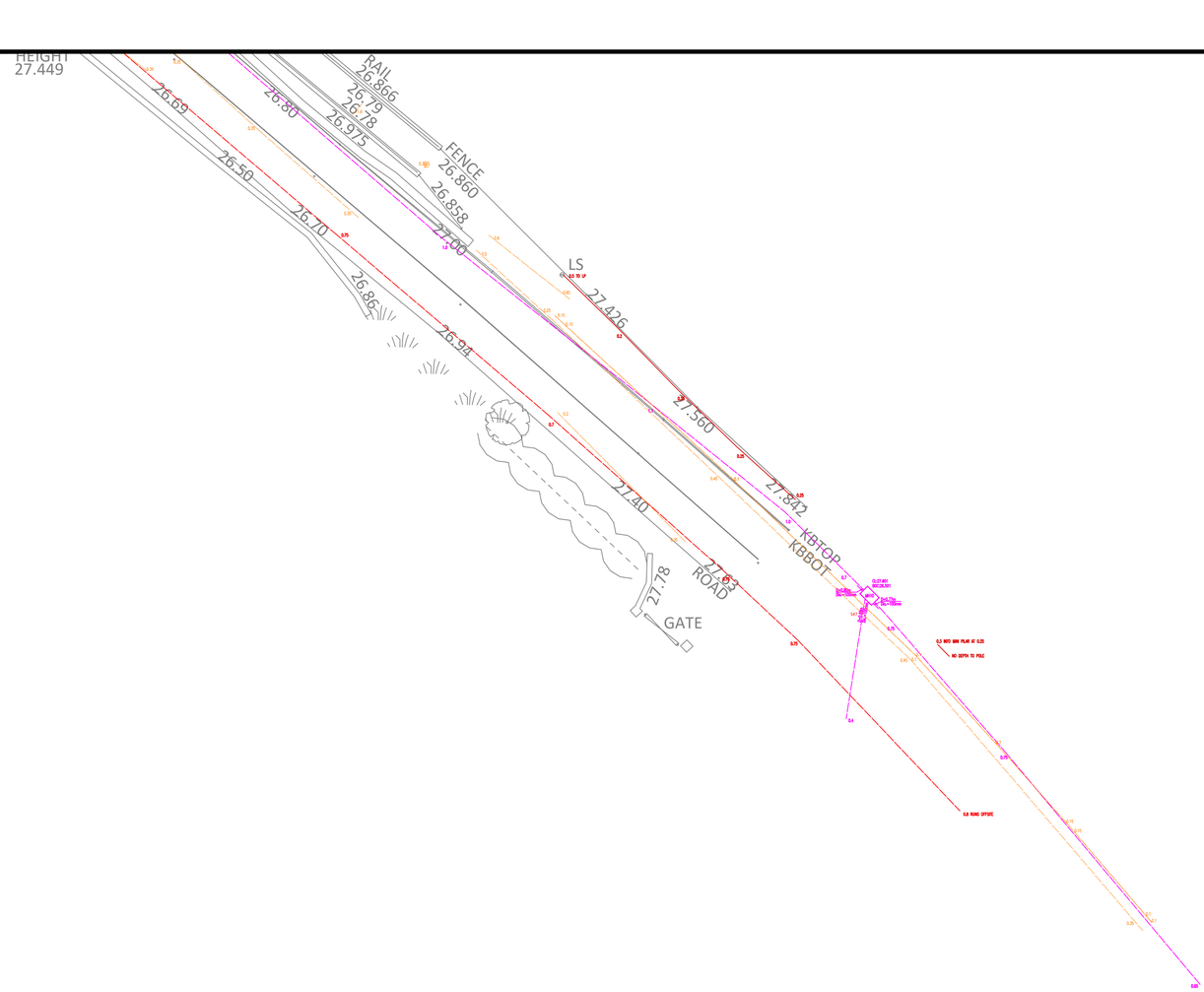
Project Title: Arklow Avoca River Park

Drawing Title: Underground Services Layout

Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 15 | Revision:



LEGEND

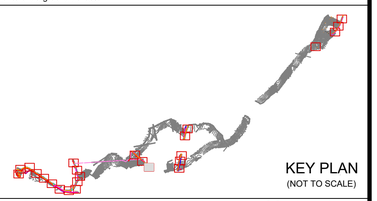
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KEY PLAN
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Table 1_Quality Level_PAS 128

Desktop Study	Quality Level - D	D
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Verification	Quality Level - A	

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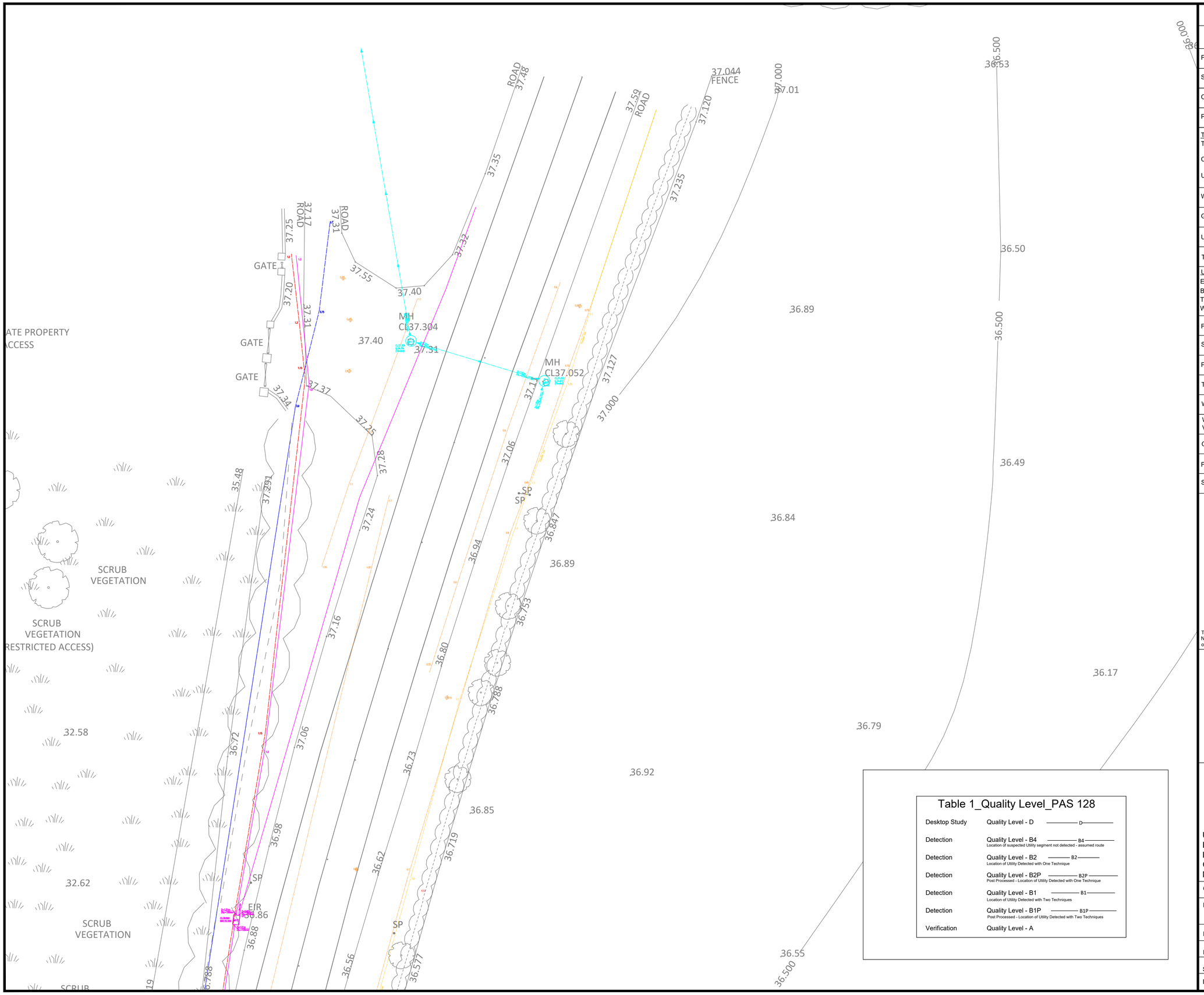
Project Title: Arklow Avoca River Park

Drawing Title: Underground Services Layout

Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 16 | Revision:



LEGEND

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NOTES:

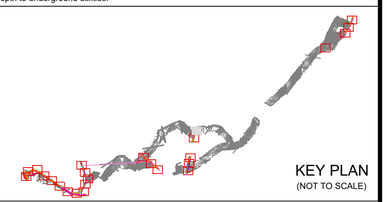
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Desktop Study	Quality Level - D	D
Detection	Quality Level - B4 Location of suspected Utility segment not detected - assumed route	B4
Detection	Quality Level - B2 Location of Utility Detected with One Technique	B2
Detection	Quality Level - B2P Post Processed - Location of Utility Detected with One Technique	B2P
Detection	Quality Level - B1 Location of Utility Detected with Two Techniques	B1
Detection	Quality Level - B1P Post Processed - Location of Utility Detected with Two Techniques	B1P
Verification	Quality Level - A	



KEY PLAN
(NOT TO SCALE)

SCANTECH GEOSCIENCE
GPR - Utility Survey
Unit 1
Enterprise, Technology &
Innovation Centre,
Clonmore Business Park,
Mullingar, Co Westmeath.
T: 01 2542680
E: info@scantech.ie
www.scantech.ie

Client: Sure Partners Limited

Project Title: Arklow Avoca River Park

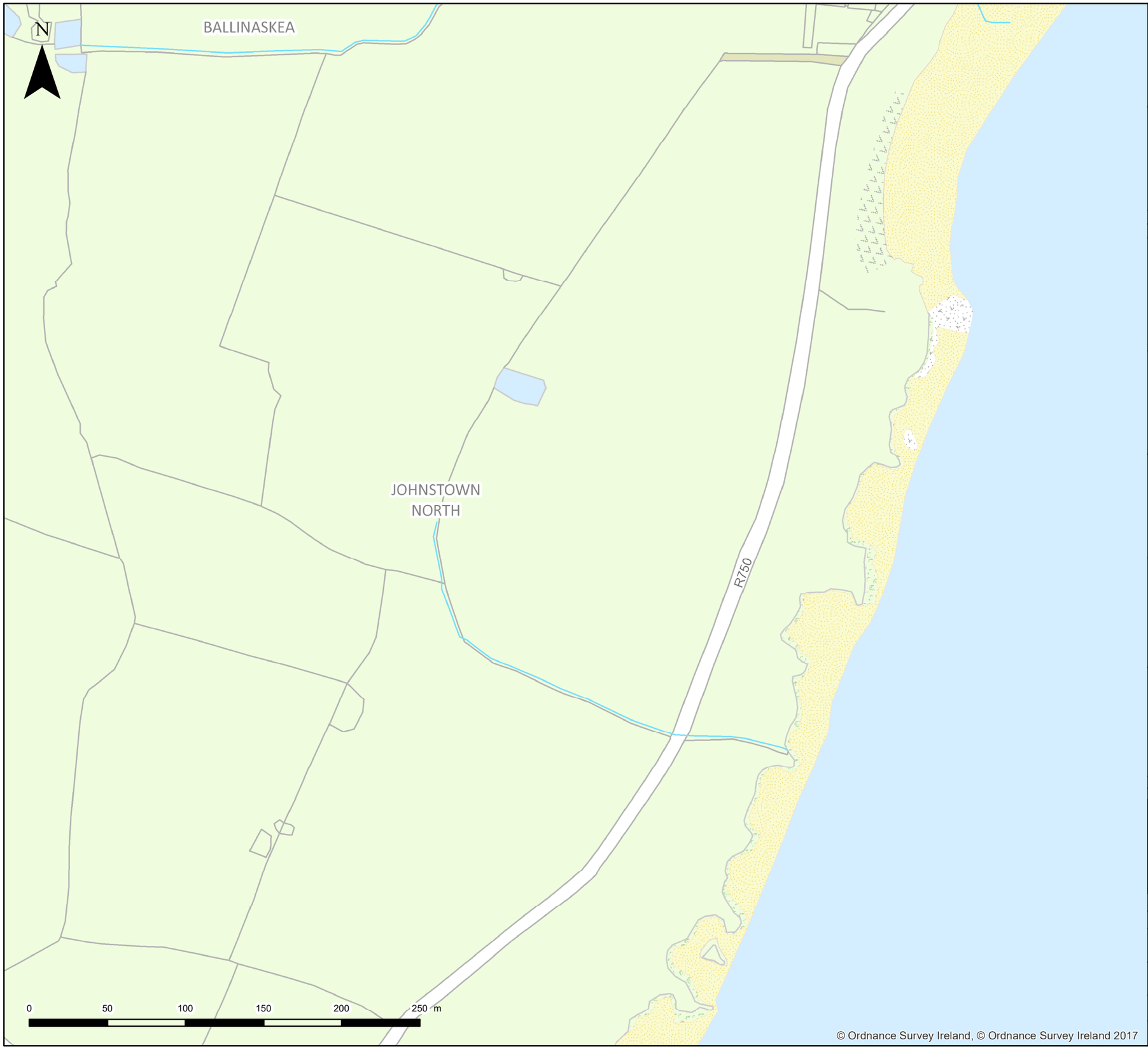
Drawing Title: Underground Services Layout

Date: 16th December 2020 | Drawn By: JC

Scale: 1/200 on A1 | Checked: R.G

Drawing No: LF100034-ENG-GP-ONX-SUR-0001-Sheet 17 | Revision:

E. Utilities Maps



Important Safety Notice: Damage to gas pipelines can result in serious injury or death. Gas network information is provided as a general guide. The exact location and depth of medium or low pressure distribution gas pipes must be verified on site by carrying out necessary investigations, including, for example, hand digging trial holes along the route of the pipe. Service pipes are not generally shown but their presence should always be anticipated.

High pressure transmission pipelines are shown in red. If a transmission pipeline is identified within 10m of any intended excavations then work must not proceed before GNI has been consulted. The true location and depth of a transmission pipeline must be verified on site by a representative of GNI. Contact can be made through 1800 427 747.

All work in the vicinity of the gas network must be completed in accordance with the current edition of the Health and Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 289 389) or can be downloaded at www.hsa.ie.

Legal Notice: Gas Networks Ireland (GNI) and its affiliates, accept no responsibility for the accuracy of any information contained in this document including data concerning location and technical designation of the gas distribution and transmission network (the"Information"). The Information should not be relied on for accurate distance or depth of cover measurements.

Any representations and warranties, express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation,direct, indirect or consequential loss, arising out of or in connection with the use or re-use of the Information.

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- Aurora Telecom Duct
- Aurora Telecom Sub Duct
- Aurora Telecom Inserted Gas Pipe

Aurora TELECOM

Aurora Telecom Queries - 01-8926166 (Office Hours)
Aurora_Network_Queries@gasnetworks.ie
Aurora Telecom Emergency Only 1800 427399 / 01 2030120

- Transmission Pipe (High Pressure)
- Transmission Pipe (Construction Issue)
- Distribution Pipe (Medium Pressure)
- Distribution Pipe (Low Pressure)
- Service Pipe (Medium Pressure)
- Service Pipe (Low Pressure)
- Strategic Pipe (Medium Pressure)
- Strategic Pipe (Low Pressure)
- Inserted
- Abandoned Pipe

C=?	Cover (depth in metres)		Pressure Monitor
CP	CP Test Point		Protection (Slabbing)
	End Cap		Protection (Sleeve)
	Hot Tap		Reducer
	Installation		Service Terminator
	Valve		Tee
	Mains Verification**		Transition

** Please contact GNI on 1800-427747 for specific information

DIAL BEFORE YOU DIG 1800 42 77 47
In Emergency call 1800 20 50 50 Gas Networks Ireland

Gas Networks Ireland

GAS NETWORK INFORMATION

Description:

Location: 727122,677364

Plot Date: 28/02/2022 11:18	Scale: 2500 @ A3
Plotted By: 1988	Ref ID: *1988_28022022111821*

ESB Networks

TITLE:

20220304-025_A0

COLOUR CODE:

- BLACK - 38KV & HIGHER VOLTAGE OVERHEAD LINES
- GREEN - MV(10KV/20KV) OVERHEAD LINES
- BLUE - LV (400V/230V) OVERHEAD LINES
- CYAN - 38KV & HIGHER VOLTAGE UNDERGROUND CABLE ROUTES
- RED - MV/LV (10KV/20KV/400V/230V) UNDERGROUND CABLE ROUTES

DATE: 04-Mar-2022

** SCALE: 1:1500

** SCALE WHEN PRINTED ON AN A0 PAGE
XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

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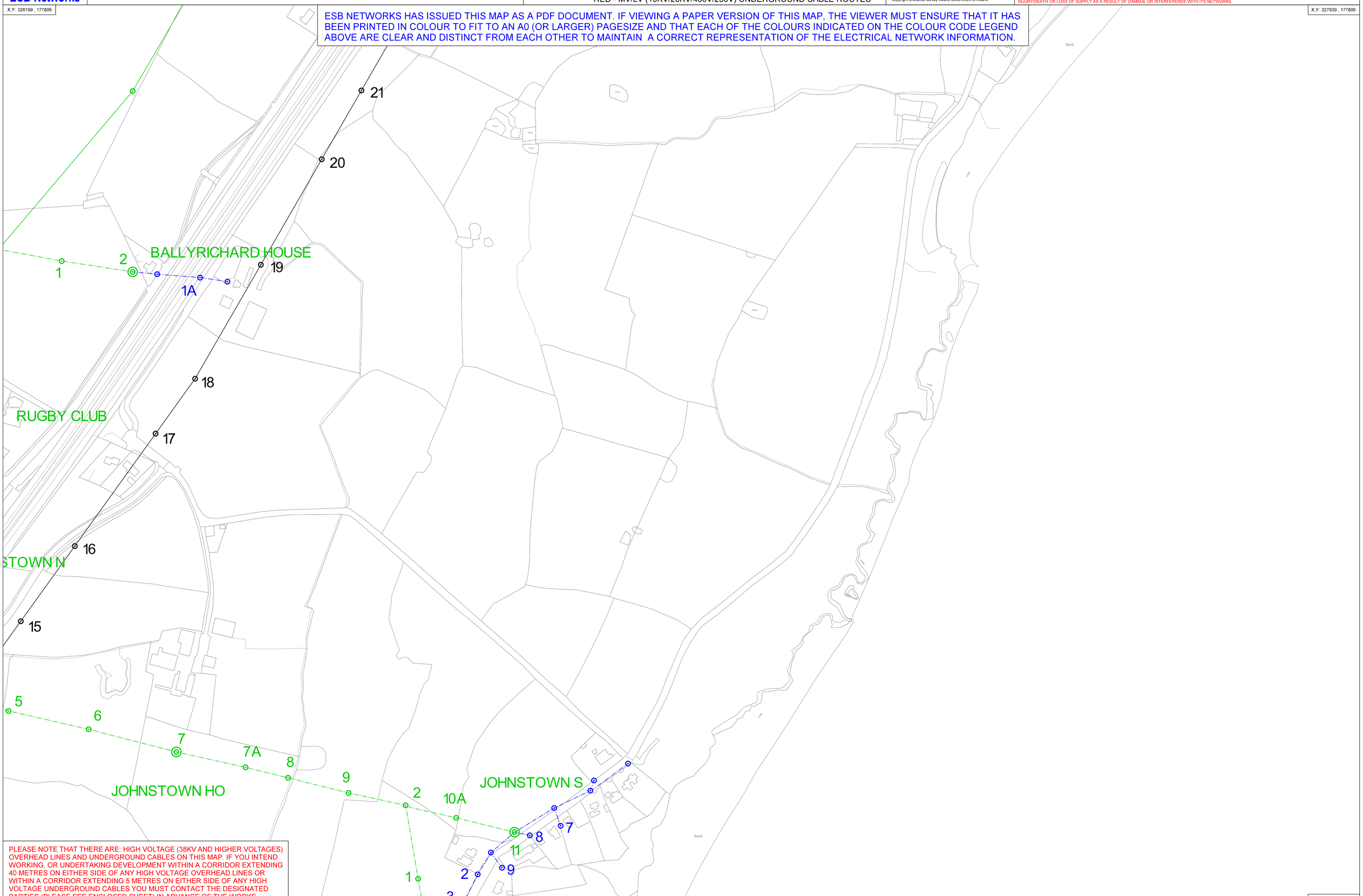
WARNING

THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (400KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE ASSUMED. ADDITIONAL MORE DETAILED INFORMATION IS AVAILABLE FOR HIGH VOLTAGE TRANSMISSION UNDERGROUND CABLES (38KV, 110KV, 220KV, 400KV) FROM THE LOCAL ESB NETWORKS TRANSMISSION REPRESENTATIVE - SEE ATTACHED LIST FOR CONTACT DETAILS OR CALL 1850 372 757. NO WORK SHOULD BE CARRIED OUT IN THE VICINITY OF 38KV OR HIGHER VOLTAGE UNDERGROUND CABLES WITHOUT PRIOR CONSULTATION WITH ESB NETWORKS. BEFORE ANY MECHANICAL EXCAVATION IS UNDERTAKEN, THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING:
(A) UP-TO-DATE MAP RECORDS; (B) CABLE LOCATER EQUIPMENT OPERATED IN BOTH POWER AND RADIO MODES;
(C) CAREFUL HAND DIGGING OF TRIAL HOLES USING 'SAFE DIGGING PRACTICE'. REFER ALSO TO 'HSA CODE OF PRACTICE FOR AVOIDING DANGER FROM UNDERGROUND SERVICES'. ESB TAKES NO RESPONSIBILITY FOR AND SHALL BEAR NO LIABILITY, HOWSOEVER ARISING, IN RELATION TO ANY DAMAGE, INJURY/DEATH OR LOSS OF SUPPLY AS A RESULT OF DAMAGE OR INTERFERENCE WITH ITS NETWORKS.

X,Y: 326199 , 177806

X,Y: 327939 , 177806

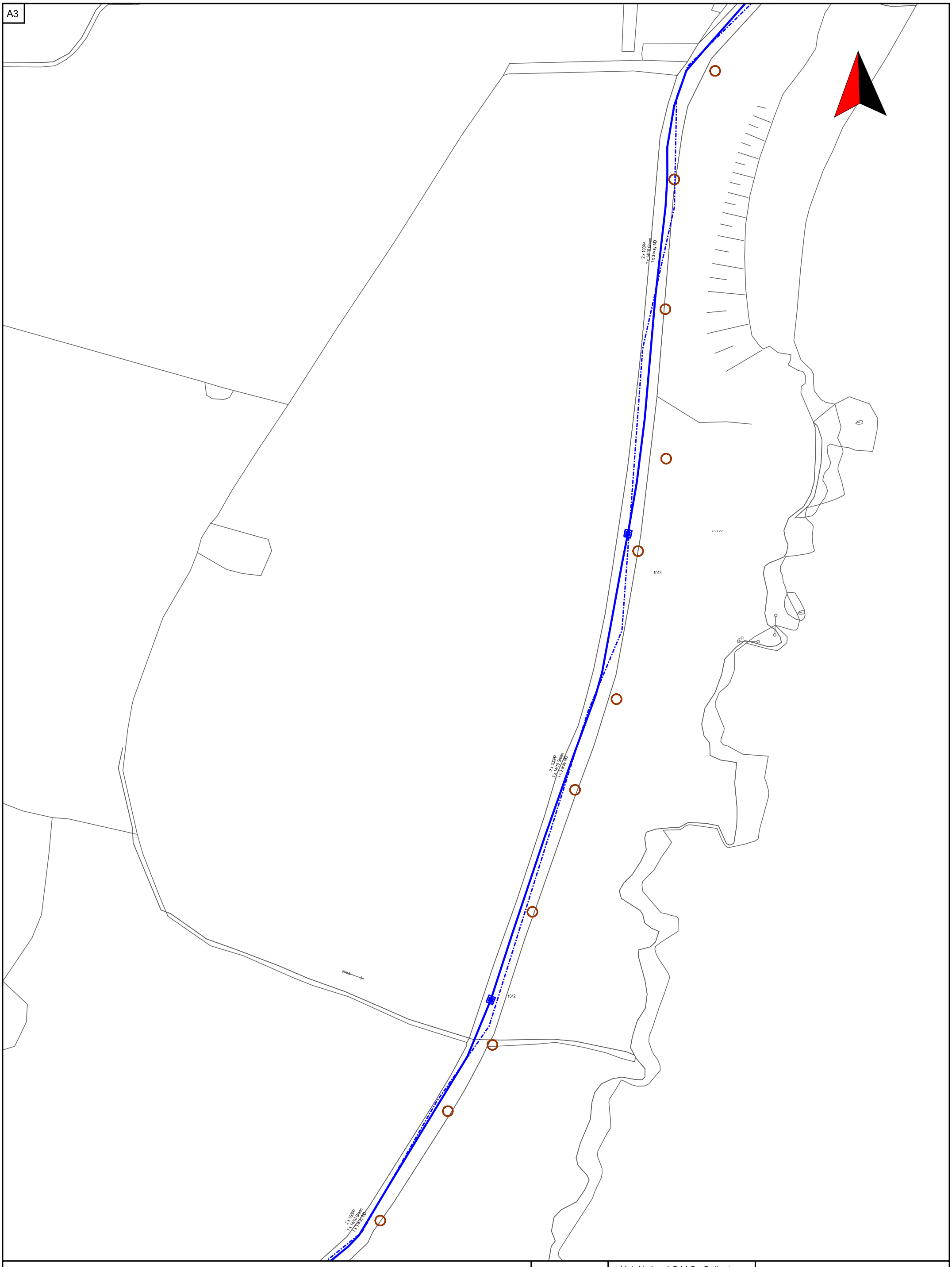
ESB NETWORKS HAS ISSUED THIS MAP AS A PDF DOCUMENT. IF VIEWING A PAPER VERSION OF THIS MAP, THE VIEWER MUST ENSURE THAT IT HAS BEEN PRINTED IN COLOUR TO FIT TO AN A0 (OR LARGER) PAGESIZE AND THAT EACH OF THE COLOURS INDICATED ON THE COLOUR CODE LEGEND ABOVE ARE CLEAR AND DISTINCT FROM EACH OTHER TO MAINTAIN A CORRECT REPRESENTATION OF THE ELECTRICAL NETWORK INFORMATION.



PLEASE NOTE THAT THERE ARE: HIGH VOLTAGE (38KV AND HIGHER VOLTAGES) OVERHEAD LINES AND UNDERGROUND CABLES ON THIS MAP. IF YOU INTEND WORKING, OR UNDERTAKING DEVELOPMENT WITHIN A CORRIDOR EXTENDING 40 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE OVERHEAD LINES OR WITHIN A CORRIDOR EXTENDING 5 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE UNDERGROUND CABLES YOU MUST CONTACT THE DESIGNATED PARTIES (PLEASE SEE ENCLOSED SHEET) IN ADVANCE OF THE WORKS

X,Y: 327939 , 176652

A3



eMaps open eir Civil Engineering Infrastructure Service

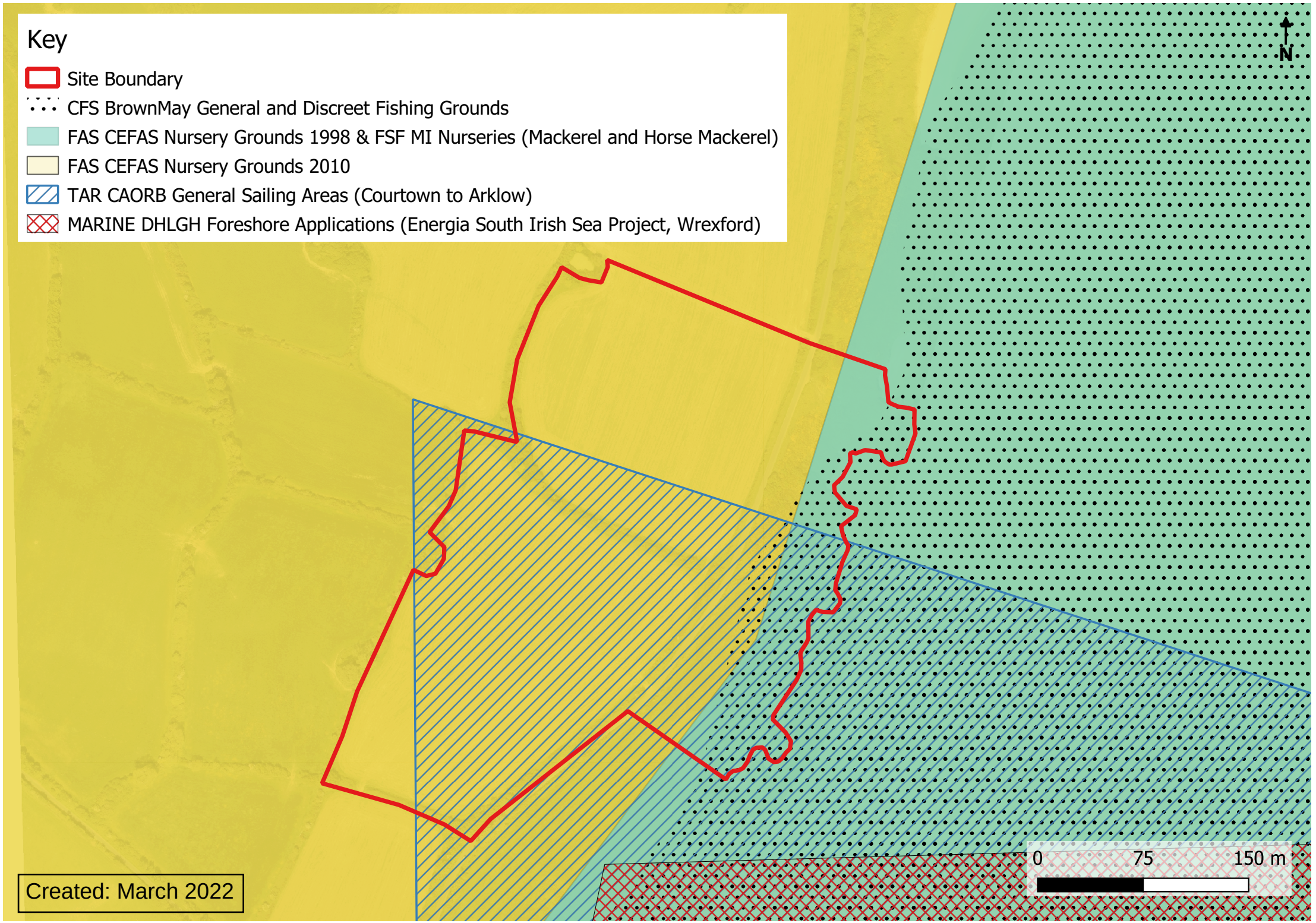
Scale: 1:1500	Irish National Grid Co-Ordinates Centre XY: 327269 m, 177351 m
Date 01/03/2022	Smallworld Powered by GE

THE INFORMATION IN THIS DRAWING IS CONFIDENTIAL AND SHOULD NOT BE DISCLOSED TO ANY THIRD PARTY WITHOUT THE EXPRESS WRITTEN CONSENT OF open eir. THE DRAWING MAY NOT BE PHOTOCOPIED OR REPRODUCED IN ANY WAY.

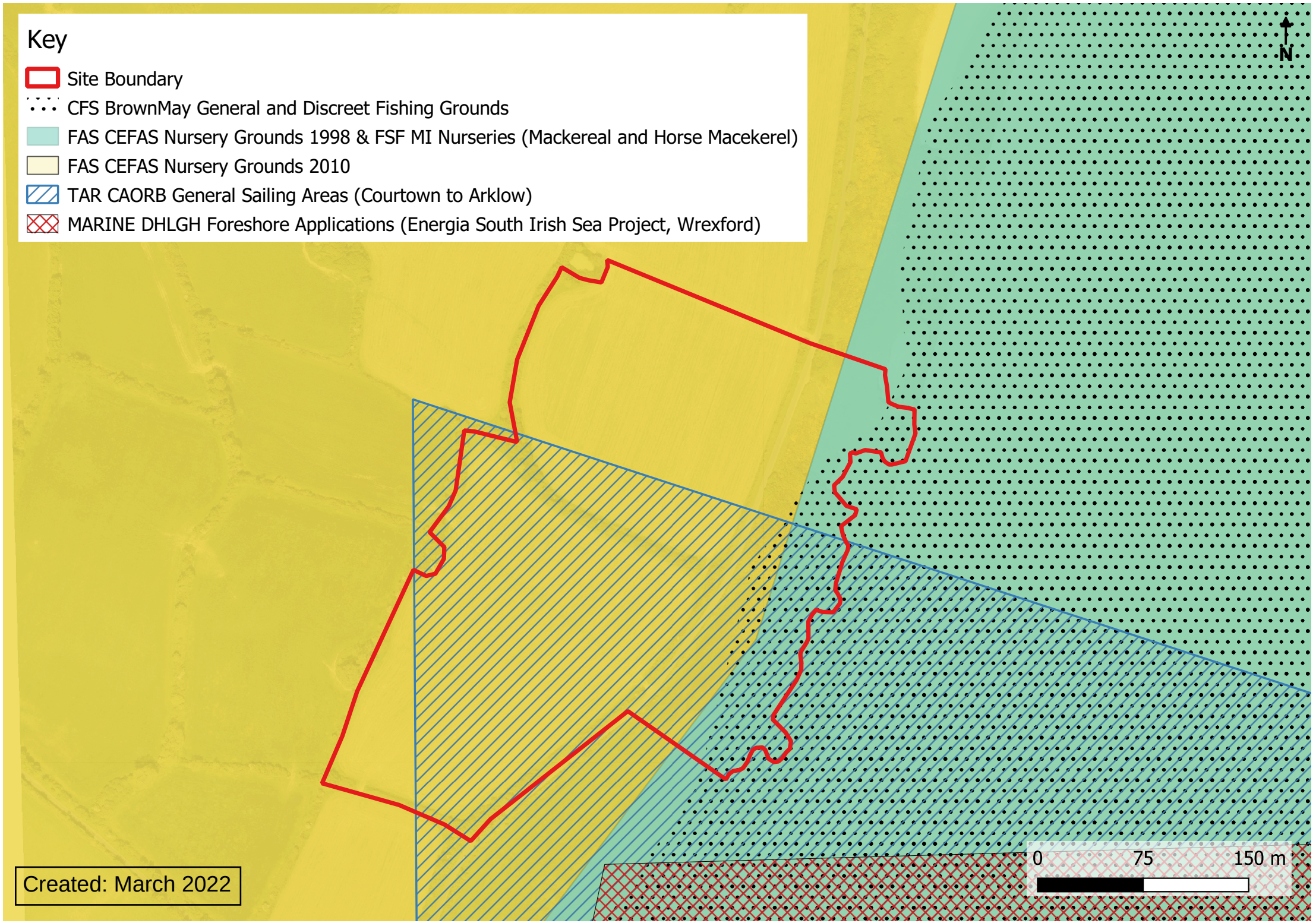
THE INFORMATION GIVEN IS COMPILED FROM PASSIVE ACCESS RECORDS AND IS BELIEVED TO BE CORRECT. THERE MAY, HOWEVER, BE DEPARTURES FROM THE COURSE[S] AND DEPTH[S] SHOWN OR INDICATED. THERE MAY ALSO BE ITEMS OF open eir INFRASTRUCTURE OF WHICH NO RECORDS IS HELD. THE INFORMATION IS GIVEN WITHOUT PREJUDICE TO THE LEGAL RIGHTS OF open eir TO COMPENSATION SHOULD open eir INFRASTRUCTURE BE DAMAGED.

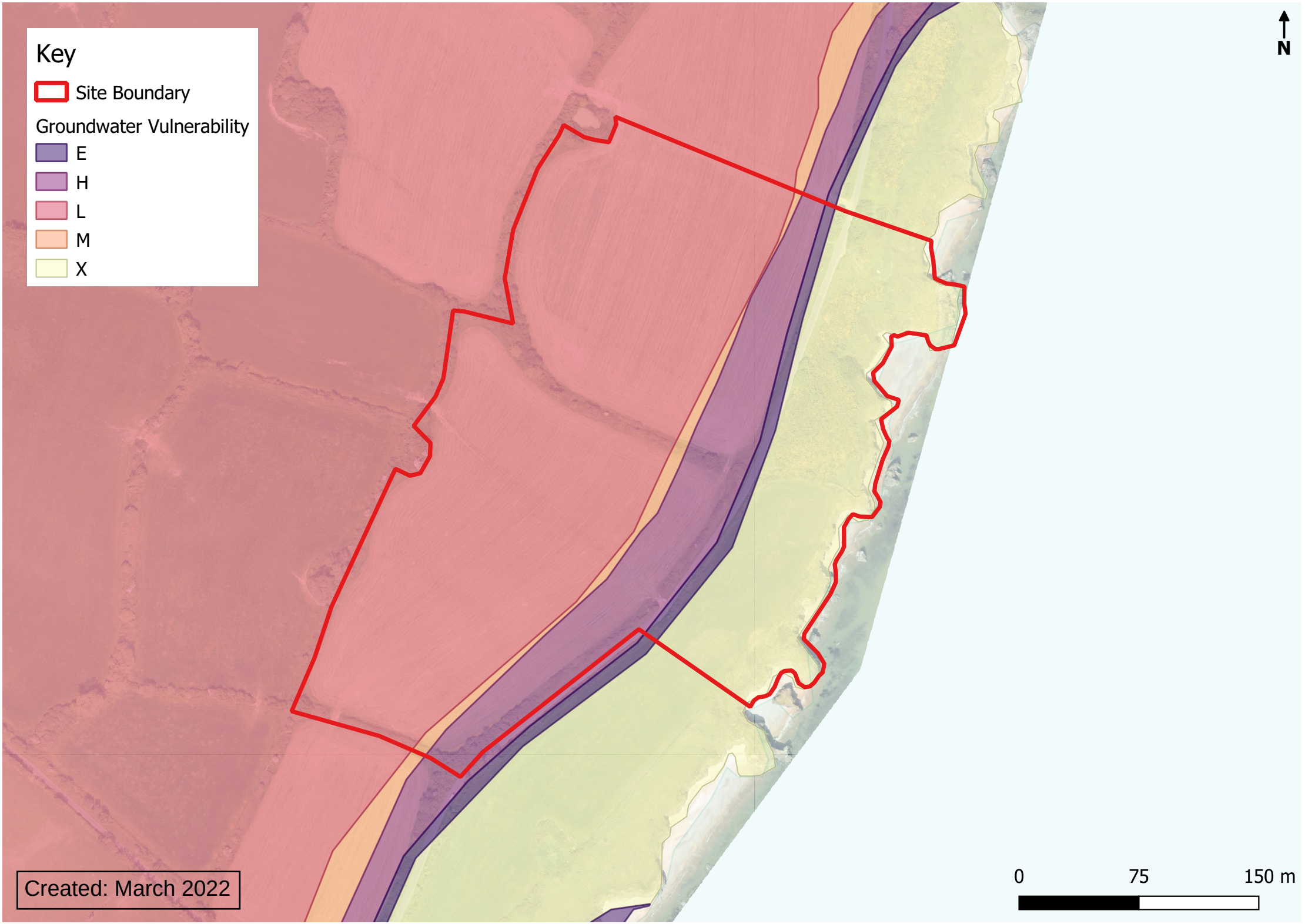
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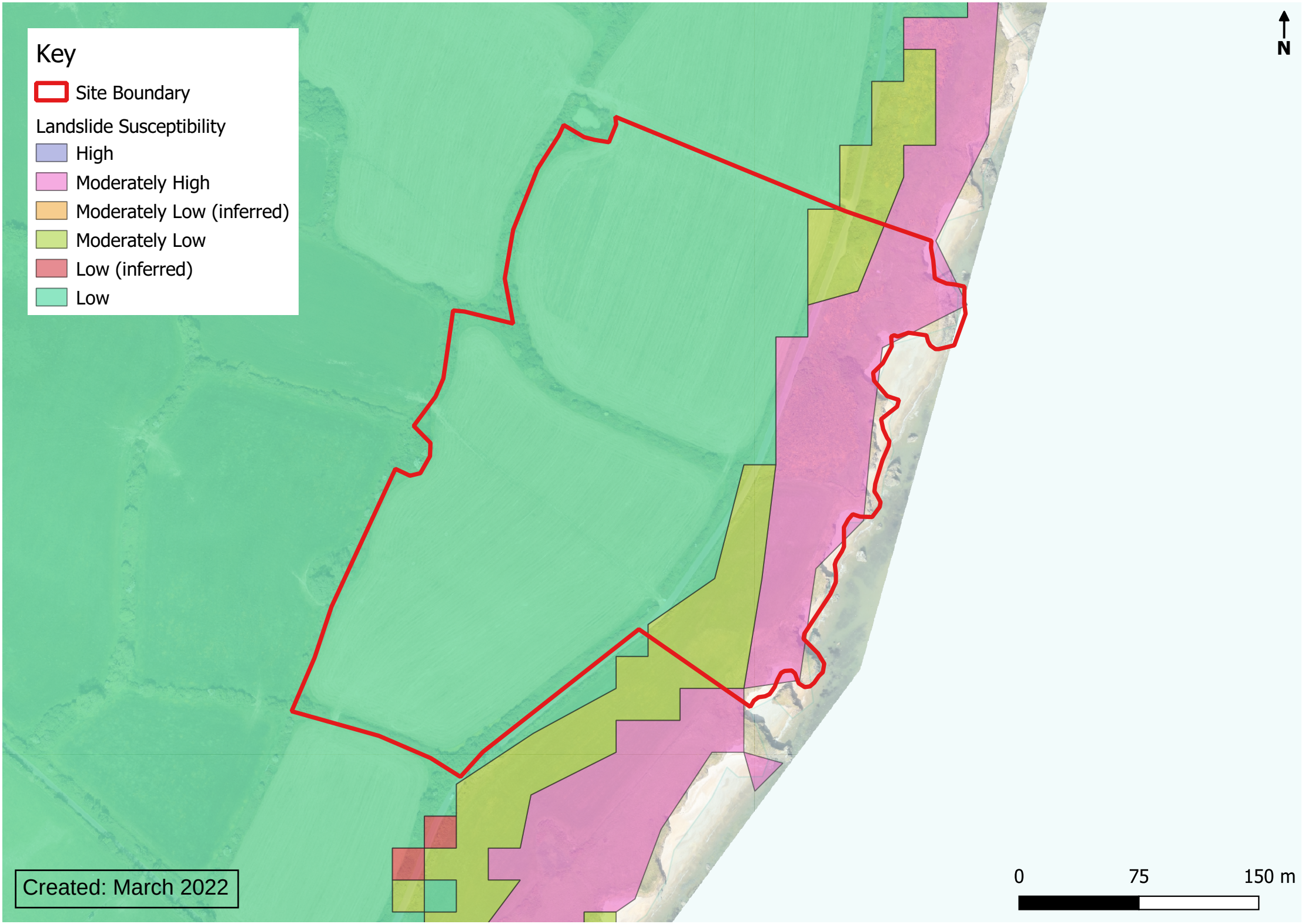
F. GIS Desk Study Constraint Plans


Key
Site Boundary
CFS BrownMay General and Discreet Fishing Grounds
FAS CEFAS Nursery Grounds 1998 & FSF MI Nurseries (Mackerel and Horse Mackerel)
FAS CEFAS Nursery Grounds 2010
TAR CAORB General Sailing Areas (Courtown to Arklow)
MARINE DHLGH Foreshore Applications (Energia South Irish Sea Project, Wrexford)
N
0
75
150 m
Created: March 2022


Key
Site Boundary
MAM JNCC Harbour Porpoise & MAM MS Grey Seal and Harbour Seal (At Sea Usage)
N
0
75
150 m
Created: March 2022


Key
Site Boundary
CFS BrownMay General and Discreet Fishing Grounds
FAS CEFAS Nursery Grounds 1998 & FSF MI Nurseries (Mackereal and Horse Macekerel)
FAS CEFAS Nursery Grounds 2010
TAR CAORB General Sailing Areas (Courtown to Arklow)
MARINE DHLGH Foreshore Applications (Energia South Irish Sea Project, Wrexford)
N
0
75
150 m
Created: March 2022


Key
Site Boundary
Groundwater Vulnerability
E
H
L
M
X
N
Created: March 2022
0
75
150 m


Key
Site Boundary
Landslide Susceptibility
High
Moderately High
Moderately Low (inferred)
Moderately Low
Low (inferred)
Low
N
Created: March 2022
0
75
150 m

G. Design Drawings

This drawing should not be scaled. Dimensions to be verified on site.
Any discrepancies should be referred to the Engineer prior to work being put in hand.

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5. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.

BATHYMETRIC SURVEY LEGEND

- EDGE OF SURVEY
- MINOR INTERVALS (1m)
- MAJOR INTERVALS (5m)

TOPOGRAPHIC SURVEY LEGEND

- MINOR INTERVALS (0.5m)
- MAJOR INTERVALS (2.5m)

SITE COMPOUND LAYOUT KEY:
1. 50 KVA GENERATOR 2M X 2M
2. TOILET BLOCK 6M X 2M
3. DRY/CHANGE ROOM 6M X 2M
4. CANTEEN 6M X 2M
5. OFFICE 6M X 2M
6. OFFICE 6M X 2M
7. 21 TON TRACKED 360 EXCAVATOR
8. DRILL PIPE STORAGE 10M X 2M
9. HDD DRILL RIG 16M X 2M
10. POWER PACK 6M X 2M
11. CONTROL CABIN 6M X 2M
12. MUD LAB 3M X 2M
13. MUD ENTRY PIT 3M X 4M
14. HIGH PRESSURE MUD PUMP 6M X 2M
15. MUD MIXING TANK 7M X 2M
16. 350 KVA GENERATOR 5M X 2M
17. RECYCLING UNIT 6M X 2M
18. WATER STORAGE TANK 6M X 2M
19. DRY DRILLING FLUID STORAGE 4M X 10M
20. WORKSHOP 6M X 2M
21. STORES 6M X 2M

sse Renewables

P05	S2	31.05.22	UPDATED FOLLOWING FURTHER SPL COMMENTS. RE-ISSUED FOR INFORMATION	LP GA
P04	S2	28.04.22	UPDATED FOLLOWING SPL COMMENTS. RE-ISSUED FOR INFORMATION	LP GA
P03	S2	14.03.22	UPDATED FOLLOWING HP1 MEETING. RE-ISSUED FOR INFORMATION	LP GA
P02	S2	21.02.22	UPDATED INCORPORATING SPL COMMENTS. RE-ISSUED FOR INFORMATION	LP GA
P01	S2	04.02.22	ISSUED FOR INFORMATION	MC GA
Status		Date	Description	By Chk

Amendments

Project
ARKLOW BANK WIND PARK PH 2

Title
EXPORT CABLES LANDFALL - HDD PLAN ALIGNMENT

Client
SURE PARTNERS LTD

Broxden House Broxden Business Park Lamberkine Drive Perth PH1 1RA
t 01738 449 801
mail@watermangroup.com www.watermangroup.com

Status
PRELIMINARY

Designed By	GA	Director	CG
Drawn By	MC	Date	04/02/22
Waterman Ref		WIE16435	
Scales @ A1		1:2000 & 1:500	

Project - Originator - Volume - Level - Type - Role - Number
16435-103-WIE-ZZ-XX-DR-C-91001
LF100034-ENG-CV-REP-0001-APPENDIX G (Plan)

Revision
P05

File Path
N:\Projects\WIE16435_Arklow_Phase2\1036_Design\Civil 3D\ALIGNMENTS & PROFILES\

A1-Wat-BS-S

1:2000 0 20m 40m 60m 80m 100m 120m 140m 160m 180m 200m
1:1 0 10 20 30 40 50 60 70 80 90 100

1:500 0 10m 20m 30m 40m 50m
1:1 0 10 20 30 40 50 60 70 80 90 100

CIRCUIT 2 ENTRY POINT E: 727160.7 N: 677376.0

CIRCUIT 1 ENTRY POINT E: 727158.5 N: 677366.2

CIRCUIT 2 MAXIMUM COVER DEPTH ONSHORE

CIRCUIT 1 MAXIMUM COVER DEPTH ONSHORE

CIRCUIT 2 MAXIMUM COVER DEPTH OFFSHORE

CIRCUIT 1 MAXIMUM COVER DEPTH OFFSHORE

CIRCUIT 2 EXIT POINT E: 727650.1 N: 677231.6

CIRCUIT 1 EXIT POINT E: 727646.6 N: 677204.1

INDICATIVE OFFSHORE CABLE ROUTE. ROUTE TO BE CONFIRMED AND DESIGNED BY OTHERS

INDICATIVE ON-SHORE CABLE ROUTE. ROUTE TO BE CONFIRMED AND DESIGNED BY OTHERS

SURFACING OF TYPE A IN ACCORDANCE WITH CLAUSE 801 (TRANSPORT INFRASTRUCTURE IRELAND, SPECIFICATION FOR ROAD WORKS, SERIES 800) PLACED ON GEOTEXTILE

TEMPORARY ROAD SURFACING OF TYPE A IN ACCORDANCE WITH CLAUSE 801 (TRANSPORT INFRASTRUCTURE IRELAND, SPECIFICATION FOR ROAD WORKS, SERIES 800) PLACED ON GEOTEXTILE

STRINGING OUT AREA IF REQUIRED (AIDED WITH STILTS AND ROLLER) NOTE INTENTION IS TO PULL DUCT IN FROM OFFSHORE

54m

52m

60m

60m

10m

VEHICLE ACCESS

CAR PARKING AREA

HARDSTANDING REQUIRED (TYPE A)

INDICATIVE JOINTING BAY. PLEASE SEE DRAWING LF100034-ENG-ONX-192_1104_6001_0025 FOR DETAILS

EXISTING SITE ENTRANCE GATE AND BELLMOUTH TO BE UPGRADED TO L.A. REQUIREMENTS

R750 ROAD

PROPOSED SITE ACCESS TRACK LIES OUT WITH RED LINE BOUNDARY. IT IS UNDERSTOOD PERMISSION HAS BEEN OBTAINED FROM LANDOWNER TO USE THIS EXISTING SITE ENTRANCE

DESIGN TO CONSIDER HEAVE OR POTENTIAL SETTLEMENT OF ROAD

R750 ROAD

-5m

-10m

-10m

50

100

150

200

250

300

350

400

450

500

550

600

650

700

750

800

813

816

INDICATIVE ONSHORE/OFFSHORE GEOLOGICAL SURVEY OF IRELAND (GSI) LINE

INDICATIVE ONSHORE/OFFSHORE GEOLOGICAL SURVEY OF IRELAND (GSI) LINE

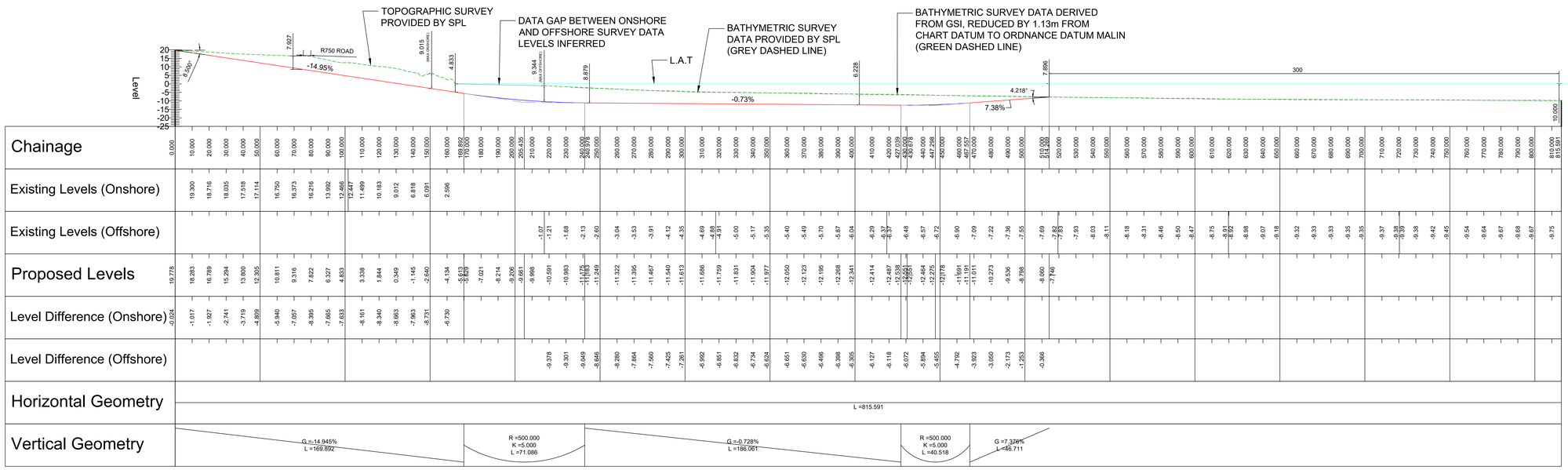
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5. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.

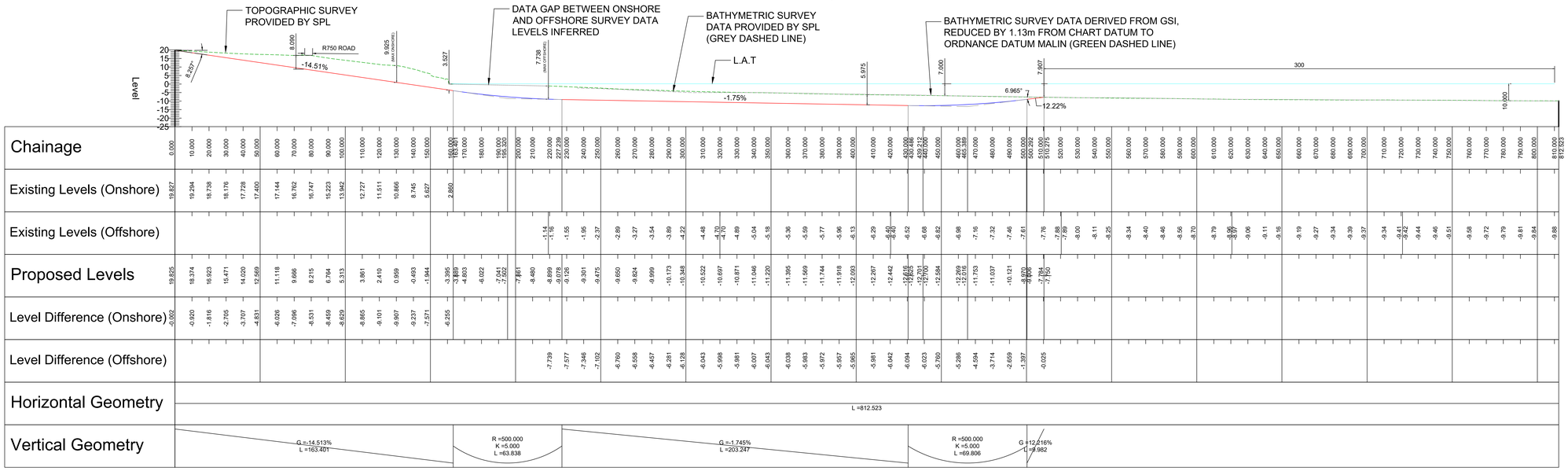
CIRCUIT 1 - LONGSECTION
SCALE: H 1:1000,V 1:1000. DATUM: -25.000



ARKLOW HARBOUR	Chart Datum (m CD)	Malin Head (m OD)
	conversion factor between CD and OD is -1.13m	
HAT	1.60	0.47
MHWS	1.40	0.27
MHWN	1.20	0.07
MSL	1.03	-0.10
MLWN	0.90	-0.23
MLWS	0.60	-0.53
LAT	0.20	-0.93

FROM ADMIRALTY TIDE TABLES UK & IRELAND, NP201B, VOLUME 1B, 2019, Page xxxix

CIRCUIT 2 - LONGSECTION
SCALE: H 1:1000,V 1:1000. DATUM: -25.000



1:1000 0 10m 20m 30m 40m 50m 60m 70m 80m 90m 100m
1:1 0 10 20 30 40 50 60 70 80 90 100

sse Renewables

P05	SSE	31.05.22	UPDATED FOLLOWING FURTHER SPL COMMENTS. RE-ISSUED FOR INFORMATION	LP GA
P04	SSE	28.04.22	UPDATED FOLLOWING SPL COMMENTS. RE-ISSUED FOR INFORMATION	LP GA
P03	SSE	14.03.22	UPDATED FOLLOWING HP1 MEETING. RE-ISSUED FOR INFORMATION	LP GA
P02	SSE	21.02.22	UPDATED INCORPORATING SSE COMMENTS. RE-ISSUED FOR INFORMATION	LP GA
P01	SSE	04.02.22	ISSUED FOR INFORMATION	MC GA
Status	Date		Description	By Chk

Amendments

Project: ARKLOW WIND PARK PH2

Title: EXPORT CABLE LANDFALL - HDD PROFILES

Client: SURE PARTNERS LTD

Waterman
Broxden House Broxden Business Park Lamberkine Drive Perth PH1 1RA
t: 01738 449 801
mail@watermangroup.com www.watermangroup.com

Status: PRELIMINARY

Designed By	GA	Director	CG	Waterman Ref: WIE16435
Drawn By	MC	Date	04/02/22	Scales @ A0: 1:1000
Project - Originator - Volume - Level - Type - Role - Number				Revision
16435-103-WIE-ZZ-XX-DR-C-81002 LF100034-ENG-CV-REP-0001-APPENDIX G (Profile)				P05

A0-Wat-BS-S

File Path: N:\Projects\WIE16435_ARKlw_Phase2\103_Design\Civil\3D\ALIGNMENTS & PROFILES\

H. Designers Risk Assessment

Designers Risk Assessment_REV03

Project Title: Arklow Phase II Cable Landfall | Project No: WIE16435-103 | Date: 27th May 2022

Prepared By: L. Phin | Checked By: G. Anton | Approved By: C. Gell

Hazard No.	**Hazard** *Potential to cause harm*	**Phase** *Construction/ Operation/ Maintenance*	**Occurrence Likelihood**	**Likely Severity**	**Risk Rating**	**Action of Designer & remaining actions on Client / Contractor**	**Safety, Health & Welfare at Work (Construction) Regulations 2013, Schedule 1 Reference No.**	**Residual Occurrence Likelihood**	**Residual Likely Severity**	**Residual Risk Rating**	**Remaining Action Responsibility**
Reference Drawings:	**16435-103-WIE-ZZ-XX-DR-C-90001 & 16435-103-WIE-ZZ-XX-DR-C-90002**										
1	Falls from height – sea cliffs launch pits	Construction Maintenance	4	5	20	**Designer** has undertaken options appraisal and determined trenchless technique as the favored option. This keeps all works away from the cliff line, with dedicated entry compound to the west side of public road. Refer to Report WIE16435-103-R-1-1-3 for details. Works in accordance with Part 4 “General Safety Provisions” **Contractor** to ensure clearly demarcated working areas and suitable fencing in place. **Client** to position access chambers for jointing bays at suitable location, which will most likely be within extents of temporary HDD compound.	1 (a)	1	5	5	Contractor Client
2	Drowning	Construction Maintenance	4	5	20	**HDD** minimises operations in the marine environment for cable landfall, with the exception of punch out and duct pulling which will require support from offshore marine vessels / barges. Works in accordance with Part 10 “Construction Works on or Adjacent to Water” **Contractor** to undertake all offshore works in full accordance with all recognised safety standards and using suitably qualified staff. **Contractor** to undertake offshore support works during appropriate weather and sea conditions. **Contractor** to ensure any existing watercourses within the site compound area are clearly indicated to all site staff / visitors. Where applicable adequate edge protection	5	2	5	10	Contractor
3	Full or partial collapse of HDD borehole.	Construction	3	5	15	**Designer** has undertaken geotechnical desk study and reviewed available ground investigation data to identify likely ground conditions and deemed HDD feasible subject to final design Works in accordance with Part 2 “Design & Management” **Client** to undertake supplementary campaign of onshore and nearshore ground investigation and provide factual data to Contractor. **Contractor** to undertake final design of HDD bores and select appropriate tooling for ground conditions proven.	1 (b)	1	5	5	Client Contractor

Hazard No.	Hazard *Potential to cause harm*	Phase *Construction/ Operation/ Maintenance*	Occurrence Likelihood	Likely Severity	Risk Rating	Action of Designer & remaining actions on Client / Contractor	Safety, Health & Welfare at Work (Construction) Regulations 2013, Schedule 1 Reference No.	Residual Occurrence Likelihood	Residual Likely Severity	Residual Risk Rating	Remaining Action Responsibility
Reference Drawings:	**16435-103-WIE-ZZ-XX-DR-C-90001 & 16435-103-WIE-ZZ-XX-DR-C-90002**										
4	Hydro-Fracture ('Frac-Out') of drill fluids to the environment.	Construction	3	5	15	**Designer** has undertaken preliminary hydro-fracture calculations for conceptual HDD profile and determined that annular pressures are likely to be within acceptable limits on basis of assumed ground conditions. Works in accordance with Part 2 "Design & Management" **Client** to undertake supplementary campaign of onshore and nearshore ground investigation and provide factual data to Contractor. **Contractor** to undertake final design of HDD bores including final hydro-fracture calculations based on ground conditions proven. **Contractor** to select drill fluids which are self- flocculating and approved for use by Environmental Regulatory Authorities.		1	5	5	Client Contractor
5	Live roadway / conflict with site traffic / sea traffic.	Construction Maintenance	4	4	16	**Designer** has indicated Site Compound utilising existing field access point. Works in accordance with Part 4 "General Safety Provisions" **Client** to consider temporary or permanent upgrade to site access point including signage. **Client** to consider access requirements for future inspection / maintenance of jointing bays and allow for easement and demarcation of access manholes within final design of works. **Contractor** to implement all required Traffic Management measures during the works as per Local Roads Authority Requirements and Approvals. **Contractor** to consider impact on sea traffic, most notably when mobilising / undertaking offshore portion of the works. **Contractor** to consider access requirements for emergency services and ensure any public right of ways are not blocked without prior permissions during the works.		1	4	4	Contractor Client
6	Earthworks excavation working adjacent to existing watercourse/drain.	Construction	4	4	16	**Designer:** Location of entry compound is set by HDD alignment. Works in accordance with Part 5 "Excavations, Shafts, Earthworks, Underground Works and Tunnels" **Contractor** to monitor weather conditions and sequence works accordingly. **Contractor** to work in accordance with Environmental Regulator requirements.	1 (b)	2	4	8	Contractor
7	Moving drill rig plant / support vehicles through	Construction	3	5	15	**Designer** Works in accordance with Part 4 "General Safety Provisions" **Contractor** to employ safe systems of works including use of		1	5	5	Contractor

Hazard No.	Hazard *Potential to cause harm*	Phase *Construction/ Operation/ Maintenance*	Occurrence Likelihood	Likely Severity	Risk Rating	Action of Designer & remaining actions on Client / Contractor	Safety, Health & Welfare at Work (Construction) Regulations 2013, Schedule 1 Reference No.	Residual Occurrence Likelihood	Residual Likely Severity	Residual Risk Rating	Remaining Action Responsibility
Reference Drawings:	**16435-103-WIE-ZZ-XX-DR-C-90001 & 16435-103-WIE-ZZ-XX-DR-C-90002**										
	site - collision with workforce.					segregated walkways and reverse parking.					
8	Earthworks excavation and replacement: Services recorded and unrecorded.	Construction	3	5	15	**Designer** has undertaken statutory authority searches and presented outputs with Report WIE16435-103-R-1-1-3. Works in accordance with Part 5 "Excavations, Shafts, Earthworks, Underground Works and Tunnels" **Client** has undertaken onsite service survey and shall provide contractor with up-to-date service plans (less than 3 months old) at time of construction. **Contractor** to undertake full services survey prior to works to verify information shown on plans. **Contractor** to scan all excavation locations prior to breaking ground.		1	5	5	Contractor Client
9	Waste/ rubbish potentially feeding rats leading to Leptospirosis	Construction	2	5	10	**Designer** Works in accordance with Part 5 "Excavations, Shafts, Earthworks, Underground Works and Tunnels" **Contractor** to ensure safe systems of works such as: appropriate PPE, minimizing exposure, hand washing and covering cuts etc.		1	5	5	Contractor
10	Temporary Works failure	Construction	2	5	10	**Contractor** to ensure a suitably qualified temporary works designer is engaged to undertake any temporary works design during the construction phase.		1	5	5	Contractor
11	Lifting Operations	Construction Maintenance	2	5	10	**Contractor** to ensure a suitable lifting plan has been developed and approved prior to any lifting operations on site. **Client** to ensure that a suitable lifting plan has been developed and approved prior to any lifting works required as part of the maintenance regime.		1	5	5	Contractor Client

Quantification

Likelihood	*1 = Highly*	*2 = Unlikely*	*3 = Likely*	*4 = Highly Likely*	*5 = Certainty*
Severity	*1 = Property Damage*	*2 = Minor Injury (medical assistance required)*	*3 = Short Term Absence (< 3 days)*	*4 = Long Term Injury (> 3 days)*	*5 = Fatality*

Risk Rating *(Severity x Likelihood)*	1–4 = Acceptable	5–9 = Low	10–14 = Medium	15–19 = High	20–25 = Unacceptable

I. Preliminary Calculations

waterman	***Spreadsheet Calcpad*** *(Macros must be enabled. Ctrl+Alt+F9 recalculates.)*	**Project** WIE16435-103
	Arklow Bank Wind Park, Phase 2 Hydrofracture Calculations	**Prepared** LP / **Date** 15-Mar-22 **Checked** CG / **Date** 16-Mar-22

Hydrofracture - Longitudinal Profile Check

The model is based on axial symetry around the borehole and the following four conditions apply: Equilibrium, Hooke's Law of elastic deformation, Mohr-Coulomb's failure criterion and absence of isotropic deformation in the plastic zone. This gives rise to a fairly complex set of expressions as shown below.

$$Pmax = Pemax + U$$ *Eqn(1)*

$$Pemax = (Pf + c.\cot\emptyset).\left\{\left(\frac{Ro}{Rpmax}\right)^2 + Q\right\}^{\frac{-\sin\emptyset}{1+\sin\emptyset}} - c.\cot\emptyset$$ *Eqn(2)*

$$Q = \frac{(\sigma o.\sin\emptyset + c.\cos\emptyset)}{G}$$ *Eqn(3)*

$$Pf = \sigma o\,(1 + \sin\emptyset) + c.\cos\emptyset$$ *Eqn(4)*

$$G = \frac{E}{2}(1 + \vartheta)$$ *Eqn(5)*

Where:

Pmax	maximum allowable mud pressure
U	initial in-situ pore pressure
Pemax	maximum allowable effective mud pressure
σ_o	initial effective stress
ϕ	internal angle of friction
c	cohesion
Ro	internal radius of borehole
Rpmax	maximum allowable radius of plastic zone
G	shear modulus
E	elasticity modulus
N	Poisson's ratio

Only enter data into green highlight cells. Other cells may contain calculations and editing them will over-write the formula.

General variables

Gravity (m/s/s):	**g**	9.81		
Density of water (kg/m3):	**ɣw**	1000		
Density of drilling mud (kg/m3):	**ɣm**	1300		
Soil density (kg/m^3):	**ɣs**	2200		*Soil characteristic values estimated based on IDL 2020 GI.*
Cohesion (kN/m^2):	**Coh**	75		
Friction angle (deg):	**Φ**	15	Radians Φr = 0.2618	
Poission's ratio :	**v**	0.35		
Elasticity modulus (kPa):	**Emod**	50000		
Shear modulus (kPa):	Gmod =	18519		

Product pipe OD (m):				
Drill bit diameter (inch):		44.00 inch	**Do** 1.118 m	
Drill pipe OD (inch):		11.00 inch	**Di** 0.279 m	
Initial radius of borehole (m):	**Ro**	0.559	*Equal half drill bit diameter*	*Rpmax usually assumed between 1/2 and 2/3 depth, assumed 1/2 as worst case scenario*
Allowable plastic radius factor	**Rpmax**	0.50		

Consider lateral soil pressure: **No** *Use drop-down to select Y/N*

Passive coefficient **ko** = IF(Y_N = "Yes", 1 - SIN(Φr), 0)
= IF(= "Yes", 1 - SIN(0.2618), 0)
= **0**

Conservative to not consider lateral soil pressures

Annular pressure calculations

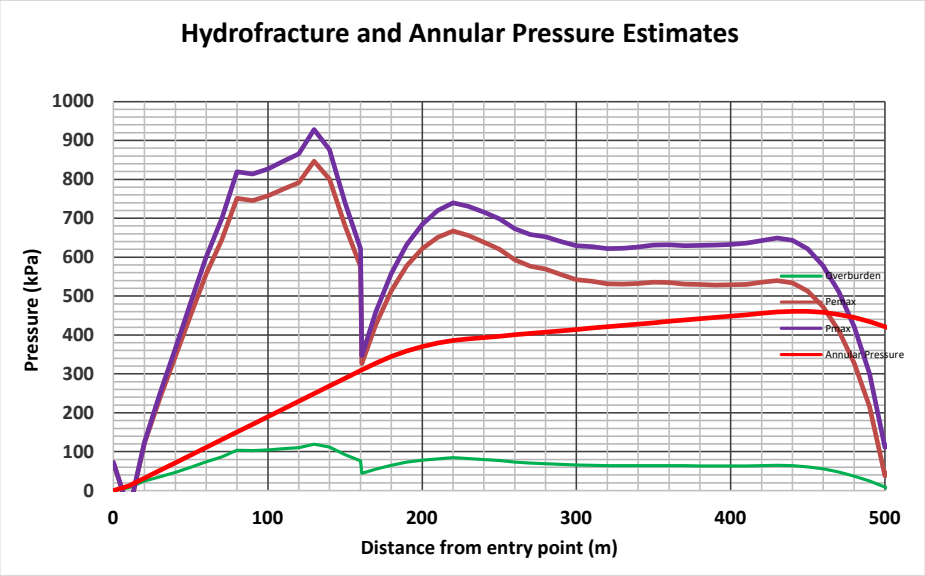
Darcy Weisbach equation for flow in an annulus is: H = f(L/Dh)(V^2/2g), where Dh is the hydraulic diameter, V the flow velocity, L flow pipe length and f is a friction factor. In the case of co-centered circular pipes Dh = Do - Di. The exact drilling operational parameters, such as flow rate are unknown, but some estimated values have been applied - but require verification. The total head is the flow head plus the static head.

Assumed flow velocity (m/s):	V	0.50
Assumed friction coefficient:	f	8.00

The calculations at each chainage location are performed in the fract-out table

Summary Figures

Elevation of entrance hole mOD =	**19.83 mOD**		
Elevation of exit hole mOD =	**-7.76 mOD**	*Diff =*	*27.59* m
Maximum cover to HDD borehole =	**9.3 m**		
Maximum overburden pressure =	**119.9 kN/m^2**		*1.2 Bar*
Maximum safe effective stress **Pemax** =	**846 kN/m^2**		*8.5 Bar*
Maximum safe stress **Pmax** =	**928 kN/m^3**		*9.3 Bar*



Expressions used in hydrofracture calculations

In the tabulation below the following functions are applied

Saturated Layer **Sat'd**: IF (WTL<=HDD, Elevn-HDD, Max(Elevn-WTL, 0))

Bouyant Layer **Bou't**: IF (WTL<=HDD, 0, Min(WTL-HDD, Elevn-HDD))

σv = (γs*Satd+(γs-γw)*Bout)*g/1000

σo = SQRT((γs*Satd+(γs-γw)*Bout)^2 + (ko * (γs*Satd + (γs-γw)*Bout))^2))

Q = (σo*SIN(Φr) + Coh*COS(Φr)) / Gmod

Pf = (σo * (1+SIN(Φr))) + (Coh * COS(Φr))

Pemax = (Pf + Coh*COT(Φr)) * (((Ro/Rpmax)^2 + Q)^(-SIN(Φr)/(1+SIN(Φr)))) - Coh*COT(Φr)

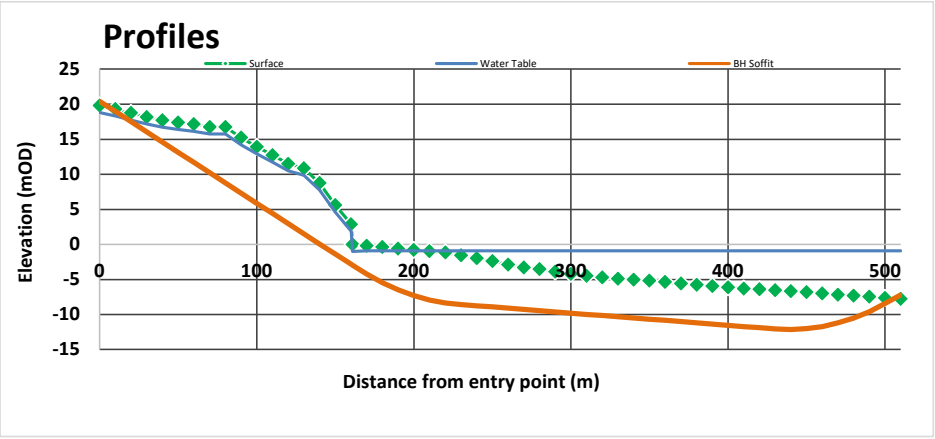
Pelim = (Pf + Coh*COT(Φr)) * (Q^(-SIN(Φr)/(1+SIN(Φr)))) - Coh*COT(Φr)

			LAT							
WT controls:			**-1**	**-0.93**						
Dist (m)	**Elev'n (mOD)**	**Loc'n**	**WTL (mOD)**	**C-Line (mOD)**	**Soffit (mOD)**	**Cover (m)**	**Sat'd (m)**	**Bou't (m)**	**U kN/m2**	**Hs kN/m3**
0.00	19.83		18.83	19.83	20.38	0.00	0.00	0.00	***0***	***0***
10.00	19.29		18.29	18.37	18.93	0.36	0.36	0.00	***0***	***11***
20.00	18.74		17.74	16.92	17.48	1.26	1.00	0.26	***3***	***30***
30.00	18.18		17.18	15.47	16.03	2.15	1.00	1.15	***11***	***48***
40.00	17.73		16.73	14.02	14.58	3.15	1.00	2.15	***21***	***67***
50.00	17.40		16.40	12.57	13.13	4.27	1.00	3.27	***32***	***85***
60.00	17.14		16.14	11.12	11.68	5.47	1.00	4.47	***44***	***104***
70.00	16.76		15.76	9.67	10.22	6.54	1.00	5.54	***54***	***122***
80.00	16.75		15.75	8.22	8.77	7.97	1.00	6.97	***68***	***141***
90.00	15.22		14.22	6.76	7.32	7.90	1.00	6.90	***68***	***159***
100.00	13.94		12.94	5.31	5.87	8.07	1.00	7.07	***69***	***178***
110.00	12.73		11.73	3.86	4.42	8.31	1.00	7.31	***72***	***196***
120.00	11.51		10.51	2.41	2.97	8.54	1.00	7.54	***74***	***215***
130.00	10.87		9.87	0.96	1.52	9.35	1.00	8.35	***82***	***233***
140.00	8.75		7.75	-0.49	0.07	8.68	1.00	7.68	***75***	***252***
150.00	5.63		4.63	-1.94	-1.39	7.01	1.00	6.01	***59***	***271***
160.00	2.86		1.86	-3.40	-2.84	5.70	1.00	4.70	***46***	***289***
160.91	0.00		-1.00	-3.53	-2.97	2.97	1.00	1.97	***19***	***291***
170.00	-0.19	sea	-0.93	-4.80	-4.24	4.05	0.74	3.31	***33***	***307***
180.00	-0.39	sea	-0.93	-6.02	-5.46	5.08	0.54	4.53	***44***	***323***
190.00	-0.58	sea	-0.93	-7.04	-6.48	5.90	0.35	5.55	***54***	***336***
200.00	-0.77	sea	-0.93	-7.86	-7.30	6.53	0.16	6.37	***63***	***346***
210.00	-0.97	sea	-0.93	-8.48	-7.92	6.95	0.00	6.95	***69***	***354***
220.00	-1.16	sea	-0.93	-8.89	-8.33	7.17	0.00	7.17	***73***	***359***
230.00	-1.55	sea	-0.93	-9.13	-8.57	7.02	0.00	7.02	***75***	***362***
240.00	-1.95	sea	-0.93	-9.30	-8.74	6.79	0.00	6.79	***77***	***364***
250.00	-2.37	sea	-0.93	-9.48	-8.92	6.55	0.00	6.55	***78***	***367***
260.00	-2.89	sea	-0.93	-9.65	-9.09	6.20	0.00	6.20	***80***	***369***
270.00	-3.27	sea	-0.93	-9.82	-9.27	6.00	0.00	6.00	***82***	***371***
280.00	-3.54	sea	-0.93	-10.00	-9.44	5.90	0.00	5.90	***83***	***373***
290.00	-3.89	sea	-0.93	-10.17	-9.61	5.72	0.00	5.72	***85***	***375***
300.00	-4.22	sea	-0.93	-10.35	-9.79	5.57	0.00	5.57	***87***	***378***
310.00	-4.48	sea	-0.93	-10.55	-9.99	5.51	0.00	5.51	***89***	***380***
320.00	-4.70	sea	-0.93	-10.70	-10.14	5.44	0.00	5.44	***90***	***382***
330.00	-4.89	sea	-0.93	-10.87	-10.31	5.42	0.00	5.42	***92***	***384***
340.00	-5.04	sea	-0.93	-11.05	-10.49	5.45	0.00	5.45	***94***	***387***
350.00	-5.18	sea	-0.93	-11.22	-10.66	5.48	0.00	5.48	***95***	***389***
360.00	-5.36	sea	-0.93	-11.40	-10.84	5.48	0.00	5.48	***97***	***391***
370.00	-5.59	sea	-0.93	-11.57	-11.01	5.42	0.00	5.42	***99***	***393***
380.00	-5.77	sea	-0.93	-11.74	-11.19	5.42	0.00	5.42	***101***	***395***
390.00	-5.96	sea	-0.93	-11.92	-11.36	5.40	0.00	5.40	***102***	***398***
400.00	-6.13	sea	-0.93	-12.09	-11.53	5.40	0.00	5.40	***104***	***400***
410.00	-6.29	sea	-0.93	-12.27	-11.71	5.42	0.00	5.42	***106***	***402***
420.00	-6.40	sea	-0.93	-12.44	-11.88	5.48	0.00	5.48	***107***	***404***
430.00	-6.52	sea	-0.93	-12.62	-12.06	5.54	0.00	5.54	***109***	***407***
440.00	-6.68	sea	-0.93	-12.70	-12.14	5.46	0.00	5.46	***110***	***408***
450.00	-6.82	sea	-0.93	-12.58	-12.03	5.21	0.00	5.21	***109***	***406***
460.00	-6.98	sea	-0.93	-12.27	-11.71	4.73	0.00	4.73	***106***	***402***
470.00	-7.16	sea	-0.93	-11.75	-11.19	4.03	0.00	4.03	***101***	***396***
480.00	-7.32	sea	-0.93	-11.04	-10.48	3.16	0.00	3.16	***94***	***386***
490.00	-7.46	sea	-0.93	-10.12	-9.56	2.10	0.00	2.10	***85***	***375***
500.00	-7.61	sea	-0.93	-8.97	-8.41	0.80	0.00	0.80	***73***	***360***
510.00	-7.76	sea	-0.93	-7.75	-7.19	0.00	0.00	-0.57	***61***	***345***

This table defines the geometry of the surface and HDD bore levels. The water table level can also be defined. A sea level can be specified and elsewhere the water table is set at ground surface (worst-case scenario).
This allows the borehole cover and saturated/ bouyant soil depths to be calculated.

U *is pressure at soffit level due to the water table elevation.*

Hs *is the static head in the borehole due to the drilling mud.*



HDD borehole profile graph based on the above table

Dist (m)	σv (kN/m²)	σh (kN/m²)	σo (kN/m²)	Pf (kN/m²)	Q	Rpmax (m)	Pemax (kN/m²)	Pmax (kN/m²)	Hf (kN/m²)	H (kN/m²)
0.0	0.0	0.0	0.0	72.4	0.00391	0.6	72	72	*0*	*0*
10.0	7.8	0.0	7.8	82.3	0.00402	0.2	-52	-52	*1*	*13*
20.0	24.6	0.0	24.6	103.4	0.00426	0.6	122	124	*2*	*32*
30.0	35.1	0.0	35.1	116.6	0.00440	1.1	237	248	*4*	*52*
40.0	46.9	0.0	46.9	131.5	0.00457	1.6	345	366	*5*	*72*
50.0	60.1	0.0	60.1	148.1	0.00475	2.1	453	485	*6*	*92*
60.0	74.2	0.0	74.2	165.8	0.00495	2.7	557	601	*7*	*111*
70.0	86.8	0.0	86.8	181.7	0.00512	3.3	643	698	*9*	*131*
80.0	103.7	0.0	103.7	202.9	0.00536	4.0	751	819	*10*	*151*
90.0	102.8	0.0	102.8	201.9	0.00535	4.0	746	813	*11*	*170*
100.0	104.8	0.0	104.8	204.4	0.00538	4.0	758	827	*12*	*190*
110.0	107.6	0.0	107.6	207.9	0.00542	4.2	775	846	*13*	*210*
120.0	110.4	0.0	110.4	211.4	0.00545	4.3	791	865	*15*	*230*
130.0	119.9	0.0	119.9	223.3	0.00559	4.7	846	928	*16*	*249*
140.0	112.0	0.0	112.0	213.4	0.00548	4.3	801	876	*17*	*269*
150.0	92.4	0.0	92.4	188.7	0.00520	3.5	680	739	*18*	*289*
160.0	76.9	0.0	76.9	169.2	0.00499	2.8	576	622	*19*	*308*
160.9	44.8	0.0	44.8	128.8	0.00454	1.5	327	346	*20*	*310*
170.0	54.9	0.0	54.9	141.6	0.00468	2.0	427	460	*21*	*328*
180.0	65.1	0.0	65.1	154.4	0.00482	2.5	514	558	*22*	*344*
190.0	72.9	0.0	72.9	164.2	0.00493	3.0	578	632	*23*	*359*
200.0	78.4	0.0	78.4	171.1	0.00501	3.3	622	685	*24*	*370*
210.0	81.9	0.0	81.9	175.5	0.00506	3.5	651	720	*26*	*379*
220.0	84.4	0.0	84.4	178.7	0.00509	3.6	667	740	*27*	*386*
230.0	82.6	0.0	82.6	176.4	0.00507	3.5	656	731	*28*	*390*
240.0	80.0	0.0	80.0	173.1	0.00503	3.4	639	715	*29*	*394*
250.0	77.1	0.0	77.1	169.5	0.00499	3.3	620	698	*30*	*397*
260.0	73.0	0.0	73.0	164.3	0.00493	3.1	593	673	*32*	*400*
270.0	70.6	0.0	70.6	161.3	0.00490	3.0	577	659	*33*	*404*
280.0	69.5	0.0	69.5	159.9	0.00488	3.0	569	653	*34*	*407*
290.0	67.4	0.0	67.4	157.3	0.00485	2.9	555	640	*35*	*411*
300.0	65.6	0.0	65.6	155.0	0.00483	2.8	542	629	*36*	*414*
310.0	64.9	0.0	64.9	154.1	0.00482	2.8	538	627	*38*	*418*
320.0	64.0	0.0	64.0	153.0	0.00481	2.7	532	622	*39*	*421*
330.0	63.8	0.0	63.8	152.8	0.00480	2.7	530	622	*40*	*424*
340.0	64.1	0.0	64.1	153.2	0.00481	2.7	532	626	*41*	*428*
350.0	64.5	0.0	64.5	153.7	0.00481	2.7	535	631	*43*	*431*
360.0	64.5	0.0	64.5	153.6	0.00481	2.7	535	632	*44*	*435*
370.0	63.8	0.0	63.8	152.8	0.00480	2.7	530	629	*45*	*438*
380.0	63.7	0.0	63.7	152.7	0.00480	2.7	530	630	*46*	*442*
390.0	63.6	0.0	63.6	152.5	0.00480	2.7	529	631	*47*	*445*
400.0	63.6	0.0	63.6	152.5	0.00480	2.7	529	633	*49*	*449*
410.0	63.8	0.0	63.8	152.7	0.00480	2.7	530	636	*50*	*452*
420.0	64.5	0.0	64.5	153.7	0.00481	2.7	535	643	*51*	*455*
430.0	65.2	0.0	65.2	154.5	0.00482	2.8	540	649	*52*	*459*
440.0	64.3	0.0	64.3	153.4	0.00481	2.7	534	644	*54*	*461*
450.0	61.3	0.0	61.3	149.6	0.00477	2.6	512	621	*55*	*461*
460.0	55.7	0.0	55.7	142.5	0.00469	2.4	472	578	*56*	*458*
470.0	47.5	0.0	47.5	132.2	0.00458	2.0	410	511	*57*	*453*
480.0	37.2	0.0	37.2	119.2	0.00443	1.6	328	421	*58*	*445*
490.0	24.7	0.0	24.7	103.6	0.00426	1.1	216	301	*60*	*434*
500.0	9.4	0.0	9.4	84.3	0.00404	0.4	38	111	*61*	*421*
510.0	-6.7	0.0	6.7	80.9	0.00401	0.6	81	142	*62*	*407*

*The pressure calculations are set out in this table. Note that **Rpmax** varies as it is set to be a proportion of the cover depth.*

Hf is a rough estimate of the drilling mud pressure in the return annular flow.

*The total head **H** is the static head **Hs** (table above) and **Hf**.*

waterman	***Spreadsheet Calcpad*** *(Macros must be enabled. Ctrl+Alt+F9 recalculates.)*	**Project** WIE16435-103
	Arklow Bank Wind Park, Phase 2 Cable Pulling Calculations	**Prepared** LP / **Date** 16-Mar-22 **Checked** CG / **Date** 16-Mar-22

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Thus for section specific variables the the section name is added as a suffix - eg **Lc**, **Lf** are the **L**engths of sections '**C**' and '**F**' respectively. And similarly **Hyc** and **Hyf** are the Hydrokinetic forces. Where there is a need to make a distinction between the **s**tart and **e**nd of a section then additional suffixes '**s**' and '**e**' are appended to the variable name. There are similar variations on this theme.

Input Data: Constants and Global Variables

Constants

Pi	π	3.142	
Gravity	g	9.81	m/s/s
Eulers Number	e	2.7182	
One metre Head of Water	Hw	0.009804	N/mm^2

Pipe Geometry

Pipe outside diameter: δ0 = 266 mm → **Do** = **0.266** **m** *Modelling Soild Section*

Pipe wall thickness: t = 133 mm

Pipe inside diameter: δi = δ0 - 2*t → **Di** = **0.000** **m**
= 266 - 2*133
= 0.00 mm

Pipe X-sect (outer): Ao = INT(π * δ0^2 / 4) → **Aom** = **5.5571E-02** **m^2**
= INT(3.142 * 266^2 / 4)
= 55571.0 mm^2

Pipe X-sect (inner): Ai = INT(π * δi^2 / 4) → **Aim** = **0.0000E+00** **m^2**
= INT(3.142 * 0^2 / 4)
= 0.0 mm^2

Pipe wall X-sect area: Ap = INT(π * (δ0^2 - δi^2) / 4) → **Apm** = **5.5571E-02** **m^2**
= INT(3.142 * (266^2 - 0^2) / 4)
= 55571.0 mm^2

Minimum radius of curvature: R = 836*δ0 / 1000
= 836*266 / 1000
= **222 m**

Densities

Density of fresh water	ρw	1000	kg/m^3	
Density of sea water	ρsea	1025	kg/m^3	
Density of drilling mud	ρm	1300	kg/m^3	

Friction Factors

Between cable and soil	CFpr	0.4	***Assumed value***

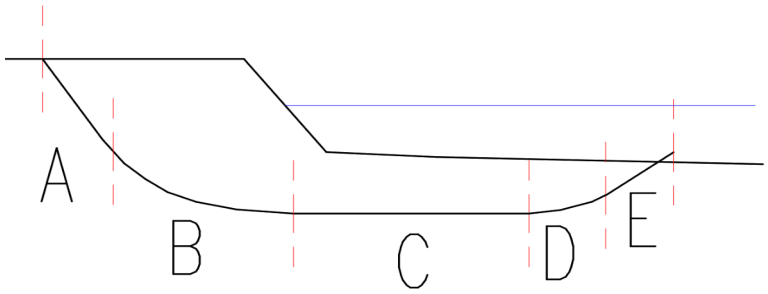
Buoyancy factors

Mass of cable	Mp=	**134.0**	**kg/m**	*Mass of cable in air as specified by Nexans*

Pipe Centre Line Profile

	A	A:B	B:C	C:D	D:E	E		
Ch	0.00	163.40	227.24	430.49	500.29	510.27		
mOD	19.83	-3.89	-9.08	-12.62	-8.97	-7.75		
Radius		500		500				
Slope	-8.257		-1		6.965			

Dimensions and levels are taken from CAD drawing



Summary Results

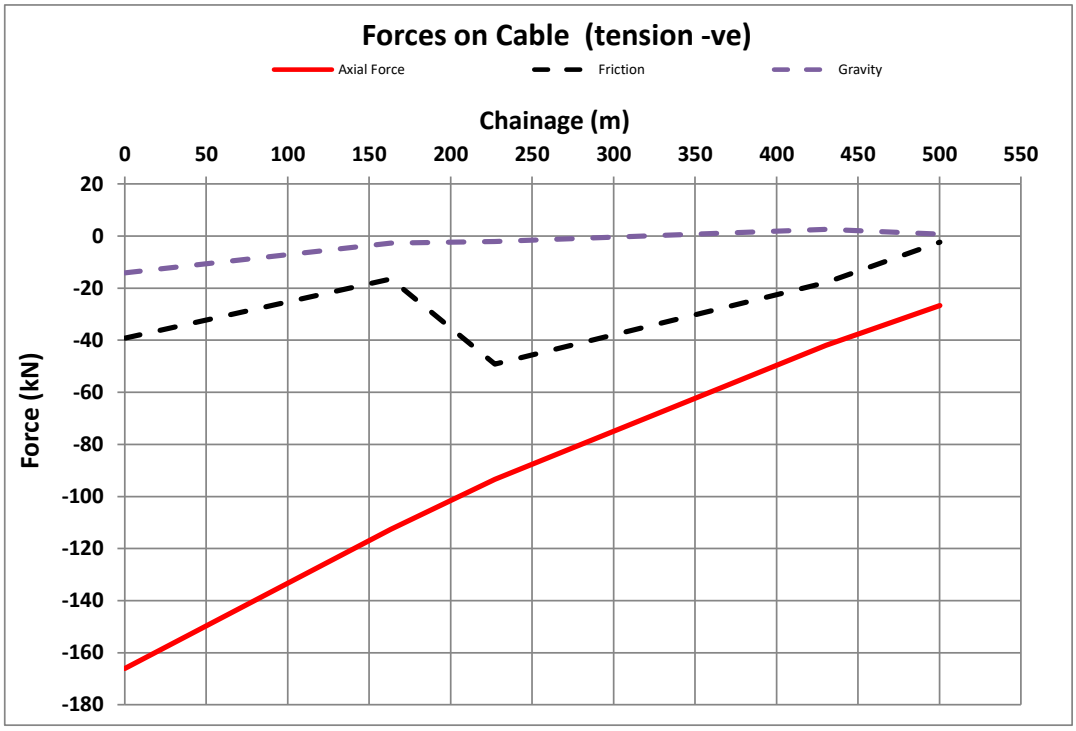
The general arrangement of the HDD borehole geometry is shown in the figure above. The analysis of the forces and combined stress during the cable pull will consider each section of the profile in order to identify the most critical portion. It is assumed that the maximum pulling force will be just as the cable reaches full insertion.

Sign Convention:

Axial Tensile Force: -ve	Axial Compressive Force: +ve
Tensile Stress -ve	Compressive Stress +ve
Weight (gravity) +ve	Buoyancy (uplift) -ve

Table of Cable Forces (kN)

Section	Length (m)	Chng (m)	Friction Comp	Hydro Comp	Gravity Comp	Axial Force
A	163.401	0.00	-39.19	-	-14.22	-166.03
B	63.838	163.40	-16.48	-	-2.78	-112.63
C	203.247	227.24	-49.25	-	-2.15	-93.36
D	69.806	430.49	-17.86	-	2.57	-41.96
E	9.982	500.29	-2.40	-	0.73	-26.67



Section E - Straight Inclined

This is a straight section and the stresses in the pipe arise from tensile (pulling) forces and radial forces acting

Length of Section	Le	9.98	m	
Slope of Section	θe	6.965	deg	0.122 radian
Pipe CL datum (start)		-7.75	mOD	
Pipe CL datum (end)		-8.97	mOD	

Friction force (tensile)

Fre = -ABS(CFpr * Le * ((Mp+Mw-Mm) * COS(θe))) * g / 1000
= -ABS(0.4 * 9.98 * ((134+0-72.2) * COS(0.122))) * 9.81 / 1000
= **-2.40 kN**

Gravity component

Gre = (Le * (Mp + Mw - Mm) * SIN(θe)) * g /1000
= (9.98 * (134 + 0 - 72.2) * SIN(0.122)) * 9.81 /1000
= **0.73 kN**

Aggregate the axial forces local to this section at the start and end of the section

Axial force section start

Faes = **-25.00 kN**

Tethering force depends on sea conditions. Nominal value of 25kN assumed.

Increment for section

dFae = Fre + Gre
= -2.4 + 0.73
= **-1.67 kN**

Axial force section end

Faee = Faes + dFae
= -25 + -1.67
= **-26.67 kN**

Section D - Vertical curve

This is a curved section as the pipe transitions from an incline to horizontal. This induces some forces that are additional to that of a straight section. These additional effects arise from the 'capstan' force required to move the pipe around a curve and the additional normal force and to bending the pipe.

Radius of curvature	Rdc	500.00 m		
Angle of curvature	θdc	6.965 deg	0.12156 radians	
Length of Section	Ld	69.81 m		
Average Slope of Section	θd	3.4825 deg	0.061 radians	
Pipe CL datum (start)		-8.97 mOD		
Pipe CL datum (end)		-12.62 mOD		

Check on curve length

Ldc = ABS(Rdc * θdc)
= 60.78 m ***(Compared to profile figure of 69.806m)*** *Not used - check only*

Check change in elevation

Hdc = Rdc * (1 - COS(θdc))
= 500 * (1 - COS(0.12156))
= 3.69 m ***(Compared to profile figure of 3.65m)*** *Not used - check only*

Capstan factor

CapFacd = EulerN^(CFpr *ABS(θdc))
= 2.7182^(0.4 *ABS(0.12156))
= 1.050 ***(Increase the pipe pull by this factor)***

Check additional normal force of pipe against borehole due to bending. This will add to the calculation of the friction force. Conservative approach is to consider deflection then determine UDL loading necessary to cause that deflection. Consider both simply supported and fully fixed ends.

Assumed deflection at midpoint

Defdm = Rdc * (1 - COS(θdc / 2))
= 500 * (1 - COS(0.12156 / 2))
= **0.92 m**

Total UDL equivalent Simply supported ends

Ndss = Defdm * (384 * Em * Im) * Ld / (5 * Ld^4) / 1000
= 0.92 * (384 * 800000000 * 0.00024575) * 69.81 / (5 * 69.81^4) / 1000
= **0.04 kN**

Total UDL equivalent Fully fixed ends

Ndfe = Defdm * (384 * Em * Im) * Ld / (Ld^4) / 1000
= 0.92 * (384 * 800000000 * 0.00024575) * 69.81 / (69.81^4) / 1000
= **0.20 kN**

Weighted UDL

Nd = (Ndss + Ndff) / 3 * 2
= (0.04 + 0.2) / 3 * 2
= **0.16 kN**

Friction forces (tensile) as if straight pipe

Frdl = -ABS(CFpr * (Ld * (Mp+Mw-Mm) * COS(θd)) * g/1000)
= -ABS(0.4 * (69.81 * (134+0-72.2) * COS(0.061)) * 9.81/1000)
= **-16.89 kN**

Friction forces (tensile) due to bending.

Frdc = -ABS(CFpr * 2 * Nd * COS(θd))
= -ABS(0.4 * 2 * 0.16 * COS(0.061))
= **-0.131 kN**

Note that in the above calculations the frictional force due to curvature is 0.77 percent of the linear friction force.

Determine the capstan effect force. It could be argued that considering additional normal force for friction and capstan force is double counting the effect of curvature, but probably not.

Capstan effect increased tension force

Cad = (CapFacd - 1) * (Frdl + Frdc)
(1.05 - 1) * (-16.89 + -0.131)
-0.85 kN

Gravity component

Grd = (Ld * Mpb * SIN(θd)) * g /1000
= (69.81 * 61.76 * SIN(0.061)) * 9.81 /1000
= **2.57 kN**

Aggregate the axial forces local to this section at the start and end of the section. Note horizontal lay out length reduces as pipe pulled in.

Axial force section start

Fads = Faee
= -26.67
= **-26.67 kN**

Increment for section

dFad = Frdl + Frdc + Cad + Grd
= -16.89 + -0.131 + -0.85 + 2.57
= **-15.30 kN**

Axial force section end

Fade = Fads + dFad
= -26.67 + -15.3
= **-41.96 kN**

Section C - Straight Inclinded

This is a straight section and the stresses in the pipe arise from pulling forces and radial forces acting on the circumfrence of the pipe. The borehole is filled with bentonite and the pipe may contain ballast water.

Length of Section	Lc	203.25	m	
Slope of Section	θc	-1	deg	-0.017 radian
Pipe CL datum (start)		-12.62	mOD	
Pipe CL datum (end)		-9.08	mOD	

Friction forces (tensile)

Frc = -ABS(CFpr * Lc * ((Mp+Mw-Mm) * COS(θc))) * g / 1000
= -ABS(0.4 * 203.25 * ((134+0-72.2) * COS(-0.017))) * 9.81 / 1000
= **-49.25 kN**

Gravity component

Grc = (Lc * Mpb * SIN(θc)) * g /1000
= (203.25 * 61.76 * SIN(-0.017)) * 9.81 /1000
= **-2.15 kN**

Aggregate the axial forces local to this section at the start and end of the section.

Axial force section start

Facs = Fade
= -41.96
-41.96 kN

Increment for section

dFac = Frc + Grc
= -49.25 + -2.15
= **-51.40 kN**

Axial force section end

Face = Facs + dFac
= -41.96 + -51.4
= **-93.36 kN**

Section B - Vertical curve

This is a curved section as the pipe transitions from an incline to horizontal. This induces some forces that are additional to that of a straight section. These additional effects arise from the 'capstan' force required to move the pipe around a curve and the additional normal force and to bending the pipe.

Radius of curvature	Rbc	500.00	m	
Angle of curvature	θbc	-8.257	deg	-0.144 radians
Length of Section	Lb	63.84	m	
Average Slope of Section	θb	-4.1285	deg	-0.072 radians
Pipe CL datum (start)		-9.08	mOD	
Pipe CL datum (end)		-3.89	mOD	

Check on curve length

Lbc = ABS(Rbc * θbc)
= 72.06 m *(Compared to profile figure of 63.84m)* *Not used - check only*

Check change in elevation

Hbc = Rbc * (1 - COS(θbc))
= 500 * (1 - COS(-0.144))
= 5.18 m *(Compared to profile figure of -5.19m)* *Not used - check only*

Capstan factor

CapFacb = EulerN^(CFpr *ABS(θbc))
= 2.7182^(0.4 *ABS(-0.144))
= 1.059 *(Increase the pipe pull by this factor)*

Check additional normal force of pipe against borehole due to bending. This will add to the calculation of the friction force. Conservative approach is to consider deflection then determine UDL loading necessary to cause that deflection. Consider both simply supported and fully fixed ends.

Assumed deflection at midpoint

Defbm = Rbc * (1 - COS(θbc / 2))
= 500 * (1 - COS(-0.144 / 2))
= **1.30 m**

Total UDL equivalent Simply supported ends

Nbss = Defdm * (384 * Em * Im) * Ld / (5 * Ld^4) / 1000
= 0.92 * (384 * 800000000 * 0.00024575) * 69.81 / (5 *
= **0.04 kN**

Total UDL equivalent Fully fixed ends

Nbff = Defdm * (384 * Em * Im) * Ld / (Ld^4) / 1000
= 0.92 * (384 * 800000000 * 0.00024575) * 69.81 / (69.81^4) /
= **0.20 kN**

Weighted UDL

Nb = (Nbss + Nbff) / 3 * 2
= (0.04 + 0.2) / 3 * 2
= **0.16 kN**

Friction forces (tensile) as if straight pipe

Frbl = -ABS(CFpr * (Lb * (Mp+Mw-Mm) * COS(θb)) * g/1000)
= -ABS(0.4 * (63.84 * (134+0-72.2) * COS(-0.072)) * 9.81/1000)
= **-15.43 kN**

Friction forces (tensile) due to bending.

Frbc = -ABS(CFpr * 2 * Nb * COS(θb))
= -ABS(0.4 * 2 * 0.16 * COS(-0.072))
= **-0.13 kN**

Note that in the above calculations the frictional force due to curvature is 0.8 percent of the linear friction force.

Determine the capstan effect force. It could be argued that considering additional normal force for friction and capstan force is double counting the effect of curvature, but probably not.

Capstan effect increased tension force

Cab = (CapFacb - 1) * (Frbl + Frbc)
(1.059 - 1) * (-15.43 + -0.13)
-0.92 kN

Gravity component

Grb = (Lb * (Mp+Mw-Mm) * SIN(θb)) * g /1000
= (63.84 * (134+0-72.2) * SIN(-0.072)) * 9.81 /1000
= **-2.78 kN**

Aggregate the axial forces local to this section at the start and end of the section. Note horizontal lay out length reduces as pipe pulled in.

Axial force section start

Fabs = Face
= -93.36
-93.36 kN

Increment for section

dFab = Frbl + Frbc + Cab + Grb
= -15.43 + -0.13 + -0.92 + -2.78
= **-19.27 kN**

Axial force section end

Fabe = Fabs +dFab
= -93.36 +-19.27
= **-112.63 kN**

Section A - Straight Inclined

This is a straight section and the stresses in the pipe arise from tensile (pulling) forces and radial forces acting on the circumfrence of the pipe. Assume the bore hole is filled with bentonite.

Length of Section	La	163.40	m	
Slope of Section	θa	-8.257	deg	-0.144 radian
Pipe CL datum (start)		-3.89	mOD	
Pipe CL datum (end)		19.83	mOD	

Friction forces (tensile)

Fra = -ABS(CFpr * La * ((Mp+Mw-Mm) * COS(θa))) * g / 1000
= -ABS(0.4 * 163.4 * ((134+0-72.2) * COS(-0.144))) * 9.81 / 1000
= **-39.19 kN**

Gravity component

Gra = (La * (Mp+Mw-Mm) * SIN(θa)) * g /1000
= (163.4 * (134+0-72.2) * SIN(-0.144)) * 9.81 /1000
= **-14.22 kN**

Aggregate the axial forces local to this section at the start and end of the section. Note horizontal lay out length reduces as pipe pulled in. (By end of this section the pipe is fully inserted.)

Axial force section start

Faas = Fabe
= -112.63
-112.63 kN

Increment for section

dFaa = Fra + Gra
= -39.19 + -14.22
= **-53.40 kN**

Axial force section end

Faae = Faas + dFaa
= -112.63 + -53.4
= **-166.03 kN**

waterman	***Spreadsheet Calcpad*** *(Macros must be enabled. Ctrl+Alt+F9 recalculates.)*	**Project** WIE16435-103
	Arklow Bank Wind Park, Phase 2 HDD Duct Pulling Calculations	**Prepared** / **Date** LP / 15-Mar-22 **Checked** / **Date** CG / 16-Mar-22

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Input Data: Constants and Global Variables

Constants

Pi	π	3.142	
Gravity	g	9.81	m/s/s
Eulers Number	e	2.7182	
One metre Head of Water	Hw	0.009804	N/mm^2

Pipe Geometry

Pipe outside diameter	δ0	800	mm	**Do**	**0.800**	**m**
Pipe wall thickness	t =	38.09524	mm			

Note SDR21 assumed to determine wall thickness

Pipe inside diameter

δi = δ0 - 2*t
= 800 - 2*38.09524
= 723.81 mm

Di **0.724** **m**

Pipe X-sect (outer)

Ao = INT(π * δ0^2 / 4)
= INT(3.142 * 800^2 / 4)
= 502654.0 mm^2

Aom **5.0265E-01** **m^2**

Pipe X-sect (inner)

Ai = INT(π * δi^2 / 4)
= INT(3.142 * 723.81^2 / 4)
= 411470.0 mm^2

Aim **4.1147E-01** **m^2**

Pipe wall X-sect area

Ap = INT(π * (δ0^2 - δi^2) / 4)
= INT(3.142 * (800^2 - 723.81^2) / 4)
= 91184.0 mm^2

Apm **9.1184E-02** **m^2**

Minimum radius of curvature

R = 836*δ0 / 1000
= 836*800 / 1000
= **669 m**

	Spreadsheet Calcpad (Macros must be enabled. Ctrl+Alt+F9 recalculates.)	Project	
waterman		WIE16435-103	
	Arklow Bank Wind Park, Phase 2 HDD Duct Pulling Calculations	Prepared	Date
		LP	15-Mar-22
		Checked	Date
		CG	16-Mar-22

Pipe Material

Young's Modulus	Emm	8.00E+02	N/mm^2	*Units of force calculations*	*Generic values for HDPE material*
	Em	**8.00E+08**	N/m^2	*Units of stress calculations*	

Densities

Density of fresh water	ρw	1000	kg/m^3		
Density of sea water	ρsea	1025	kg/m^3		
Density of drilling mud	ρm	1300	kg/m^3		
Density of pipe material	ρp	950	kg/m^3	*HDPE*	*Generic value*

Friction Factors

Between pipe and soil	CFpr	0.5		*Assumed value*	
Between pipe and bentonite	CFpb	50	N/m^2		

Pipe Ballast

Density of fluid in pipe	ρb	1000	kg/m^3	*Default, water 1000kg/m^3*	***Assumed filled***
Pressure of ballast fluid	Pb	0	bar	**Pb 0 N/mm^2**	***Assumed unpressurised***
Bentonite at surface	EBen	14.525	mOD	*To ordnance datum*	

Buoyancy factors

Mass of pipe — *Mass of pipe in air*

Mp = (Ap / 10^6) * ρp
= (91184 / 10^6) * 950
= **86.6 kg/m**

Mass of ballast in pipe — *Mass of ballast water in air*

Mw = (Ai / 10^6) * ρb
= (411470 / 10^6) * 1000
= **411.5 kg/m**

Mass of drilling mud — *Mass of mud displaced by pipe*

Mm = (Ao / 10^6) * ρm
= (502654 / 10^6) * 1300
= **653.5 kg/m**

Buoyant mass of pipe — **Mpb** not used directly, but useful check on buoyancy

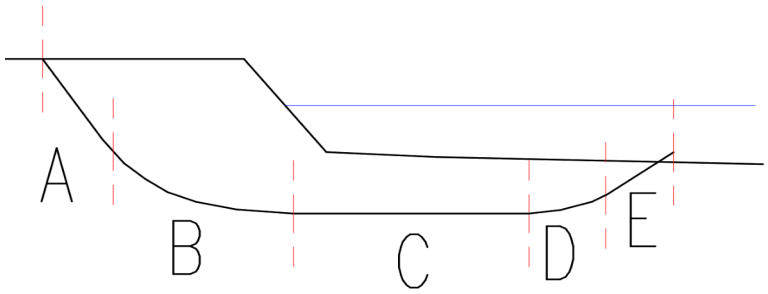
Mpb = (Mp + Mw) - Mm
= (86.6 + 411.5) - 653.5
= **-155.36 kg/m**

Result is -ve. Pipe floats so force up

Pipe Centre Line Profile

	A	A:B	B:C	C:D	D:E	E		
Ch	0.00	163.40	227.24	430.49	500.29	510.27		
mOD	19.83	-3.89	-9.08	-12.62	-8.97	-7.75		
Radius		500		500				
Slope	-8.257		-1		6.965			

Dimensions and levels are taken from CAD drawing



Summary Results

The general arrangement of the HDD borehole geometry is shown in the figure above. The analysis of the forces and combined stress during the pipe pull will consider each section of the profile in order to identify the most critical portion. It is assumed that the maximum pulling force will be just as the pipe reaches full insertion.

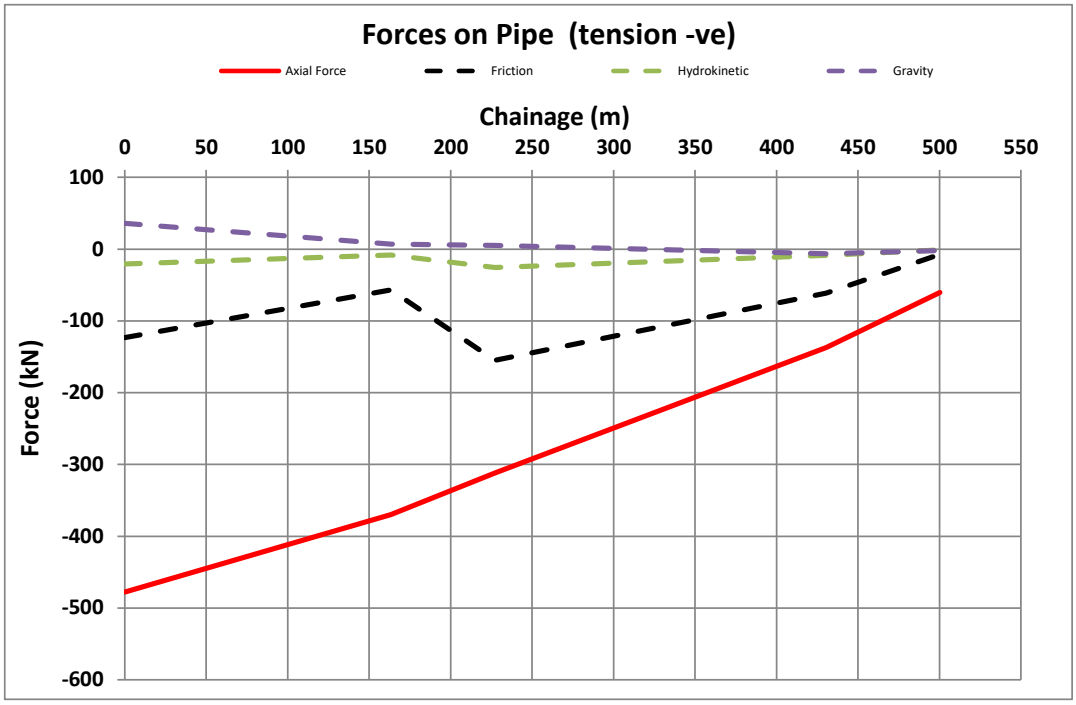
During pipe pulling the HDD borehole will be filled with bentonite and the pipe. Possibly the pipe will be flooded with ballast water and in some cases may be pressurised. Calculation of the friction forces and the pulling forces requires the buoyancy and pipe curvature to be taken into account.

Sign Convention:

Axial Tensile Force: -ve	Axial Compressive Force: +ve
Tensile Stress -ve	Compressive Stress +ve
Weight (gravity) +ve	Buoyancy (uplift) -ve

Table of Pipe Forces (kN)

Section	Length (m)	Chng (m)	Friction Comp	Hydro Comp	Gravity Comp	Axial Force
A	163.401	0.00	-123.22	-20.53	35.76	-477.89
B	63.838	163.40	-56.89	-8.02	7.00	-369.89
C	203.247	227.24	-154.85	-25.54	5.41	-311.99
D	69.806	430.49	-61.12	-8.77	-6.46	-137.00
E	9.982	500.29	-7.55	-1.25	-1.84	-60.65



Section E - Straight Inclined

This is a straight section and the stresses in the pipe arise from tensile (pulling) forces and radial forces acting

Length of Section	Le	9.98	m	
Slope of Section	θe	6.965	deg	0.122 radian
Pipe CL datum (start)		-7.75	mOD	
Pipe CL datum (end)		-8.97	mOD	
Hydrotatic Head (start end)	Hhes	22.28	m	***(NB: This is bentonite head)***
Hydrostatic Head (end end)	Hhee	23.50	m	***(NB: This is bentonite head)***

Friction force (tensile)

Fre = -ABS(CFpr * Le * ((Mp+Mw-Mm) * COS(θe))) * g / 1000
= -ABS(0.5 * 9.98 * ((86.6+411.5-653.5) * COS(0.122))) * 9.81 / 1000
= **-7.55 kN**

Hydrokinetic force (tensile)

Hye = -(π * Do * Le * CFpb) / 1000
= -(3.142 * 0.8 * 9.98 * 50) / 1000
= **-1.25 kN**

Gravity component

Gre = (Le * (Mp + Mw - Mm) * SIN(θe)) * g /1000
= (9.98 * (86.6 + 411.5 - 653.5) * SIN(0.122)) * 9.81 /1000
= **-1.84 kN**

Bouyancy is resisting by pushing back this section

Aggregate the axial forces local to this section at the start and end of the section

Axial force section start

Faes = **-50.00 kN**

Pipe floating offshore. Tethering force depends on sea conditions. Nominal value of 50kN assumed.

Increment for section

dFae = Fre + Hye + Gre
= -7.55 + -1.25 + -1.84
= **-10.65 kN**

Axial force section end

Faee = Faes + dFae
= -50 + -10.65
= **-60.65 kN**

Section D - Vertical curve

This is a curved section as the pipe transitions from an incline to horizontal. This induces some forces that are additional to that of a straight section. These additional effects arise from the 'capstan' force required to move the pipe around a curve and the additional normal force and to bending the pipe.

Radius of curvature	Rdc	500.00 m		
Angle of curvature	θdc	6.965 deg	0.12156 radians	
Length of Section	Ld	69.81 m		
Average Slope of Section	θd	3.4825 deg	0.061 radians	
Pipe CL datum (start)		-8.97 mOD		
Pipe CL datum (end)		-12.62 mOD		
Hydrotatic Head (start end)	Hhds	23.50 m	***(NB: This is bentonite head)***	
Hydrostatic Head (end end)	Hhde	27.14 m	***(NB: This is bentonite head)***	

Check on curve length

Ldc = ABS(Rdc * θdc)
= 60.78 m ***(Compared to profile figure of 69.806m)*** *Not used - check only*

Check change in elevation

Hdc = Rdc * (1 - COS(θdc))
= 500 * (1 - COS(0.12156))
= 3.69 m ***(Compared to profile figure of 3.65m)*** *Not used - check only*

Capstan factor

CapFacd = EulerN^(CFpr *ABS(θdc))
= 2.7182^(0.5 *ABS(0.12156))
= 1.063 ***(Increase the pipe pull by this factor)***

Check additional normal force of pipe against borehole due to bending. This will add to the calculation of the friction force. Conservative approach is to consider deflection then determine UDL loading necessary to cause that deflection. Consider both simply supported and fully fixed ends.

Assumed deflection at midpoint

Defdm = Rdc * (1 - COS(θdc / 2))
= 500 * (1 - COS(0.12156 / 2))
= **0.92 m**

Total UDL equivalent Simply supported ends

Ndss = Defdm * (384 * Em * Im) * Ld / (5 * Ld^4) / 1000
= 0.92 * (384 * 800000000 * 0.00663311) * 69.81 / (5 * 69.81^4) / 1000
= **1.11 kN**

Total UDL equivalent Fully fixed ends

Ndfe = Defdm * (384 * Em * Im) * Ld / (Ld^4) / 1000
= 0.92 * (384 * 800000000 * 0.00663311) * 69.81 / (69.81^4) / 1000
= **5.53 kN**

Weighted UDL

Nd = (Ndss + Ndff) / 3 * 2
= (1.11 + 5.53) / 3 * 2
= **4.42 kN**

Friction forces (tensile) as if straight pipe

Frdl = -ABS(CFpr * (Ld * (Mp+Mw-Mm) * COS(θd)) * g/1000)
= -ABS(0.5 * (69.81 * (86.6+411.5-653.5) * COS(0.061)) * 9.81/1000)
= **-53.10 kN**

Friction forces (tensile) due to bending.

Frdc = -ABS(CFpr * 2 * Nd * COS(θd))
= -ABS(0.5 * 2 * 4.42 * COS(0.061))
= **-4.417 kN**

Note that in the above calculations the frictional force due to curvature is 8.31 percent of the linear friction force.

Determine the capstan effect force. It could be argued that considering additional normal force for friction and capstan force is double counting the effect of curvature, but probably not.

Capstan effect increased tension force

Cad = (CapFacd - 1) * (Frdl + Frdc)
(1.063 - 1) * (-53.1 + -4.417)
-3.60 kN

Hydrokinetic force (tensile)

Hyd = -(π * Do * Ld * CFpb) / 1000
= -(3.142 * 0.8 * 69.81 * 50) / 1000
= **-8.77 kN**

Gravity component

Grd = (Ld * Mpb * SIN(θd)) * g /1000
= (69.81 * -155.36 * SIN(0.061)) * 9.81 /1000
= **-6.46 kN**

Bouyancy is resisting by pushing back this section

Aggregate the axial forces local to this section at the start and end of the section. Note horizontal lay out length reduces as pipe pulled in.

Axial force section start

Fads = Faee
= -60.65
= **-60.65 kN**

Increment for section

dFad = Frdl + Frdc + Cad + Hyd + Grd
= -53.1 + -4.417 + -3.6 + -8.77 + -6.46
= **-76.35 kN**

Axial force section end

Fade = Fads + dFad
= -60.65 + -76.35
= **-137.00 kN**

Section C - Straight Inclinded

This is a straight section and the stresses in the pipe arise from pulling forces and radial forces acting on the circumfrence of the pipe. The borehole is filled with bentonite and the pipe may contain ballast water.

Length of Section	Lc	203.25	m	
Slope of Section	θc	-1	deg	-0.017 radian
Pipe CL datum (start)		-12.62	mOD	
Pipe CL datum (end)		-9.08	mOD	
Hydrotatic Head (start end)	Hhcs	27.14	m	***(NB: This is bentonite head)***
Hydrostatic Head (end end)	Hhce	23.60	m	***(NB: This is bentonite head)***

Friction forces (tensile)
Frc = -ABS(CFpr * Lc * ((Mp+Mw-Mm) * COS(θc))) * g / 1000
= -ABS(0.5 * 203.25 * ((86.6+411.5-653.5) * COS(-0.017))) * 9.81 / 1000
= **-154.85 kN**

Hydrokinetic force (tensile)
Hyc = -(π * Do * Lc * CFpb) / 1000
= -(3.142 * 0.8 * 203.25 * 50) / 1000
= **-25.54 kN**

Gravity component
Grc = (Lc * Mpb * SIN(θc)) * g /1000
= (203.25 * -155.36 * SIN(-0.017)) * 9.81 /1000
= **5.41 kN**

Aggregate the axial forces local to this section at the start and end of the section.

Axial force section start
Facs = Fade
= -137
-137.00 kN

Increment for section
dFac = Frc + Hyc + Grc
= -154.85 + -25.54 + 5.41
= **-174.99 kN**

Axial force section end
Face = Facs + dFac
= -137 + -174.99
= **-311.99 kN**

Section B - Vertical curve

This is a curved section as the pipe transitions from an incline to horizontal. This induces some forces that are additional to that of a straight section. These additional effects arise from the 'capstan' force required to move the pipe around a curve and the additional normal force and to bending the pipe.

Radius of curvature	Rbc	500.00	m	
Angle of curvature	θbc	-8.257	deg	-0.144 radians
Length of Section	Lb	63.84	m	
Average Slope of Section	θb	-4.1285	deg	-0.072 radians
Pipe CL datum (start)		-9.08	mOD	
Pipe CL datum (end)		-3.89	mOD	
Hydrotatic Head (start end)	Hhbs	23.60	m	***(NB: This is bentonite head)***
Hydrostatic Head (end end)	Hhbe	18.41	m	***(NB: This is bentonite head)***

Check on curve length

Lbc = ABS(Rbc * θbc)
= 72.06 m ***(Compared to profile figure of 63.84m)*** *Not used - check only*

Check change in elevation

Hbc = Rbc * (1 - COS(θbc))
= 500 * (1 - COS(-0.144))
= 5.18 m ***(Compared to profile figure of -5.19m)*** *Not used - check only*

Capstan factor

CapFacb = EulerN^(CFpr *ABS(θbc))
= 2.7182^(0.5 *ABS(-0.144))
= 1.075 ***(Increase the pipe pull by this factor)***

Check additional normal force of pipe against borehole due to bending. This will add to the calculation of the friction force. Conservative approach is to consider deflection then determine UDL loading necessary to cause that deflection. Consider both simply supported and fully fixed ends.

Assumed deflection at midpoint

Defbm = Rbc * (1 - COS(θbc / 2))
= 500 * (1 - COS(-0.144 / 2))
= **1.30 m**

Total UDL equivalent Simply supported ends

Nbss = Defdm * (384 * Em * Im) * Ld / (5 * Ld^4) / 1000
= 0.92 * (384 * 800000000 * 0.00663311) * 69.81 / (5 *
= **1.11 kN**

Total UDL equivalent Fully fixed ends

Nbff = Defdm * (384 * Em * Im) * Ld / (Ld^4) / 1000
= 0.92 * (384 * 800000000 * 0.00663311) * 69.81 / (69.81^4) /
= **5.53 kN**

Weighted UDL

Nb = (Nbss + Nbff) / 3 * 2
= (1.11 + 5.53) / 3 * 2
= **4.42 kN**

Friction forces (tensile) as if straight pipe

Frbl = -ABS(CFpr * (Lb * (Mp+Mw-Mm) * COS(θb)) * g/1000)
= -ABS(0.5 * (63.84 * (86.6+411.5-653.5) * COS(-0.072)) * 9.81/1000)
= **-48.52 kN**

Friction forces (tensile) due to bending.

Frbc = -ABS(CFpr * 2 * Nb * COS(θb))
= -ABS(0.5 * 2 * 4.42 * COS(-0.072))
= **-4.41 kN**

Note that in the above calculations the frictional force due to curvature is 9 percent of the linear friction force.

Determine the capstan effect force. It could be argued that considering additional normal force for friction and capstan force is double counting the effect of curvature, but probably not.

Capstan effect increased tension force

Cab = (CapFacb - 1) * (Frbl + Frbc)
(1.075 - 1) * (-48.52 + -4.41)
-3.95 kN

Hydrokinetic force (tensile)

Hyb = -(π * Do * Lb * CFpb) / 1000
= -(3.142 * 0.8 * 63.84 * 50) / 1000
= **-8.02 kN**

Gravity component

Grb = (Lb * (Mp+Mw-Mm) * SIN(θb)) * g /1000
= (63.84 * (86.6+411.5-653.5) * SIN(-0.072)) * 9.81 /1000
= **7.00 kN**

Bouyancy is assisting by raising this section

Aggregate the axial forces local to this section at the start and end of the section. Note horizontal lay out length reduces as pipe pulled in.

Axial force section start

Fabs = Face
= -311.99
-311.99 kN

Increment for section

dFab = Frbl + Frbc + Cab + Hyb + Grb
= -48.52 + -4.41 + -3.95 + -8.02 + 7
= **-57.91 kN**

Axial force section end

Fabe = Fabs +dFab
= -311.99 +-57.91
= **-369.89 kN**

Section A - Straight Inclined

This is a straight section and the stresses in the pipe arise from tensile (pulling) forces and radial forces acting on the circumfrence of the pipe. Assume the bore hole is filled with bentonite.

Length of Section	La	163.40	m	
Slope of Section	θa	-8.257	deg	-0.144 radian
Pipe CL datum (start)		-3.89	mOD	
Pipe CL datum (end)		19.83	mOD	
Hydrotatic Head (start end)	Hhas	18.41	m	***(NB: This is bentonite head)***
Hydrostatic Head (end end)	Hhae	-5.30	m	***(NB: This is bentonite head)***

Friction forces (tensile)

Fra = -ABS(CFpr * La * ((Mp+Mw-Mm) * COS(θa))) * g / 1000
= -ABS(0.5 * 163.4 * ((86.6+411.5-653.5) * COS(-0.144))) * 9.81 / 1000
= **-123.22 kN**

Hydrokinetic force (tensile)

Hya = -(π * Do * La * CFpb) / 1000
= -(3.142 * 0.8 * 163.4 * 50) / 1000
= **-20.53 kN**

Gravity component

Gra = (La * (Mp+Mw-Mm) * SIN(θa)) * g /1000
= (163.4 * (86.6+411.5-653.5) * SIN(-0.144)) * 9.81 /1000
= **35.76 kN**

Aggregate the axial forces local to this section at the start and end of the section. Note horizontal lay out length reduces as pipe pulled in. (By end of this section the pipe is fully inserted.)

Axial force section start

Faas = Fabe
= -369.89
-369.89 kN

Increment for section

dFaa = Fra + Hya + Gra
= -123.22 + -20.53 + 35.76
= **-107.99 kN**

Axial force section end

Faae = Faas + dFaa
= -369.89 + -107.99
= **-477.89 kN**

J. Example Drilling Fluid Data Sheet

EXAMPLE BENTONITE MATERIALS SAFETY DATA SHEET

MSDS

CLEAR SOLUTIONS
Performance Drilling Products
The Earth Can Trust

PRODUCT NAME: Ultrabore®

Safety Data Sheet No: 5002EC

1. Identification of the Substances and Details of the Company

Product Description: Drilling Fluid Additive
Company Name and Address:
Clear Solutions International Ltd
Unit B3, Wem Industrial Estate
Soulton Road
Wem
Shropshire SY4 5SD
UK

Date Prepared: August 2009
Issue No: 3
Date Reviewed: March 2016

Tel: +44 (0) 1939 235754
Fax: +44 (0) 1939 232399
Email: info@drilling-products.com

2. Hazards Identification

Classification of the substance
Classification Regulation (EC) No 1272/2008: not hazardous
Classification Directive 67/548/EEC, 1999/45/EC: not classified

Label elements
Labeling Regulation (EC) No 1272/2008: not classified

Other hazards
Not applicable

3. Composition/Information on Ingredients

Substances
Chemical nature: Naturally occurring mineral
CAS No. 1302-78-9
Consists mainly of montmorillinite with < 10% accessory minerals (quartz, feldspar, mica and calcite). Respirable Crystalline Silica (<7.1µ) may be present at <1% and therefore not classified as hazardous.

4. First Aid Measures

Skin Contact: Rinse thoroughly with cold water and seek medical attention if symptoms persist.
Eye Contact: Rinse thoroughly with cold water and seek medical attention if symptoms persist.
Inhalation: Remove person to fresh air, and if symptoms persist seek medical attention.
Ingestion: Drink several glasses of water or milk. If large quantities are ingested seek medical attention.

5. Fire Fighting Measures

Non combustible - when extinguishing fires bear in mind product becomes slippery when wet.

PRODUCT NAME: Ultrabore®

Safety Data Sheet No: 5002EC

6. Accidental Release Measures

Personal precautions: Do not breathe dust – see section 8. Becomes slippery when wet.
Environmental risk: Non-toxic.
Cleaning up: Sweep or vacuum up and dispose of as non-toxic waste.

7. Handling and Storage

Handling: Avoid the creation of dust, and ensure adequate ventilation at point of use. See section 8.
Storage: Store in clean, dry environment.

8. Exposure Controls/Personal Protection



Hand Protection: Use barrier creams and rubber gloves as required.
Skin Protection: Normal work wear.
Respiratory Protection: Use dust masks. Ensure adequate ventilation and dust control measures to maintain dust levels below OES* limit.
*OES level (Occupational Exposure Standard): Dry bentonite is classed as a nuisance dust with an 8 hour TWA for total dust inhalation of 10mg/m^3 and 5 mg/m^3 for respirable dust. Quartz present in small quantities in this product has a Maximum Exposure Limit (MEL) of 0.4mg/m^3 respirable dust for an 8 hour TWA period. (Respirable dust is that portion with a particle size <7.1µ).
Eye protection: Wear safety glasses.

9. Physical and Chemical Properties

Appearance:	Light grey to off-white powder
Odour:	Odourless
pH – 2% suspension:	7 – 9.5
S.G:	2.5
Solubility:	Forms suspension in water
Decomposition Temperature:	Not Evaluated
Flammability:	Non-flammable
Explosive properties:	None
Vapour pressure:	N/A
Flash point:	N/A
Melting point:	N/A
Boiling point:	N/A

10. Stability and Reactivity

Conditions to avoid: Avoid generation of dust. Slippery when wet.
Materials to avoid: Oxidising agents.
Hazardous Decomposition Products: None.

11. Toxicological Information

Ingestion: Orally non-toxic.

PRODUCT NAME: Ultrabore®
Safety Data Sheet No: 5002EC

Eye contact: Causes irritation due to physical abrasion by dust particles.
Eye contact: Causes irritation due to physical abrasion by dust particles.
Skin contact: Non-toxic may cause skin dryness and chapping.
Inhalation: Long term exposure to bentonite dust in excess of the OES limit may result in fibrosis of the lung tissue. The presence of respirable crystalline silica may lead to silicosis if the MEL is persistently exceeded over a long time.

12. Ecological Information

Toxicity
LC_{50} (96hrs) Rainbow Trout: 16000 mg/l
LC_{50} (24hrs) C. dubia and H. limbata: >500 mg/l

13. Disposal Considerations

Dispose of in accordance with local and national regulations using an approved disposal contractor.

14. Transport information

There are no specific transport precautions required as product is classified as not dangerous but product should be kept dry as it becomes slippery when wet and avoid dust creation.

15. Regulatory Information

Dangerous Substances Directive 67/548/EEC and Dangerous Preparations Directive 88/379/EEC do not apply.
Follow safety guidelines S22 – do not breathe dust and use only in well-ventilated areas.
COSHH regulations 2002 apply in the UK.

16. Other Information

Typical uses of this product are civil engineering, oil well drilling, ceramics, foundry applications, land fill barriers, bore hole sealing.

The information herein has been compiled from sources believed to be reliable and is accurate to the best of our knowledge. However, CLEAR SOLUTIONS INTERNATIONAL LTD cannot give guarantees regarding information from other sources, and expressly does not make any warranties, nor assumes any liability, for its use.

UK and Ireland Office Locations

