Appendix A14.2 Ground Investigation Report



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Appendix A

Ground Investigation Layout Plan and Geological Survey Ireland Maps

Appendix B In-Situ Testing Figures

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Appendix D Factual Ground Investigation Report

Appendix E Historical Ground Investigation Data

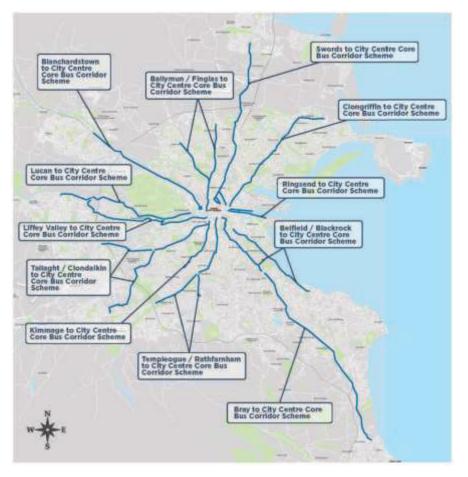
Appendix F Geotechnical Risk Register

1 Introduction

1.1 **Project Overview**

The BusConnects Dublin - Core Bus Corridors Infrastructure Works (herein after called the 'CBC Infrastructure Works') involves the development of continuous bus priority infrastructure and improved pedestrian and cycling facilities on 16 radial core corridors in the Greater Dublin Area (GDA), across the local authority jurisdictions of Dublin City Council (DCC), South Dublin County Council (SDCC), Dún Laoghaire-Rathdown County Council (DLRCC), Fingal County Council (FCC), and Wicklow County Council (WCC). Overall, the CBC Infrastructure Works encompasses the delivery of approximately 230km of dedicated bus lanes and 200km of cycle tracks along 16 of the busiest corridors in Dublin.

In June 2018, the National Transport Authority (NTA) published the Core Bus Corridors Project Report. The report was a discussion document outlining proposals for the delivery of a CBC network across Dublin. The 'Blanchardstown to City Centre CBC' (hereinafter also known as the 'Proposed Scheme') is identified in this document as forming part of the Radial Core Bus Network.



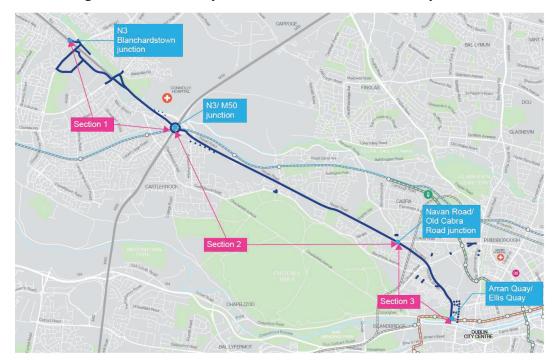
The BusConnects radial Core Bus Corridor network is shown in Figure 1.

Figure 1: BusConnects Radial CBC Network

This Ground Investigation Report (GIR) has been prepared to inform the Preliminary Design stage of the Proposed Scheme.

The Proposed Scheme commences at Junction 3 (Blanchardstown / Mulhuddart) southbound off-slip from the N3. The Proposed Scheme proceeds along the R121 Blanchardstown Road South into the Blanchardstown Shopping Centre.

From a new terminus to the north-west of Blanchardstown Shopping Centre the Proposed Scheme is routed onto the N3 Navan Road via the Snugborough Road junction and follows the N3 and Navan Road as far as the junction with the Old Cabra Road. From here, the Proposed Scheme is routed along Old Cabra Road, Prussia Street, Manor Street and Stoneybatter to the junction with King Street North. The core bus corridor is then routed via Blackhall Place as far as the junction with Ellis Quay, where it joins the prevailing traffic management regime on the North Quays. At the Stoneybatter / Brunswick Street North junction, cyclists proceed along Brunswick Street North, George's Lane and Queen Street as far as Ellis Quay/Arran Quay.



Refer to Figure 2 for overall layout of the Blanchardstown to City Centre CBC.

Figure 2: Blanchardstown to City Centre CBC

The Proposed Scheme has been broken into five sections as follows:

- N3 Blanchardstown Junction to Snugborough Road
- Snugborough Road to N3/M50 Junction
- N3/M50 Junction to Navan Road/Ashtown Road Junction
- Navan Road/Ashtown Road Junction to Navan Road/Old Cabra Road Junction
- Navan Road/Old Cabra Road Junction to Ellis Quay

1.2 Scope and Objective of the Report

This GIR has been prepared in accordance with IS EN 1997-1:2005 'Eurocode 7: Geotechnical Design – Part 1: General Rules' and. IS EN 1997-2: 2007 'Eurocode 7: Geotechnical Design – Part 2: Ground Investigation and testing'. This GIR contains information for the Proposed Scheme only.

The purpose of the GIR is to:

- Present a review of desk study and existing ground investigation information relevant to the project.
- Summarise details of the existing ground investigations undertaken and the available geotechnical information.
- Present the interpreted ground conditions and material properties for the main geological units encountered across the scheme.

This GIR has been prepared for the purposes of informing the preliminary design only and is not intended to be used for detailed design.

1.3 Geotechnical Category of the Project

The project has been identified as a Geotechnical Category 2 scheme in accordance with IS EN 1997-1:2004. Geotechnical Category 2 is defined as a project which includes "conventional types of geotechnical structures, earthworks and activities, with no exceptional geotechnical risks, unusual or difficult ground conditions or loading conditions".

1.4 Study Area

The study area includes the proposed alignment and the immediate surrounding area, as shown in the site location plans presented in Appendix A.

Structures in the study area are listed below:

- Retaining Walls
 - Retaining Wall 01 (RW01), 270m long and max 3.0m height approximate ITM coordinates 706861:E, 739684:N
 - Retaining Wall 03 (RW03), 100m long and max 4.0m height approximate ITM coordinates 709301:E, 737937:N
 - Retaining Wall 07A (RW07A), 100m long and max 1.5 height approximate ITM coordinates 710202:E, 737440:N
 - Retaining Wall 07B (RW07B), 250m long and max 3.0m height approximate ITM coordinates 710202:E, 737440:N
 - Retaining Wall 09 (RW09), approximate ITM coordinates 708752:E, 738337:N. RW09
- Bridges
 - Tolka River Bridge Widening (BR01), approximate ITM coordinates 708240:E, 738731:N

 Mill Road Bridge Widening (BR02), approximate ITM coordinates 707796:E, 739014:N

1.5 Symbols and Abbreviations

The following symbols and abbreviations are used to define the ground properties:

- NMC Natural moisture content, as encountered on-site in the soil, in %
- MC Moisture content, in %
- LL Liquid Limit, in %
- PL Plastic Limit, in %
- *I_p* the soils plasticity index
- $c_{\rm u}$ undrained shear strength, in kPa
- f' effective angle of shearing resistance, in degrees
- f'_p peak effective angle of shearing resistance, in degrees
- f'_{cv} is the soils constant volume angle of shearing resistance, in degrees
- f'_{dil} is the contribution to φ'_{pk} from soil dilatancy, in ° (degrees)
- c' drained cohesion, in kPa
- γ –unit weight density, in kN/m³
- γ '-submerged unit weight density, in kN/m³
- γ_{sat} –submerged unit weight density, in kN/m³
- γ_b –bulk unit weight density, in kN/m³
- m_v Coefficient of volume compressibility, in m²/MN
- *E* Young modulus, Elastic modulus, in MPa
- E_{uv} Undrained elastic modulus, in MPa
- *E'v* Drained Young modulus, in MPa
- M-Constrained modulus, in MPa
- u Poisson's ratio, unitless
- SPT Standard Penetration Test, results expressed using "N"
- N uncorrected SPT readings, in blows/300mm.
- CBR California Bearing Ratio, results expressed in %
- DCP Dynamic Cone Penetrometer
- DPH Dynamic Probe Heavy, results expressed using "N100"

 $DPSH-Dynamic\ Probe\ Super-Heavy,\ results\ expressed\ using\ ``N_{100}''$

 N_{100} - in blows/100mm.

2 Existing Information

2.1 Sources of Information

The site setting and geotechnical information for the site were interpreted from both publicly available information and from the site specific ground investigation carried out from October 2020 to March in 2021 by GII Ltd. (Project No:9754-07-20 R5, Rev D, 18.June.2021). The project specific ground investigation report is given in Appendix D.

The publicly available sources of information reviewed are as follows:

- Geological Survey of Ireland (GSI) (<u>www.gsi.ie</u>):
 - Bedrock map;
 - Quaternary Sediments;
 - Quaternary Geomorphology;
 - GeoUrban Unconsolidated Sediments;
 - GeoUrban Depth to Bedrock;
 - Groundwater Aquifer;
 - Groundwater Recharge Map;
 - o Groundwater well database;
 - Groundwater vulnerability;
 - Subsoil Permeability Map
 - Karst landforms database;
 - Mineral locations map;
 - Quarry locations map;
 - Historical Geotechnical boreholes.
- Environmental Protection Agency (EPA) Map Viewer (https://gis.epa.ie/EPAMaps/):
 - Soils (National);
 - Subsoils (National);
 - River Waterbodies
- Aerial images and mapping:
 - Ordnance Survey of Ireland (http://map.geohive.ie/mapviewer.html) mapping;
 - Bing maps (www.bing.com/maps) aerial photography and mapping (licensed); and
 - Google maps (www.google.com/maps) aerial photography online mapping.
- Rivers of Dublin (C.L. Sweeney, 1991)

2.2 Topography

The EPA contour map shows that the alignment slopes from approximately 60m OD at Blanchardstown Road down to 40m OD at Old Cabra Road.

Then, the elevation continues dropping further reaching the 10m OD contour close to River Liffey.

2.3 Geological Maps and Memoirs

2.3.1 Quaternary Sediments

The GSI Quaternary Geomorphology map shows several glacial features, the majority of which are noted at the northern part of the proposed route. A glaciofluvial terrace is present under the N3 at Blanchardstown, immediately north and south of Junction 3. An historic meltwater channel underlies the River Tolka. Hummocky sands and gravels intersect the CBC at the Junction of Blanchardstown Road South and Blakestown Way to the west of Blanchardstown Shopping Centre. Another glaciofluvial terrace intersects the CBC at Junction 2 of the N3 and extends east and west underlying the Tolka River Valley Park and the green urban area north east of Main Street in Blanchardstown. A localised pocket of hummocky sands and gravels is recorded underlying the N3 at Talbot Court south of the N3/M50 Junction. Going further south, a glaciofluvial terrace is present east of the N3/M50 Junction underlying New River Road to River Road. The last glacial feature (glaciofluvial terrace) intersects the CBC along the R805 between King Street North and Blackhall Court.

The GSI Quaternary Subsoil map shows that the alignment is underlain mainly by Till derived from Limestone with localised areas of Gravels derived from Limestone and Alluvium. Along the River Tolka pockets of Gravels derived from Limestone, Alluvial deposits and bedrock subcrop/outcrop are noted. Gravels derived from Limestone intersect the CBC west of Blanchardstown Shopping Centre, at St. Brigid's Church Blanchardstown, at Talbot Court south of the N3/M50 Junction and on the eastern side of the N3/M50 Junction. There is a large pocket of Alluvium which intersects the CBC west of Nephin Road, Cabra. Moving further south towards city centre Gravels derived from Limestone are recorded along King Street North. A pocket of alluvium intercepts the CBC at Hendrick Street to Ellis Quay and the area underlying Croppies Acre Memorial Park. Urban fill is recorded from King Street North to the River Liffey.

The Geological Survey of Ireland (GSI) Quaternary map is presented in Appendix A.

2.3.2 Solid Geology

The GSI Bedrock Geology 100k map states that the rock type along the examined route is calcareous Shale of Tober Colleen Formation and Limestone of Lucan Formation (locally known as Calp Limestone). The Tober Colleen Formation is shown at two locations along the proposed route. The first location is north east of Blanchardstown Shopping Centre.

The second location extends from approximately Mill Road underpass to N3/M50 Junction. The Lucan Formation is shown to be present along the remaining part of the proposed route. The GSI Bedrock Geology 100k map shows two faults crossing the examined route.

The former is noted close to Blanchardstown Shopping Centre and the latter at M50 Junction. An anticline fold structure is shown to intersect the CBC adjacent to Talbot Court south of the Navan Road. The GSI Depth to Bedrock map presents rockhead to typically range from 0 to 10m BGL apart from the northern and southern ends of the alignment where it increases up to 15 and 20m BGL, respectively.

There are no karst features identified within Proposed Scheme in the GSI karst database.

The GSI Bedrock Geology map is presented in Appendix A.

2.4 Historical Maps and Aerial Photos

Historical maps of the site and surrounding area available from the Ordnance Survey of Ireland, have been reviewed to provide historical information for the project. The maps can be viewed online with Ordnance Survey Ireland's map viewer (<u>http://map.geohive.ie/mapviewer.html</u>). The following maps have been studied:

- Ordnance Survey of Ireland (OSI) 6-inch mapping series, 1:5000, 1837-1842.
- Ordnance Survey of Ireland (OSI) 25-inch mapping series, 1:5000, 1888-1913.
- Ordnance Survey of Ireland (OSI) 6-inch Cassini mapping series, 1:5000, 1830-1930.
- Ordnance Survey of Ireland (OSI) 1995 aerial photography
- Ordnance Survey of Ireland (OSI) 2000 aerial photography
- Ordnance Survey of Ireland (OSI) 2005 aerial photography

N3 Blanchardstown Junction to Snugborough Road

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with a small number of scattered developments. Three gravel pits are located on the eastern bank of the River Tolka and to the north of Snugborough Road. Another gravel pit is located beneath the current footprint of the Snugborough Road bridge over the N3.

The OSI 25-inch mapping (between 1888 and 1913) shows no notable increase in development within the study area, however the 6-inch Cassini shows a small increase in development including the Coolmine Cottages to the north of the N3 Junction 3.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution.

Significant urban development is recorded in the study area with large housing estates located to the north west of the R121 (Blanchardstown Road South) and to the north east of the Tolka River. The construction of the Blanchardstown Centre is also evident.

The 2000 OSI aerial photography shows an increase in residential development to the north and west of the N3 Junction 3 as well as the constructed Blanchardstown Centre.

The 2005 OSI aerial photography imagery shows further residential development to the north and west of the N3 Junction 3.

The 2019 Google Maps aerial imagery shows no notable change in land use from the OSI 2005 aerial photography.

Snugborough Road to N3/M50 Junction

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with scattered developments mostly in the vicinity of Blanchardstown Village. Four gravel pits are located in the River Tolka Valley Park on the northern bank of the River Tolka and south of Waterville Road. A corn mill was located on the northern bank of the River Tolka at the Mill Road. A worsted mill was located on the northern bank of the Royal Canal on the Old Navan Road. A quarry was located at Ashleigh Green and another quarry was located under the footprint of the N3/M50 Junction roundabout.

The OSI 25-inch mapping (between 1888 and 1913) shows an increase in residential development around Blanchardstown Village and an increase in industrial development around the Royal Canal. The Midland Great Western Railway runs parallel with the Royal Canal west of the N3/M50 Junction. A corn mill was located on the northern bank of the River Tolka at the Mill Road. A Margarine factory was located on the northern bank of the Royal Canal at the Old Navan Road. Disused gravel pits were located on the northern side of the River Tolka at the eastbound N3 slip road and beneath the current footprint of the N3. A gravel pit was located on the northern bank of the River Tolka south of Waterville Road. A quarry was located beneath the footprint of the N3.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. Significant urban development is recorded in the study area south of the N3. The construction of the M50 is also evident.

The 2000 OSI aerial photography shows an increase in residential development to the south of the N3. A construction site is evident in the land around Tory Square. Connolly Hospital occupies a significant area of land to the north of the N3. The construction of the M50 north and southbound is completed.

The 2005 OSI aerial photography imagery shows further development to the north of the N3 north of Waterville Road and within the grounds of Connolly Hospital.

The 2019 Google Maps aerial imagery shows an increase in road infrastructure around the N3/M50 Junction. Landscaping of Waterville Park is completed with the installation of a pond.

N3/M50 Junction (Junction 6) to Navan Road/Ashtown Road Junction

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with scattered developments. A quarry was located west of Phoenix Park Avenue. An oil mill was located on Mill Lane.

The OSI 25-inch mapping (between 1888 and 1913) shows very little increase in residential development in the study area with notable development in commercial and industrial uses. South of the Navan Road the land use changed from agricultural land to the Phoenix Park Club Racecourse. The Ashtown Oil Mills are located at Mill Lane. The Midland Great Western Railway runs along the bank of the Royal Canal which is within the study area between the N3/M50 Junction (Junction 6) and the Navan Road/Ashtown Road Junction.

The 6-inch Cassini mapping shows further industrial development west of Mill Lane with a Polish factory and Ashtown Tin Box Manufactory. A burial ground was located on River Road east of the M50.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. Significant urban development is recorded in the study area south of the N3/M50 Junction. The construction of the M50 is also evident.

The 2000 OSI aerial photography shows an increase in residential development to the south of the N3 between the N3/M50 Junction and Castleknock Manor and industrial and commercial development west of Ashtown Road. The Phoenix Racecourse buildings have been demolished and the land within the study area retuned to grassland.

The 2005 OSI aerial photography imagery shows some further development in the study area the most notable of which being the construction site west of Castleknock Road on the site of the former Phoenix Racecourse.

The 2019 Google Maps aerial imagery shows an increase in road infrastructure around the N3/M50 Junction and the increase in development west of Castlenock Road.

Navan Road/Ashtown Road Junction to Navan Road/Old Cabra Road Junction

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with scattered dwellings.

The OSI 25-inch mapping (between 1888 and 1913) shows a slight increase in mixed development throughout the study area. A graveyard was located on the Navan Road at St Joseph's School for Deaf Boys and a military cemetery was located south of Slemish Road

The 6-inch Cassini mapping shows further development particularly between Baggot Road and the Navan Road/Old Cabra Road Junction. The military cemetery is still evident south of Slemish Road.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. Significant urban development is recorded in the study area. Undeveloped areas include Phoenix Park and Pope John-Paul Park as well as a number of sports grounds.

The 2000 OSI aerial photography shows an increase in residential development east of Kinvara Avenue and commercial development west of Dunard Road.

The 2005 OSI aerial photography imagery shows some no notable further development in the study area compared to the 2000 OSI aerial photography.

The 2019 Google Maps aerial imagery no notable further development in the study area compared to the 2005 OSI aerial photography.

Navan Road/Old Cabra Road Junction to Ellis Quay

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with scattered dwellings between the Navan Road/Old Cabra Road Junction and the North Circular Road. Between the North Circular Road and Brunswick Street North there is an increase in the density of development and between Brunswick Street North and Ellis Quay the area comprises predominantly urban development.

The OSI 25-inch mapping (between 1888 and 1913) shows a significant increase in urban development in the study area, particularly to the south of the Old Cabra Road between North Circular Road and Brunswick Street. The Amiens Street & North Wall Branch railway line transects the Proposed Scheme east of the Navan Road/Old Cabra Road Junction. A tramway transects the Proposed Scheme at North Circular Road. A sawmill was located on Brunswick Street North. A Scavenging Depot and Destructor and a Malt House were located on Stanley Street. A tramway ran from the Scavenging Depot and Destructor on Stanley Street, along North Brunswick Street, Georges Lane and down Queen Street and onto Ellis Quay. A tramway also ran along Ellis Quay. A graveyard was located south of Kings Street North and another west of Ard Ri Place. A cattle market and abattoir were located on the North Circular Road

The 6-inch Cassini mapping shows significant development between the Navan Road/Old Cabra Road Junction and the North Circular Road. The cattle market and abattoir identified on North Circular Road in the OSI 25-inch mapping are also identified on the Cassini mapping.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. The photo shows an increase in residential development south of the Old Cabra Road Junction and in the place of the cattle market off North Circular Road.

The 2000 OSI aerial photography shows some no notable further development in the study area compared to the 2000 OSI aerial photography.

The 2005 OSI aerial photography imagery shows some no notable further development in the study area compared to the 2000 OSI aerial photography.

The 2019 Google Maps aerial imagery no notable further development in the study area compared to the 2005 OSI aerial photography

Historical maps of the site and surrounding area is presented in Appendix A.

2.5 **Records of Mines and Mineral Deposits**

The GSI Bedrock Active and Historic Pits and Quarries database states that there are multiple historic quarries and pits which intersect or are near the alignment between Blanchardstown Road and the M50. There are no active quarries or pits shown near the alignment

The GSI Mineral Localities database states that there are no mineral localities within proximity to the alignment with the closest one approximately 850m offset.

GSI Mineral Localities map is presented in Appendix A.

2.6 Land Use Information

N3 Blanchardstown Junction to Snugborough Road

The Corine Land Cover 2018 classifies the land use of the study area between the N3 Blanchardstown Junction to Snugborough Road as a discontinuous urban fabric, with sections being described as industrial-commercial units and green urban areas. The green urban areas include the Tolka Valley Park and Millennium Park located within the study area and the industrial and commercial units area include for the Blanchardstown Shopping Centre. The N3 itself is classified as road and rail network.

Snugborough Road to N3/M50 Junction

The Corine Land Cover 2018 classifies the land use of the study area between Snugborough Road and the N3/M50 Junction as predominantly discontinuous urban fabric. Green urban areas include the Tolka Valley Park and the N3 itself is classified as road and rail network.

N3/M50 Junction (Junction 6) to Navan Road/Ashtown Road Junction

The Corine Land Cover 2018 classifies the land use to the south of the Navan Road between the N3/M50 Junction (Junction 6) and the Navan Road/Ashtown Road Junction as predominately discontinuous urban fabric with a large area north of Deerpark Drive classified as green urban areas. The area to the north of the Navan Road is classified as land principally occupied by agriculture with significant areas of natural vegetation

Navan Road/Ashtown Road Junction to Navan Road/Old Cabra Road Junction

The Corine Land Cover 2018 classifies the land use in the study area between Navan Road/Ashtown Road Junction and Navan Road/Old Cabra Road as predominately discontinuous urban fabric. The area to the south of Blackhorse Avenue is classified as green urban areas.

Navan Road/Old Cabra Road Junction to Ellis Quay

The Corine Land Cover 2018 classifies the land use in the study area between Navan Road/Old Cabra Road Junction and the railway line as predominately discontinuous urban fabric.

The land use between the railway line and Ellis Quay is predominately continuous urban fabric with an area of green urban fabric to the east at TU Dublin, Grangegorman Campus.

2.7 Archaeological and Historical Sites

The National Inventory of Architectural Heritage (NIAH) database states that there are

- Nine NIAH sites within 30m of the alignment north of Old Cabra Road, these include three bridges, two church/chapel, one gate lodge, one workhouse, one gates/railings/walls, one post box.
- 89 No. NIAH sites within 30m of the alignment south of Old Cabra Road

The National Monuments (DAHG) database states that there are three DAHG sites within 30m of the alignment, these include one Mill, one House -18th/19th century and one bowling green.

2.8 Hydrology and Hydrogeology

The GSI Groundwater Aquifer map states that the proposed alignment is mainly underlain by a locally important aquifer described as bedrock which is moderately productive only in local zones. The northern part of the proposed alignment is also underlain by a poor aquifer where bedrock is generally unproductive except for local zones. A fault crosses the proposed route between Snugborough and Blanchardstown Road. According to the relevant GSI map the groundwater vulnerability varies highly. The groundwater vulnerability is classified as low at the southern section of the proposed alignment changing to moderate at approximately the corner of Cabra and Old Cabra Road. North to Ashtown Roundabout it appears as high. Extreme groundwater vulnerability is noted northwest to Phoenix Park Avenue, at M50 Roundabout, around Mill Road, close to Snugborough Road and at the northern section of the proposed route. Areas where rock at or near surface are sporadically presented at the northern part of the proposed alignment. Based on the relevant GSI map the subsoil permeability is typically classified as low. High subsoil permeability is noted in a localised area between M50 Roundabout and Snugborough Road. The GSI Wells and Springs map shows a feature (borehole) approximately 350m east of Stoneybatter. Another well, also presented as borehole, is noted around 850m south of the M50 Roundabout.

The GSI Groundwater vulnerability map, Subsoil Permeability map, Wells and Spring maps and Groundwater Aquifer map is presented in Appendix A.

2.9 Contaminated Land

The works will mostly be carried out in made ground since most of the alignment is classified as discontinuous urban fabric, with sections being described as industrial-commercial units and green urban areas. Also, there are multiple historic quarries and pits close to the alignment and made ground is mentioned in the recent and historical boreholes.

In the recent ground investigation carried out from October 2020 to March 2021 by GII Ltd. (Project No:9754-07-20 R5, Rev D, 18.June.2021), geoenvironmental testing was undertaken on 22 No. samples, in natural ground and made ground, from eight ground investigation locations. No signs of contamination were noted on borehole, trial pit and slit trench logs and all environmental test results suggest an 'Inert' Waste Acceptance Criteria (WAC) classification.

However, the ground investigations do not cover the whole alignment and contamination is a possibility. Potential sources are listed below and presented in Appendix A.

- Circle K (Blanchardstown, Ashtown, Brady's,)
- Navan road parkway station
- Phoenix industrial estate
- Gowan (Navan Road)
- Train line
- Go Station
- Maxol (Navan Road)
- MSL Motors
- Park Rite
- Tramline
- The park motor centre
- Prussia auto centre
- Polycar Ireland
- James Gas Station
- Old quarry/gravel pits
- Old Ford site
- Old worsted
- Old oil mill
- Old factories

2.10 Seismicity of the Area

Ireland lies in an area of very low tectonic activity with few seismic events in the last 30 years. From the data collected by the Irish National Seismic Network (INSN) the following number of seismic events have been registered since 1980 in Ireland and nearby areas in the UK:

- 32 No. Negligible ($M_L \leq 1.0$);
- 50 No. Micro $(1.0 \le M_L \le 1.9);$
- 24 No. Minor $(2.0 < M_L \le 3.9)$;
- 2 No. Light ($4.0 < M_L \le 4.9$);

1 No. Moderate $(5.0 \le M_L \le 5.9) - M_L = 5.4$ in Lleyn Peninsula, Wales, 1984.

Where M_L is the Richter magnitude scale of the earthquake.

Based on the information above it is considered that the area presents a low risk for seismic events affecting the planned development and therefore there is no further assessment required regarding seismicity of the site.

3 Field and Laboratory Studies

3.1 Historical Ground Investigation

Historical Ground investigations have been carried out on the site between 1970 and 2006. Some historical ground investigation years are unknown.

The ground investigations available for the site are listed in the table below. 40m offset from the centreline was adopted to use select historical ground investigation data.

GSI Report ID	Title	Year	Author	Location	Used GI
R67	Housing Development	1980	Irish Soils Laboratories Ltd.	Blakestown Section 2A Blanchardstown Dublin 15	1 Trial pits
R5614	River Tolka Flood Alleviation Works	Unknown	Unknown	Finglas Dublin 15	2 CablePercussionboreholes2 Atterbergand MoistureContent2 PSD
R461	Greater Dublin Drainage Scheme	1968	Unknown	Grand Canal to Blanchardstown Dublin 15	2 boreholes (drilling type unspecified)
R717	North Eastern Pipeline	1984	Site investigations Ltd.	Brown's barn – Abbotstown Co. Dublin	1 Trial Pits, 2 Cable Percussion Boreholes,
R5619	Commercial Development	Unknown	Unknown	Phoenix Park Racecourse	4 Cable Percussion Boreholes and 2 Trial Pits

Table 1: Historical ground investigations (GSI)

GSI Report ID	Title	Year	Author	Location	Used GI
					4 Atterberg and Moisture Content
					2 PSD.
R5709	Commercial Development	Unknown	Unknown	Black Hall Place Dublin 7	2 Cable Percussion Boreholes
R3743	Development	Unknown	Unknown	Black Hall Place Dublin 7	2 Cable Percussion Boreholes
R3880	Law Society Premises	Unknown	Unknown	Blackhall Place Smithfield Dublin 7	4 Cable Percussion Boreholes
R838	Lark Homes Apartments, Ellis Quay.	1990	IGSL	Ellis Quay Dublin	5 Boreholes
R2161	Proposed new Liffey bridge	1999	IGSL	River Liffey Blackhall Place Dublin	1 Percussion Borehole 1 PSD 2 UCS 2 Point Load
R745	Housing at Queen Street	1984	Site Investigations Ltd.	Queen Street Dublin 7	1 Cable Percussion Borehole and 2 Trial Pits.
R3919	Residential Development	Unknown	Unknown	Queen Street Dublin 7	5 Cable Percussion boreholes 2 Atterberg
					and Moisture Content
					5 PSD

GSI Report ID	Title	Year	Author	Location	Used GI
R210	Leisure Centre Blanchardstown	1996	IGSL	Blanchardstown Dublin	2 Trial Pits
R742	Redevelopment at Benburb Street	1985	Site Investigations Ltd.	Benburb Street	6 Boreholes
R2158	Arran Quay Terrace	1999	IGSL	Arran Quay Terrace, Dublin	6 Boreholes
R6617	Blanchardstown Hotel and Apartment Complex	2006	IGSL	Blanchardstown S.C	6 Boreholes6 Atterberg and Moisture Content3 PSD

3.2 Recent Ground Investigation

This section details the recent ground investigation carried out from October 2020 to March in 2021 by GII Ltd. (Project No:9754-07-20 R5, Rev D, 18.June.2021).

Table 2, 3, and 4 summarise the exploratory holes, in situ testing and laboratory testing for the 2021 ground investigations, respectively. A specific assessment of the results will be presented in further sections.

Quantity
3 no.
no.
o no.
5 r

Table 2: Summary of exploratory holes carried out for the recent ground investigation

*2 No of standpipe was installed to 1 cable percussive followed by rotary core and a rotary core borehole.

Table 3: Summary of in situ testing carried out for the recent ground investigation

In situ Testing	Quantity
Standard Penetration Test	51 no.

Table 4: Summary of laboratory testing carried out for the recent ground investigation

Laboratory Testing	Quantity
Moisture Content	9 no.
Particle Size Distribution	7 no.
Atterberg Limits	7 no.
Organic Matter	2 no.
Geo - Environmental Testing (WAC Assessment)	22 no.
Unconfined Compressive Strength	11 no
Point Load	22 no

4 Preliminary Geotechnical Design Parameters

This section provides an interpretation of the ground conditions across the alignment and outlines the methodology used to derive the different parameters. Results from previous works and published papers on Dublin Boulder Clays (Long & Menkiti, 2007a, Long & Menkiti, 2007b) and Irish Glacial soils (Hanrahan, 1977) are used to compare the obtained values and, in some cases, where the available data is limited, to derive the relevant values. Similarly, for the bedrock, published values for Limestone bedrock was researched in rock mechanics literature (Goodman 1989, Wyllie 2005) and used.

4.1 Topsoil

Topsoil is encountered in most of the exploratory locations and generally described brown to greyish brown to dark greyish brown slightly sandy slightly gravelly with occasional to frequent rootlets. The general thickness of the topsoil is 0 to 0.6m.

No interpretation is required for Topsoil. Wherever encountered within the earthworks footprint, it will be removed.

4.2 Made Ground

The made ground is encountered at 52 No. out of 78 No. ground investigation locations. From the descriptions, it is likely reworked glacial till. Waste material, such as brick, concrete and plastic, is recorded in 25 No. of the 52 No. made ground locations. Made ground that does not contain waste could potentially be reused as fill, subject to an assessment of the material properties at each area of excavation.

The thickness of the made ground except Navan Road/Old Cabra Road Junction to Ellis Quay section is variable from 0.4m to 5m but is typically 2m. Thickness of made ground at Navan Road/Old Cabra Road Junction to Ellis Quay section is variable from 4m to 7.8m but is typically 2.5m.

A general description of the made ground, except for the Navan Road/Old Cabra Road Junction to Ellis Quay section, is brown to greyish brown to brownish grey to grey, slightly sandy slightly gravelly to gravelly Clay with some angular to subangular cobbles, occasional boulders, occasional rootlets. Occasional fragments of plastic, rope, concrete, wood, cloth, tarmacadam, brick and organic matter noted in a few exploratory locations. At some locations the made ground is described as brown gravelly clayey fine to coarse Sand with occasional angular to subrounded cobbles, rootlets and occasional fragments of metal, plastic and red brick.

The description of the made ground at Navan Road/Old Cabra Road Junction to Ellis Quay, based on historical ground investigation data, is that it comprises red brick, silt and gravel.

Due to the variability of the thickness and composition of the made ground, more ground investigation is recommended for detail design.

4.2.1.1 Classification

The laboratory testing for made ground is presented in Appendix C.

The Natural Moisture Content (NMC) is determined from ten samples and Atterberg limits are determined from six samples. The NMC of the made ground ranges from 6% to 38%. The average NMC for the made ground is 14%. The average liquid limit is 37% with a minimum limit of 30% and maximum of 54%. The average plastic limit is 21% with a minimum limit of 17% and a maximum of 28%. The average plasticity index is 16% with a minimum plasticity index of 12% and a maximum of 26%. Cohesive made ground is described as low to high plasticity clay.

The PSD test was carried out for two samples. The PSD curves for the cohesive deposits have a fines content greater than 6% and 52% passing the 0.063mm sieve, with 20% to 83% gravel.

4.2.1.2 Unit Weight

In accordance with BS8002:2015, a unit weight of 17kN/m³ is above the groundwater table and 18kN/m³ below the groundwater table adopted for made ground to be conservative.

4.2.1.3 Standard Penetration Tests

In total, ten Standard Penetration Tests (SPT) were carried out on the made ground. The range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values typically ranged from 4 to 10, with an average of 5. SPT results of R05-CP03 are refusal due to existence of bricks. Base on this SPT values of R05-CP03 are ignored.

4.2.1.4 Undrained Shear Strength

Laboratory testing was not conducted on samples of made ground. Therefore, reference was made to Table 9 of BS5930:2015 and Stroud and Butler (1975), the undrained shear strength has been estimated based on the following:

• $c_u = f_1 \times N$ (kPa) (f_1 has conservatively been taken as 5.5kPa based on the range of plasticity index test results).

The undrained shear strength (cu) is determined as 25kPa.

4.2.1.5 Effective Stress Parameters

Laboratory testing was not conducted on samples of made ground.

To be conservative an effective angle of shearing resistance of made ground accepted as alluvium.

4.2.1.6 Soil Stiffness

The soil undrained stiffness (Eu) can be calculated based on the relationship with undrained shear strength. Jamiolkowski (1979) suggests a value of Eu between 200 cu and 1000 cu. In the examined case the Eu will be calculated as follows:

Eu' = 200 x cu = 4MPa

The drained stiffness (E') can be approximated by taking 80% of this value which leads to a value of

E' = 3MPa

4.3 Cohesive Deposits

4.3.1 Glacial Till Deposits

Local glacial till deposits are known as Dublin Boulder Clay which is a subdivision of Till derived from Limestone. It is encountered in the majority of the exploratory locations, except some parts of the Navan Road/Old Cabra Road Junction to Ellis Quay section.

A general description of the glacial till is firm to very stiff, brown to light brown to greyish brown to light grey to grey, slightly sandy to sandy, slightly gravelly to gravelly Clay with occasional cobbles. The thickness of the glacial till is variable between 0.3 m to 10m. The typical thickness of the glacial till is 2.5m.

4.3.1.1 Classification

The laboratory testing for glacial till deposits are presented in Appendix B

The Natural Moisture Content (NMC) and Atterberg limits were determined for 15 No. samples. The NMC of the glacial till deposits ranges from 10% to 34%. The average NMC for the alluvial material is 14%. The average liquid limit is 32% with a minimum limit of 20% and maximum of 62%. The average plastic limit is 17% with a minimum limit of 10% and a maximum of 39%. The average plasticity index is 15% with a minimum plasticity index of 8% and a maximum of 25%. Cohesive material is described as high plasticity silt and low to high plasticity clay.

The PSD test was carried out for seven samples. The PSD curves for the cohesive deposits have a fines content greater than 26% and 64% passing the 0.063mm sieve, with 15% to 46% gravel.

4.3.1.2 Unit Weight

In accordance with BS8002:2015, a clay with high to very high undrained shear strength, like the one examined herein, has a weight density which typically varies from 18 to 24kN/m³. A value of 21kN/m³ is adopted.

4.3.1.3 Standard Penetration Tests

In total, 23 No. Standard Penetration Tests (SPT) were carried out on the cohesive deposits in boreholes. The range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values ranged from 28 to refusal, except for a value of 11 within the first 5m of a borehole at Auburn Avenue.

4.3.1.4 Undrained Shear Strength

Laboratory testing was not conducted on samples of cohesive deposits. Therefore, reference was made to Table 9 of BS5930:2015 and Stroud and Butler (1975), the undrained shear strength has been estimated based on the following:

• $c_u = f_1 \ge N$ (kPa) (f₁ has conservatively been taken as 5.5kPa based on the

A general undrained shear strength (cu) for the alignment and a specific undrained shear strength (cu) for Auburn Ave are determined.

- The general undrained shear strength (c_u) for the alignment is determined as 165kPa
- The undrained shear strength (c_u) at Auburn Ave is 60kPa

4.3.1.5 Effective Stress Parameters

Laboratory testing was not conducted on samples of cohesive deposits.

Long and Menkiti (2007) report a value of 44° for the peak compressive angle of shearing resistance (ϕ'_p) for all formations of the Dublin Boulder Clay. Long and Mentiki (2007) also report a value of 36° for the critical state angle of shearing resistance (ϕ'_{cs}). This value of ϕ'_{cs} compares favourably with the findings of Lehane and Faulkner (1998) and Farrell and Wall (1990) who report values of 34°±1° and 35° respectively. In all cases a c'= 0kPa is recommended.

Taking the above into account, a value of $\phi'_p = \phi'_{cs} = 32^\circ$ is chosen for preliminary design.

4.3.1.6 Soil Stiffness

For stiff consolidated clays, the soil undrained stiffness (Eu) can be calculated based on the relationship with undrained shear strength. Jamiolkowski (1979) suggests a value of Eu between 500 cu and 1000 cu. In the examined case the Eu will be calculated as follows:

- $E_u = 500 \text{ x } c_u = 80 \text{MPa}$
- $E_u = 500 \text{ x } c_u = 30 \text{MPa}$

The drained stiffness (E') can be approximated by taking 80% of this value which leads to a value of approximately 64MPa and 24MPa.

4.3.1.7 In-situ Stress

No in situ testing or laboratory testing in which K_0 is directly or indirectly measured was carried out as part of the GI. Long & Menkiti (2007) recommended a K_0 value in the range of 1.0 to 1.5 for design. Taking the above into account a value of 1.5 is chosen.

4.3.2 Alluvial Deposits

There are alluvial deposits at the Tolka River Bridge Widening and possibly at the old Phoenix Park Racecourse.

The thickness of the alluvium is 2.8m at the Tolka River Bridge Widening and the material is described as very soft to soft, brown, slightly sandy/gravelly Clay.

Alluvium was recorded in the historical borehole logs in the old Phoenix Park Racecourse. It is described as soft to very soft, brown to dark brown, slightly peaty gravelly Clay with cobbles and boulders. The thickness of the alluvium in this area is variable between 1.5 to 1.7m. Recent ground investigations did not record any alluvium. This suggests that the alluvium was removed for the construction of the road. There may be alluvium outside of the earthworks footprint of the existing road.

4.3.2.1 Classification

The laboratory testing for alluvium deposits is presented in Appendix C

The Natural Moisture Content (NMC) and Atterberg limits were determined for one sample. The NMC of the alluvium deposits is 20%. The liquid limit is 24%. The plastic limit is 15%. The plasticity index is 9%. Alluvium deposit is described as low plasticity clay.

4.3.2.2 Unit Weight

In accordance with BS8002:2015, a unit weight of 17kN/m3 is recommended for alluvial deposits above the groundwater table and 18kN/m3 below the groundwater table.

4.3.2.3 Standard Penetration Tests

In total, two Standard Penetration Tests (SPT) were carried out on the alluvium deposits in boreholes. The range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values are 3 and 6.

4.3.2.4 Undrained Shear Strength

Laboratory testing was not conducted on samples of cohesive deposits. Therefore, reference was made to Table 9 of BS5930:2015 and Stroud and Butler (1975), the undrained shear strength has been estimated based on the following:

• $c_u = f_1 \ge N$ (kPa) (f₁ has conservatively been taken as 5.5kPa based on the range of plasticity index test results).

The undrained shear strength (cu) is determined as 20kPa.

4.3.2.5 Effective Stress Parameters

Laboratory testing was not conducted on samples of alluvium. Therefore, reference was made to Section 4.3.1.4 of BS8002:2015.

An effective angle of shearing resistance of 27° is recommended for alluvial deposits based on the available plasticity index test results.

4.3.2.6 Soil Stiffness

The soil undrained stiffness (Eu) can be calculated based on the relationship with undrained shear strength. Jamiolkowski (1979) suggests a value of Eu between 200 cu and 1000 cu. In the examined case the Eu will be calculated as follows:

 $Eu' = 200 \times c_u = 4MPa$

The drained stiffness (E') can be approximated by taking 80% of this value which leads to a value of E' = 3MPa

4.4 Granular Deposits

Granular deposits are encountered at Blanchardstown Shopping Centre, Tolka River Bridge Widening, old Phoenix Park Racecourse and most of the Navan Road/Old Cabra Road Junction to Ellis Quay section.

Description of granular deposits at Blanchardstown Shopping Centre is Dense brownish grey sandy clayey Gravel. The thickness of the granular deposit is 0.6m.

The description of granular deposits at Tolka River Bridge Widening is grey, slightly clayey, sandy/gravelly, medium to coarse sub angular to sub rounded Gravel/Sand. The total thickness of the granular deposit is 16m. This description is based on the driller's description and these materials may include more cohesive material than is recorded.

Description of granular deposits at old Phoenix Park Racecourse is dense grey angular to subangular fine to coarse Gravel with some angular to subangular cobbles. The total thickness of the granular deposit is 0.5m.

Description of granular deposits at the Navan Road/Old Cabra Road Junction to Ellis Quay section is dense to very dense, brown to greyish brown, fine to coarse slightly sandy Gravel / gravelly Sand. Thickness of the granular deposit is variable between 1m to 11m with an average of 5m thickness.

4.4.1 Classification

The laboratory testing for granular deposits are presented in Appendix B.

The Natural Moisture Content (NMC) and Atterberg limits were determined for one sample. The NMC of the granular deposits is 10%.

The PSD test was carried out for six samples. The PSD curves for the granular deposits have a fines content less than 5% passing the 0.063mm sieve, with 75% to 95% gravel.

4.4.2 Unit Weight

Based on the available GI results, this stratum is typically described as gravel or sand below groundwater level. Most of the SPT N values are above 30 which, according to BS5930, corresponds to a dense layer. This leads to a γ value ranging between 19 to 23kN/m³ (BS8002: 2015). A value of 20kN/m³ is adopted.

4.4.3 Standard Penetration Tests

In total 34 No. Standard Penetration Tests (SPT) were carried out on the granular deposits in boreholes. The range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values typically ranged from 28 to refusal. In two areas SPT values are less than 28;

- Tolka River Bridge Widening. SPT values are 19 between 12mbgl and 16mbgl
- N3/M50 Junction. SPT value is 23 at 10m

4.4.4 Effective Stress Parameters

Peck *et al* established a relationship between the SPT N and critical state friction angle ($\varphi'_{cv,k}$) for coarse grained soils. Following from that a graph was introduced correlating the above parameters. Several SPT tests were completed within the Granular Deposits. The results ranged from 28 to above 50 (refusal). The factual report of the site specific ground investigation mentions that the lower values occurred due to blowing conditions. Thus, they will be ignored. The remaining SPT N values vary from 28 to above 50 with the majority of them exceeding a value of 30. This value is selected for the preliminary design. An SPT N value of 30 according to the graph mentioned above, corresponds to a $\varphi'_{cv,k}$ of approximately 36°.

A $\varphi'_{cv,k}$ value of 32° is selected for preliminary design. Due to the nature of this layer (coarse-grained) c'= 0kPa.

4.4.5 Soil Stiffness

For the estimation of the stiffness the following empirical relationship will be used:

E' = 1.5 SPT N (in MPa) which leads to an E' of 45MPa.

4.4.6 In-situ Stress

No in situ testing or laboratory testing in which K_0 is directly or indirectly measured was carried out as part of the GI.

In situ stress is determined with the approach presented in BS EN 1997-1:2004+A1:2013

 $K_0 = 1 - \sin \phi = 0.45^*$

* ϕ value is presented above as $\phi'_{cv,k}$

4.5 Bedrock

Bedrock was encountered in some of the historical ground investigations and all the recent ground investigation locations, apart from at the Tolka River Bridge Widening. The top of the bedrock is variable between 0.3m to 9.5m below ground level.

The bedrock is mainly described as medium strong to strong grey/dark grey fine to medium grained laminated Limestone, locally interbedded with weak black fine grained laminated Mudstone or Clay. Some of the bedrock is described as medium strong to strong thinly laminated dark grey fine grained calcareous Mudstone with occasional specs of pyrite, locally interbedded with grey fine grained Limestone.

Depth to bedrock map presented in "GeoUrban Depth to Bedrock (GSI)" is usually consistent with the top of the bedrock determined from the borehole logs, except at the Tolka River Bridge Widening. The depth to bedrock on the GeoUrban Depth to Bedrock (GSI) map is 3m to 5m below ground level. However, the top of the rock in the borehole is deeper than 35m.

4.5.1 **Rock Mass Description and Characteristics**

TCR (Total Core Recovery) is variable between 93% to 100% with an average 97%. The SCR (Solid Core Recovery) ranges between 14% to 100% with an average of 66%.

The RQD (Rock Quality Designation) ranges between 7% and 100% with average of 50%.

Fracture sets were described as Closely to Very closely spaced, locally Non Intact and medium spaced. Condition of the fractures are generally described as planar smooth with variable fracture angles, generally 10° to 30° and 40° to 60°.

The Fracture Index (FI) ranges from Mostly Non Intact (>25) to 1 with an average of 10.

4.5.2 Unit Weight

11 No. Unconfined Compressive Strength (UCS) tests were carried out on rock samples and Bulk Density were measured for each sample as a part of the test. Test results are is presented in Appendix C.

Based on the available GI results, the γ value is between 25kN/m³ to 28kN/m³. A value of 26kN/m³ is adopted.

4.5.3 Rock Strength

11 No. Unconfined Compressive Strength tests (UCS) and 22 No. Point Load tests were carried out on rock samples.

UCS test result range is between 15MPa to 59MPa.

Point Load Testing ($I_{s(50)}$) was determined on axial and diametral samples. The relationship UCS = f* $I_{s(50)}$ (MPa), where f = 20 (although may range between 20 and 24) is commonly used for Dublin Basin (Lucan Formation) Limestones and 23 for mudstone. To be conservative 20 is adopted for all samples. Point load test results ($I_{s(50)}$) are ranging between 0.8 to 8 (UCS=16MPa to 160MPa).

A value of 20MPa is adopted for Intact Uniaxial Compressive Strength.

Test results are is presented in Appendix C.

4.6 Stratigraphic Profile

The stratigraphic profile for the Proposed Scheme is summarised in Table 5, Table 6 and Table 7. In each profile the Cohesive Deposits and Granular Deposits are interbedded.

Stratum	Typical Depth (m BGL)	Typical Thickness (m)
Topsoil	0.0	0.0 to 0.2
Made Ground	0.0 to 0.2	1 to 3
Cohesive Deposits	0.2 to 3	3 to 8
Granular Deposits	0.2 to 8	0.0 to 0.5

Table 5: Summary of stratigraphic profile for the Proposed Scheme except NavanRoad/Old Cabra Road Junction to Ellis Quay and Tolka River Bridge Widening

Stratum	Typical Depth (m BGL)	Typical Thickness (m)
Bedrock	4 to 8	N/A

Table 6: Summary of stratigraphic profile for the Navan Road/Old Cabra Road Junction to Ellis Quay

Stratum	Typical Depth (m BGL)	Typical Thickness (m)
Topsoil	0.0	0.0 to 0.4
Made Ground	0.0 to 0.2	0 to 5
Cohesive Deposits	0.2 to 5	0 to 2
Granular Deposits	2 to 7	2 to 6
Bedrock	2 to 8	N/A

Table 7:	Summary of	f stratigraphic	profile for Tolka	River Bridge Widening
----------	------------	-----------------	-------------------	-----------------------

Stratum	Depth (m BGL)	Thickness (m)
Alluvium	0.0	2.8m
Cohesive Deposits	2.8 15.7 27.4	5.4 3 7.6
Granular Deposits	8.2 18.7 35	7.5 7.6 N/A

4.7 Groundwater

4.7.1 Summary of Groundwater Conditions

Groundwater data is presented in Table 8.

Table 8: Groundwater level data

Borehole	Date	Groundwater Level (m BGL)	Standpipe / Water strike/Observation Reading		
R5-RC01	09.04.2021	5.69	Standpipe		
R5-CP04	09.04.2021	3.02	Standpipe		
R838/B61972	13.02.1990	3	Water Strike		
R838/B61973	20.02.1990	3.8	Water Strike		
R838/B61974	19.02.1990	3	Water Strike		
R838/B61976	22.02.1990	3.75	Water Strike		
R5614/B135148	1.05.2004	6.3	Water Strike		
R5619/B135217	28.11.2003	2	Ground Water Observation		
R5619/B135218	29.11.2003	1.5	Ground Water Observation		
R5709/B135926	7.04.2004	11.50	Ground Water Observation		
R5709/B135927	05.04.20004	13.50	Ground Water Observation		
R2161/B81466	27.0.1999	3	Ground Water Observation		

Based on these groundwater measures, groundwater level for preliminary design should be taken as 2m below ground level.

4.8 Summary of Preliminary Design Parameters

A summary of the interpreted characteristic parameters for each stratum is presented in Table 9.

Stratum	γ (kN/m ³)	K ₀	c _u (kPa)	φ (°)	c´ (kPa)	UCS (MPa)	Eu (MPa)	E´ (MPa)	
Topsoil	No geotechnical parameters will be provided for these layers								
Made Ground	17	-	20	25	0	N/A	4	3	
Alluvium Deposits	17	-	20	25	0	N/A	4	3	
Glacial Till Deposits	21	1.5	165	32	0	N/A	80	64	
Granular Deposits	20	0.45	N/A	32	0	N/A	N/A	52.5	
Limestone/Mudstone	26		N/A	-	-	20	N/A	550	

Table 9: Summary of Interpreted Characteristic Parameters

5 Geotechnical Risk Register

This geotechnical risk register in Appendix F has been completed based on available existing information including that gained from compilation of this GIR.

It highlights the geotechnical risks and the consequence of those risks occurring. It contains proposed measures to mitigate the risks.

It does not cover health and safety risks unless specifically related to the geotechnical works. Risk control measures will, whenever possible, reduce all risks to an acceptable 'low' level.

The following risk ratings have been adopted:

Low Risk (LOW): No action required by Designer or Contractor

Medium Risk (MED): Action required unless good reason not to e.g. design change or construction mitigation measure

High Risk (HIGH): Action required e.g. design change

Geotechnical Risk Register is given in Appendix F.

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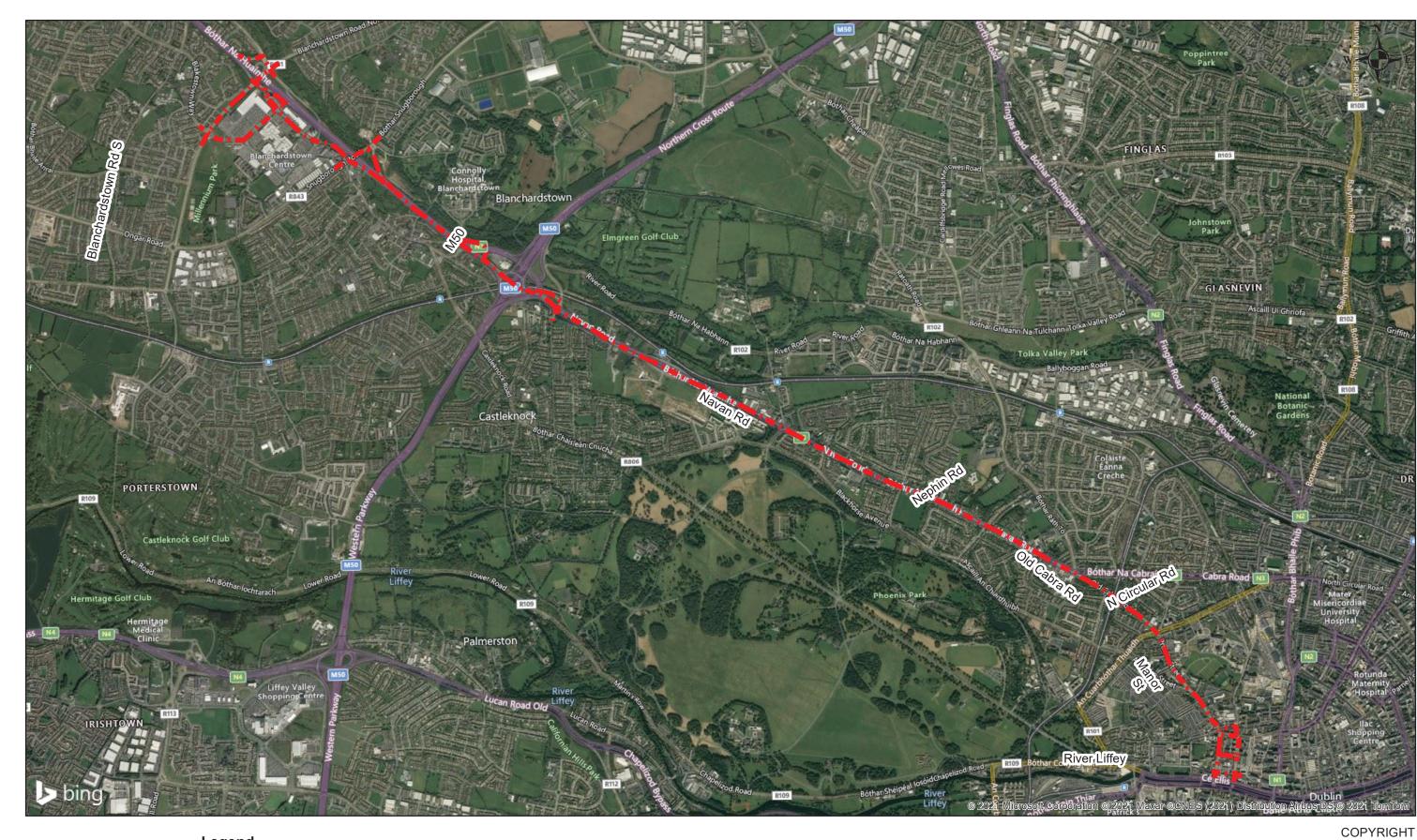
BS EN 1997-2: 2007 Euroceode 7: Geotechnical Design – Part 2 : Ground Investigation and testing

BS5930:2015. Code of Practice for Site Investigation

Hanrahan, E.T. (1977) "Irish glacial till:origin & characteristics" Foras Forbartha, Dublin. 164.

Appendix A

Ground Investigation Layout Plan and Geological Survey Ireland Maps

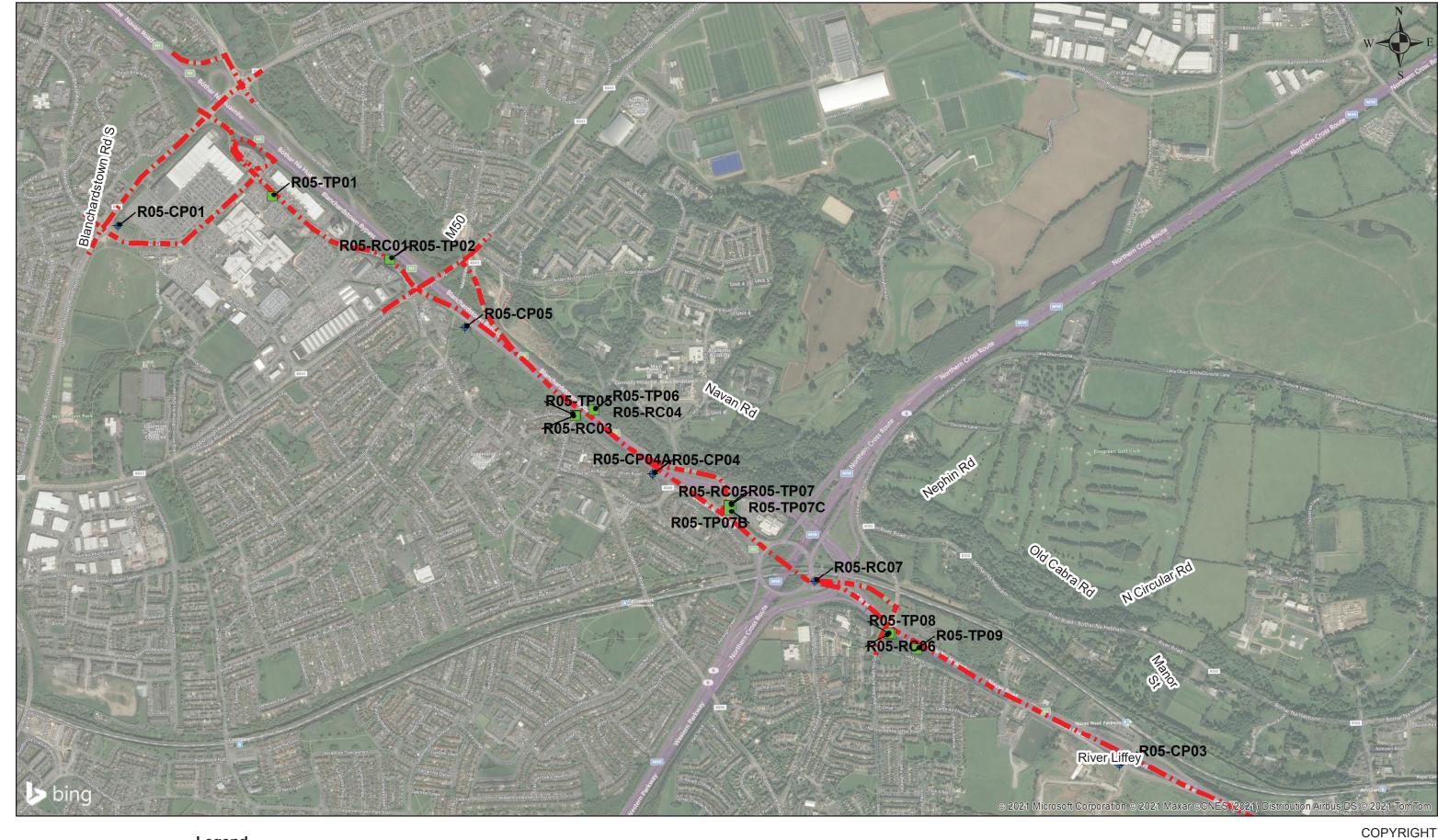


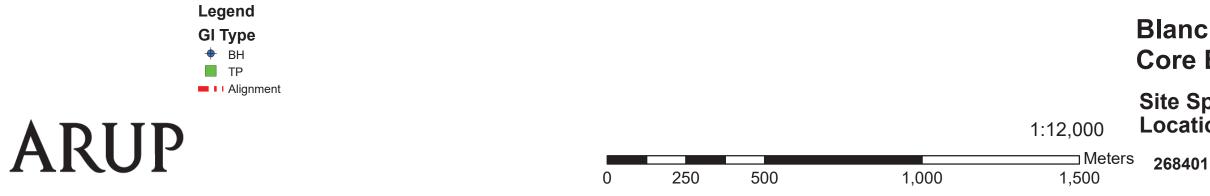
	Legend Alignment			Blanchar Core Bus
			1:27,500	Aerial View
ARUP		0 250 500 1,000	Meters 1,500	268401



ew (Bing Map)

ardstown to City Centre us Corridor

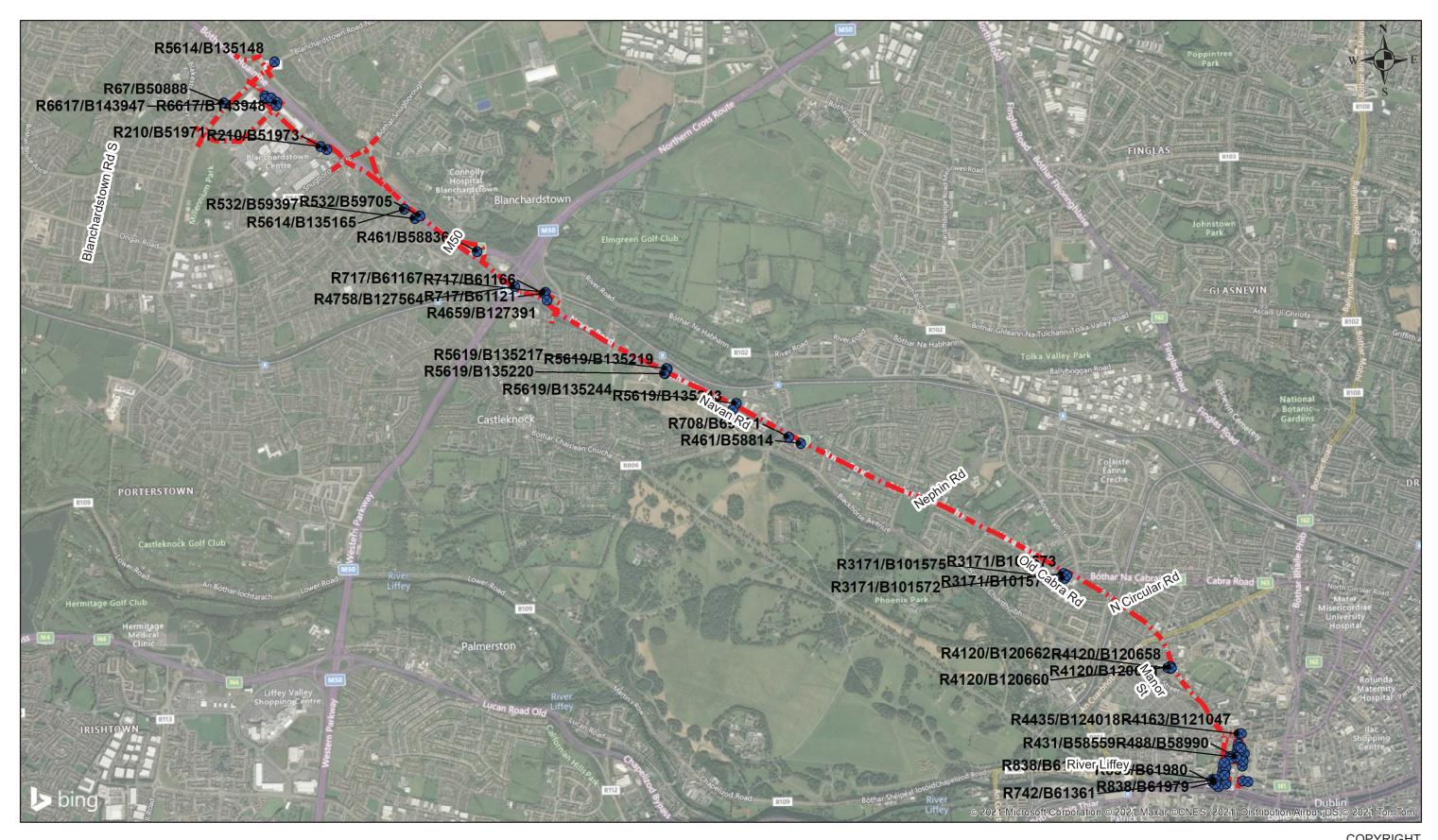






Blanchardstown to City Centre Core Bus Corridor

Site Specific Ground Investigation Location Plan



Hisrorical Ground Investigtion (GSI) - 20m Offset

Alignment

ARUP

1:27,500

□Meters 0 250 500 1,000 1,500

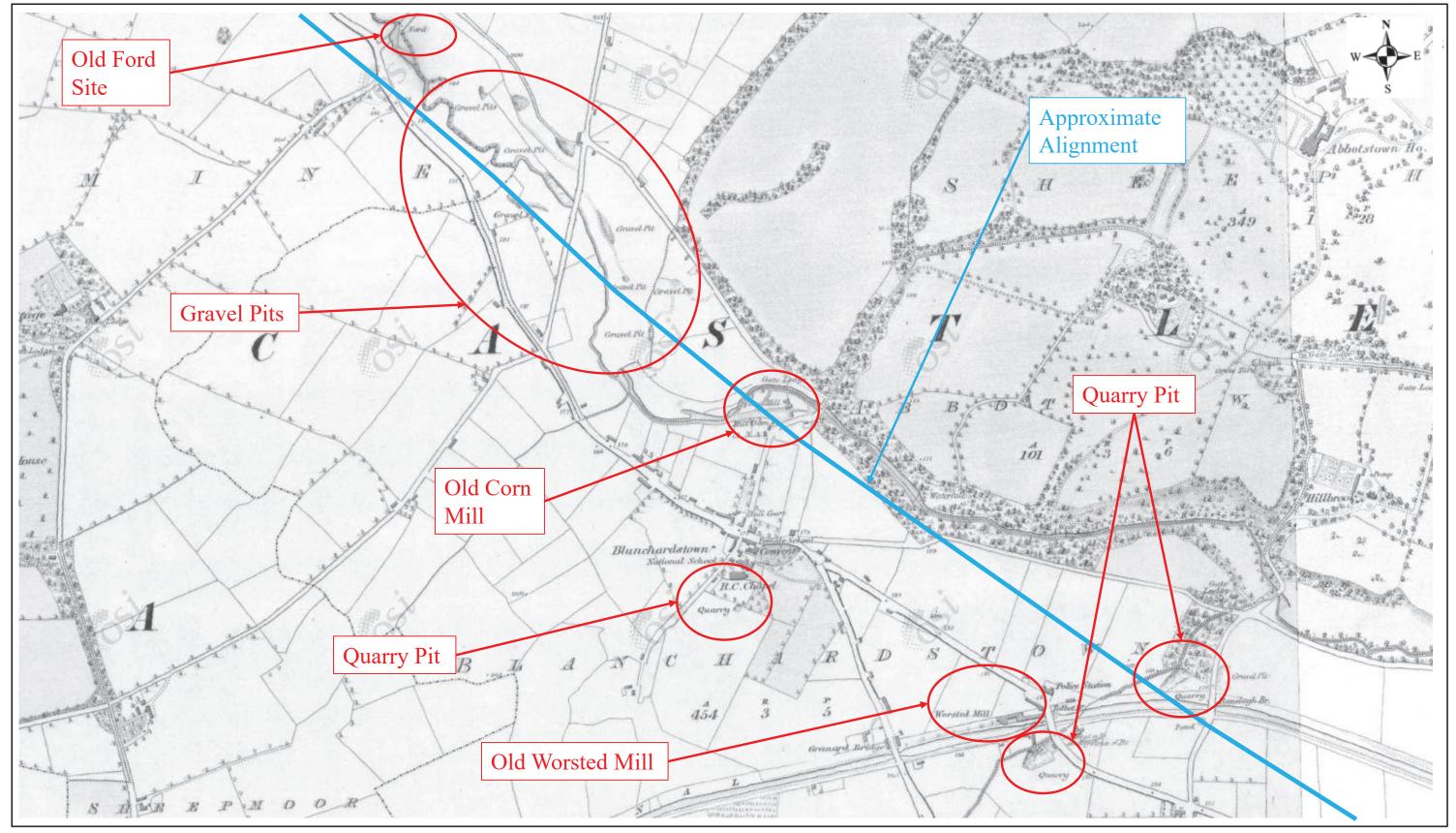
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Blanchardstown to City Centre **Core Bus Corridor**

Historical Boreholes (GSI) 20m Offset from the Route 5

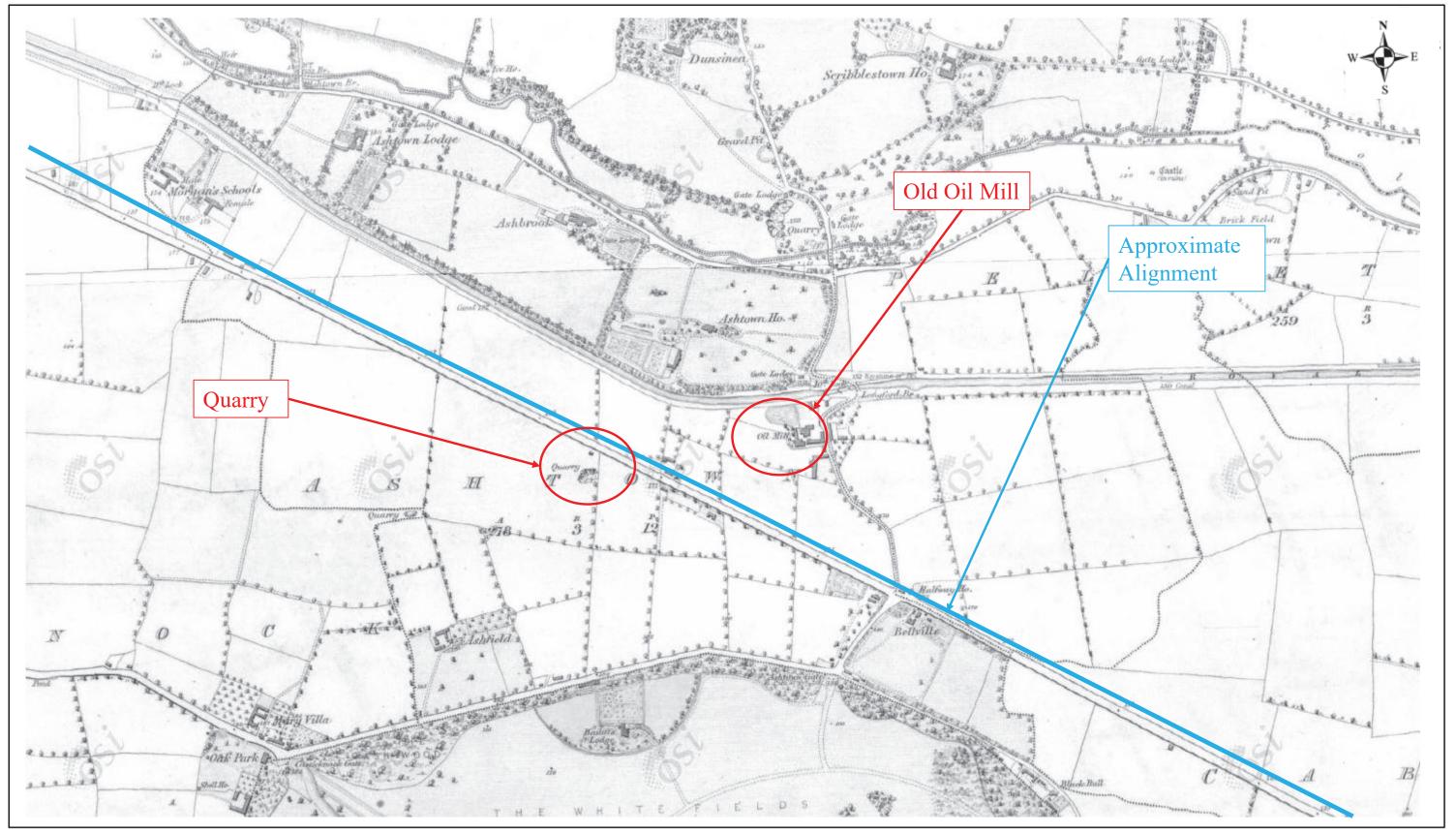


ARUP

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Blanchardstown to City Centre Core Bus Corridor Historic Map 6 Inch (1837 - 1842)



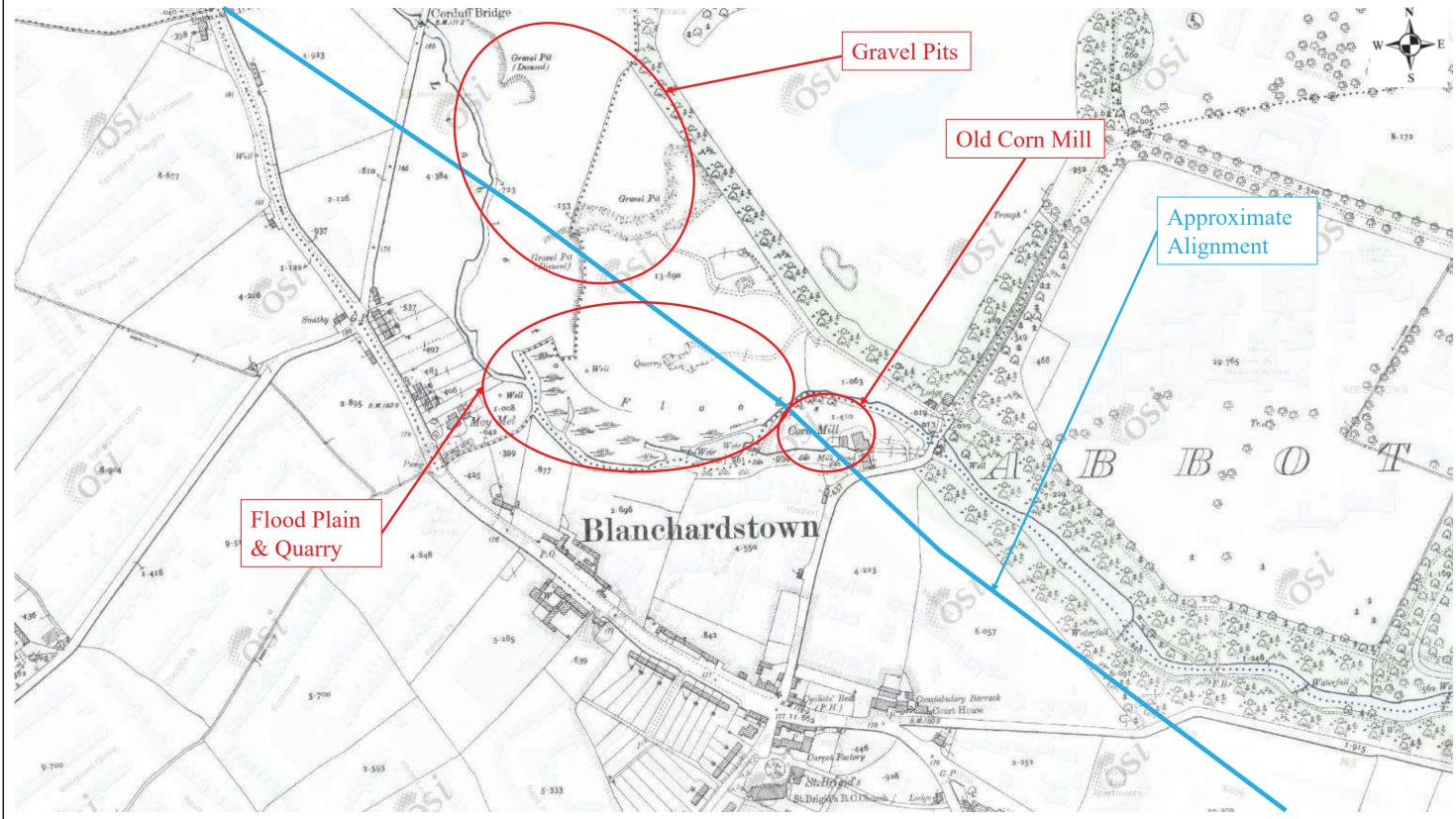
ARUP

Historic Map 6 Inch (1837 - 1842)

Not to Scale

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Blanchardstown to City Centre Core Bus Corridor



ARUP

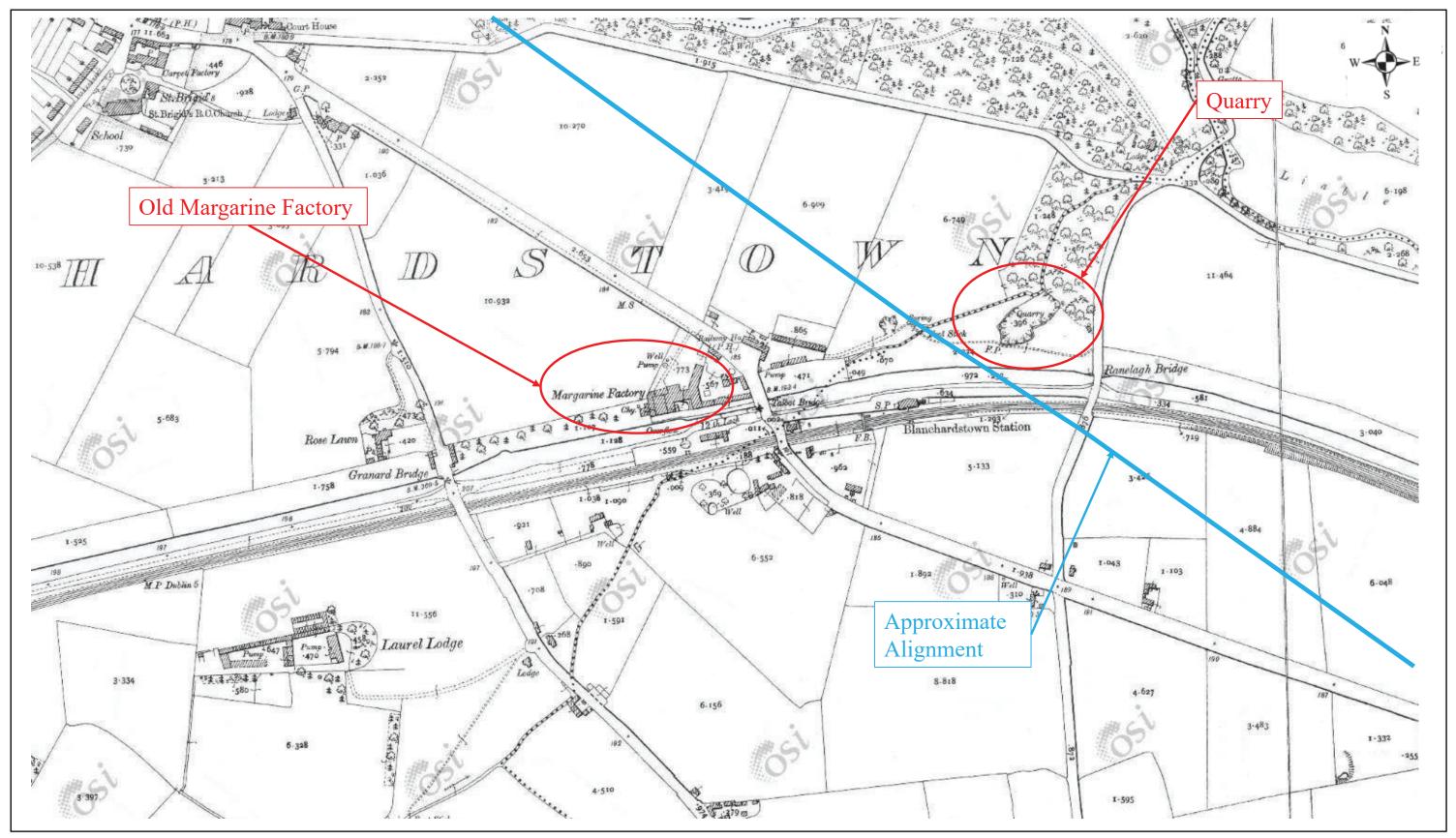
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Blanchardstown to City Centre Core Bus Corridor

Historic Map 25 Inch (1888 - 1913)



ARUP

(1888 - 1913)

Not to Scale

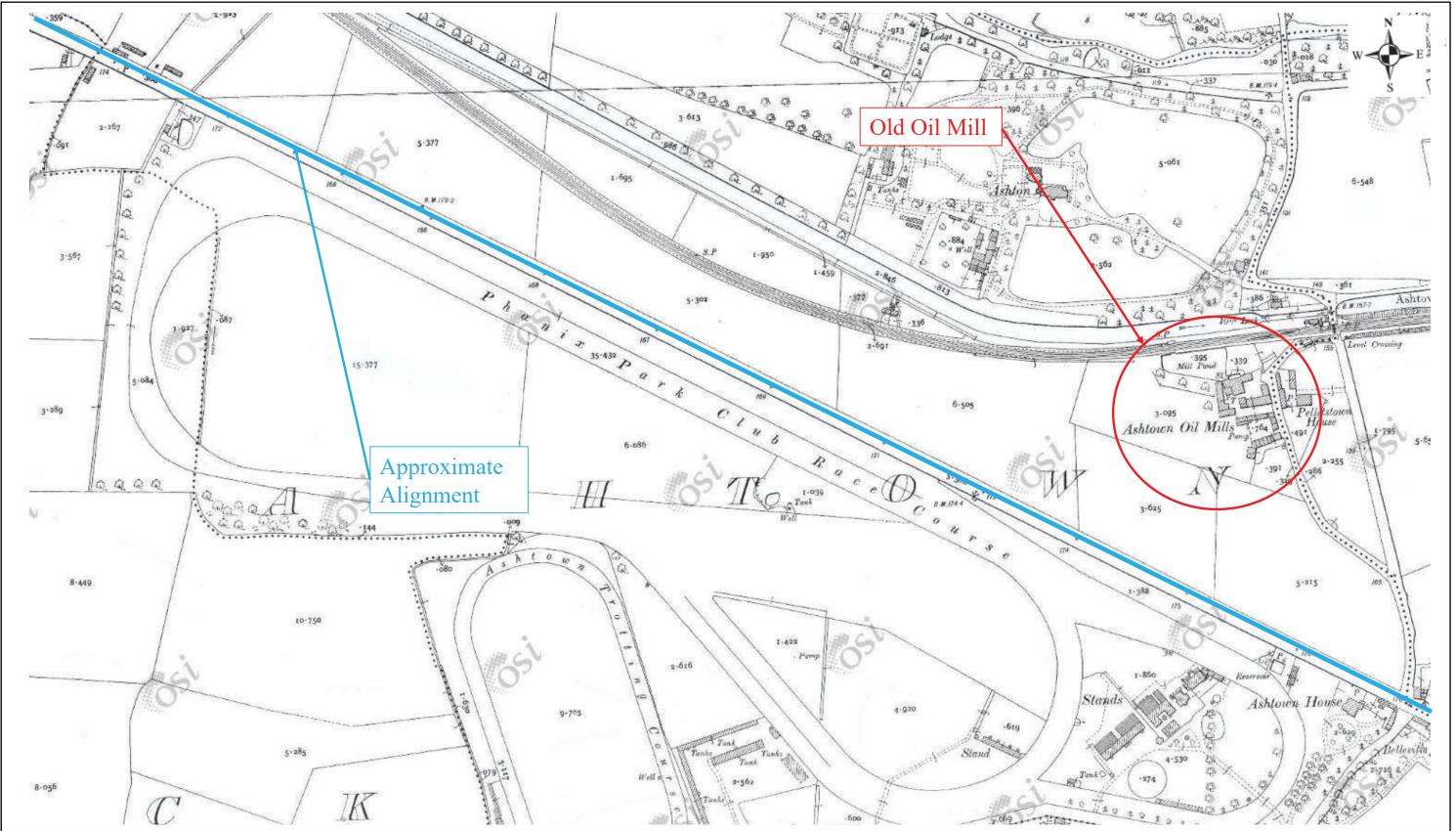
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FIGURE A07

Historic Map 25 Inch

Blanchardstown to City Centre Core Bus Corridor

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ARUP

Not to Scale

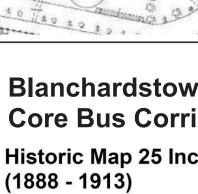
268401

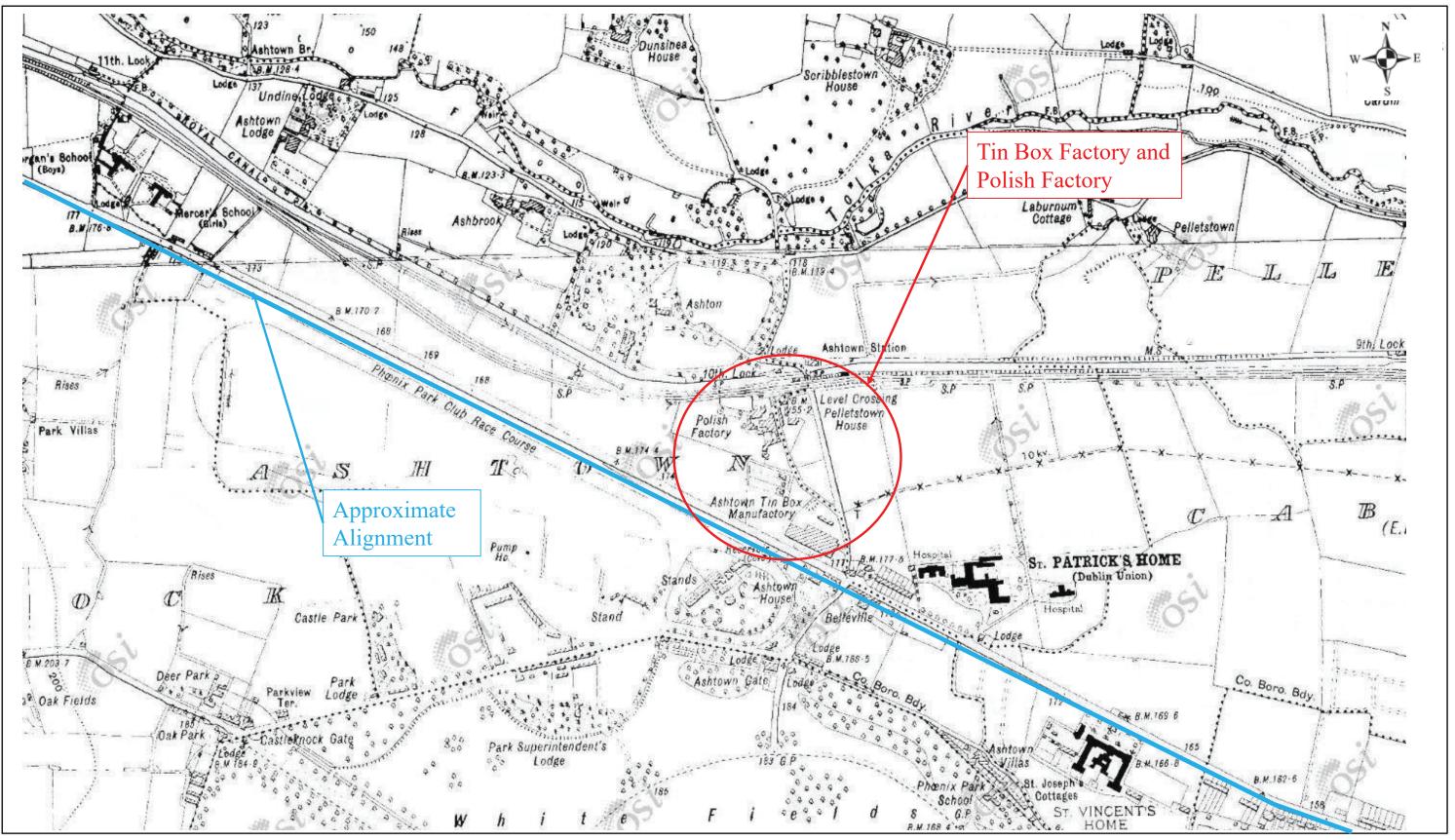


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Blanchardstown to City Centre Core Bus Corridor

Historic Map 25 Inch





ARUP

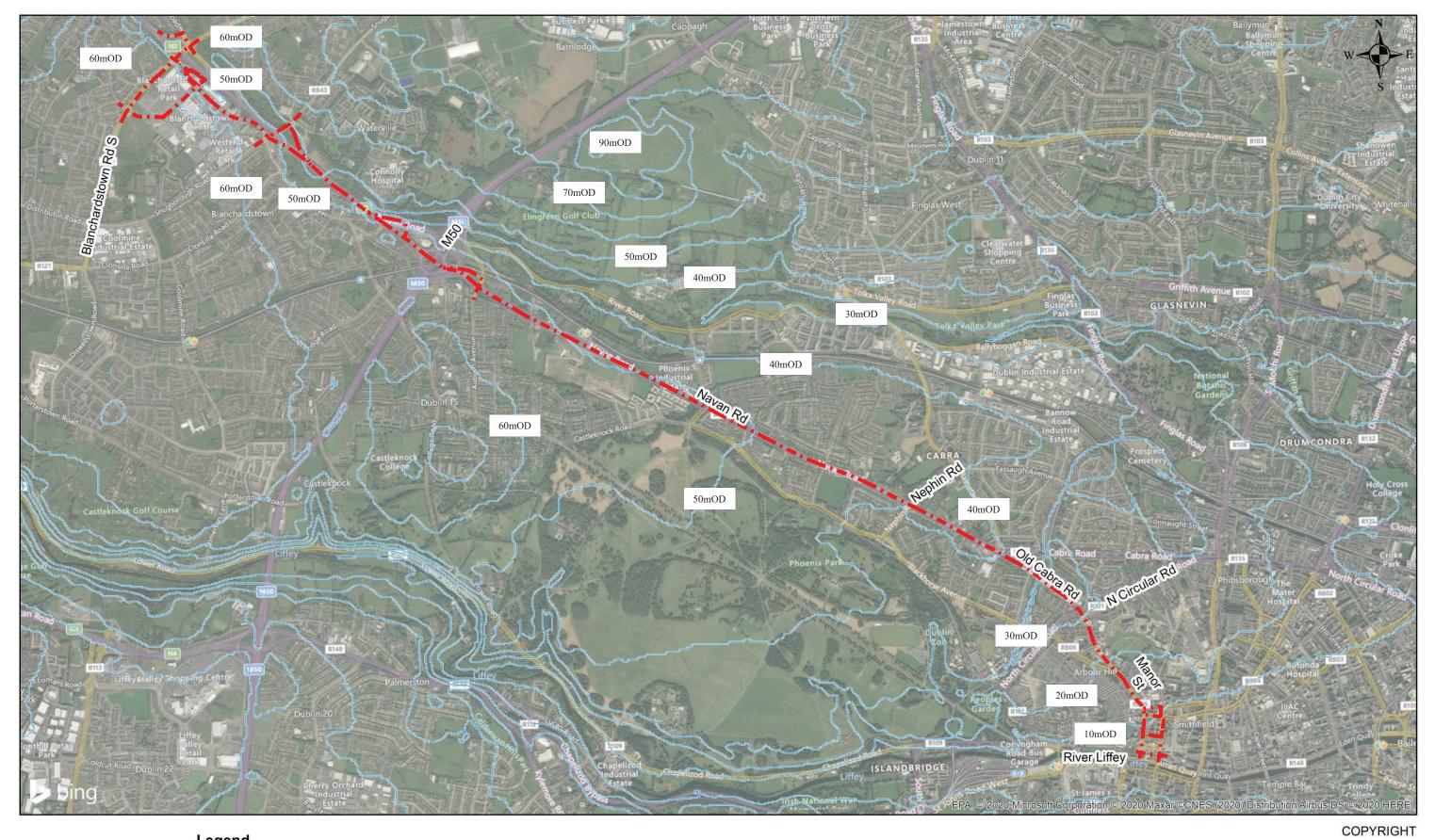
(1830-1930)

Not to Scale

268401

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Blanchardstown to City Centre **Core Bus Corridor** 6 Inch Cassini

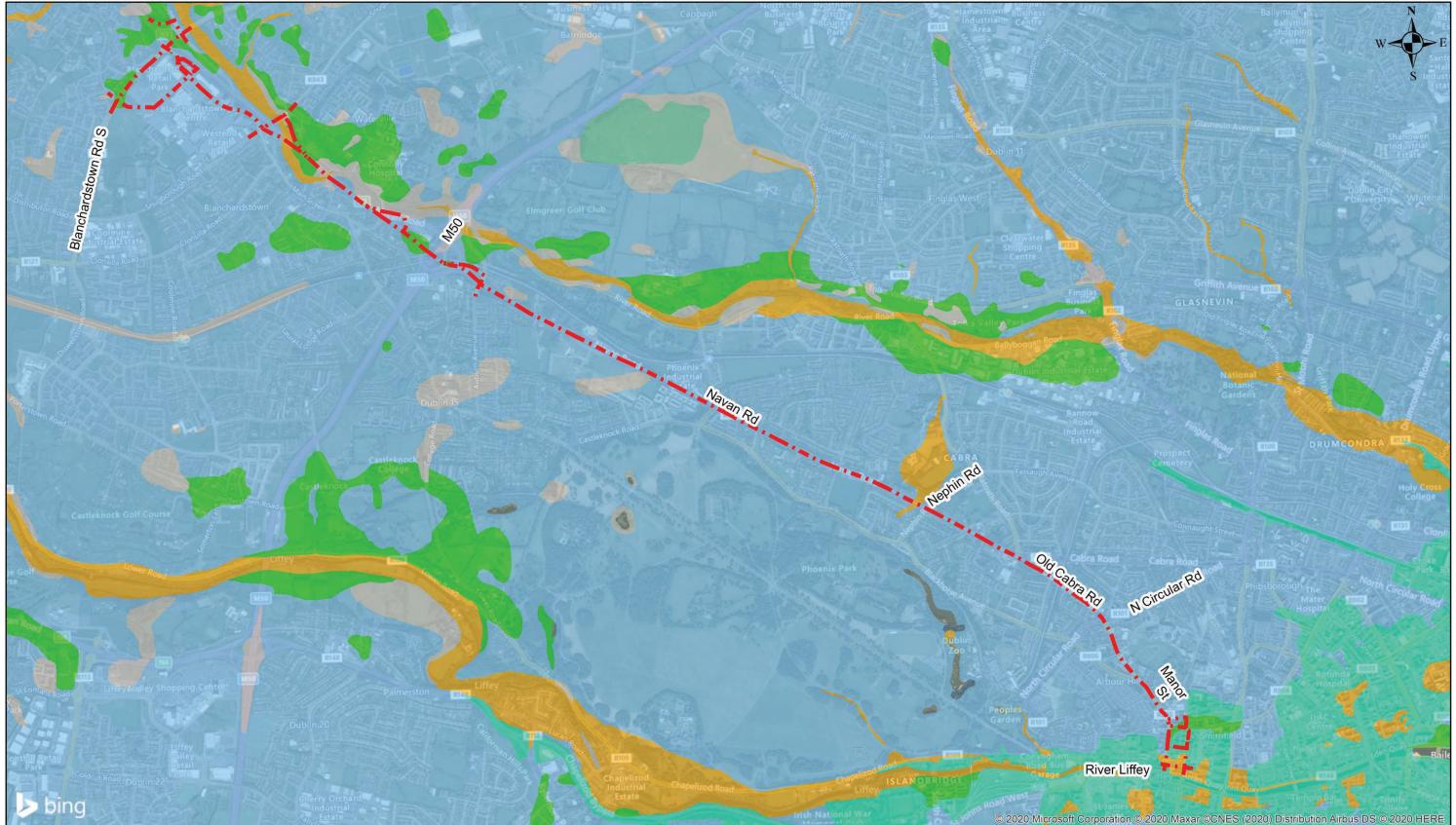


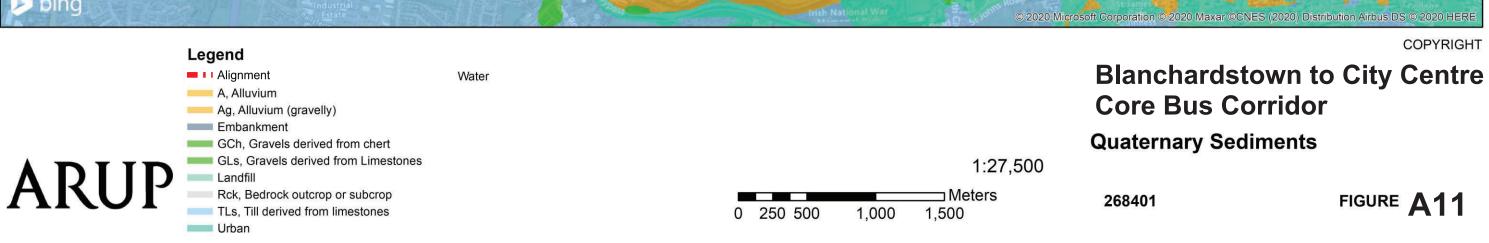
Legend Alignment				Blanchar Core Bus
				EPA 20m Co
			1:27,500	
	0 250 500	1,000	Meters 1,500	268401

ARUP

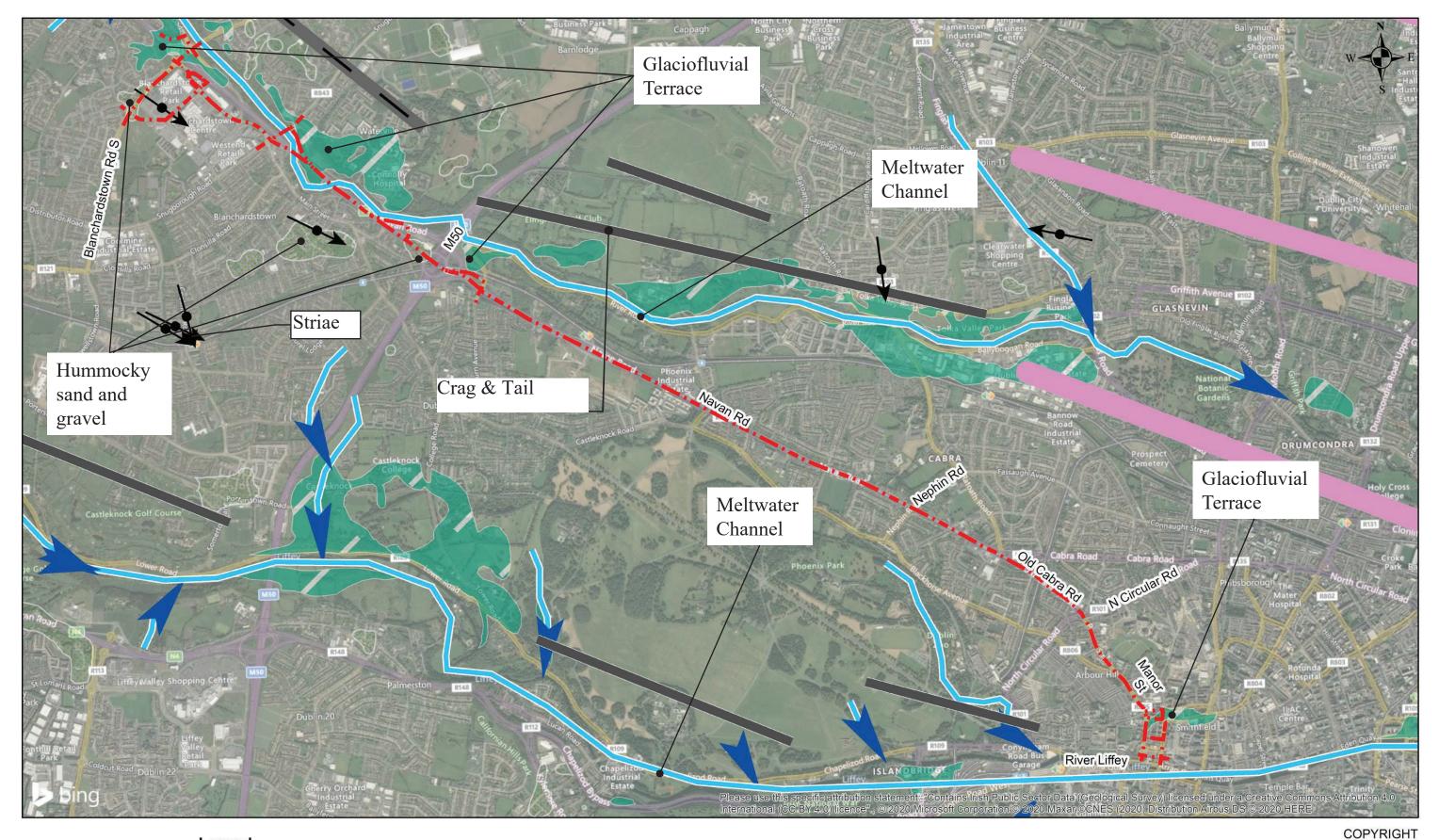
FIGURE A10

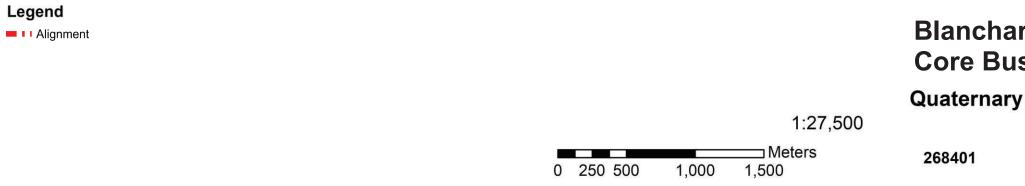
ardstown to City Centre us Corridor Contour Map







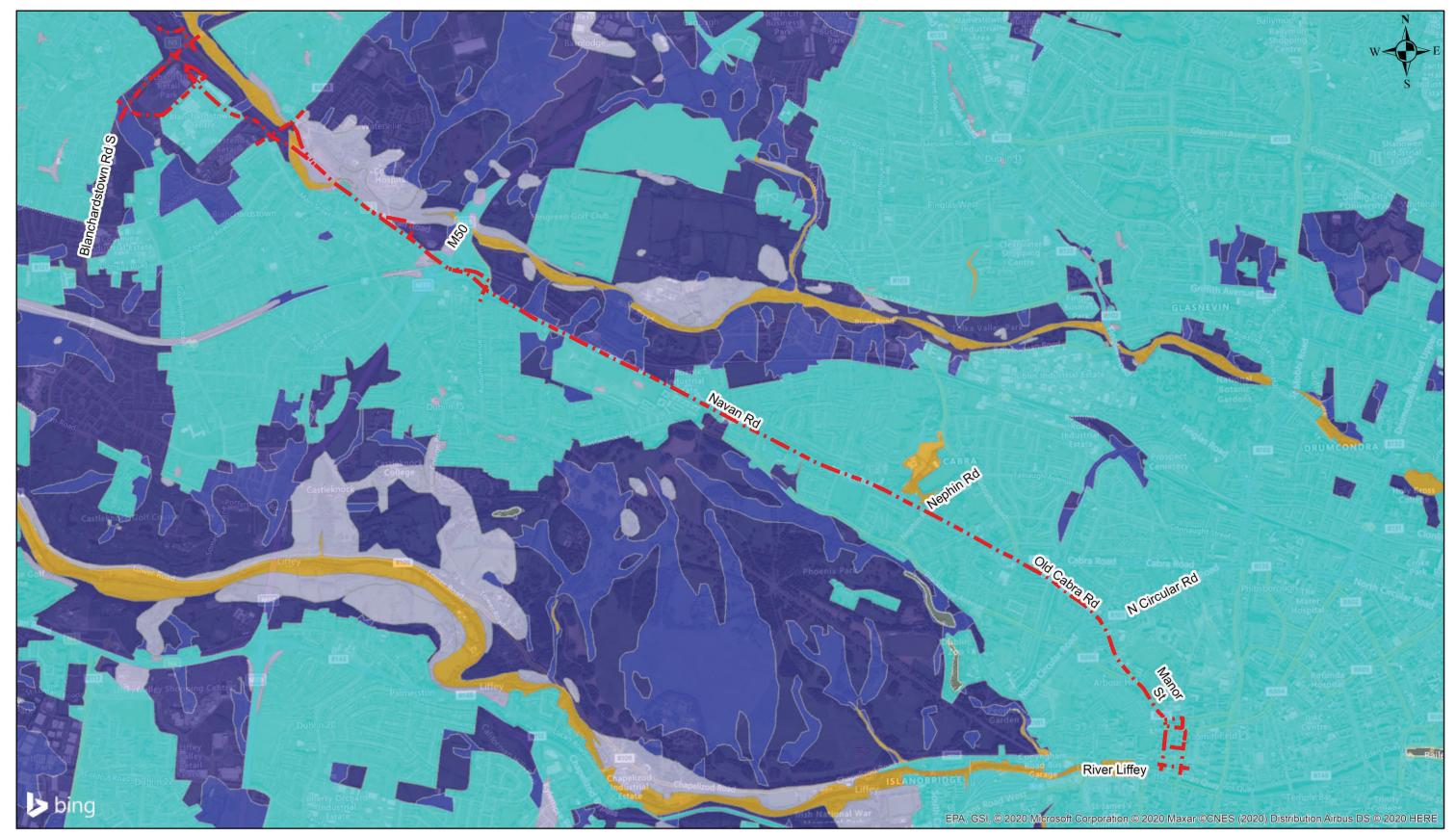




ARUP

FIGURE A12

Blanchardstown to City Centre Core Bus Corridor Quaternary Geomorphology



	Legend I Alignment Alluvium BminDW - Till derived chiefly from limestone					Blanch Core B
ARUP	BminPD - Till derived chiefly from limestone BminSW - Bedrock at Surface - Calcareous Made Ground	∎ 0	250 500	1,000	1:27,500 Meters 1,500	GSI Grou (Teagasc) ²⁶⁸⁴⁰¹

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hardstown to City Centre Bus Corridor

oundwater Subsoils ic)

FIGURE A13



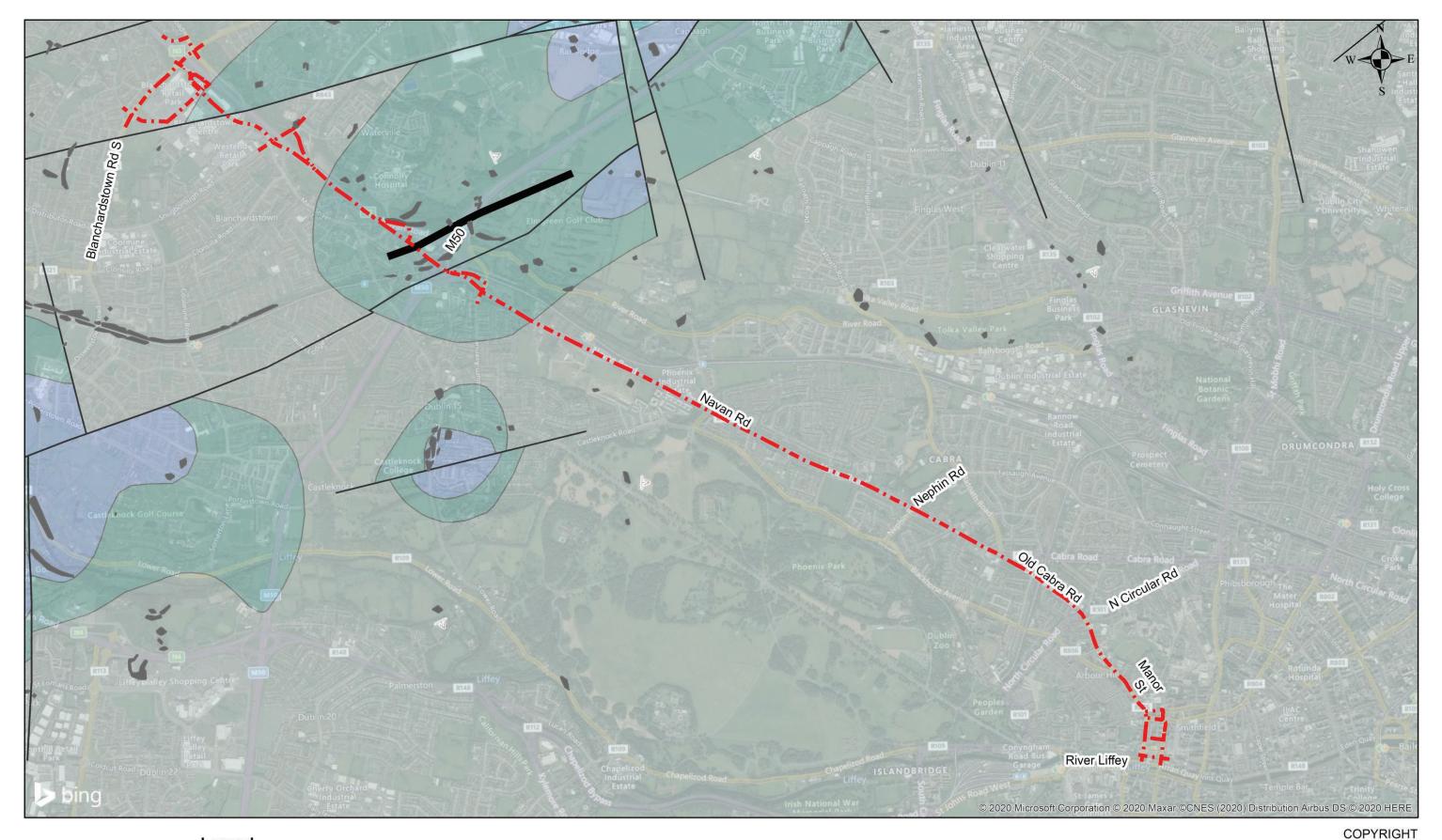
Legend A - Gravelly TLs - Limestone till (Carboniferous)			Blanch Core B
GLs - Limestone sands and gravels (Carboniferous) GLs - Limestone sands and gravels (Carboniferous) TwGLs - Interstratified till with gravel derived from Lower Carboniferous Limestone Rck - Bedrock at surface	0 250 500 1,000 1,5	1:27,500 Meters 00	GSI Geol Unconso 268401

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chardstown to City Centre Bus Corridor

oUrban solidated Sediments

FIGURE A14

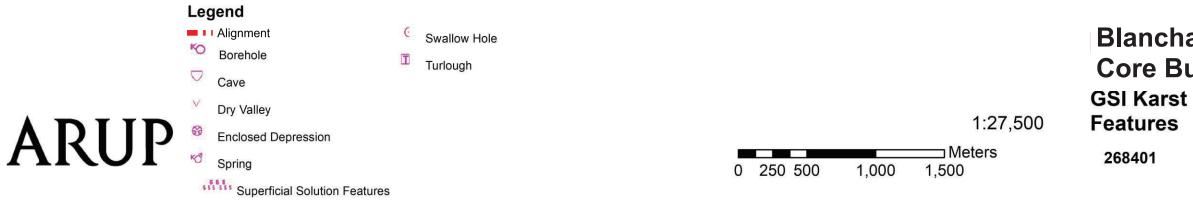






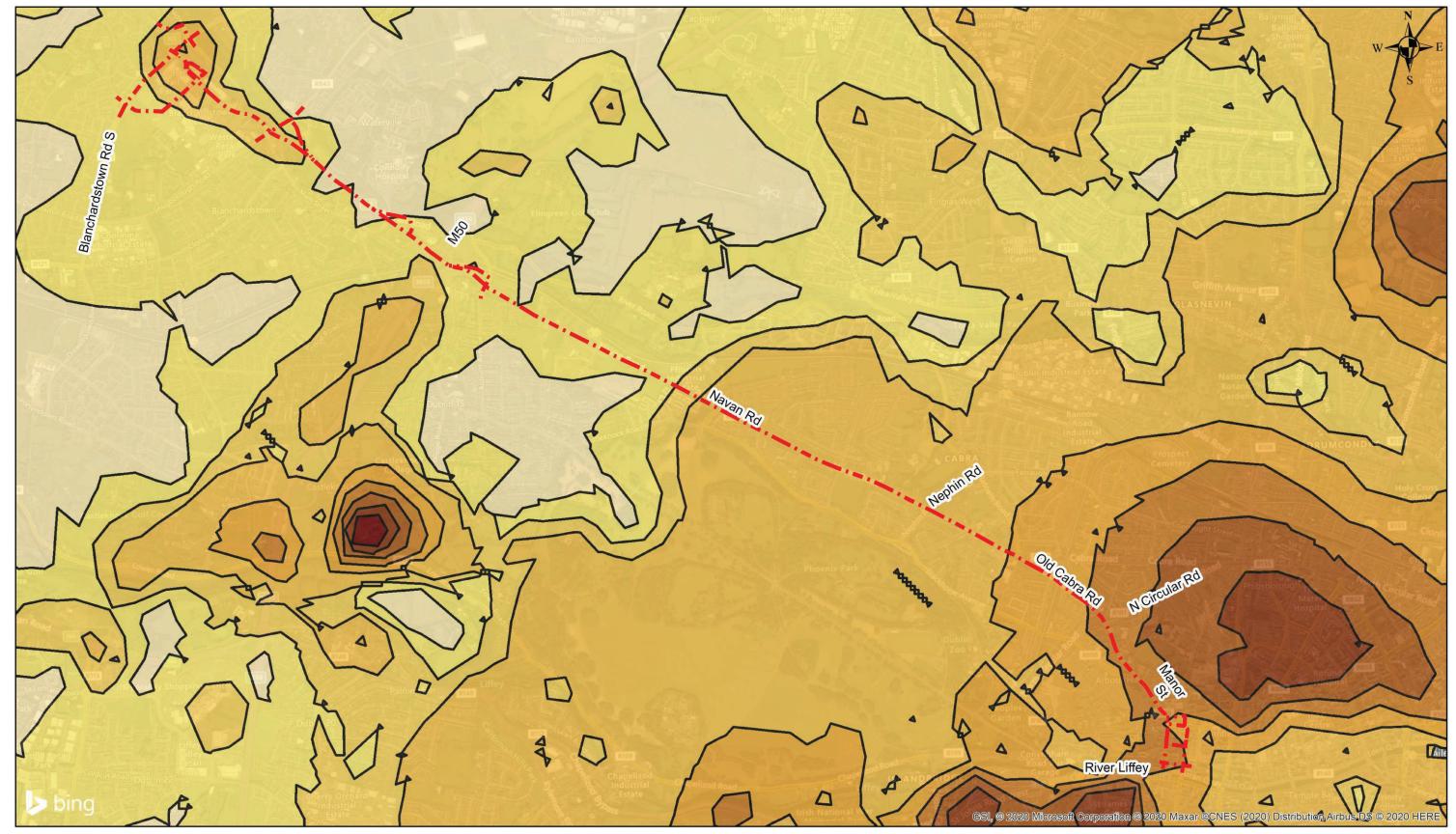
Blanchardstown to City Centre Core Bus Corridor







Blanchardstown to City Centre **Core Bus Corridor**

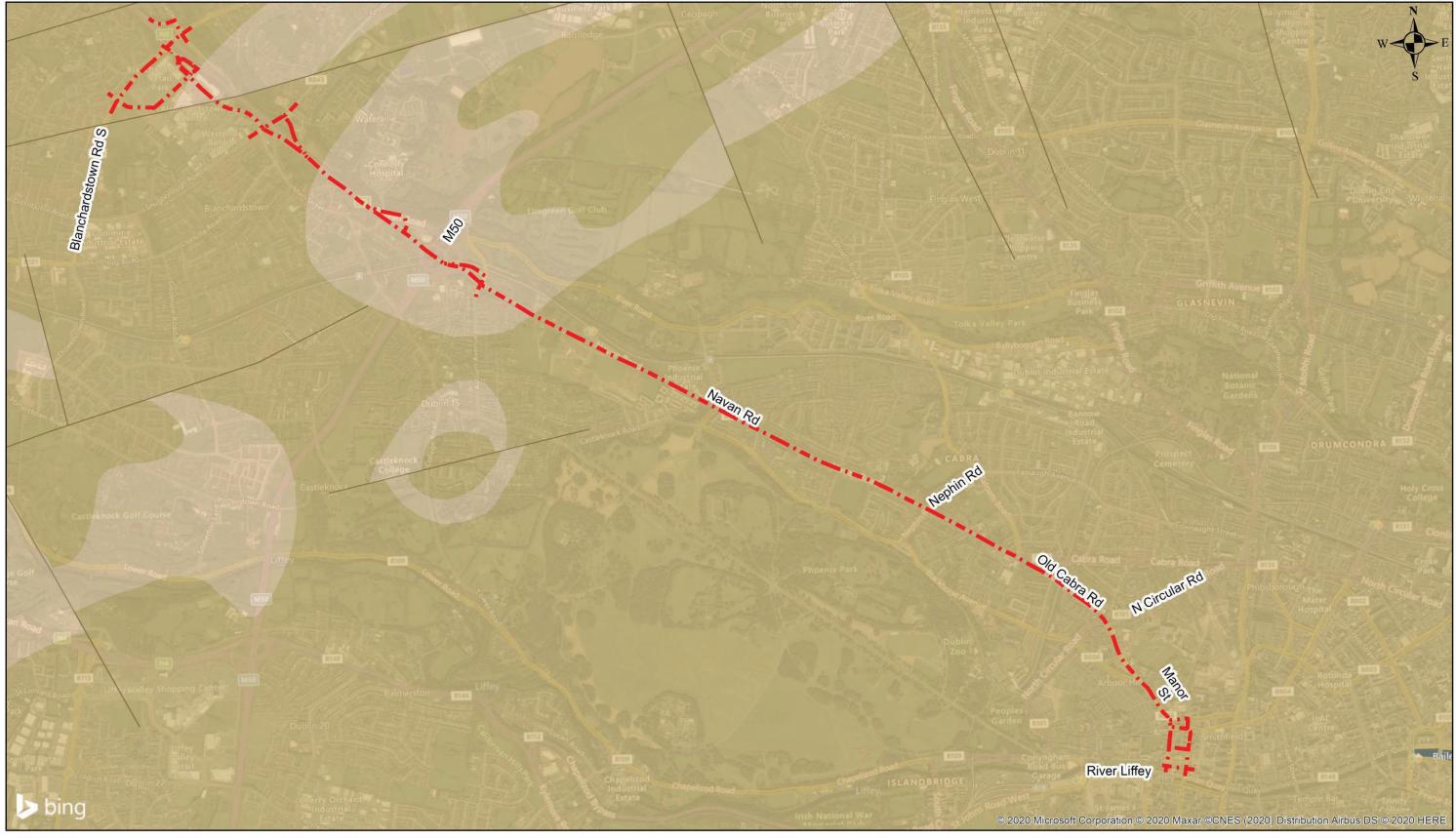




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Blanchardstown to City Centre Core Bus Corridor

268401 Depth to Bedrock (Dublin County) FIGURE A17



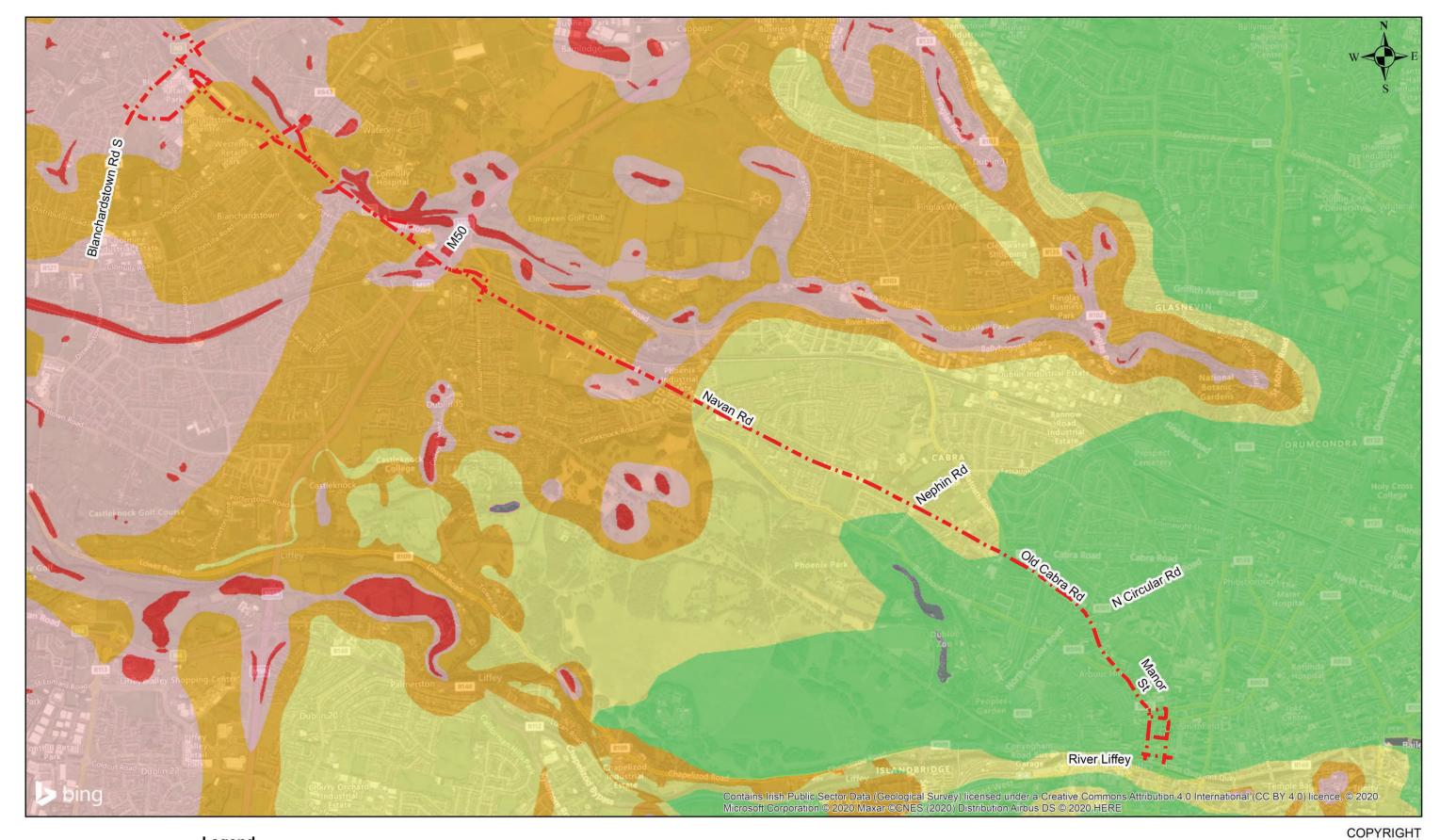


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Blanchardstown to City Centre Core Bus Corridor

GSI Groundwater





	Legend Alignment National Groundwater Vulnerability Ireland		Blanch Core B
ARUP	 Rock at or near Surface or Karst Extreme High Moderate Low Water 	1:27,500 Meters 0 250 500 1,000 1,500	GSI Grou Vulnerab 268401



hardstown to City Centre Bus Corridor oundwater ability



Blanc Core GSI GW & Sprin	1:27,500			
268401	Meters 1,500	1,000	250 500	0

ARUP

📕 📭 Alignment

Groundwater Wells and Springs



chardstown to City Centre Bus Corridor W Wells ings



Legend

ARUP

Alignment
 River Network and River Flow Direction Arrows

Lake Segments **Estimated Historic Rivers and**

Streams

Estimated Historic Rivers and Streams

Blanchardstown to City Centre Core Bus Corridor Rivers of Dublin & EPA Waterbodies FIGURE A21 268401

0 250 500

1,000

1:27,500

□Meters

1,500

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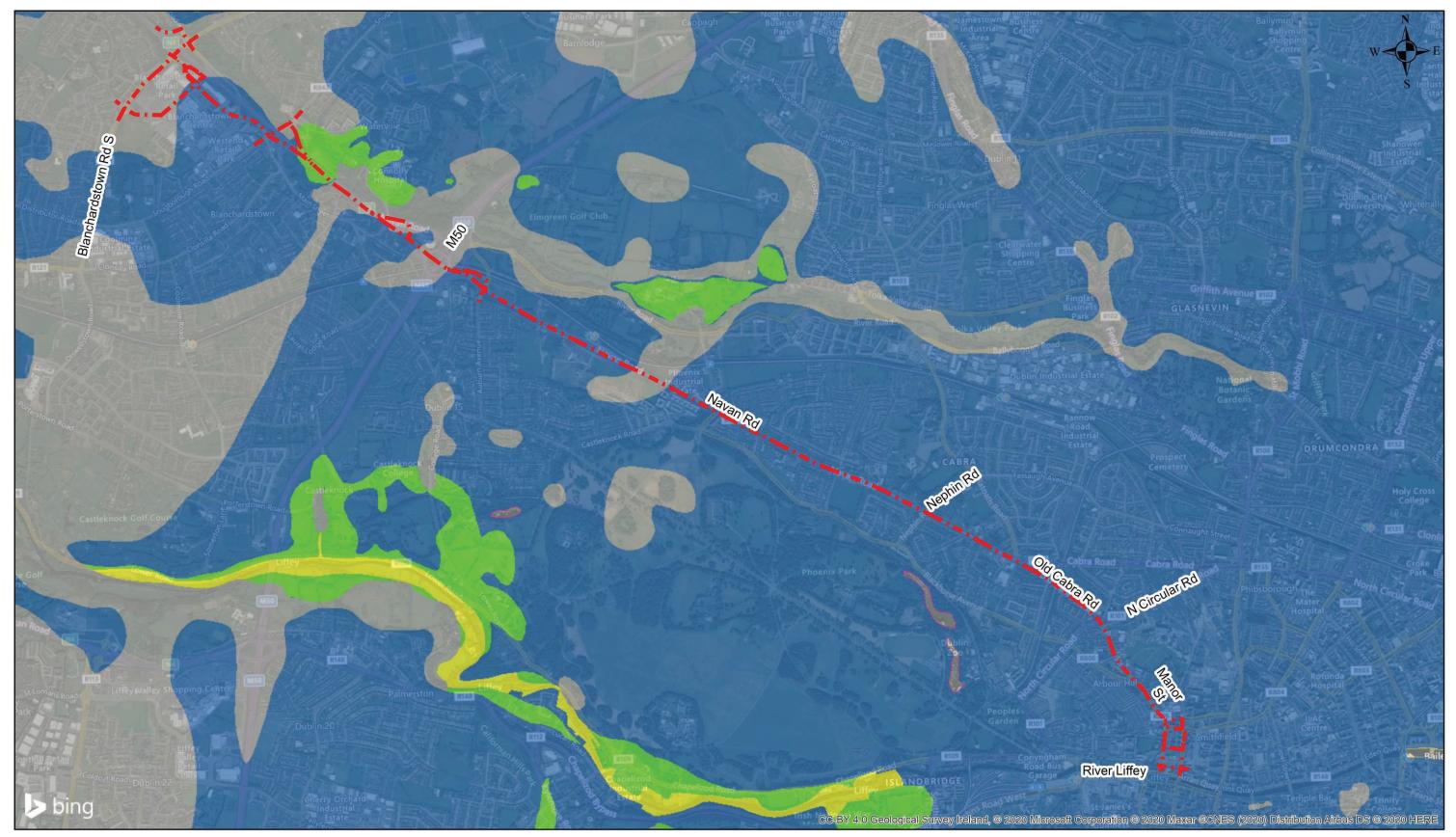


💻 🛯 🖌 Alignment 51-100 mm 551-600 mm National Groundwater Recharge 501-550 mm 💻 1-50 mm 451-500 mm 💻 0 mm Ireland 401-450 mm 💳 🛛 Water Annual Recharge (mm) 351-400 mm — 1401-2000 mm 301-350 mm 1:27,500 ARU 1001-1400 mm 251-300 mm 901-1000 mm 201-250 mm □ Meters 801-900 mm 0 250 500 1,500 151-200 mm 1,000 701-800 mm 101-150 mm — 601-700 mm

Blanchardstown to City Centre Core Bus Corridor Groundwater Recharge

268401





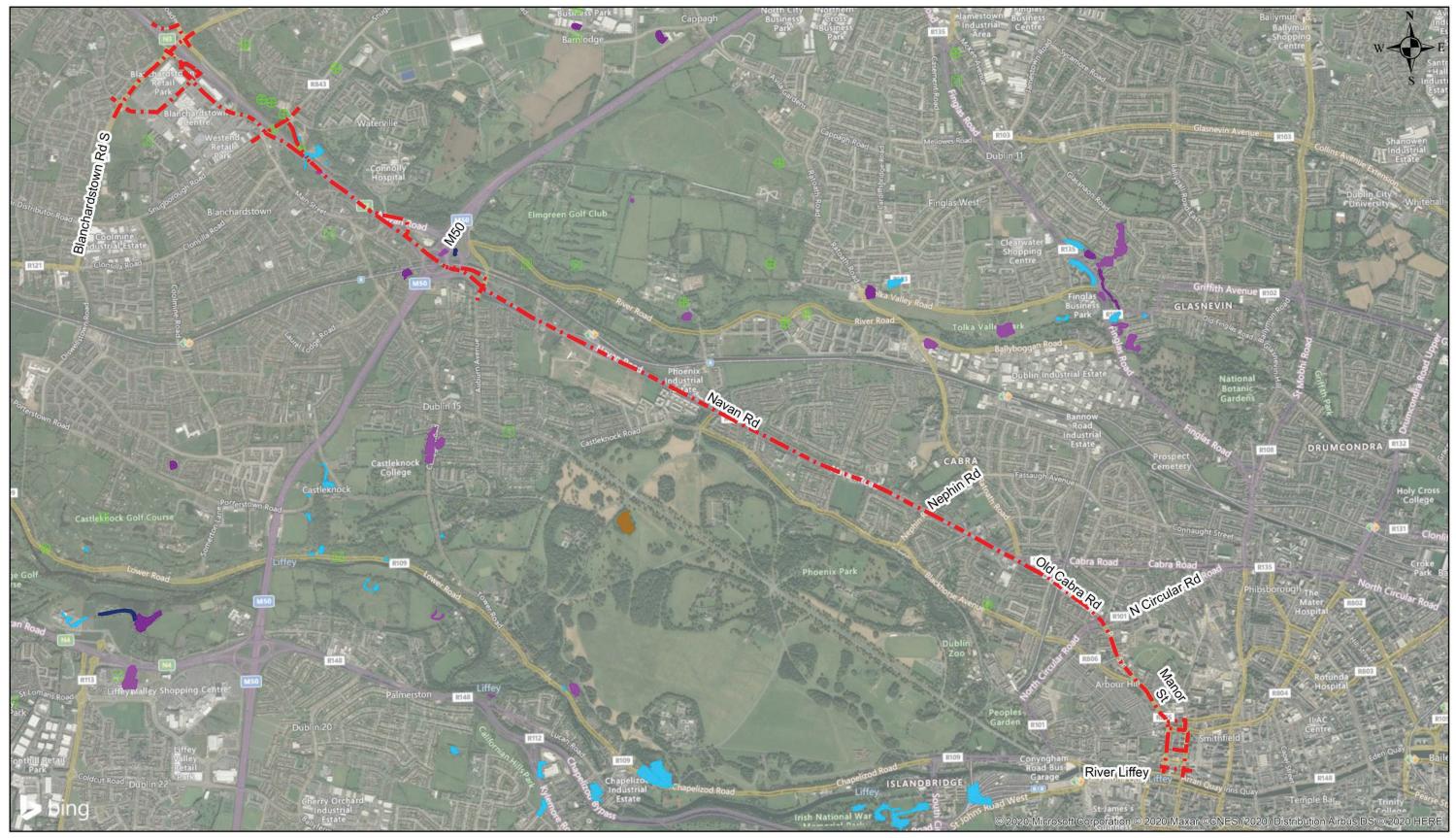


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Blanchardstown to City Centre Core Bus Corridor

Subsoil Permeability





	Legend Alignment Pit Quarry				Blanch Core B
	Early to Mid-20thC: Pits Mid-19thC: Pits Mid-20thC: Quarries Early to Mid-20thC: Quarries			1:27,500	GSI Activ Pits & Q
ARUP	Mid-19thC: Quarries	0 250 500	1,000	Meters 1,500	268401

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chardstown to City Centre Bus Corridor

tive and Historic Quarries

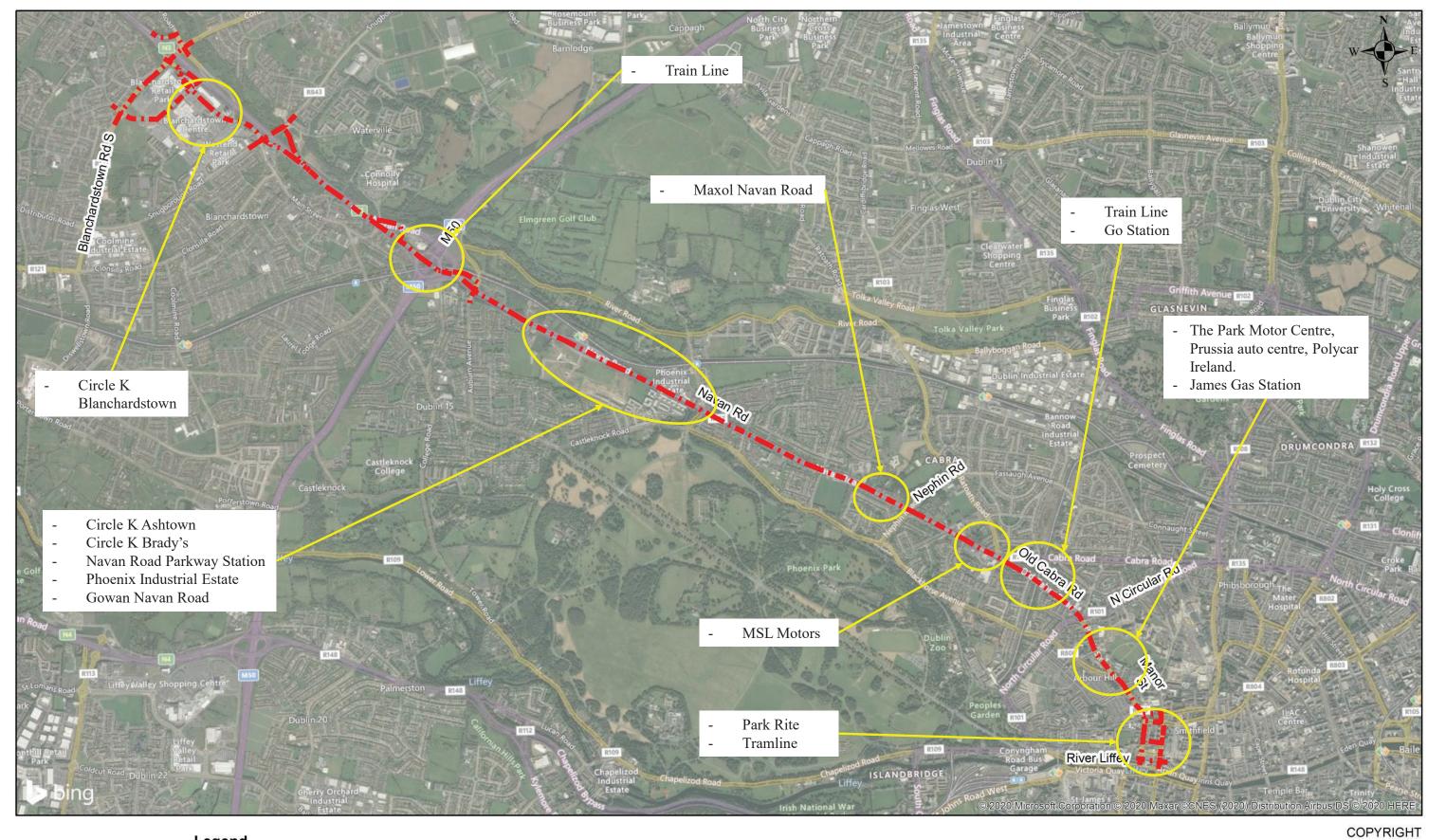








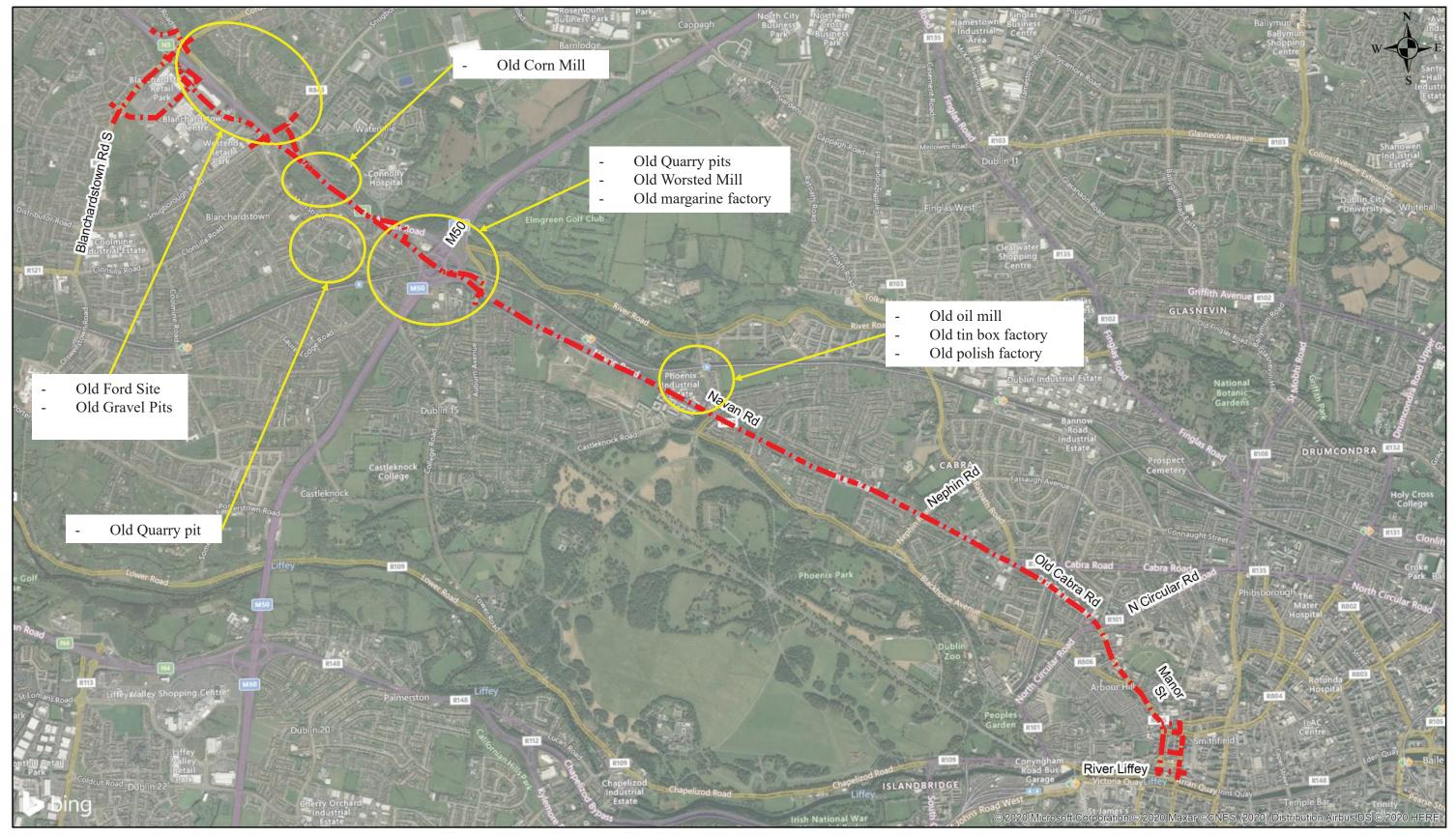
Blanchardstown to City Centre Core Bus Corridor



	Legend Alignment					Blancha Core Bu
					1:27,500	Potential S of Contami
ARUP		0	250 500	1,000	Meters 1,500	268401

chardstown to City Centre Bus Corridor

tial Sources ntamination - 2020 Aerial Map ^{1 FIGURE} A26



Legend Alignment					Blanchard Core Bus
				1:27,500	Potential Sou of Contamina
	0	250 500	1,000	Meters 1,500	268401

ARUP

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dstown to City Centre Corridor

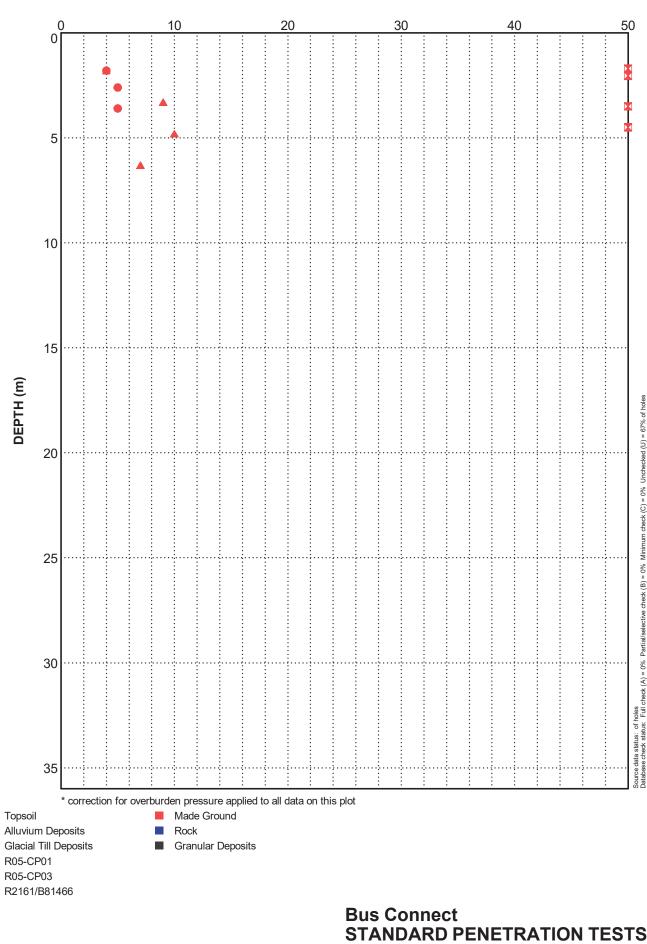
ources nation - Historic

FIGURE A27

Appendix **B**

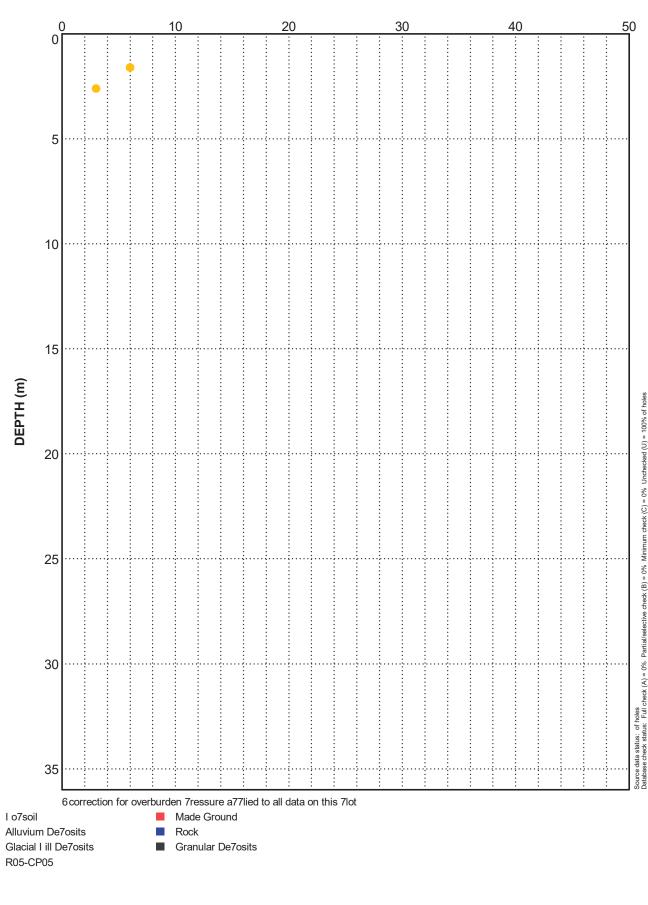
In-Situ Testing Figures

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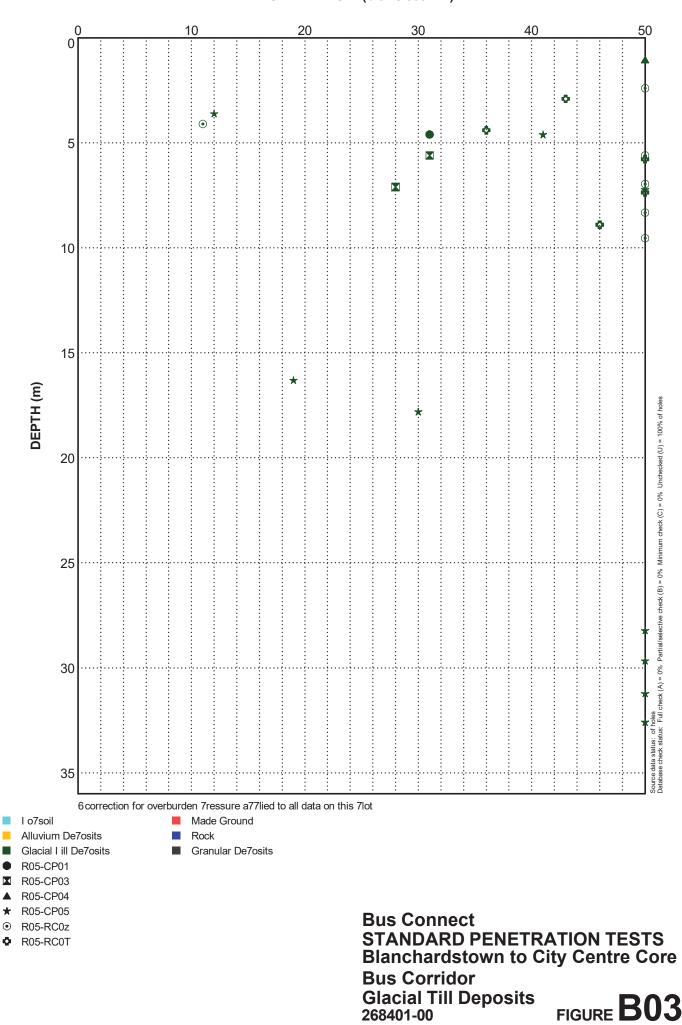
Partial/selective





Bus Connect STANDARD PENETRATION TESTS Blanchardstown to City Centre Core Bus Corridor Alluvium 268401-00 FIGURE **B02**

SPT N VALUE* (blows/300mm)

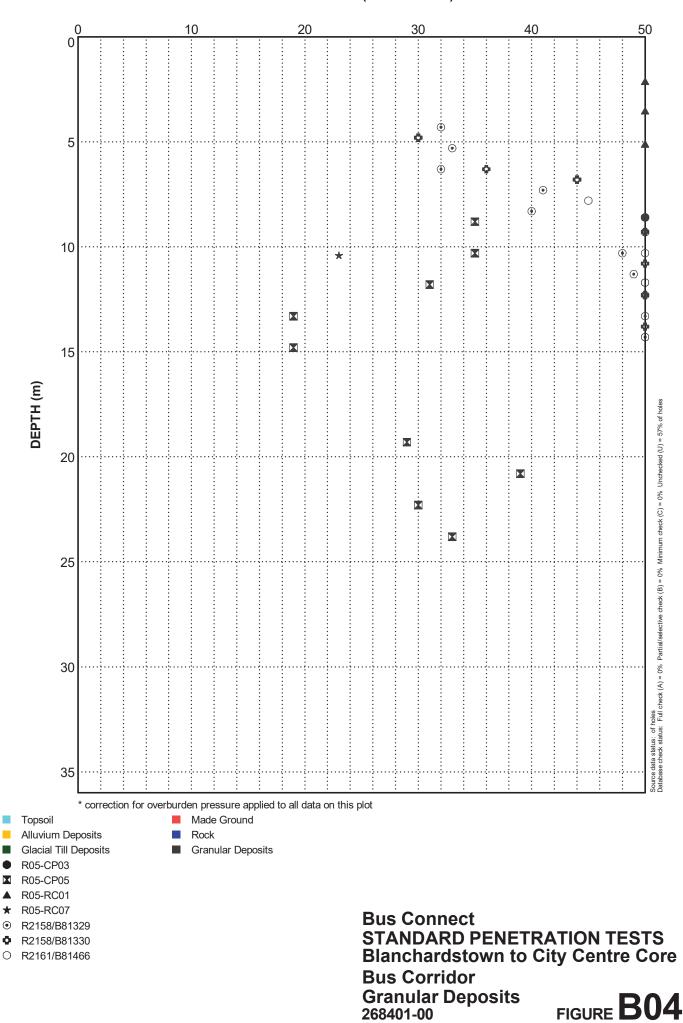


SPT N VALUE* (blows/300mm)

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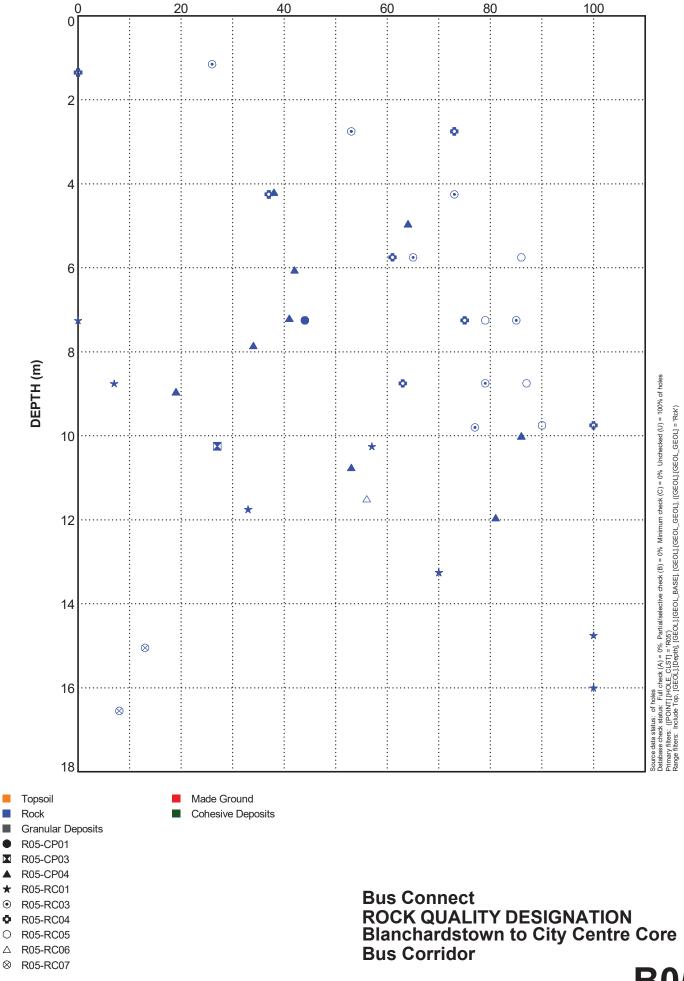


SPT N VALUE* (blows/300mm)

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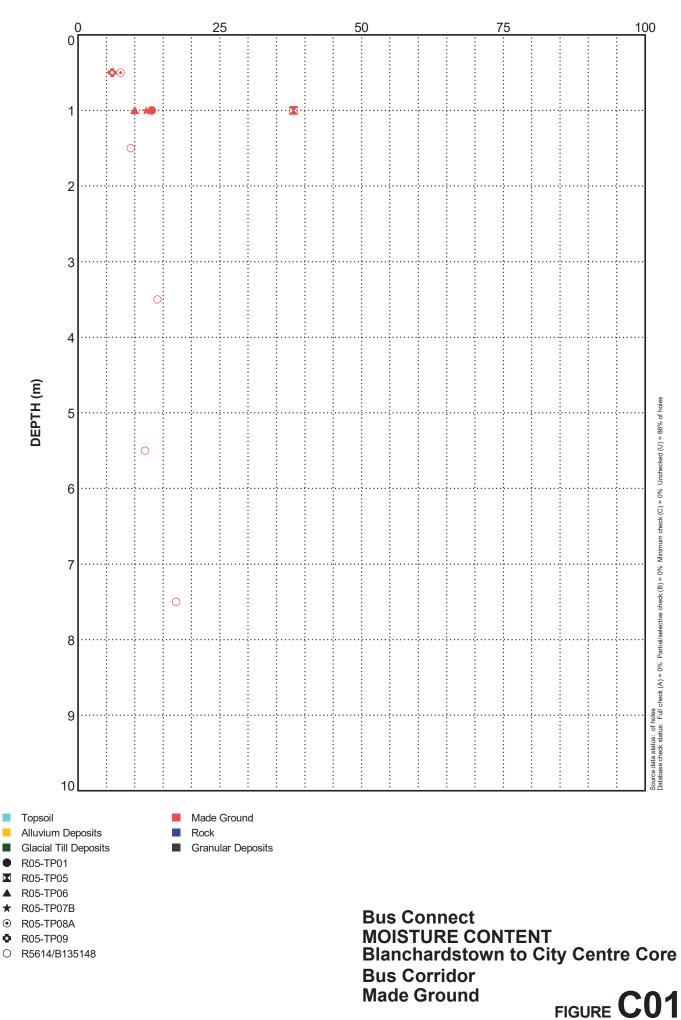
268401-00

FIGURE **B05**

Appendix C

Laboratory Testing Figures

MOISTURE CONTENT (%)

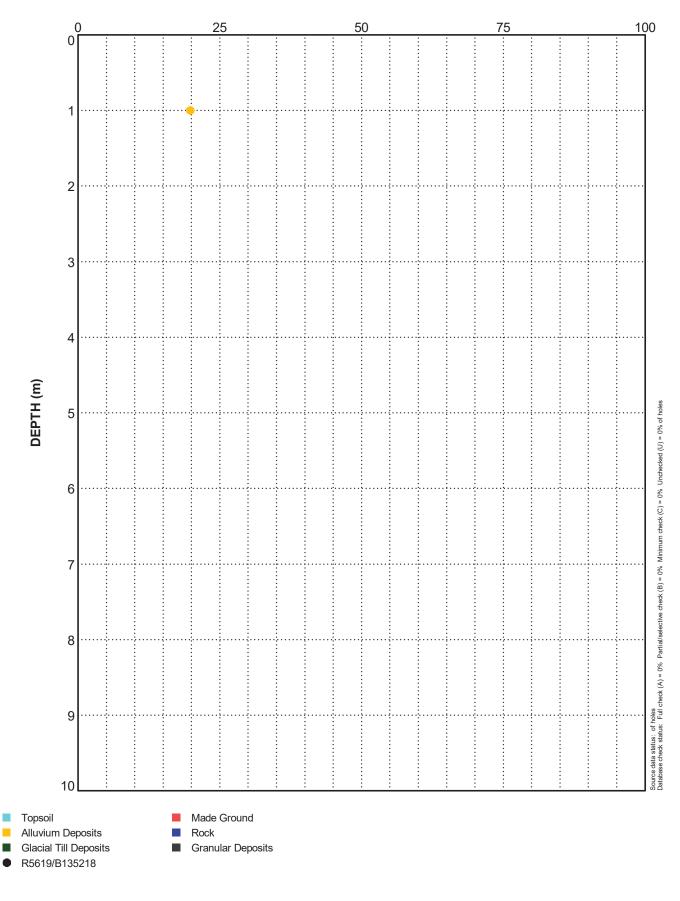


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MOISTURE CONTENT (%)



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268401-00

Alluvium

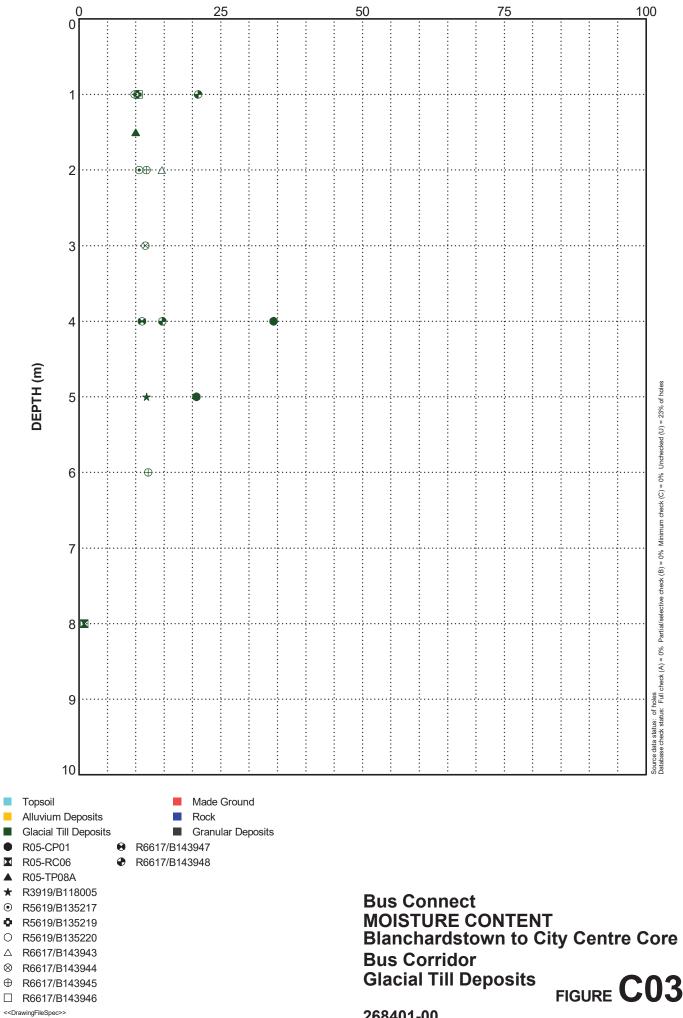
Bus Connect

Bus Corridor

MOISTURE CONTENT Blanchardstown to City Centre Core

FIGURE CO2

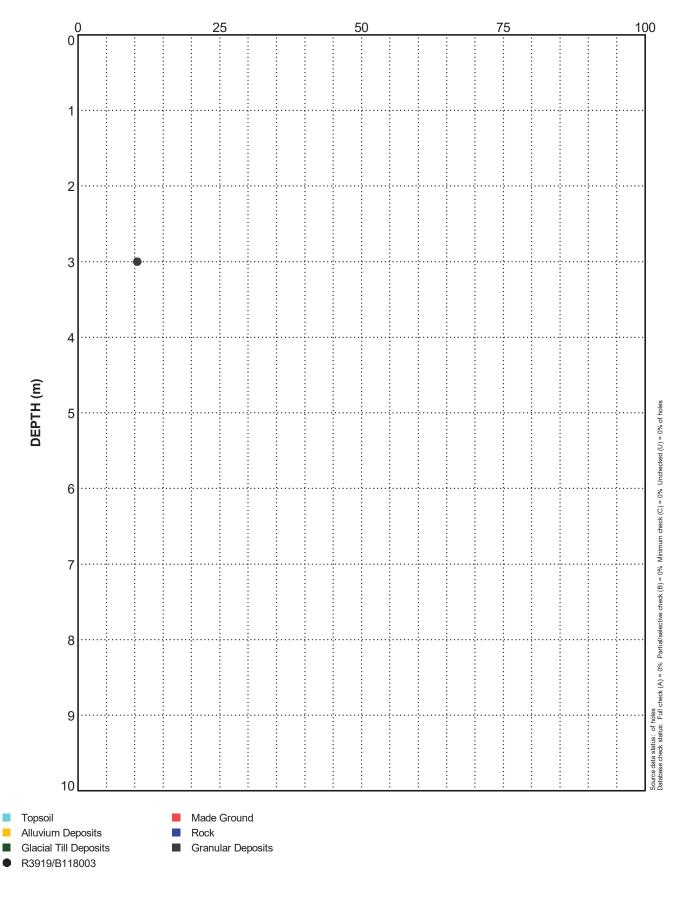
MOISTURE CONTENT (%)



*

output

MOISTURE CONTENT (%)



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Bus Connect

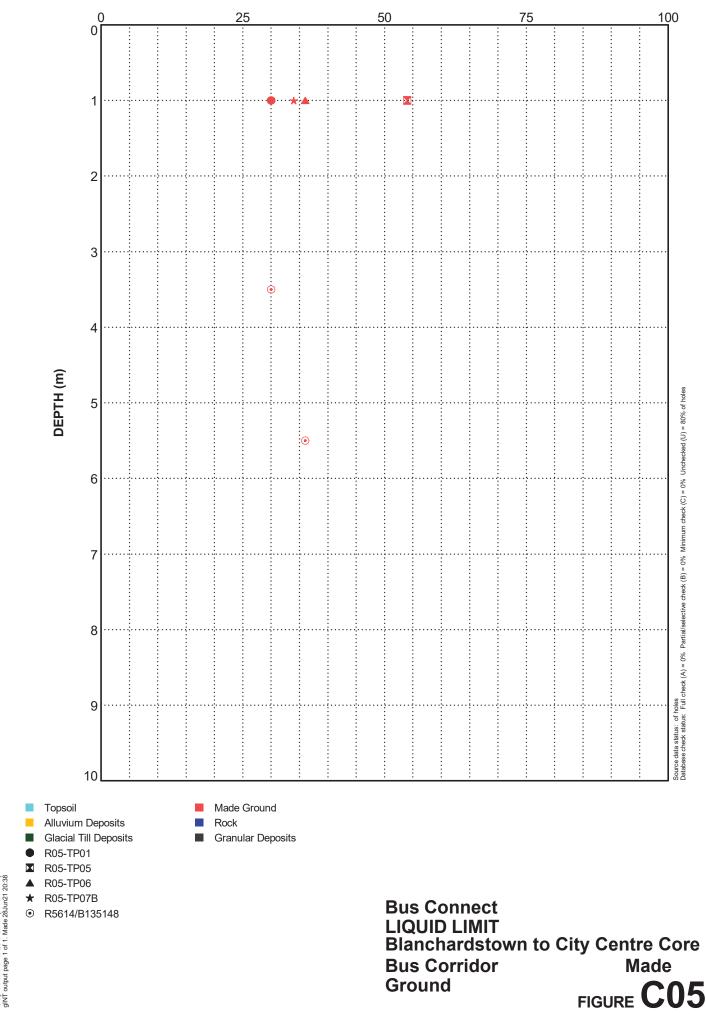
Bus Corridor

Granular Deposits

MOISTURE CONTENT Blanchardstown to City Centre Core

FIGURE C04

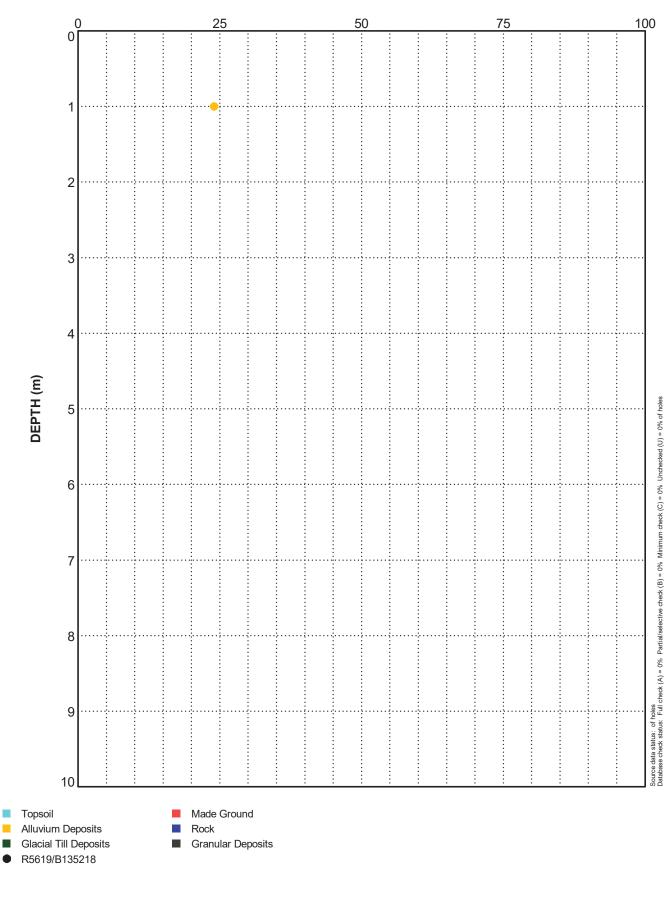
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268401-00

Ground

LIQUID LIMIT (%)



Bus Connect LIQUID LIMIT Blanchardstown to City Centre Core Bus Corridor Alluvium FIGURE **C06**

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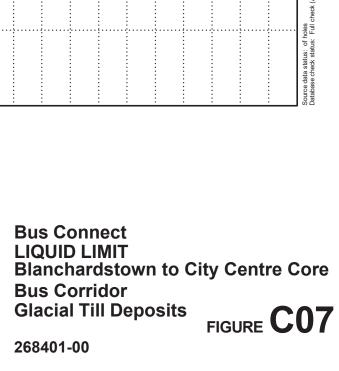
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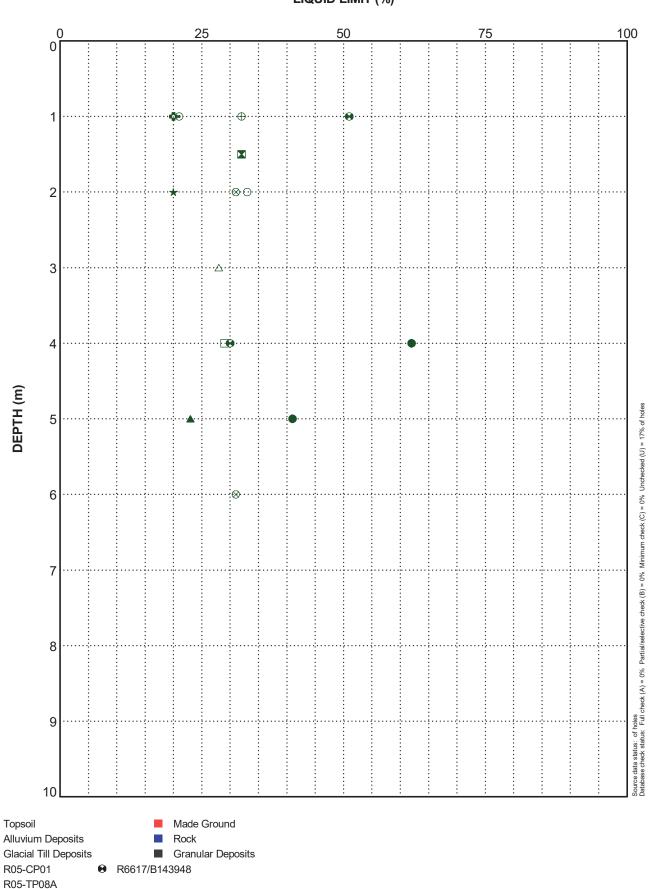
R5619/B135217

R5619/B135219

R5619/B135220

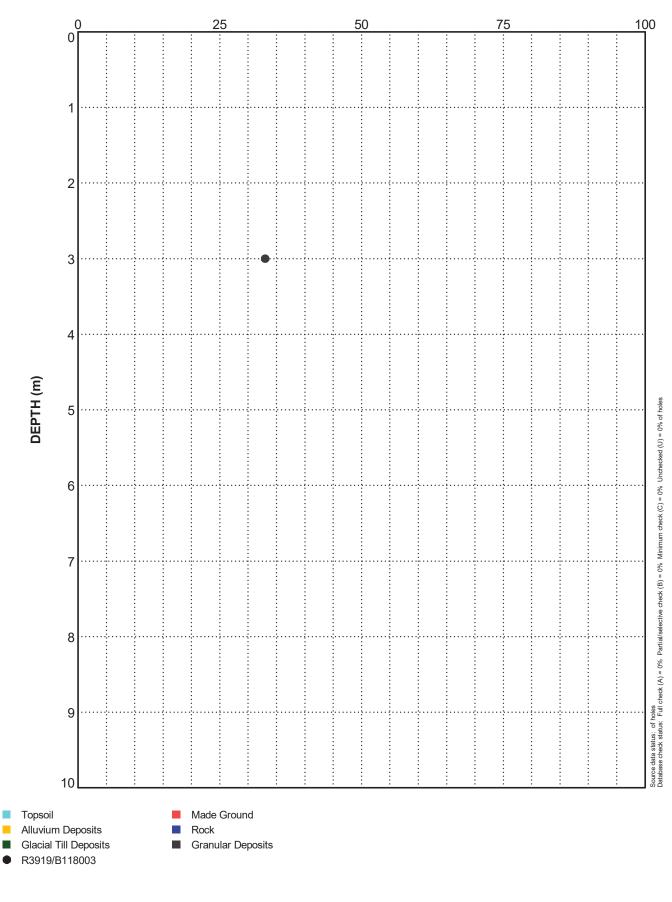
R6617/B143943





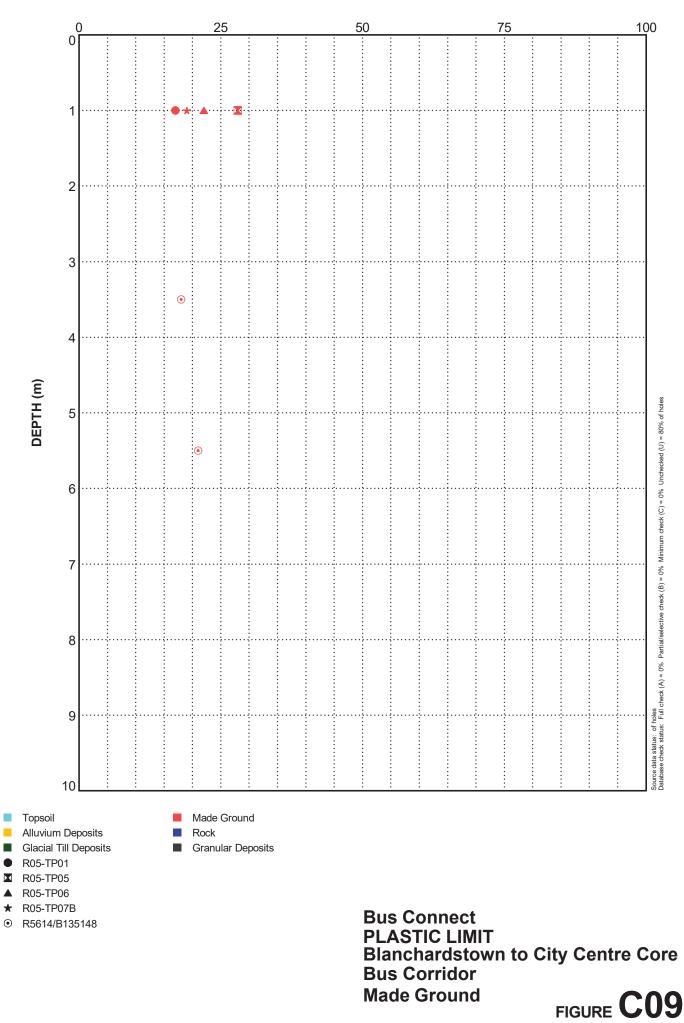
LIQUID LIMIT (%)

LIQUID LIMIT (%)

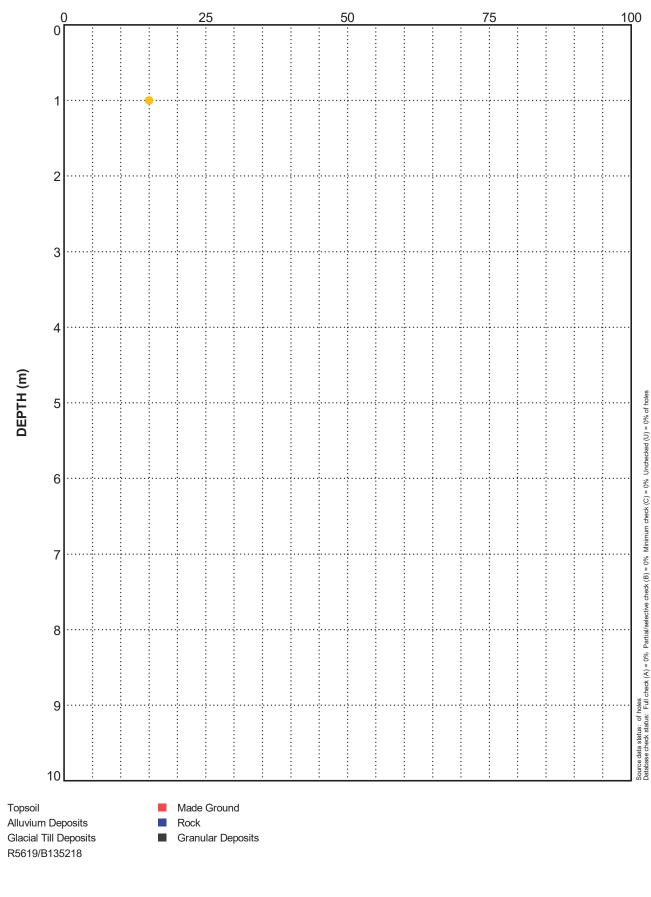


Bus Connect LIQUID LIMIT Blanchardstown to City Centre Core Bus Corridor Granular Deposits FIGURE **C08**

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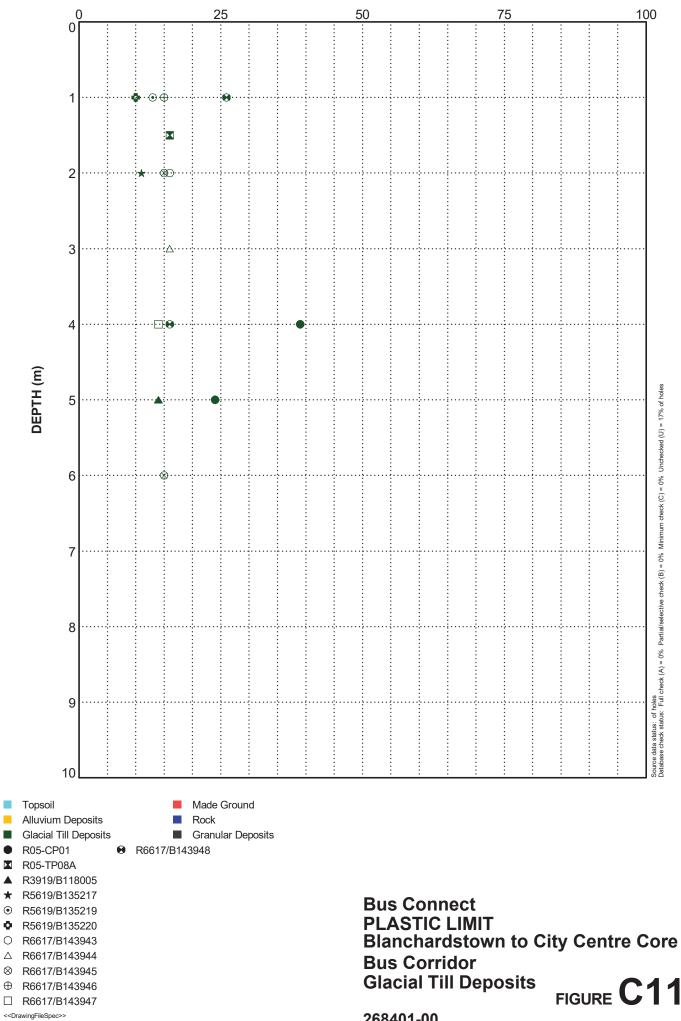


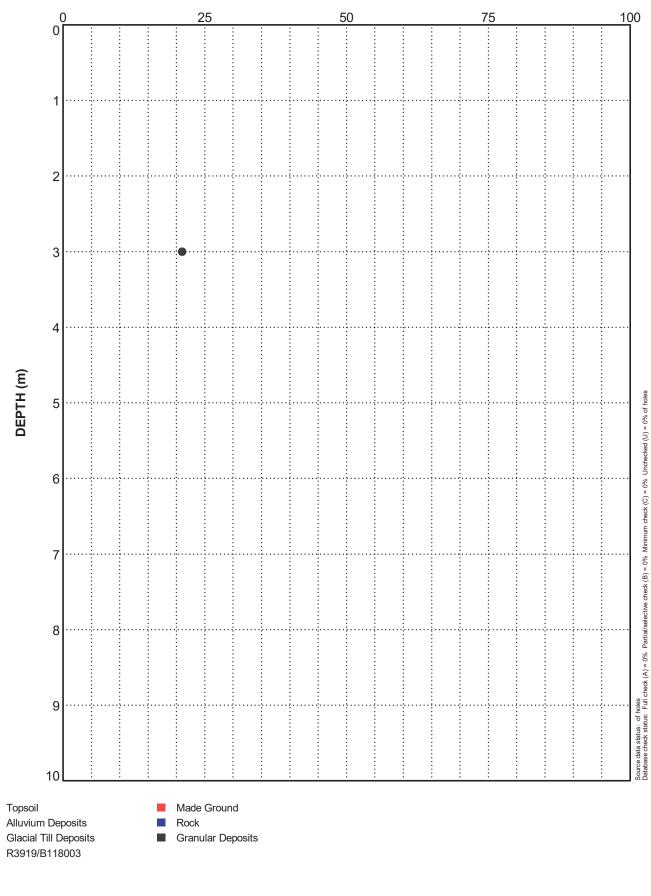
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Bus Connect PLASTIC LIMIT Blanchardstown to City Centre Core Bus Corridor Alluvium FIGURE **C10**

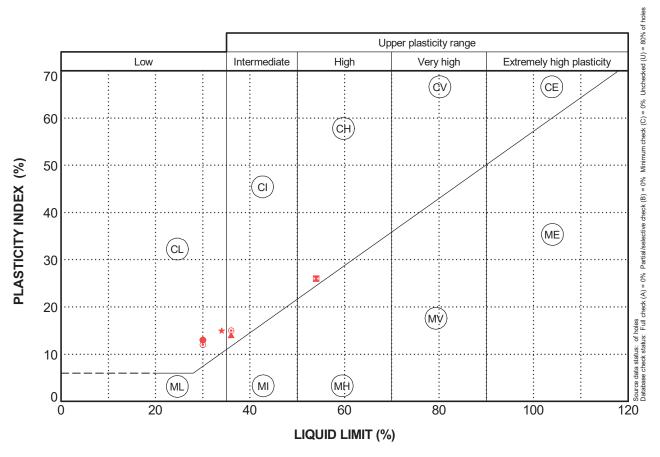
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Bus Connect PLASTIC LIMIT Blanchardstown to City Centre Core Bus Corridor Granular Deposits FIGURE **C12**

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Made Ground

Rock

Granular Deposits

Bus Connect PLASTICITY CHART Blanchardstown to City Centre Core Bus Corridor Made Ground FIGURE **C13**

Topsoil

R05-TP01 R05-TP05

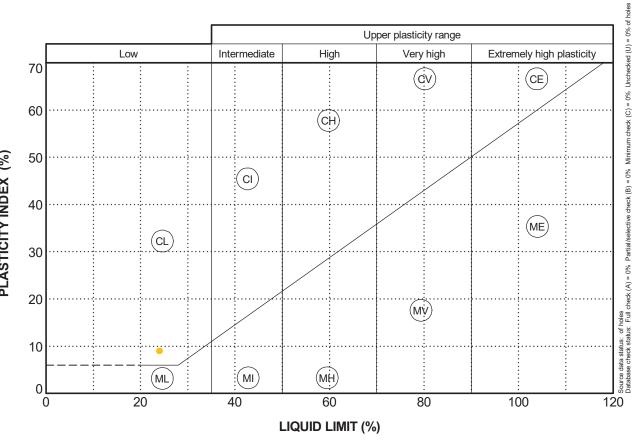
R05-TP06

R05-TP07B

R5614/B135148

Alluvium Deposits

Glacial Till Deposits



Made Ground

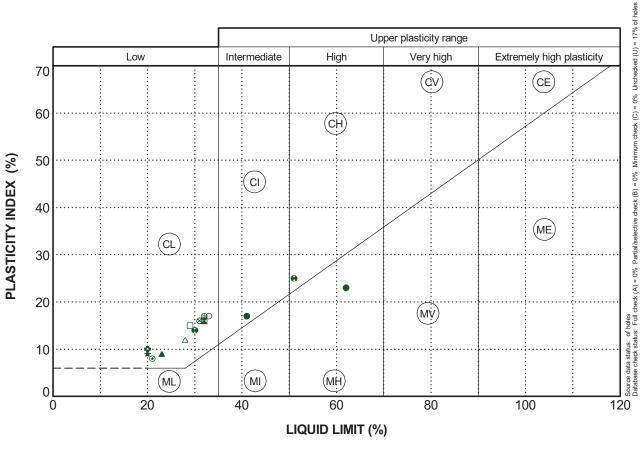
Rock

Granular Deposits

Bus Connect PLASTICITY CHART Blanchardstown to City Centre Core Bus Corridor Alluvium FIGURE **C14**

output

INT



Topsoil Alluvium Deposits Glacial Till Deposits R05-CP01 A R05-TP08A R3919/B118005 R5619/B135217 R5619/B135219 R5619/B135220 R6617/B143943 R6617/B143944 \otimes R6617/B143945 \oplus R6617/B143946

R6617/B143947

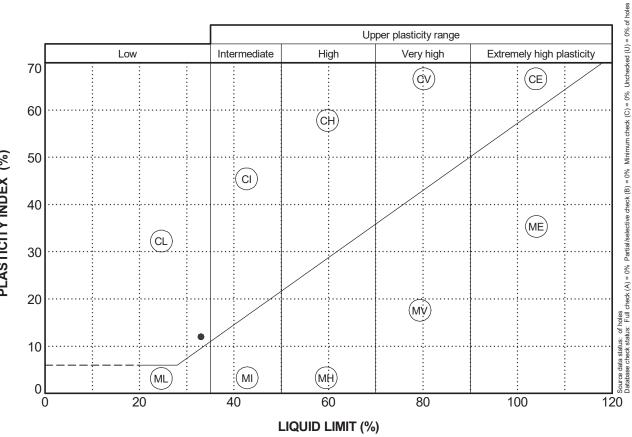
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Made Ground Rock Granular Deposits

R6617/B143948

Bus Connect PLASTICITY CHART Blanchardstown to City Centre Core **Bus Corridor Glacial Till Deposits** FIGURE C15





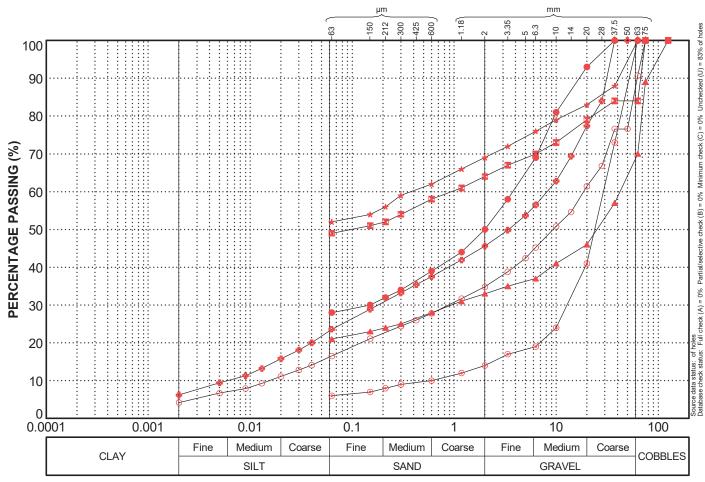
Made Ground

Rock

Granular Deposits

> **Bus Connect** PLASTICITY CHART Blanchardstown to City Centre Core **Bus Corridor Granular Deposits** FIGURE C16

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PARTICLE SIZE (mm)

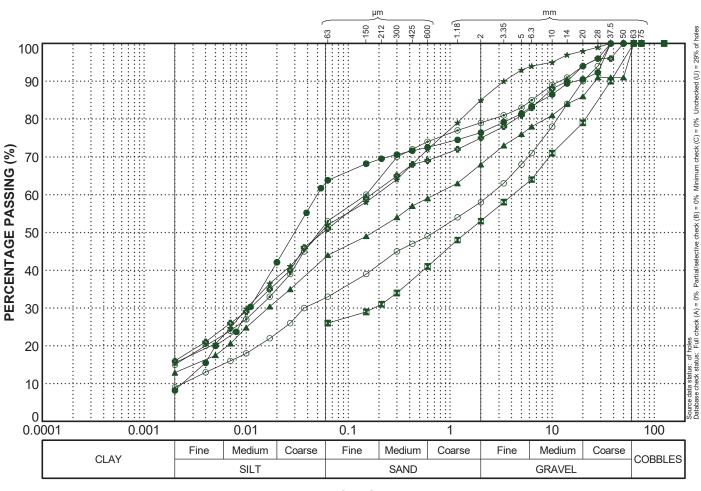
- R05-TP01, 1.00m
- R05-TP05, 1.00m
- R05-TP06, 1.00m
- * R05-TP07B, 1.00m
- ۲ R05-TP09, 0.50m
- ø R5614/B135148, 1.50m
- Ο R5614/B135148, 7.50m

Made Ground Alluvium Deposits Rock Glacial Till Deposits Granular Deposits

Topsoil

Bus Connect PARTICLE SIZE DISTRIBUTION Blanchardstown to City Centre Core **Bus Corridor Made Ground** FIGURE C17 268401-00

Standard sieve sizes

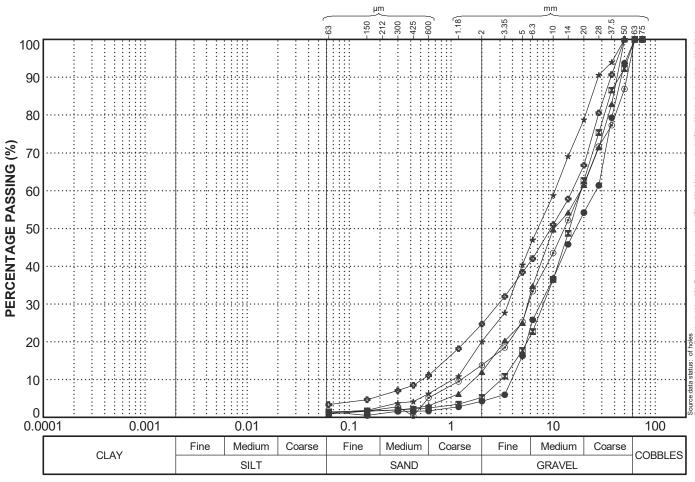


Standard sieve sizes

PARTICLE SIZE (mm)

- R05-CP01, 4.00m
- R05-TP08A, 1.50m
- ▲ R5619/B135217, 2.00m
- ★ R5619/B135219, 1.00m
- R6617/B143943, 2.00m
- R6617/B143947, 4.00m
- O R6617/B143948, 4.00m

Bus Connect PARTICLE SIZE DISTRIBUTION Blanchardstown to City Centre Core Bus Corridor Glacial Till Deposits 268401-00 FIGURE **C18** 31 PS0 Signet alpendestroplob short datarup job/268401-00 bus connects/gir/r05/02_gint/r05/02_gint/r05/02 gint/r05/09/. (Template : 3.0); Library : \\global teur ope/dublin\]obs2_divits\ground engineering(1.0 technical/personal folders/ozgur alpen/gintarup_uklib_3-0-502.8 gib page 1 of 7, Made 25U/7127.83.3 v10.00.01.07 ect : c:\usel bh: 3.3.31 1 output paç



PARTICLE SIZE (mm)

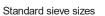
- R2161/B81466, 9.00m
- R3919/B118003, 3.00m
- ▲ R3919/B118004, 3.50m
- ★ R3919/B118005, 2.50m
- R3919/B118006, 5.00m
- R3919/B118007, 4.00m

Topsoil
Made Ground
Alluvium Deposits
Rock

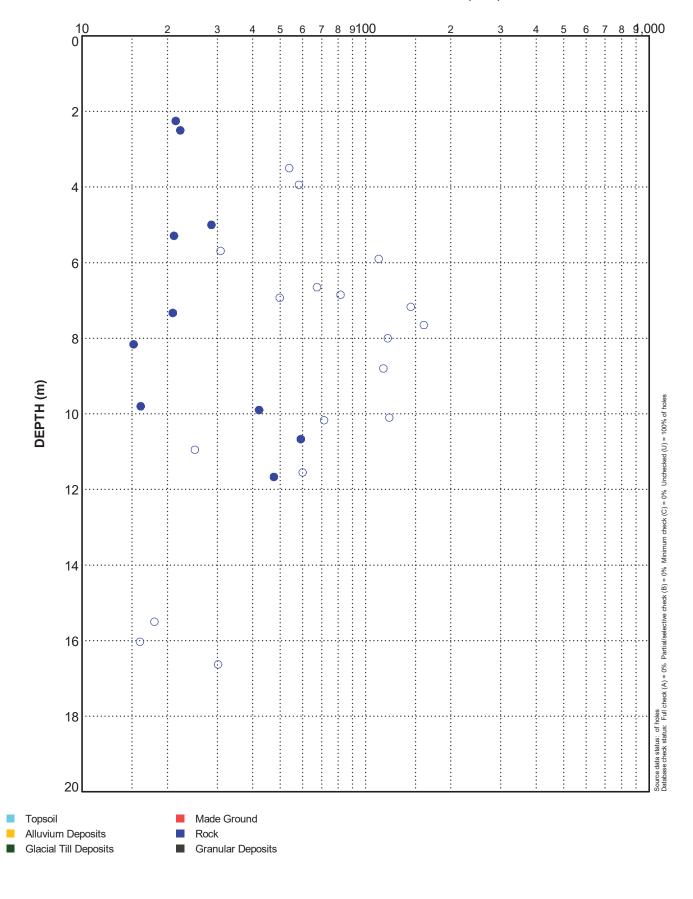
Glacial Till DepositsGranular Deposits

Bus Connect PARTICLE SIZE DISTRIBUTION Blanchardstown to City Centre Core Bus Corridor Granular Deposits 268401-00 FIGURE **C19**

INT.

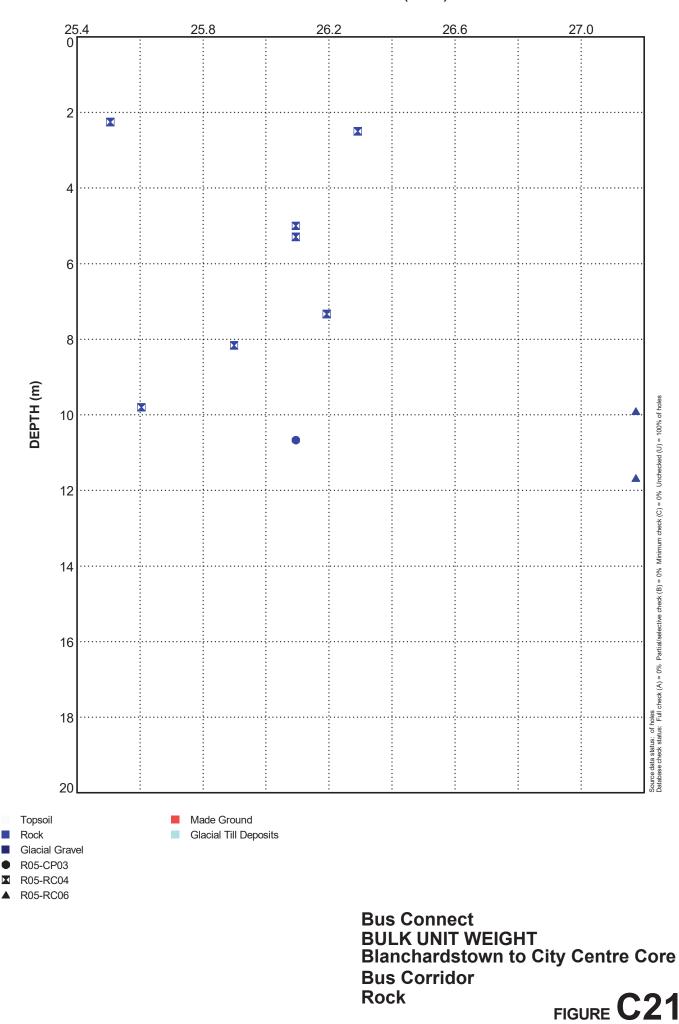


UNIAXIAL COMPRESSIVE STRENGTH (MPa)



Bus Connect POINT LOAD INDEX Blanchardstown to City Centre Core **Bus Corridor** Rock FIGURE C20

ght v10.00.01.07 Licenced to Arup Project : c.userstoggur approdentizative job/268401-00_bus connects/gr/t05(02_gint/t05(02_gint/t05(02_gint/t05(02_gint/t05(02_gint/t05(02_gint/t05(02))) Project : c.userstoggur approdentizative job/268401-00_bus connects/gr/t05(02_gint/t05(02_gint/t05(02))) Project : c.userstoggur approdentizative in the second of the second regiment of the second regime <<DrawingFileSpec>>



BULK UNIT WEIGHT (kN/m³)

<<DrawingFileSpec>>

Appendix D

Factual Ground Investigation Report

National Transport Authority Blanchardstown to City Centre Core Bus Corridor Scheme

Factual Ground Investigation Report

268401-00

Issue | 21 December 2021

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 268401-00

Ove Arup & Partners Ireland Ltd

Arup 50 Ringsend Road Dublin 4 D04 T6X0 Ireland www.arup.com

ARUP



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

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

Ground Investigations Ireland Bus Connect Detailed Stage 1 Lot 1 Route 5 National Transport Authority Ground Investigation Report June 2021



Directors: Fergal McNamara (MD), James Lombard, Conor Finnerty, Aisling McDonnell & Barry Sexton Ground Investigations Ireland Limited | Registered in Ireland Company Regsitration No.: 405726



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

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

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





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

 Tel:
 01 601 5175 / 5176

 Email:
 info@gii.ie

 Web:
 www.gii.ie

GROUND INVESTIGATIONS IRELAND

Geotechnical & Environmental

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1.0 Preamble

On the instructions of Arup, a site investigation was carried out by Ground Investigations Ireland Ltd., between October 2020 and March 2021 at the site of the proposed bus corridor along Route 5: Blanchardstown to the City Centre.

2.0 Overview

2.1. Background

It is proposed to construct a new Bus Connects Core Bus Corridor on several commuter routes into Dublin City Centre. Route 5 is proposed to run between Blanchardstown and the City Centre.

2.2. Purpose and Scope

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

- Visit project site to observe existing conditions
- Carry out 13 No. Trial Pits to a maximum depth of 2.2m BGL
- Carry out 5 No. Cable Percussion boreholes to maximum depth of 5.2m BGL with rotary follow on to a maximum depth of 35.2m BGL
- Carry out 6 No. Rotary Core Boreholes to a maximum depth of 17.3m BGL
- Carry out 2 Window samples to take environmental samples.
- Installation of 2 No. Groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing
- Factual Report

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and insitu testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.

The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Trial Pits

The trial pits were excavated using a 3T tracked excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report. At a number of locations trial pits refused at shallow depths due to obstructions. In some locations a second, third or fourth attempt was made at a different location. These additional pits are labelled with A, B or C after the trial pit reference on the logs.

3.3. Window Sampling

The window sampling was carried out at the locations R5-CP01A and R5-CP03A shown in the location plan in Appendix 1 using a Tecopsa SPT Tec 10 percussion drilling rig. The window sample boreholes were undertaken to replace environmental samples that were previously taken from R5-CP01 and R5-CP03 and not tested. The window sampling consists of a 1m long steel tube with a cutting edge and an internal plastic liner which is mechanically driven into the ground utilising a 50kg weight falling a height of 500mm. Upon completion of the 1m sample, the tube is withdrawn and the plastic liner removed and sealed for logging and sub sampling by a Geotechnical Engineer/Engineering Geologist. The tube is replaced in the borehole and a subsequent 1m sample can be recovered. Occasionally outer casing or a reduced diameter tube is utilised to enable the window sample to progress in difficult drilling conditions. Geotechnical or environmental soil samples can be recovered from each of the liners following logging. The window sample records are provided in Appendix 3 of this Report.

3.4. Cable Percussion Boreholes

The Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.

The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.

Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60° cone. The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil.

At the location of R5-CP04 the cable percussion drilling refused at a shallow depth therefore another attempt was made adjacent to the first attempt and labelled CP04A.

The cable percussion borehole logs are provided in Appendix 3 of this Report.

3.5. Rotary Boreholes

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown on the location plan in Appendix 1. The rotary boreholes were completed from the ground surface or alternatively, where noted on the individual borehole log, from the base of the cable percussion borehole where a temporary liner was installed to facilitate follow-on rotary coring.

The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the "overshoot" recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit, and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids. It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 3 of this Report.

3.6. Surveying

The exploratory hole locations have been recorded using a KQ GEO Technologies KQ-M8 System which records the coordinates and elevation of the locations to ITM or Irish National Grid as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.7. Groundwater Monitoring Installations

Groundwater Installations were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm uPVC/HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. The standpipe and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.8. Laboratory Testing

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

Environmental & Chemical testing as required by the specification, including the specified by ARUP based on suite E testing and organic matter content was carried out by Element Materials Technology Laboratory in the UK.

Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), hydrometer, tests were carried out in NMTL's Geotechnical Laboratory in Carlow or Pro Soils Laboratory in the UK.

Rock strength testing including Point Load (Is₅₀) and Unconfined Compressive Strength (UCS) testing was carried out in Pro Soils Geotechnical Laboratory in the UK.

The results of the laboratory testing are included in Appendix 4 of this Report.

4.0 Ground Conditions

4.1. General

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

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

- Topsoil / Surfacing
- Made Ground
- Granular Deposits
- Cohesive Deposits
- Bedrock

TOPSOIL: Topsoil was encountered in the majority of the exploratory holes and was present to a maximum depth of 0.2m BGL. Concrete surfacing was present in R05-TP02 to a depth of 0.11m BGL

MADE GROUND: Made Ground deposits were encountered from the surface or beneath the Topsoil and were present to depths of between 0.25 and 5.0m BGL across the proposed route. It should be noted that a number of the trial pits refused within the made ground. The Made Ground deposits were described generally as *brown sandy gravelly CLAY with occasional cobbles.* The secondary sand and gravel constituents varied across the site. At some locations *occasional fragments of concrete, red brick, wood, tarmacadam and plastic were* encountered within the made ground. Also, some, occasional or frequent cobble and boulder content was encountered where noted on the exploratory hole logs.

Tarmacadam obstruction was encountered in R05-TP07 and TP07A with a concrete obstruction encountered in TP07B. Tarmacadam was also encountered in RC05-TP07C between 0.5 and 0.7m BGL with angular to sub angular Gravel fill below.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Made Ground or topsoil and were described typically *brown or grey sandy gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits was typically firm to very stiff and generally increased with depth in the majority of the exploratory holes however R05-CP05 encountered very soft and soft deposits to a depth of 2.8m BGL. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

GRANULAR DEPOSITS: Generally minimal granular deposits were encountered within some boreholes however a significant depth of granular material was found within R05-CP05. It should be noted that the rotary drilling technique can wash away finer material so this should be considered where poor recovery is noted on the borehole logs.

The granular deposits were typically described as Grey / brown sandy sub rounded to sub angular fine to coarse GRAVEL or fine to coarse SAND. The secondary sand/gravel and silt/clay constituents varied across the site and with depth while occasional or frequent cobble and boulder content also present where noted on the exploratory hole logs.

Based on the SPT N values the deposits are typically medium dense and become dense with depth. The driller noted blowing sands or gravels during drilling in R05-CP05.

BEDROCK: The rotary core boreholes recovered Medium strong to strong grey/dark grey fine to medium grained laminated LIMESTONE locally interbedded with weak black fine grained laminated Mudstone or Clay. This is typical of the Calp Formation, which is noted on the geological mapping of the proposed site. Rare visible pyrite veins were noted during logging which are typically present within the Calp Limestone. The depth to rock generally varies from 0.3m BGL in R05-RC05 to 10.6 mBGL in R05-RC07 however, rock was not encountered in R05-CP05 at a depth of 35.20m BGL where the borehole was terminated. The total core recovery is good, typically 100% with some of the uppermost runs dropping to 80 or 90%. The SCR and RQD both are relatively poor in the upper weathered zone, often recovered as non-intact, however both indices show an increase with depth in each of the boreholes.

4.2. Groundwater

No groundwater was noted during the investigation however we would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in R05-RC01 and R05-RC04 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 5 of this Report.

4.3. Laboratory Testing

4.3.1. Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered from R05-CP01 generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be SILT of intermediate to high plasticity. A sample from TP08A at 1.5 m shows the primary constituent to be Gravel however the material is described as CLAY based on material behaviour encountered when on site. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 12% and 47% generally with fines contents of 26 to 64%

The Particle Size Distribution tests carried out on the made ground deposits show they are either cohesive or granular and generally well graded. The particle size distribution tests on the cohesive made ground deposits from TP01, TP05 and TP07A generally gave percentages of sand and gravel ranging between 15% to 50%, with fines contents of 28% to 52%. The Particle Size Distribution tests carried out on the granular made ground deposits from TP06 and TP09 gave percentages of sands between 8% to 12%, gravel between 37% to 86%, with fines contents of 6% to 21%.

4.3.2. Environmental Laboratory Testing

A Total of 29 samples were analysed for a Suite of testing specified by ARUP based on suite E according to engineers Ireland.

The possibility for contamination, not revealed by the testing undertaken should be borne in mind particularly where Made Ground deposits are present, or the previous site use or location indicate a risk of environmental variation.

The results from the completed laboratory testing is included in Appendix 4 of this report.

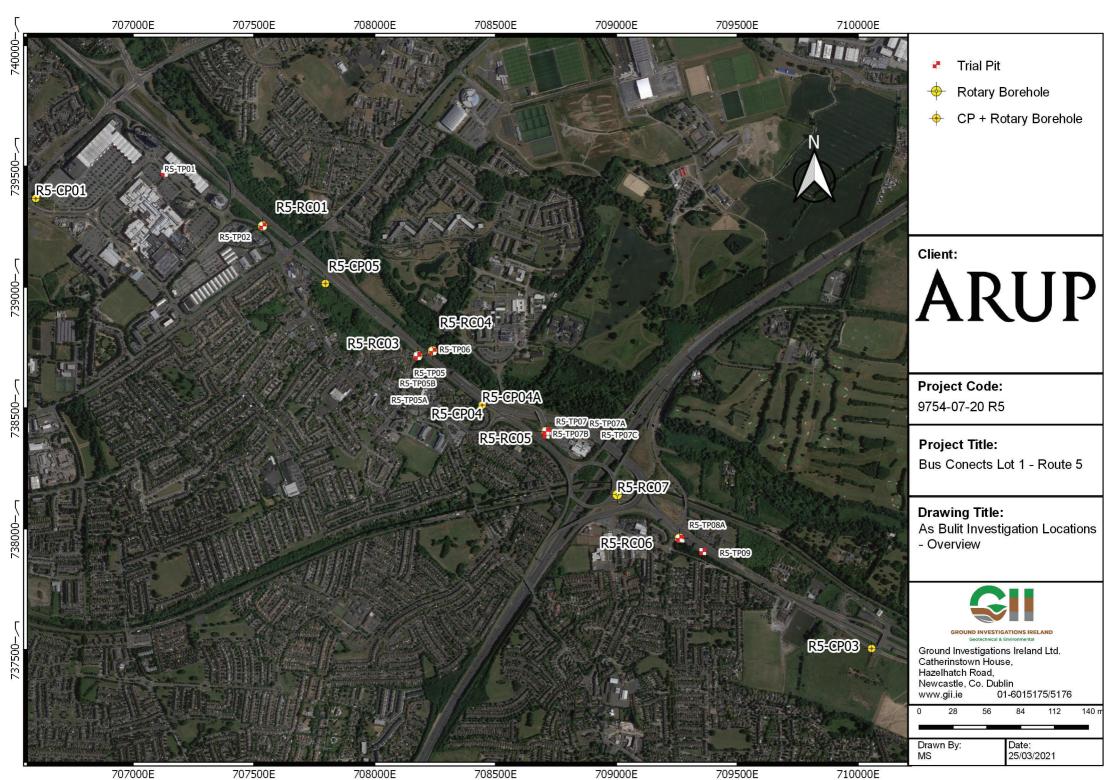
4.3.3. Rock Laboratory Testing

The rock testing carried out on samples recovered from the boreholes reported Unconfined Compressive Strength (UCS) values ranging between 16.1 and 59.1 MPa while the point load testing gave Is50 values ranging between 0.80 to 8.03 MPa. These results correlate to the strength descriptions ranging between of Weak to Strong and confirming the variability of this stratum and the descriptions on the logs.

The results from the completed laboratory testing is included in Appendix 4 of this report.

APPENDIX 1 - Site Location Plan







707900E



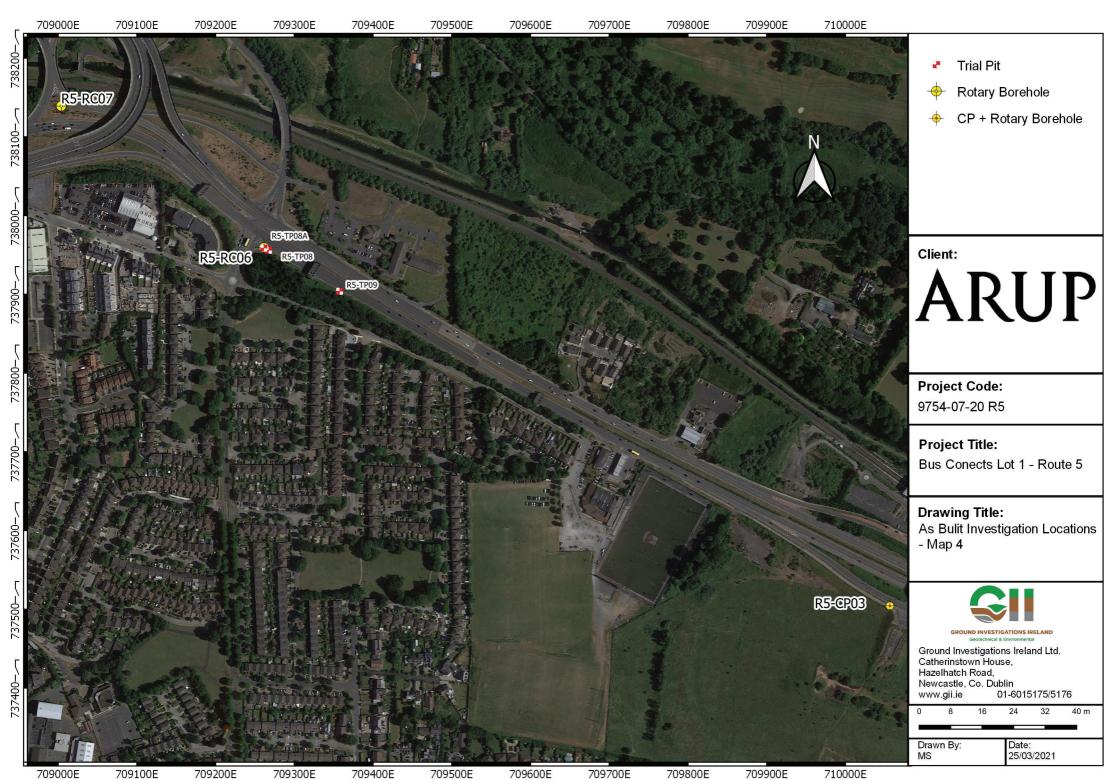
50

708200E



708250E





APPENDIX 2 – Trial Pit Records



		na Inv	estigations Ire www.gii.ie	1		Site Bus Connect Detailed Stag	ge 1 Lot 1	Number R05-TP
/achine : 37 /ethod : Tr	Tracked Excavator	Dimensio 1.60m (L	o ns) x 0.40m (W) x 1.60m (D)		Level (mOD) 59.98	Client National Transport Authori	ty	Job Number 9754-07-2
		Location 7071	130 E 739469 N	Dates 17	/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend
.50	EN			59.58	(0.40) 	Clay with frequent rootlets	slightly sandy slightly gravelly slightly sandy gravelly Clay with ar cobbles and occasional r to subangular fine to coarse	
.00 .00	B T				(0.90)			
.50 .50	B EN			58.68	(0.30)	Stiff grey slightly sandy gra subangular cobbles and o angular to subangular fine Obstruction: presumed b		0 <u>10 0</u> 0 <u>10 </u>
Plan	· · ·					Complete at 1.60m		
						Trial pit terminated at 1.60m boulder Trial pit stable No groundwater encountere Trial pit backfilled upon com	BGL due to an obstruction on a d during excavation pletion	presumed
			· · ·	· ·	•			
					. –	scale (approx)	Logged By Fig	ure No.

			estigations Ir www.gii.ie	eland	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Trial P Numbo R05-TF
<pre>lachine : 3T Tracke lethod : Trial Pit</pre>	d Excavator		ns) x 0.40m (W) x 1.10m (D)		Level (mOD) 55.94	Client National Transport Authority	Job Numb 9754-07
		Location 7075	36.8 E 739250.1 N	Dates 23	9/11/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m) Samp	le / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
				55.83 55.73	- (0.10)	CONCRETE MADE GROUND: Grey sandy angular to subangular fine to coarse Gravel with occasional rootlets Stiff brown slightly sandy gravelly CLAY with occasional angular to subangular cobbles and boulders. Gravel is angular to subangular fine to coarse. Possible Made	
50 B 50 EN 50 T				55.39	0.55 (0.55)	Ground. Very stiff brown slightly sandy gravelly CLAY with occasional angular to subangular cobbles and boulders. Gravel is angular to subangular fine to coarse	
00 B 00 T 10 EN				54.84		Obstruction: presumed boulders Complete at 1.10m	
						Pemerke	
lan						Remarks Trial pit terminated at 1.10m BGL due to an obstruction on pre	esumed
lan	·		· · ·	· ·		Trial pit terminated at 1.10m BGL due to an obstruction on pre	esumed
lan 	·	- -	· · · ·	· ·		Trial pit terminated at 1.10m BGL due to an obstruction on pre boulders Trial pit stable	esumed
Man 	·	· · ·	· · · ·			Trial pit terminated at 1.10m BGL due to an obstruction on pre boulders Trial pit stable	esumed

S		nd Inv	/estigations lre www.gii.ie	land I	_td	Site Bus Connect Detailed Sta	ge 1 Lot 1	Trial P Numb R05-TI	er
Machine:3 ⁻ Method:Tr	Tracked Excavator	Dimensio 1.50m (L	ons _) x 0.30m (W) x 1.60m (D)		Level (mOD) 46.78	Client National Transport Authori	ty	Job Numb 9754-07	
		Location 708	177.1 E 738714.5 N	Dates 16	/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend	Water
0.50 0.50 1.00 1.50	FN BT EN			46.58 45.88 45.23 45.18		gravelly Clay with some ar occasional boulders and o angular to subangular fine MADE GROUND: Brown s Clay with occasional angu is angular to subangular fi	brown slightly sandy slightly ngular to subangular cobbles, iccasional rootlets. Gravel is to coarse slightly sandy slightly gravelly lar to subangular cobbles. Gravel ne to coarse		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Plan .						Remarks Trial pit terminated at 1.60m Trial pit stable	BGL due to service encountered		
						No groundwater encountere Trial pit backfilled upon com	d during excavation pletion		
 	· ·		· · ·						
						Scale (approx)	Logged By Figu PC 9754-0	re No. 7-20.R05-	

			vestigations Ire www.gii.ie	eland	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Trial Pit Number R05-TP05/
lachine : 3 lethod : 1	T Tracked Excavato rial Pit		ons L) x 0.30m (W) x 0.40m (D)		Level (mOD) 46.66	Client National Transport Authority	Job Number 9754-07-2
		Location	1	Dates	144/0000	Project Contractor	Sheet
		708	8178.7 E 738712.8 N	10	6/11/2020	Ground Investigations Ireland	1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
Plan				46.46		Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets MADE GROUND: Brown slightly sandy gravelly Clay with frequent angular cobbles. Gravel is angular to subangular fine to coarse Obstruction: presumed rock Complete at 0.40m	
		·				Trial pit terminated at 0.40m BGL due to an obstruction on p Trial pit stable	presumed rock
					•	No groundwater encountered during excavation Trial pit backfilled upon completion	
					•		
					1		

			estigations Ire www.gii.ie	land	Ltd	Site Bus Connect Detailed Sta	ge 1 Lot 1	Number R05-TP05E	
lachine: 37 lethod: Tr	Tracked Excavator		o ns) x 0.30m (W) x 0.90m (D)		Level (mOD) 46.70	Client National Transport Author	ity	Job Number 9754-07-2	
		Location 7081	176.9 E 738710.5 N	Dates 16	6/11/2020	Project Contractor Ground Investigations Irel	and	Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend	
				10.50	(0.20)	Brown slightly sandy sligh occasional rootlets			
				46.50	- 0.20 	Firm greyish brown slight frequent angular to suban to subangular fine to coars	y sandy gravelly CLAY with gular cobbles. Gravel is angula se	ar <u>6 7 4 4</u> 6 7 4 4 6 7 4 4 6 7 7 4 6 7 7 4 6 7 7 6	
90	B EN			45.80		Obstruction: presumed r	rock	6 - 2 - 4 - 0 - 0 - 0 - 0 - 0 - 0	
90	EN					Complete at 0.90m			
Plan .						Remarks Trial pit terminated at 0.90m	BGL due to an obstruction on	presumed rock	
				•		Trial pit stable No groundwater encountere Trial pit backfilled upon com	ed pletion		
				•					
•	 		· · ·		· ·				
					s	icale (approx)	Logged By F	igure No.	

	Grou	nd In	vestigations lı www.gii.ie	reland	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Trial Pit Number R05-TP
lachine:3T lethod:Tri	Tracked Excavato al Pit		ions L) x 0.30m (W) x 2.00m (D		Level (mOD) 45.00	Client National Transport Authority	Job Numbe 9754-07-
		Location 708	ו 3240.6 E 738731.7 N	Dates 16	6/11/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
50 50 .00 .00 .00	FN BT EN BT			44.80	(1.50) (1.50) (0.30) 2.00	Dark greyish brown slightly sandy slightly gravelly TOPSOIL with frequent rootlets MADE GROUND: Brown gravelly clayey fine to coarse Sand with occasional angular to subangular cobbles, rootlets and occasional fragments of metal, plastic and red brick Brown sandy clayey angular to subangular fine to coarse GRAVEL with some angular to subangular cobbles (possible weathered rock) Obstruction: boulder or possible rock Complete at 2.00m	
				·		Trial pit terminated at 2.00m BGL due to obstruction on a bould possible rock	ler or
						possible rock Trial pit stable No groundwater encountered during excavation Trial pit backfilled upon completion	
•	· · ·		· · ·	•	· · ·		
					-	cale (approx) Logged By Figur	e No.

		nd Inv	estigations Ire www.gii.ie	land	Ltd	Site Bus Connect Detailed Stag	ge 1 Lot 1		l Pit nber TP0
Machine:37 Method:Tr	Tracked Excavator	Dimensio 1.70m (L	ns) x 0.30m (W) x 0.25m (D)		Level (mOD) 53.48	Client National Transport Authorit	ty	Job Num 9754-	nber
		Location	708.4 E 738402.6 N	Dates 17	//11/2020	Project Contractor Ground Investigations Irela	and	She 1	et 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)		escription	Leger	
(m) 0.20 Plan	B			(mOD) 53.38 53.23		_Brown slightly sandy slight	ily gravelly TOPSOIL ghtly sandy gravelly Clay w ounded cobbles and occas		
						Trial pit terminated at 0.25m Trial pit stable No groundwater encountere	d during excavation (Surfac		
						be seen in pit on photograph Trial pit backfilled upon com	1) pletion		
						cale (approx)	Logged By	Figure No.	

S	Grou	nd Inv	/estigations lre www.gii.ie	land	Ltd	Site Bus Connect Detailed Stat	ge 1 Lot 1	Trial Pit Number R05-TP07/
lachine:3 ⁻ lethod :Tr	T Tracked Excavator ial Pit		ons _) x 0.30m (W) x 0.70m (D)		Level (mOD) 53.22	Client National Transport Authori	ty	Job Number 9754-07-20
		Location 708	715.6 E 738400 N	Dates 17	7/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend
.50	B			53.02	(0.20) 0.20 (0.50)	Brown slightly sandy slight MADE GROUND: Grey sli some angular to subround and occasional fragments Obstruction: Tarmacadar Complete at 0.70m	ghtly sandy gravelly Clay wit ed cobbles, occasional rootl of plastic and rope	
Plan .		·		•		Remarks Trial pit terminated at 0.70m	BGL due to an obstruction of	on tarmacadam
						Trial pit stable No groundwater encountere Trial pit backfilled upon com	d during excavation pletion	
	 		 		· ·			
					 s	cale (approx)	Logged By PC 97	Figure No.

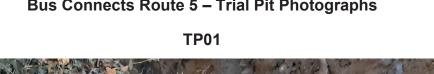
->			estigations Ire www.gii.ie			Bus Connect Detailed Stage 1 Lot 1	Number R05-TP07
Nachine: 3 Nethod : Ti	Γ Tracked Excavato ial Pit		ns) x 0.50m (W) x 1.65m (D)		Level (mOD) 53.56	Client National Transport Authority	Job Number 9754-07-2
		Location 7087	09.8 E 738385.1 N	Dates 17	7/11/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
				53.36	(0.20) 0.20	Greyish brown slightly sandy slightly gravelly TOPSOIL wit	h
					-	MADE GROUND: Grey slightly sandy gravelly Clay with frequent angular to subrounded cobbles, occasional boulders, rootlets and occasional fragments of concrete, plastic, tarmacadam and wood	
.50 .50	EN T						
.00 .00	B T				(1.45) 		
.50	EN			51.91	- 1.65	Obstruction: Concrete	
						Complete at 1.65m	
Plan .						Remarks	
						Trial pit terminated at 1.65m BGL due to an obstruction on co Trial pit stable No groundwater encountered during excavation Trial pit backfilled upon completion	oncrete

			estigations Ire www.gii.ie			Bus Connect Detailed Stag	ge 1 Lot 1	Number R05-TP070
lachine:31 lethod:Tr	Tracked Excavator	Dimensio 2.00m (L	n s) x 0.70m (W) x 1.30m (D)		Level (mOD) 53.48	Client National Transport Authority		Job Number 9754-07-2
		Location 7087	709.3 E 738400.6 N	Dates 23	8/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend
0.50 1.00 1.30 Plan . 	В Т В	(m) 		53.28 52.98 52.78 52.38 52.18	(0.20) 0.20 0.20 0.30) 0.50 0.70 0.70 0.40) 1.10 0.20) 1.30 1.30 0.20 0.70 0.70 0.70 0.70 0.20) 0.70 0.70 0.20) 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.70 0.20 0.20 0.70 0.20 0.20 0.20 0.70 0.20	Greyish brown slightly san occasional rootlets MADE GROUND: Grey slig some angular to subround and occasional fragments TARMACADAM MADE GROUND: Compac subangular fine to coarse	dy slightly gravelly TOPSOIL with ghtly sandy gravelly Clay with ed cobbles, occasional rootlets of plastic ted dark grey sandy angular to Gravel ted light grey angular to Gravel with occasional angular to BGL d during excavation	
	· · ·	•			· ·			
						cale (approx)	Logged By Figu	re No.

	nd Inves w	tigations Ire ww.gii.ie	land I	Ltd	Site Bus Connect Detailed Sta	ge 1 Lot 1	Trial P Numb R05-TI	oer
lachine : 3T Tracked Excavator lethod : Trial Pit	Dimensions 1.60m (L) x 0.8	50m (W) x 0.60m (D)		Level (mOD) 53.18	Client National Transport Authori	ty	Job Numb 9754-07	
	Location		Dates	10010004	Project Contractor		Sheet	:
	709267.3	E 737955.2 N	18	/02/2021	Ground Investigations Irela	and	1/1	1
Depth (m) Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend	Water
Plan			52.98 52.58	. (0.20) - 0.20 - 0.20 - 0.40) - 0.60 	Brown sandy TOPSOIL wi MADE GROUND: Light browith occasional cobbles an Services encountered at Terminated at 0.60m	own slighty gravelly sandy Clay nd occasional pockets of fine sand 0.60m BGL		
		· ·		•				

			estigations Ire www.gii.ie	land l	Ltd	Site Bus Connect Detailed Stag	ge 1 Lot 1	Trial Pit Number R05-TP08
lachine: 3 ⁻ lethod: Ti	Γ Tracked Excavator ial Pit	Dimonolo	ns) x 0.50m (W) x 2.20m (D)		Level (mOD) 53.23		Client National Transport Authority	
		Location 7092	61.2 E 737957.9 N	Dates 18	/02/2021	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend
.50 .50 .50 .20	B EN EN			53.03	(0.20) 0.20 (0.60) (0.60) (1.40) 2.20 2.20	Brown sandy TOPSOIL wit MADE GROUND: Dark gre coarse Gravel with many a		
						Trial pit terminated at 2.20m No groundwater encountere Trial pit stable Trial pit backfilled upon com	d during excavation	
						mai pit backilleu upon com	pieuon	
•	· ·	•		· ·	. s	icale (approx)	Logged By Figur	re No.

Ground Investigations Ireland Ltd www.gii.ie					Site Bus Connect Detailed Stag	iled Stage 1 Lot 1		ber	
lachine : 3T Tracked Excavator lethod :Trial Pit	Dimensions 1.70m (L) x 0.45m (W) x 1	.40m (D)	Ground Level (mOD) 52.38		Client National Transport Authority			Job Number 9754-07-20	
	Location 709357.4 E 737903.1 N		Dates 18/02/2021		Project Contractor Ground Investigations Ireland			Sheet 1/1	
Depth (m) Sample / Tests	Water Depth (m) Field Reco	ords (mC	vel De OD) (Thic	epth m) kness)	D	escription	Legen	Water	
.50 B EN 40 B EN			2.18	(0.20) 0.20 (1.20)	Dark brown sandy TOPSO MADE GROUND: Brown of angular Gravel with many and occasional boulders	layey sandy angular to sub angular to subangular cobb	les		
Plan 	· · · ·	· · ·			temarks Trial pit terminated due to se Trial pit stable No groundwater encountere Trial pit backfilled upon com		m BGL		
		· ·		. s	cale (approx)	Logged By	Figure No.		















TP05A



TP05A



TP05B



TP05B





R5-RC04 (Inspection Pit)



*Note: above photo taken at the location of TP06 on a subsequent day when the area was cleared to create space for the rotary core rig







TP07A



TP07B



TP07B



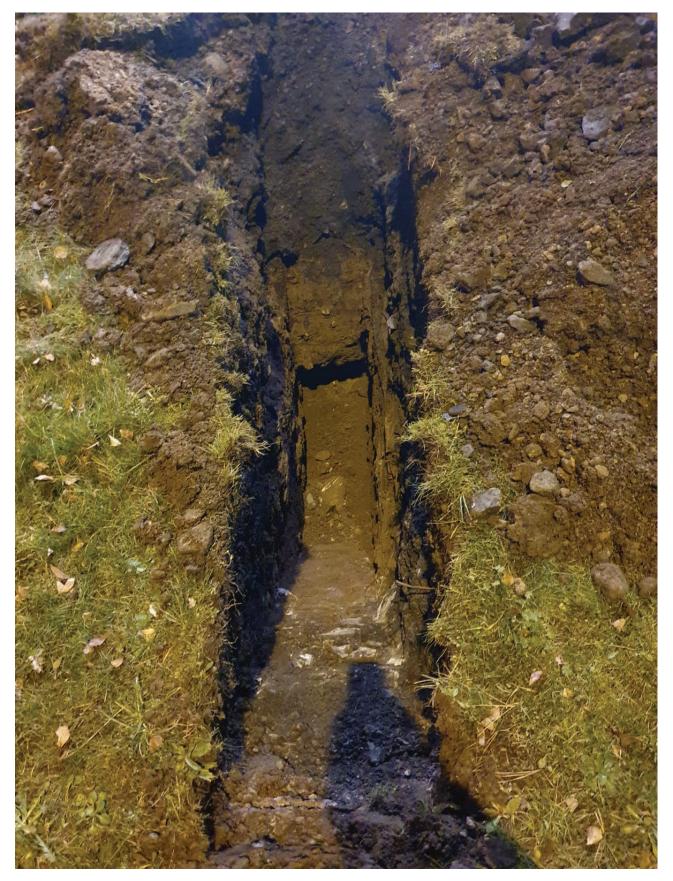
TP07C



TP07C

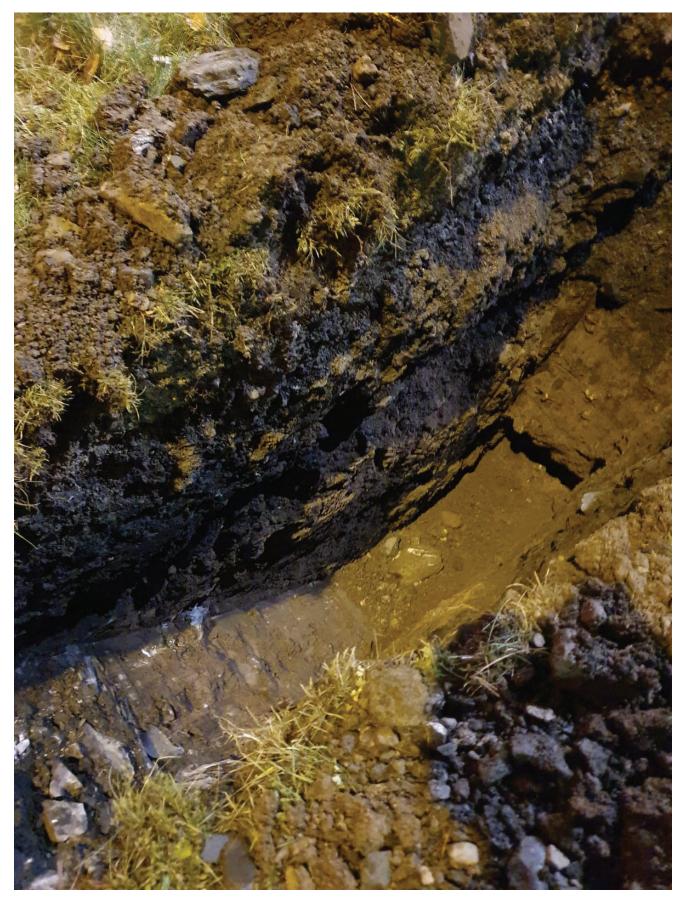


TP08A



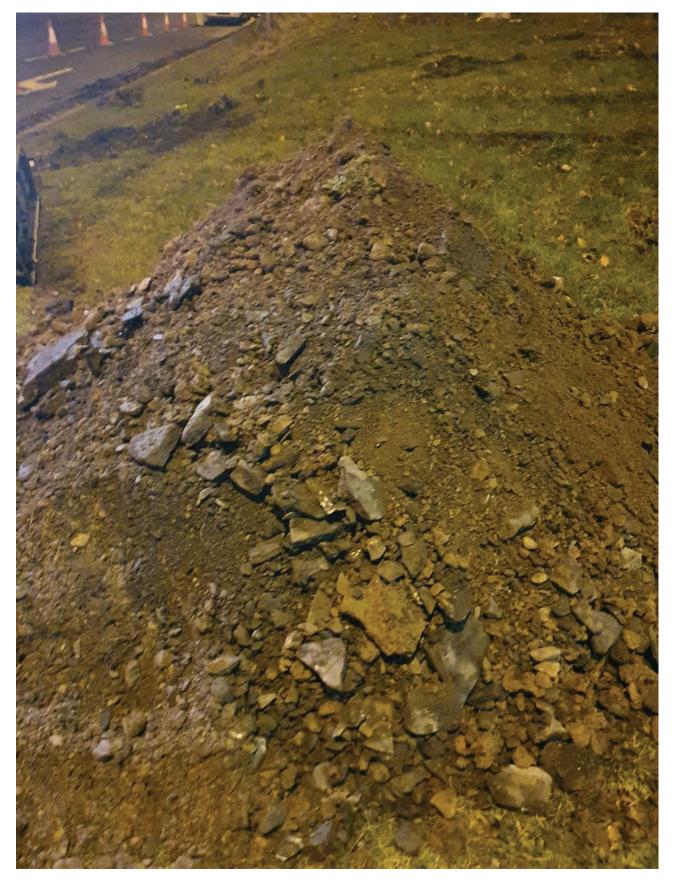
Bus Connects Route 5 – Trial Pit Photographs

TP08A



Bus Connects Route 5 – Trial Pit Photographs

TP08A



Bus Connects Route 5 – Trial Pit Photographs

TP09



TP09



APPENDIX 3 – Borehole Records



Machine : Da			Casing	WW Diamete			Ltd Level (mOD)	Site Bus Connect Detailed Stage 1 Lot 1 Client	Boreho Numbe R05-CF Job Numbe
Method : Ca			200 96r)mm cas nm case	ed to 5.20m d to 8.00m		65.64	National Transport Authority	9754-07-
	un rotary i		Location 706		739366.5 N	Dates 03	/11/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m)	Sample	/ Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
.50 .00 .20-1.65 .50 .00-2.45 .00 .00 .50 .00-3.45 .00 .00 .50	EN BTSPT(C) EN SPT(C) BT EN SPT(C) BT EN	N=5			1,0/1,1,1,1 1,0/1,1,2,1 2,1/2,1,1,1	65.44 64.04 62.24	(0.20) 0.20 0.20 (1.40) (1.40) (1.80) (1.80) (0.60)	Brown slightly sandy slightly gravelly TOPSOIL. MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional fragments of cloth. MADE GROUND: Grey slightly sandy slightly gravelly Clay with occasional fragments of wood and organic matter.	
.00-4.45 .00 .00	SPT(C) B T	N=31			2,3/6,7,8,10	61.64 61.34	4.00 (0.30) 4.30 (0.70)	Very stiff grey slightly sandy slightly gravelly clayey SILT. Very stiff light grey mottled brown slightly sandy gravelly clayey SILT	
i.00 i.00-5.16 i.00 i.00	TCR 100	SCR 14	RQD 9	FI MNI	B SPT(C) 50/10 T	60.64	5.00	Medium strong thinly to thickly laminated grey fine grained argillaceous LIMESTONE with occasional calcite veining. Distinctly weathered 5.00m-6.70m BGL - Mostly Non Intact	
.50 .70 .40 .00	100	70	44	16		58.24	7.40 (0.60) 8.00	 6.70m-7.40m BGL - Two fracture sets. F1: Very closely spaced, 10° to 20°, planar smooth. F2: Very closely to closely spaced, 50° to 70°, planar smooth Medium strong to strong thinly to thickly laminated grey fine grained argillaceous LIMESTONE with occasional calcite veining. Partially weathered 7.40m-7.80m BGL - F1: Closely spaced, 20° to 40°, planar smooth Complete at 8.00m 	
orehole cor	follow on find nplete at 8 ater encourt ckfilled upo	rom 5.00m .00m BGL ntered dur n complet	n BGL due . on engine ring drilling tion	e to slight eers Inst	collapse at base of t ruction drilling with water flu				JS & F

With Redary Solitors of Location Location Dates 021112020- 191112020 Project Contractor Ground Investigations Iroland 0°(h) 000 000 Sample / Tests Claim 000 Very Market 000 Poject Contractor Ground Investigations Iroland Description 0.50 EN 55.55 0.10 Brown slightly sandy slightly gravelly CDPSOIL MADE GROUND: Dark grav sandy gravelly CLV with many coldes 0.50 EN 54.55 1.00 Brown slightly sandy slightly gravelly CLV with many coldes 0.50 EN 8.11/11.17.22 54.55 1.00 MADE GROUND: Brownish gray sandy gravelly CLV with many coldes 0.50 EN 50/ 12.13/13.23.14 50/ 1.00 3.50 EN 12.13/13.23.14 51.65 4.00 7 Max 51.65 4.00 0.000 3.50 EN 12.13/13.23.14 51.65 4.00 4.00 3.60 12.13/13.23.14 51.65 5.00 3.50 EN 13.44/10.21.19 51.65 5.00 3.60 2.3 2.3 2.44/10.8.1 5.0.0	Machine : Da Be Method : Ca	ando 2000 eretta T44) +	Casing	WV Diamete	gations Ire vw.gii.ie r d to 4.00m d to 11.00m	Ground	LIO Level (mOI 55.65	Bus Connect Detailed Stage 1 Lot 1) Client National Transport Authority	Number R05-CP0 Job Number 9754-07-2
Iso EN B Good State Iso Brown slightly gravely TOPSOLL MADE GROUND: Dark gray sandy gravely CLay with many cobbies 100 B SPT(C) 50/200 B 1.00 MADE GROUND: Brownish gray sandy gravely CLay with many cobbies 100 SPT(C) 50/200 B B 1.1/11.17.22 SS 100 SPT(C) 50/200 B B 1.1/11.17.22 SS 100 SPT(C) 50/200 B SS SS SS 260 EN SS SS SS SS 100 SPT(C) 50/100 SS SS SS SS 100 SS SS SS SS SS SS 100 SS SS SS <t< th=""><th></th><th></th><th></th><th>Locatio</th><th>n</th><th></th><th>02</th><th>2/11/2020- 0/11/2020</th><th></th><th>Sheet 1/2</th></t<>				Locatio	n		02	2/11/2020- 0/11/2020		Sheet 1/2
3.50 EN MADE CROUND: Dark grey sandy gravely Clay with many cobbies. 1.00 B 1.00 MADE CROUND: Brownish grey sandy gravely Clay with many cobbies. 1.20-150 SPT(C) 50:200 EN 8.11/11.17.22 1.00 MADE CROUND: Brownish grey sandy gravely Clay with many cobbies. 2.00-340 BT SPT(C) 50:190 S0' 1.2.13/13.23.14 1.00 3.00-340 BT 1.2.13/13.23.14 1.00 Correct grey substiguing to accessional cobbies. Correct grey substiguing to ac	Depth (m)	Sample	e / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness) Description	Legend
120-155 SPT(C) 50/200 8,11/11,17.22 (3.00) 150 EN 50/ 200-2.04 SPT(C) 50/140 50/ 100 EN 12,13/13,23,14 100-3.34 SPT(C) 50/190 12,13/13,23,14 100-4.34 FN 14,11/10,21,19 100-4.34 SPT(C) 50/190 14,11/10,21,19 100-4.34 TCR SCR 100-4.34 SPT(C) S0/190 T 100-4.34 SPT(C) S0/190 14,417/18,9 100-4.34 SPT(C) S0/190 S1.65 100-4.34 SPT(C) S0/190 350-5.45 SPT(C) N=31 23 SPT(C) N=31 350-6.45 SPT(C) N=28 20 SPT(C) N=28 350-6.45 SPT(C) N=28 20 SPT(C) N=28 350-6.45 SPT(C) N=28 20 SPT(C) N=28 350-6.45 SPT(C) N=28 350-7 SPT(C) N=28 350-7 SPT(C) N=28 350-8 SPT(C) N=28 350-8 SPT(C)	1.00							(0.90	MADE GROUND: Dark grey sandy gravelly Clay with many cobbles.	
0.00 B T Image: Constraint of the constraint	.20-1.55 .50 2.00-2.04 2.00 2.00	SPT(C) EN SPT(C) B T								
1.00 35 T T Graduet of the coarse of the coar	3.00 3.00 3.50 4.00	B T EN		RQD	FI	14,11/10,21,19 B	54.05			
300-8.45 20 3.4/4.8.8.8 SPT(C) N=28 3.4/4.8.8.8 SPT(C) N=28 (3.00) 3.00-8.45 20 12.128.5.7.30 SPT(C) N=50 (3.00) 3.00-8.45 3.00 47.65 8.00 3.00 47.65 8.00 47.15 8.50 47.15 8.50 47.15 8.50 47.15 8.50 47.15 8.50 47.15 8.50 47.15 8.50 47.15 8.50 47.15 8.50 47.15 8.50	4.00 4.00	35				T 4,4/7,7,8,9	51.05		dense grey subangular to subrounded fine to coarse GRAVEL with occasional cobbles. Driller's notes - Made Cround, Brown condy grouply Clay with earne orbitation	
5:50-6:95		23		-			50.65	5.00	subangular to subrounded fine to coarse Gravel with occasional cobbles. Driller's notes: Brown sandy gravelly	2 2 2 2 2 2 2 2 2 2 2 2 2 2
.00-8.45 .00 .00 .00 .00 .00 .00 .00 .50 .51 .51 .51 .52 .51 .53 .51 .54 .55 .55 .55 .50 .55 .50		20		_				(3.00		
82 51 21 .50 13							47.65	<u>-</u>	Dense grey angular to subangular fine to coarse GRAVEL	0.0.0
.50 8.50m-10.40m BGL - F1: Very closely to closely	.50	82	51	21			47.15	8.50	LIMESTONE interbedded with medium strong thinly laminated dark grey fine grained calcareous MUDSTONE.	
	.50				13			(2.50	spaced, 10° to 30°m planar smooth with clay staining	
Remarks Scale Cable percussion drilling refusal at 4.00m BGL. Scale Cotary follow on from 4.00m BGL Image: Scale Jo groundwater encountered during drilling (Rotary drilling with water flush may conseal water strike) Scale Jorehole complete at 11.00m BGL on engineers instruction. 1:50	able percus totary follow	/ on from 4	1.00m BGL	_		drilling with water flu	ish may co	nseal water	(approx)	Logge By

S		Grou	nd In	vesti wv	gations Ire vw.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1		Boreh Numb R05-Cl	er
Machine:D B Flush : Core Dia:6-	eretta T44	+	20	Diamete Omm cas mm case	r ed to 4.00m d to 11.00m		Level (mOD) 55.65	Client National Transport Authority		Job Numb 9754-07	
Method : C		ssion ollow on	Locatio		737504.1 N	Dates 02 19	2/11/2020- 2/11/2020	Project Contractor Ground Investigations Ireland		Sheet 2/2	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
10.40	100	54	27	3		44.65		10.40m-11.00m BGL - F1: Very closely to medi spaced, 10° to 20°, planar smooth Complete at 11.00m	m		
Remarks									Scale (approx)	Logge By	
									1:50 Figure N 9754-07-2		

Machine : Da	ando 2000		1		igations Ire vw.gii.ie _r		Ltd	Site Bus Connect Detailed Stage 1 Lot 1 Client	Borehol Number R05-CP0 Job
	eretta T44 ′ater		20	0mm cas	sed to 1.00m ed to 12.70m		50.32	National Transport Authority	Number 9754-07-2
Core Dia: 64	1 mm		Locatio			Dates		Project Contractor	Sheet
Method : Ca	able Percu ith Rotary f				738509.8 N		/12/2020	Ground Investigations Ireland	1/2
Depth	TCR	SCR	RQD			Level	Depth		
(m)	(%)	(%)	(%)	FI	Field Records	Level (mOD)	(m) (Thickness)	Description	Legend
0.00						50.12	(0.20)	TOPSOIL	
								Brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and boulders. Gravel is subangular	
1 00 4 04					50/50		(0.80)	to subrounded fine to coarse	<u>0</u> ,0-0
1.00-1.04 1.00	18				SPT(C) 50*/40 50/0 B	49.32	1.00	Poor recovery, recovery consists of: Dark grey slightly	C.P.C
1.00	10							sandy gravelly CLAY with occasional cobbles and boulders Gravel is medium to coarse, sub-angular to sub-rounded.	
								(Drillers notes: Gravelly CLAY with boulders).	0.0
							(1.40)		<u> <u> </u></u>
2.20					-	47.92	2.40	Weak to medium strong dark grey massive fine to medium	0.0.0
								grained LIMESTONE interbedded with firm dark grey slightly silty slightly sandy gravelly CLAY. Gravel is fine to	
	100	41	24					coarse, sub-angular to sub-rounded. Distinctly weathered.	
							(1.65)		
							-		
3.70									
						46.27	4.05	Weak to medium strong dark grey massive fine to medium	
	100	53	38					grained LIMESTONE with widely spaced, thin beds of firm dark grey slightly slity slightly sandy gravelly CLAY. Gravel	
								is fine to coarse, sub-angular to sub-rounded. Partially to distinctly weathered.	
4.70	100	90	64						
								2.40m - 8.40m BGL: Fracture set 1: 20-30 degrees, discontinuities are rough, undulating with clay, closely	
5.20				6				spaced. Fracture set 2: 60-65 degrees, discontinuities are rough to stepped, undulating with clay and iron	
								staining, medium spaced.	
	100	58	42						
							(4.35)		
							<u> </u>		
6.90									
	100	43	41						
7.50	100	64	24						
	100	61	34						
8.20									
3.40					-	41.92	8.40	Medium strong dark grey massive fine grained LIMESTONE with clay and iron staining on surfaces.	
								Partially weathered.	
	90	53	19	10			= <u> </u>		
				13					
9.70 10.00									
Remarks Borehole cor	npleted at	12.70m B	GL. on er	ngineers	instruction.			Scale (approx	Logged
Borehole bac	ckfilled on ater encour	completion	n. ring drillin	g (Rotary	y drilling with water flu	ush may co	nseal water st		JD/JS
			or i noul.					Figure	
									-20.R05-CP

end	SI		Grou	nd In	vesti	gations Ire ww.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Bore Num R05-0	ber
Interd Construction with NSMI (SM) (SM) Construction TO 2044.4 T E 735509.8 N Desc (SM) Project Contractor Ground Investigations Instand Cond Investigations Instand Rescription Legan Legan Legan Legan Legan Rescription Legan Legan 30 100 60 60 90 90 100 63 8 1.00 (ST) 8.00 (ST) 1.00 (ST) </th <th>Be Iush :W</th> <th>eretta T44 ater</th> <th>+</th> <th>20</th> <th>0mm cas</th> <th>ed to 1.00m</th> <th></th> <th></th> <th></th> <th>Num</th> <th></th>	Be Iush :W	eretta T44 ater	+	20	0mm cas	ed to 1.00m				Num	
30 100 66 66 100 70 83 (4.30) 8.40m-12.20m PGL Tracture ast 10-10 durgree, drawn drawn arbitrary, tracture ast 10-10 durgree, drawn arbitrary, tracture ast 10-10 durgree, drawn drawn arbitrary, tracture ast 10-10 durgree, drawn arbitrary, tra	lethod : Ca	able Percu	ssion follow on			738509.8 N		/12/2020			et /2
20. 100 7/8 5.3 1 4 1 1 1 7 7 8 1 1 1 1	Depth (m)				FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legen	ıd
70 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.30				-				8.40m - 12.70m BGL: Fracture set 1: 0-10 degrees, discontinuities are smooth to rough, undulating, with clay and iron smearing, very closely to closely spaced. Fracture set 2: 30-40 degrees, discontinuities are stepped, undulating, with clay and iron staining, closely spaced.		ННННННН
70 Complete at 12.70m	1.20	100	87	81	4						НННННННН
(approx) By	2.70								Complete at 12.70m		T
1:50 JD/.	Remarks	I							Scal (appro	e Logo x) By	jer
									1:50	JD/.	JS

Machine : D Method : C	Dando 2000 Cable Percussion	Casing I	Diamete	/W.gii.ie r ed to 1.00m		Level (mOD) 50.39	Client National Transport Authority	Job Numb 9754-07
		Location 708		738511.3 N	Dates 04	/12/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
1.00-1.04	SPT(C) 50*/40 B			50/50			TOPSOIL Brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and boulders. Gravel is subangular to subrounded fine to coarse Refusal at 1.00m	

			WV	gations Ire ww.gii.ie			Site Bus Connect Detailed Stage 1 Lot 1	Borehol Number R05-CP0
T4	ando 2000 + Bereta 44 able Percussion ith Rotary follow on	20		r ed to 4.80m ed to 35.20m		Level (mOD) 46.78	Client National Transport Authority	Job Numbe 9754-07-
WI	In Rolary Ioliow on	Locatio		739014.4 N	Dates 07	/12/2020	Project Contractor Ground Investigations Ireland	Sheet 1/4
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.50 1.00-1.45 1.00	B SPT(C) N=6 B			1,1/2,1,1,2	45.28	(1.50)	Soft greyish brown slightly sandy gravelly CLAY. Gravel is fine to coarse, sub-angular. Very soft brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse, sub-angular.	
2.00-2.45 2.00	SPT(C) N=3 B			1,0/1,0,1,1		(1.30)		
3.00 3.00-3.45	B SPT(C) N=12			Water strike(1) at 3.00m, rose to 2.70m in 20 mins. 2,2/2,3,3,4	43.98	(0.65)	Firm to stiff greyish brown slightly sandy gravelly CLAY. Gravel is fine to coarse, sub-angular. Very stiff greyish brown slightly sandy gravelly CLAY with	
.00 .00-4.45	B TCR SCR	RQD	FI	4,5/6,8,13,14 SPT(C) N=41		(1.25)	occasional sub-rounded cobbles. Gravel is fine to coarse, sub-angular.	
5.20	50	-			42.08	4.70	Poor recovery, recovery consists of: Dark brown slightly sandy gravelly CLAY with occasional boulders. (Drillers notes: Gravelly CLAY with boulders).	
.70-7.08 .70	33	_		7,7/6,8,36 SPT(C) 50/225		(3.50)		12 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
	13			0.7/0.0.0.40				20101010 10101010 210101010
.20-8.65 .20	30	_		8,7/8,6,9,12 SPT(C) N=35	38.58	(0.80)	Poor recovery, recovery consists of: Grey slightly clayey medium to coarse sub-angular to sub-rounded GRAVEL with occasional cobbles.	
.70-10.15 .70		_		7,6/7,8,9,11 SPT(C) N=35	37.78	9.00	Poor recovery, recovery consists of: Grey sandy fine to coarse, sub-rounded GRAVEL., (Driller notes Gravell)	
Remarks orehole con from 20.2 to	npleted at 35.20m E 21.7 and 24.7 to 26	GL.on en 2 Driller r	gineers in notes blo	nstruction wing sand	1		Scale (approx)	Logged By
Borehole bac Groundwater	ckfilled on completion r encountered at 3.0 pm 4.70m to 4.80m f	n. 0m BGL		-			1:50 Figure	JS No. 20.R05-CP

SI		Grou	nd In		igations Ire vw.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Boreho Numbe R05-CP
Machine : Da T ² Flush : Core Dia: 64	14) + Bereta	96	0mm cas mm case	er sed to 4.80m ed to 35.20m		Level (mOD) 46.78	National Transport Authority	Job Numbe 9754-07-
Method : Ca wi	able Percu th Rotary	ussion follow on	Locatio 70		739014.4 N	Dates 07	/12/2020	Project Contractor Ground Investigations Ireland	Sheet 2/4
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
11.20-11.65	26				9,8/8,7,9,7 SPT(C) N=31	35.58	(2.20)		
11.20	20						(1.50)	Poor recovery, recovery consists of: Grey sandy fine to coarse, sub-rounded GRAVEL., (Driller notes Gravell with clay)	
12.70-13.15 12.70	13				4,5/4,4,5,6 SPT(C) N=19	34.08		Poor recovery, recovery consists of: Grey medium to coarse, sub-rounded to sub-angular GRAVEL. (Driller notes Gravell with clay)	
14.20-14.65 14.20	10				5,5/4,5,4,6 SPT(C) N=19		(3.00)		
15.70-16.15 15.70	26				6,8/4,5,4,6 SPT(C) N=19	31.08		Poor recovery, recovery consists of: Dark brown sandy CLAY. (Driller notes sandy Clay)	
17.20-17.65 17.20	23				7,9/6,8,9,7 SPT(C) N=30		(3.00)		
18.70-19.15 18.70	6				9,8/6,7,8,8 SPT(C) N=29	28.08		Poor recovery, recovery consists of: Dark brown fine to coarse SAND.(Driller notes Sand)	
Remarks								Scale (approx	Loggec By
								1:50 Figure	JS No.
								9754-07- ed by the GEOtechnical DAtabase SYstem (GEODASY) © all r	20.R05-CF

S		Grou	nd In		igations Ire vw.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1		Boreho Numbe R05-CP
Machine : Da T4 Flush : Core Dia: 64	4) + Bereta		0mm cas	er sed to 4.80m ed to 35.20m		Level (mOD) 46.78	Client National Transport Authority		Job Numbe 9754-07-
Method : Ca		ission follow on	Locatio 70		739014.4 N	Dates 07	7/12/2020	Project Contractor Ground Investigations Ireland		Sheet 3/4
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend
20.20-20.65 - 20.20	10				7,7/8,9,10,12 SPT(C) N=39			20.2 to 21.7 Driller notes blowing sand		
21.70-22.15 - 21.70	26				9,7/6,7,9,8 SPT(C) N=30		(6.30)			
23.20-23.65 - 23.20			-		8,8/6,9,7,11 SPT(C) N=33					
	23				9,7/10,11,14,12					
24.70-25.15 24.70	30				SPT(C) N=47	21.78		24.7 to 26.2 Driller notes blowing sand Poor recovery, recovery consists of: Brown clay Cobbles with occasional boulders. (Driller notes boulders)	ey gravelly Clay with	0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
26.20	50					19.38	27.40			
27.70-28.08 - 27.70	50				9,11/8,12,30 SPT(C) 50/225	19.30		Very stiff brown slightly sandy gravelly CLAY wit occasional cobbles and boulders. Gravel is fine sub-angular to sub-rounded.	h to coarse,	
29.20-29.50 29.20					7,9/14,36 SPT(C) 50/150					<u>1000000000000000000000000000000000000</u>
	13						(4.80)			
Remarks									Scale (approx)	Logged By
									1:50 Figure N 9754-07-2	

Machine : Da			nd In _{Casing}	W١	igations Ire ww.gii.ie		Ltd	Site Bus Connect Detailed Stage 1 Lot 1 Client	Boreho Numbe R05-CP
T4 Flush :		, Dereta			er sed to 4.80m ed to 35.20m		46.78	National Transport Authority	9754-07-
Core Dia: 64			Locatio		ed to 35.20m	Dates		Project Contractor	Sheet
Method : Ca wi	able Percu th Rotary	ission follow on	70	7796.1 E	E 739014.4 N	07	/12/2020	Ground Investigations Ireland	4/4
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
30.70-31.08 30.70	50				8,11/10,13,27 SPT(C) 50/225				
32.20-32.43 - 32.20					12,15/50 SPT(C) 50/75	14.58	32.20	Very stiff dark grey slightly sandy gravelly CLAY with occasional cobbles and boulders. Gravel is fine to coarse, sub-angular to sub-rounded.	00000000000000000000000000000000000000
33.70-33.70 -	50				25/50 SPT(C) 25*/0		(2.80)		10101000000000000000000000000000000000
33.70	30				50/0				
35.20						11.78 11.58	—	Grey slightly clayey medium to coarse sub-angular GRAVEL. Complete at 35.20m	, , , , , , , , , , , , , , , , , , ,
Remarks		1	1	1	1	1		Scale (approx	Logged c) By
								1:50	JS
								Figure	e No.

Machine : Be Flush : W	eretta T44 /ater			Diamete	WW.gii.ie er ed to 16.50m		Level (mOD) 55.93	Client National Transport Authority		Job Num 9754-	
Core Dia: 64		I	Locatio		5 739250.3 N	Dates 27 30	//11/2020- //11/2020	Project Contractor Ground Investigations Ireland		Shee 1	et /2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water =	nstr
9.00	15	0	0				(2.00)	Poor recovery, recovery consists of MADE GROUND: grey/brown clayey angular to sub-angular fine to coarse Gravel with occasiona fragments of concrete. Driller notes: Clay fill.			%
2.00 2.00-2.12	20	0	0		20,50/ SPT(C) 70*/115	53.93		Poor recovery, recovery consists of dark grey slightly clayey sub-angular to sub-rounded fine to coarse GRAVEL with occasional sub-angular to sub-rounded cobbles. Driller notes: Clayey sandy GRAVEL.		0,00,00,00,000,00,00,00,00,00,00,00,00,	ిటి రోడికోం చికి రోడికినం చికి రాజులు జీ రాజులు కొనికి రాజులు కొనికి రాజులు కొనికి రాజులు కారాజులు కొనికి రాజులు కొనికి రాజులు
.50 .50-3.52 .00-5.10	35	0	0		50/ SPT(C) 50*/20 17,50/ SPT(C) 67*/95		(4.30)				<u>కోండిద్</u> రం <u>చిద్దం కాదింది చిద్దం కాదింది. చిద్దం చాదింది. ఇద్దం 50 లేగి</u> లాపుండి ఇండా దర్శంకో రాహిండి <u>ఇండా దర్శం కొండి కాదింది. కొండి రా</u> డి
.20	77	15	0								ోంగిర్ లో పెక్టించింది. రాజు అక్టుండు రాజు గారాలు ఆర్థించింది రాజు అక్కిండా రాజు రాజు
.20 .50				11		49.63	6.30	Weak to mediu strong dark grey thinly laminated calcareous MUDSTONE. Distinctly to partially weathered. 6.20m - 6.80m BGL Fracture set 1: 40-50			10280.02200200
.80	100	30	0	NI				degrees, discontinuities are planar smooth with clay smearing, closely spaced. 6.80m - 7.80m Non-Intact			
.80 .00	100	63	7	25			(3.70)	7.80m - 9.50m Fracture set 1: 20-30 degrees, discontinuities are planar to undulating smooth, clean, very closely to closely spaced. Fracture set 2: 80-90 degrees, undulating rough with some oxidation along fracture surfaces.			
50				NI	_			9.50m - 10.0m Non-Intact			
0.00 Remarks orehole cor tandpipe in 00m to GL	npltete 16.5 stalled, sea	50m on e led from	ngineers i 16.50m to	instructio	H	slotted from	⊢ n 7.00m to 1.0	0m with a pea gravel surround, sealed from	Scale (approx)	Logg	geo

Machine : Be		Grou	1	WW	gations Ire /w.gii.ie			Site Bus Connect Detailed Stage 1 Lot 1		N R0	orehol umber 5-RC0
Machine:Be Flush :W				Diameter mm case	r d to 16.50m		Level (mOD) 55.93	Client National Transport Authority		N	ob umber 54-07-2
Core Dia: 64	mm		1			Datas					
Wethod : Ro	otary Corec	ł	Locatio		739250.3 N	Dates 27/ 30/	/11/2020- /11/2020	Project Contractor Ground Investigations Ireland		5	h eet 2/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	100	73	57				10.00	Medium strong dark grey thinly laminated calcareous MUDSTONE. Partially weathered. 10.0m - 14.0m Fracture set 1: 0-20 degrees, undulating to stepped rough, clean, close to medium spacing. Fracture set 2: 50-60 degrees, planar smooth, clay staining, closely spaced.			
11.00	100	50	33	8			(4.00)				
12.50	100	87	70	4							
14.00	100	100	100			41.93	14.00	Medium strong to strong dark grey thinly laminate calcareous MUDSTONE. Unweathered. 14.0m - 16.50m Fracture set 1: 20-30 degrees, stepped smooth, clean.	d		
15.50				1			(2.50)				
	100	100	100			39.43	16.50				
16.50								Complete at 16.50m			
Remarks			I			1		1	Scale (approx)	Lo B	ogged y
									1:50 Figure I		Tmcl

S	(Grou	nd In		igations Ire vw.gii.ie	land	Ltd		Site Bus Connect Detailed Stage 1 Lot 1	Boreho Numbe R05-RC
	/ater		-	Diamete	r ed to 10.10m	Ground	Level 46.58	(mOD)	Client National Transport Authority	Job Numbe 9754-07-
Core Dia: 64 Wethod : R		b	Locatio		738712.8 N	Dates 17	7/11/20	20	Project Contractor Ground Investigations Ireland	Sheet 1/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	De ((Thic	epth m) kness)	Description	Legend
).30					_	46.38 46.28		(0.20) 0.20 0.30	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets	
).70				NI	_			(1.00)	MADE GROUND: Brown slightly sandy gravelly Clay with frequent angular cobbles. Gravel is angular to subangular fine to coarse	
.30	90	40	26	20		45.28		1.30	Weak to medium strong thinly laminated dark grey fine grained calcareous MUDSTONE. Distinctly weathered 0.30m-0.70m BGL - Mostly Non Intact 0.70m-1.30m BGL - F1: Very closely spaced, 60° to	
									80°, undulating smooth Medium strong to strong thinly laminated dark grey fine grained calcareous MUDSTONE with occasional specs of	
2.00				6					pyrite. Partially to distinctly weathered 1.30m-3.00m BGL - F1: Very closely to closely spaced, 60° to 80°, undulating smooth	
	100	76	53							
.00										
3.50	100	77	73	4					3.00m-4.60m BGL - F1: Closely to medium spaced, 60° to 80°, undulating smooth	
4.60				NI	_					
5.00 5.30					-				4.60m-5.30m BGL - Mostly Non Intact	
	100	79	65					(8.80)		
5.50	100	100	85	3					5.30m-10.10m BGL - F1: Closely to medium spaced, 10° to 40°, undulating smooth to rough	
3.00	100	91	79							
9.50	100	95	77							
Remarks Borehole con	mplete at 10 ckfilled upo	0.10m BG	GL on eng	ineers ins	structrution.	<u> </u>	<u> </u>		Scale (approx)	Logged By
lo groundw	ater encour	ntered du	ring drillin	ıg (Rotary	drilling with water flu	sh may co	onseal	water st	rike) 1:50 Figure	PC
										20.R05-R0

Re Dia : 64 mm thad : Rotary Correct Decention 706178.6 E 738712.8 N Dates TYT112220 Project Contractor Ground investigations treated Description Legend 10 Image: Set Market Set Ma		nd Investigations www.gii.ie		Site Bus Connect Detailed Stage 1 Lot 1		Boreh Numb R05-R0	per
Description Description Stept	ush : Water				Numb		
Image: Description of the second s	ore Dia: 64 mm ethod :Rotary Cored		Dates 17/11/2020				
events			ords Level Depth (mOD) (m) (Thicknes	s) Description		Legend	Wator
(approx) Bygged				Complete at 10.10m			
1:50 PC	Remarks				Scale (approx)	Logge By	ed
					1:50	PC	

		טטוכ		WW	gations Ire /w.gii.ie			Bus Connect Detailed Stage 1 Lot 1		Number R05-RC
Nachine : B	/ater			Diamete mm case	r d to 10.00m		Level (mOD) 45.40	Client National Transport Authority		Job Numbe 9754-07-
Core Dia: 64 Method : R		1	Locatio		38732.9 N	Dates 17	//11/2020	Project Contractor Ground Investigations Ireland		Sheet 1/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Nater Nater
							(0.70)	Brownish grey angular to subangular fine to coarse GRAVEL with occasional angular to subangular cobbles		
0.70	68	0	0			44.70	0.70	Weak thinly laminated dark grey fine grained calcareous MUDSTONE. Distinctly weathered		
				MNI			(1.55)	0.70m-2.25m BGL - Mostly Non Intact		
2.00 2.25	100	73	73			43.15	2.25	Medium strong to strong thinly laminated dark gre fine grained calcareous MUDSTONE. Partially to distinctly weathered with occasional calcite veining		
3.50				3				2.25m-4.50m BGL - F1: Closely to medium spaced, 20° to 50°, undulating rough with occasional clay infilling/staining		
	100	48	37							
4.50 5.00				MNI				4.50m-5.00m BGL - Mostly Non Intact		
	100	73	61				(7.75)			
5.50	100	92	75	3				5.00m-9.00m BGL - F1: Closely to medium spaced, 40° to 60°, undulating smooth to rough with occasional clay infilling/staining		
.00	100	63	63							
0.00				MNI				9.00m-9.50m BGL - Mostly Non Intact		
0.50	100	100	100	1				9.50m-10.00m BGL - F1: Closely spaced, 10°		
	d standpipe	installed	from 3.40	neers ins)m to 1.00	truction. Om BGL with pea gra	vel surroui	nds, plain stan	dpipe installed from 1.00m BGL to ground level	Scale (approx)	Logged By
ith bentonit	e surround	s and flus	sh cover		drilling with water flu			· · · ·	1:50 Figure M	PC

	.				w.gii.ie			Bus Connect Detailed Stage 1 Lot 1		5-RC(
lachine : Bei lush : Wa				Diamete mm case	r d to 10.00m		Level (mOD) 45.40	Client National Transport Authority			ob umbe 54-07-
ore Dia: 64	mm		Locatio	n		Dates		Project Contractor			
lethod : Ro	tary Core	d	708240 E 738732.9 N			17	/11/2020	Ground Investigations Ireland			heet 2/2
I					I						
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Watei	Inst
						35.40	10.00	to 20°, undulating smooth to rough with occasional clay staining Complete at 10.00m			
							- - - - - -				
emarks							-		Scale (approx)	Lc	ogge y
									(approx) 1:50		y PC

Machine : B		irou	1		gations Ire vw.gii.ie r		Level (mOD)	Bus Connect Detailed Stage 1 Lot 1 Client	Number R05-RC	
lush : W	/ater		96	mm case	ed to 10.00m		53.43	National Transport Authority	Number 9754-07-2	
Core Dia: 64	4 mm		Locatio	n		Dates		Project Contractor	Sheet	
Nethod : R	otary Cored	ł			738399.7 N		/12/2020	Ground Investigations Ireland	1/1	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	
	12						(2.00)	Poor recovery, recovery consists of: MADE GROUND: Grey slightly clayey fine to coarse angular Gravel with rare concrete fragments. (Gravel is of limestone mostly). Drillers notes: Clay fill.		
2.00	23					51.43	2.00	Poor recovery, recovery consists of: Grey/brown clayey angular medium to coarse Gravel. (Drillers notes: Yellow brown boulder CLAY).	0,	
3.50	73	40	33			49.93	(0.80)	Grey/brown clayey angular medium to coarse GRAVEL. Possible weathered bedrock. (Drillers notes: Yellow brown boulder CLAY).		
1.30 5.00				7		49.13	4.30	Medium strong to strong dark grey extremely to very closely laminated fine to medium grained LIMESTONE with some calcite rich veins and clay smearing. Partially weathered.		
5.30 5.30	100	90	86	3				4.30m - 10.0m BGL: Fracture set 1: 30-40 degrees, discontinuities are rough to stepped, undulating with clay smearing, very closely to medium spaced. Fracture set 2: 5-20 degrees, discontinuities are rough to stepped, undulating, clean, closely to medium spaced.		
5.50	93	86	79	5			(5.70)			
9.00	100	95	87							
0.10 0.40 0.50	100	100	90	3		40.40				
0.00 Remarks					1	43.43	10.00	01-		
Borehole cor Borehole ba	ckfilled on a	completio	n. Č				need wat in t	Scale (approx)	Logged By	
o groundwa	ater encour	nerea du	ung arilling	y (Rotary	drilling with water flu	isn may co	nsear water st	rike) 1:50	JS	
								Figure		

Machine : Be	ater			Diamete	vw.gii.ie er ed to 12.00m		Level (mOD) 53.12	Client National Transport Authority	R05-RC0 Job Number 9754-07-2
Core Dia: 64		d	Locatio		737958.4 N	Dates 04	/03/2021	Project Contractor Ground Investigations Ireland	Sheet 1/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
	33					52.92 52.32	(0.20) 0.20 (0.60) 0.80 (0.60)	Brown sandy TOPSOIL with occasional rootlets MADE GROUND: Dark grey angular to subangular fine to coarse Gravel with many angular cobbles and boulders Stiff light brown slightly gravelly sandy CLAY with many angular to subangular cobbles of Limestone and occasional angular boulders	
2.00 2.00-2.25	23		_		2,2/3,47 SPT(C) 50/100	50.92		Poor recovery. Recovery consists of grey slightly clayey angular to subangular fine to coarse Gravel with finer material washed away by flush (Firm) Driller's notes: Light brown boulder Clay	
3.50 3.50-3.95	39		-		3,3/2,2,3,4 SPT(C) N=11				
5.00 5.00-5.45	87		_		6,6/10,12,14,14 SPT(C) N=50	48.12	5.00	Very stiff greyish brown slightly sandy gravelly CLAY with frequent cobbles and occasional boulders of Limestone	20100000000000000000000000000000000000
3.50 3.50-6.80	87		_		10,10/15,35 SPT(C) 50/150				
8.00 8.00-8.16	83		_		7,18/50 SPT(C) 50/10				<u>.000000000000000000000000000000000000</u>
9.50 9.50-9.52 9.60				·	25/50 SPT(C) 25*/10 50/10	43.52	9.60	Medium strong to strong thinly laminated to thinly bedded dark grey fine to medium grained argillaceous LIMESTONE. Partially weathered with occasional calcite	
Borehole cor	nplete at 1	2.00m BG	SL on engi	ineers in	etails from 0.00m - 2 struction / drilling with water flu				Logged By PC

		Groui	nd In	vocti	actions Iro	and	td	Site		Borehol	
		Gioui			gations Irel w.gii.ie	anu	Liu	Bus Connect Detailed Stage 1 Lot 1	ſ	Number R05-RC0	
Machine : B	eretta T44		Casing	Diamete	r	Ground	Level (mOD)	Client	\neg	Job	
Flush : W	/ater		96	mm case	d to 12.00m	:	53.12	National Transport Authority		Number	
Core Dia: 64	4 mm									9754-07-2	20
			Locatio	n		Dates	100/0004	Project Contractor		Sheet	
Method : R	lotary Core	a	70	9261.5 E	737958.4 N	04	/03/2021	Ground Investigations Ireland		2/2	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
10.50	93	67	57	1 MNI			(2.40)	 veining 9.60m-10.80m BGL - F1: Medium to widely spaced, 0° to 10°, undulating smooth with occasional clay infill 10.80m-11.50m BGL - Mostly Non Intact. Recovery indicates two fracture sets - F1: Closely spaced, 0° to 10°, undulating smooth with brown staining. F2: One 			
11.50	100	67	56	2		41.12	12.00	subvertical fracture, 80° to 90°, undulating smooth to rough with brown staining and clay infill 11.50m-12.00m BGL - F1: Medium spaced, 0° to 10°, undulating smooth with brown staining			
Remarks								Complete at 12.00m	le (x)	Logged	
Remarks								Scal (appro 1:50	ox)	Logged By	
								Figu			_

		R RQD		738138.2 N Field Records	Dates 12/ 14/ Level (mOD) 57.39	03/2021- 03/2021 Depth (m) (Thickness) (0.20) 0.20 0.20	Project Contractor Ground Investigations Ireland Description Brown slightly sandy slightly gravelly TOPSOIL Poor recovery. Recovery consists of brown/grey clayey angular to subrounded fine to coarse Gravel with	Sheet 1/2 Legend
30	(%) (%		FI	Field Records		(ṁ) (Thickness) 	Brown slightly sandy slightly gravelly TOPSOIL Poor recovery. Recovery consists of brown/grey clayey angular to subrounded fine to coarse Gravel with	Legend
30 30-2.75	30				57.39	(0.20) 0.20	Poor recovery. Recovery consists of brown/grey clayey angular to subrounded fine to coarse Gravel with	
30 30-2.75						(2.10)	occasional cobbles of mudstone and limestone with finer material washed away by flush. Driller's notes: Brown boulder Clay	19797979797 19797979797
	21			3,5/7,11,15,10 SPT(C) N=43	55.29	2.30	Poor recovery. Recovery consists of grey clayey subangular to subrounded fine to coarse Gravel with occasional cobbles of limestone with finer material washed away by flush (very stiff). Driller's notes: Brown boulder Clay.	10,00,00,00,00 10,00,00,00,00 10,00,00,00,00,00,00,00,00 10,00,00,00,00,00,00,00,00,00,00,00,00,0
80 80-4.25	44			4,6/5,8,10,13 SPT(C) N=36				
30 30-5.62	31			16,9/25,19,6 SPT(C) 50/170				
80 -7.20				12,11/15,17,12,6 SPT(C) 50/250		(7.70)		<u> </u>
30 30-8.75	13			7,8/10,9,15,12 SPT(C) N=46				
80 10 25	19			5,5/7,6,4,6 SPT(C) N=23				20120200000000000000000000000000000000
80-10.25 Remarks prehole compl	blete at 17.30m	BGL on engi	neers inst	SPT(C) N=23 ruction. drilling with water flu	F		Scale (approx)	Logge
o groundwate	er encountered	i auring drilling	g (Rotary d	aming with water flu	isn may cor	iseai water s	trike) 1:50	PC

achine : Be					gations Ire /w.gii.ie r	Ground			Bus Connect Detailed Stage 1 Lot 1 Client	R05-F				
ush :Wa	ater		96	mm case	d to 17.30m	:	57.59	9	National Transport Authority	Num 9754-0				
ore Dia: 64	mm		Locatio	n		Dates			Project Contractor	Shee				
ethod : Ro	otary Cored	ł	70	9003.9 E	738138.2 N	12/03/2021- 14/03/2021			Ground Investigations Ireland		2/2			
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	C (Thi	Depth (m) ickness)	Description	Legen	ıd			
	100	11				47.59 46.99		10.00 (0.60) 10.60	Possible weathered rock recovered as grey angular to subangular fine to coarse Gravel of limestone and mudstone Weak to medium strong thinly laminated dark grey MUDSTONE interbedded with weak to medium strong thinly laminated to thinly bedded grey fine grained LIMESTONE. Distinctly weathered with occasional calcite		H IIIII * * * * * 1			
.30	100	10		NI					LINES IONE. Distinctly weathered with occasional calcite veining					
	100	14	7					(5.10)	10.00m-15.00m BGL: Mostly Non Intact					
5.00	100	30	13					15.70						
5.80	100	48	8	19				(1.60)	Medium strong thinly laminated dark grey MUDSTONE. Partially to distinctly weathered with occasional calcite veining and rare specs/bands of pyrite 15.00m-17.30m BGL - F1: Very closely to closely					
									spaced, 0° to 10°, planar smooth					
7.30						40.29		17.30	Complete at 17.30m					
emarks							E_		Scale (approx) Logg By	je			
											~			
									1:50	PC	,			







































S	Grou	nd Inv	estigations Ir www.gii.ie	eland	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Numb R05-CF	
	EOTEC 10 ive-in Windowless impler	Dimensio 98m	ns m to 4.00m		Level (mOD) 65.83	Client National Transport Authority	Job Numb 9754-0	
		Location 7066	07.8 E 739366.6 N	Dates 28	/05/2021	Project Contractor Ground Investigations Ireland	Sheet	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	d j
0.20-1.20	B EN			65.63	(0.20) 0.20 (1.00)	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets MADE GROUND: Greyish brown slightly sandy slightly gravelly Clay with occasional rootlets		
1.20-2.00 1.50	B EN			64.63	- 1.20	MADE GROUND: Grey slightly sandy slightly gravelly Clay with occasional fragments of organic matter and wood and a rare fragment of glass		
2.00-3.00	В							~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
2.50	EN				(2.80)			XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.50	EN			61.83		Refusal at 4.00m BGL		XXXXXXXXXXXXXXXXXXXXXX
						Complete at 4.00m		
1.00m-2.00m	BGL 95% recovery BGL 95% recovery BGL 95% recovery					Scale (approx) Logg By	ec
3.00m-4.00m Refusal at 4.0	BGL 95% recovery BGL 95% recovery 00m BGL					1:25 Figure 9754-07	PC No. -20.R5-CF	

C	Grou	nd In	vestigations Irel		Site Bus Connect Detailed Stage 1 Lot 1		Number	r		
			www.gii.ie				-		R05-CP0	3A
Machine : G Method : Dr Sa	EOTEC 10 rive-in Windowless ampler	Dimensi 98r	nm to 2.00m	Ground	Level (55.65	mOD)	Client National Transport Authority		Job Number 9754-07-2	
		Locatio	ı	Dates 28/05/2021		21	Project Contractor		Sheet	
		710	0056.5 E 737504.1 N				Ground Investigations Ireland		1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Dej (n (Thick	pth n) (ness)	Description		Legend	Water
0.10-1.00	В			55.55	- ((0.10) 0.10	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets			
							MADE GROUND: Dark grey/brown slightly sandy gra Clay with occasional subangular cobbles and occasion fragments of concrete and red brick	avelly onal		
0.50	EN									
1.00 1.00-2.00	EN B				(((1.90)				
					- - - - -					
1.80	EN									
				53.65		2.00	Refusal at 2.00m BGL			
					-		Complete at 2.00m			
					-					
					-					
					-					
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							I			
Remarks 0.00m-1.00m 1.00m-2.00m Refusal at 2.	n BGL 90% recovery n BGL 80% recovery 00m BGI						(a	Scale approx)	Logged By	I
rtoraoar at Z.								1:25	PC	
								Figure N 754-07-20	o.).R5-CP0	3A

Bus Connects Route 5 – Window Sample Photographs

R5-CP01A



Bus Connects Route 5 – Window Sample Photographs

R5-CP03A

	ESTIGATIONS IFELAND of & Environmented			
Client	NATIONAL TRANSPORT AUTHORITY	00011011	9754-07-20	8/14 BM #
	BUS CONNECT ROUTE 5	-Late.	28105121.	1934 - 194 - 194 - 194
Borehol	le ref: ROS-CPO3A	Depth: From	0.00 to 2.00	Dm
Box No:		•		
CM 10	าป้านไม่มีแ	50 60	70 80 90	100
	CARRENT & MAN	The states of the	AND MOTOR WEAT	
		a state of the state		BUSSE V
	the second se		P	
TO THE SAME		COLOR STREET	TO TO SHOW	Sand RAT
· 12 - 2 36		the second		
S. Bate. M	and and the second			
		11 - 20 - 21 - 23 - 128 - 11 - 17 - 261 0 - 11 - 2 - 4 - 6 - 7 - 8 - 0 - 21 - 2 - 3 - 4	128 . 127 . 28 . 29 . 30	45. 361 37. 36 39 40. 4 8 9 901 2 3 4 5 6 7 8 9 1ml 2 3 40

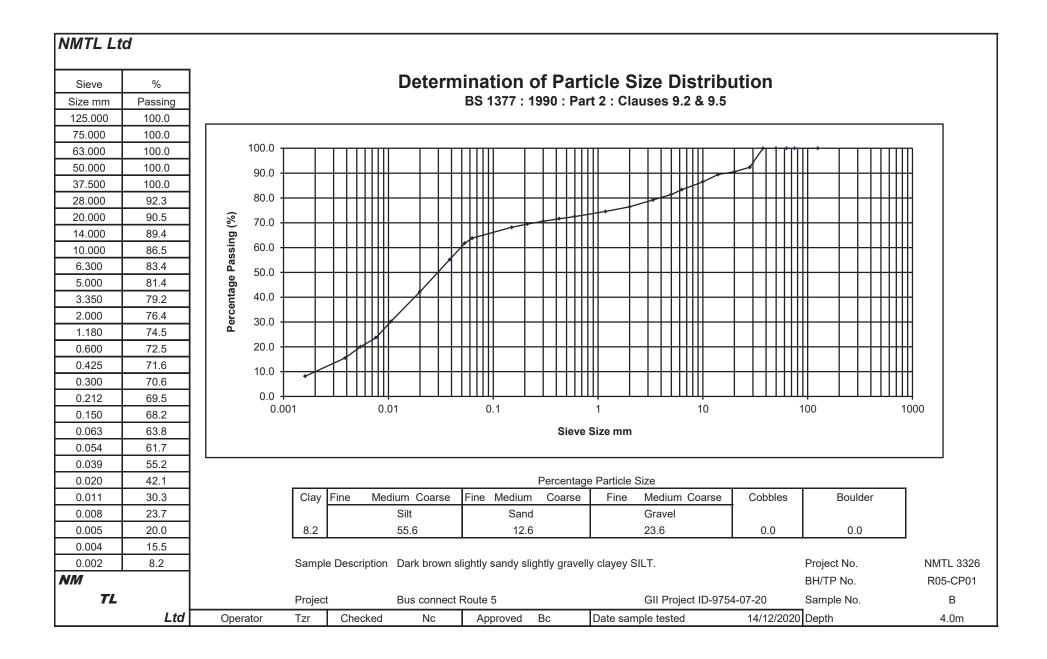
APPENDIX 4 – Laboratory Testing

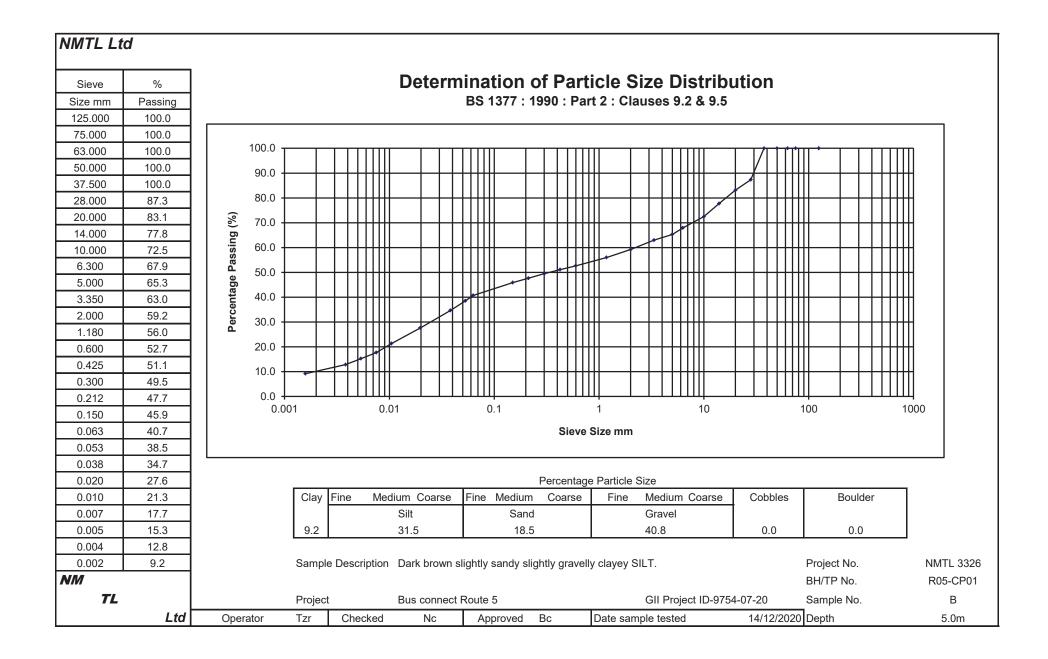


National Materials Testing Laboratory Ltd.

							301411417		ILSI KI					
				Particle			Index Pro	perties	Bulk	Cell	Undrained Tria	xial Tests	Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
R05-CP01	4.0	В	34.3		71.6	62	39	23						
R05-CP01	5.0	В	20.7		51.1	41	24	17						
											ļ			
											ļ			
											ļ			
											ļ			
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											ļ			
											ļ			
											L			
NMTL	4	Notes :									Job ref No.	NMTL 3326		9754-07-20
			1. All BS t	ests carried	d out using p	oreferred (definitive)	method ur	nless otherw	vise stated.	Location	Bus Conn	ect Routes	

SUMMARY OF TEST RESULTS







LABORATORY REPORT



Contract Number: PSL21/1700

Report Date: 25 March 2021

Client's Reference: 2868817

Client Name: Ground Investigations Ireland Ltd Catherinestown House Hazelhatch Road Newcastle Co Dublin D22 YD52

For the attention of: Patrick Cochran/John Duggan

Contract Title: Bus Connect Route 5

Date Received:	26/2/2021
Date Commenced:	26/2/2021
Date Completed:	25/3/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

A Watkins (Director) R Berriman (Quality Manager) S Royle (Laboratory Manager)

£K#

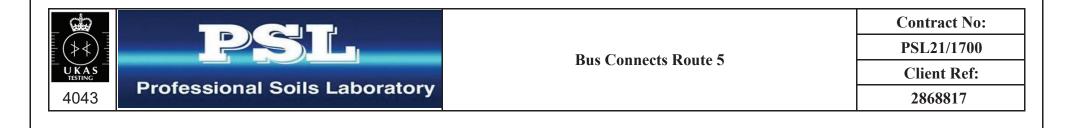
L Knight (Senior Technician) S Eyre (Senior Technician) T Watkins (Senior Technician)

Page 1 of

5 – 7 Hexthorpe Road, Hexthorpe, Doncaster DN4 0AR tel: +44 (0)844 815 6641 fax: +44 (0)844 815 6642 e-mail: rberriman@prosoils.co.uk awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
R5-TP01		В	1.00		Brown very sandy very clayey GRAVEL.
R5-TP05		В	1.00		Brown gravelly slightly sandy CLAY with cobbles.
R5-TP06		Т	1.00		Brown highly weathered MUDSTONE.
R5-TP07B		В	1.00		Brown slightly gravelly slightly sandy CLAY with cobbles.
<u> </u>					



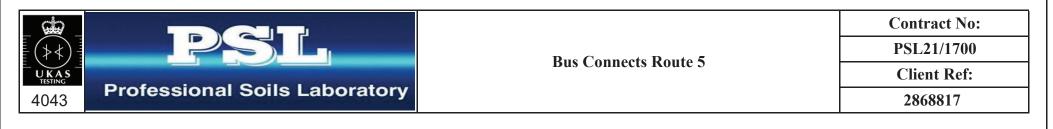
SUMMARY OF SOIL CLASSIFICATION TESTS

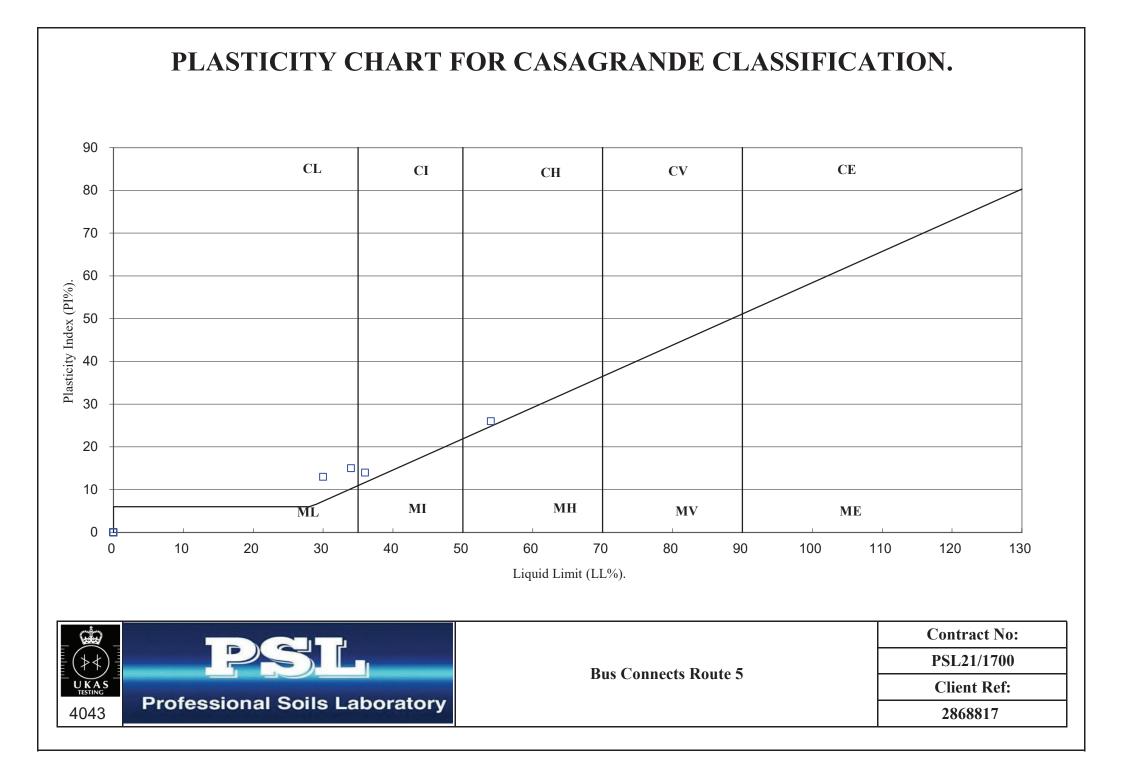
(BS1377 : PART 2 : 1990)

					Moisture	Linear	Particle	Liquid	Plastic	Plasticity	Passing	
Hole	Sample	Sample	Тор	Base	Content	Shrinkage		Limit	Limit	Index	.425mm	Remarks
Number	Number	Туре	Depth	Depth	%	%	Mg/m ³	%	%	%	%	
			m	m	Clause 3.2	Clause 6.5	Clause 8.2	Clause 4.3/4	Clause 5.3	Clause 5.4		
R5-TP01		В	1.00		13			30	17	13	34	Low Plasticity CL
R5-TP05		В	1.00		38			54	28	26	56	High Plasticity CH
R5-TP06		Т	1.00		10			36	22	14	27	Intermediate Plasticity CI
R5-TP07B		В	1.00		12			34	19	15	61	Low Plasticity CL

SYMBOLS : NP : Non Plastic

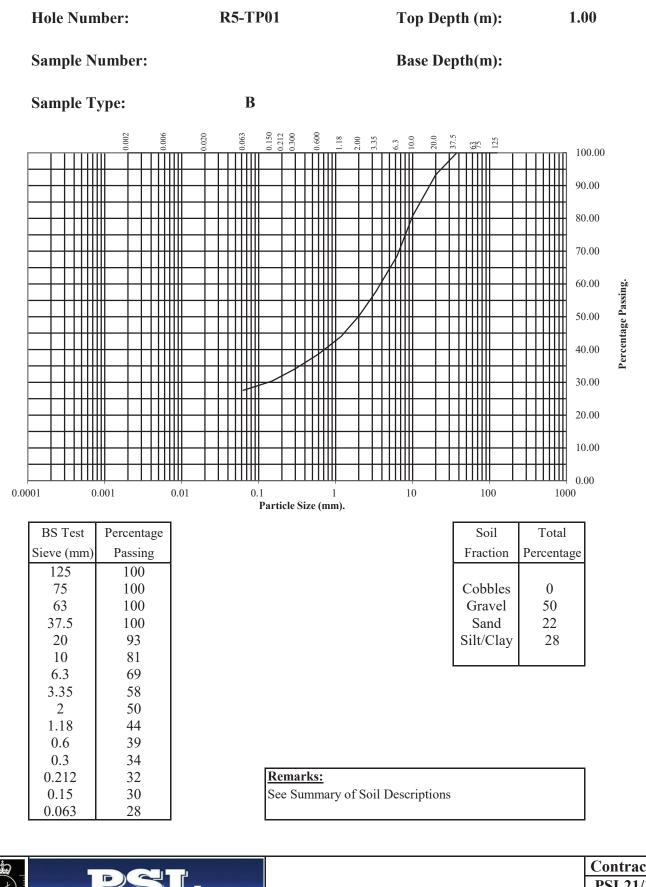
*: Liquid Limit and Plastic Limit Wet Sieved.



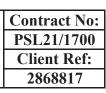


BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

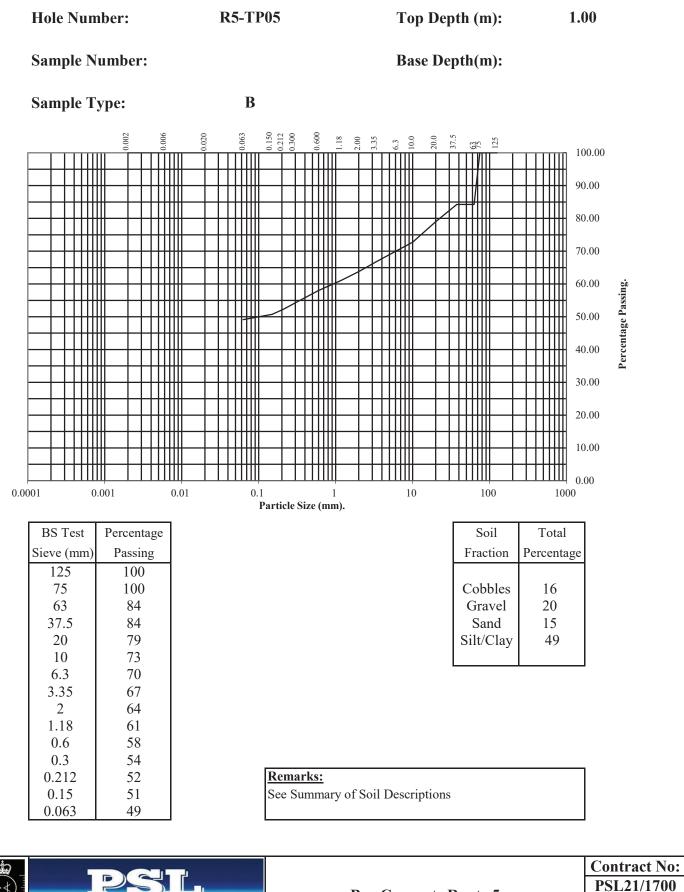






BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2



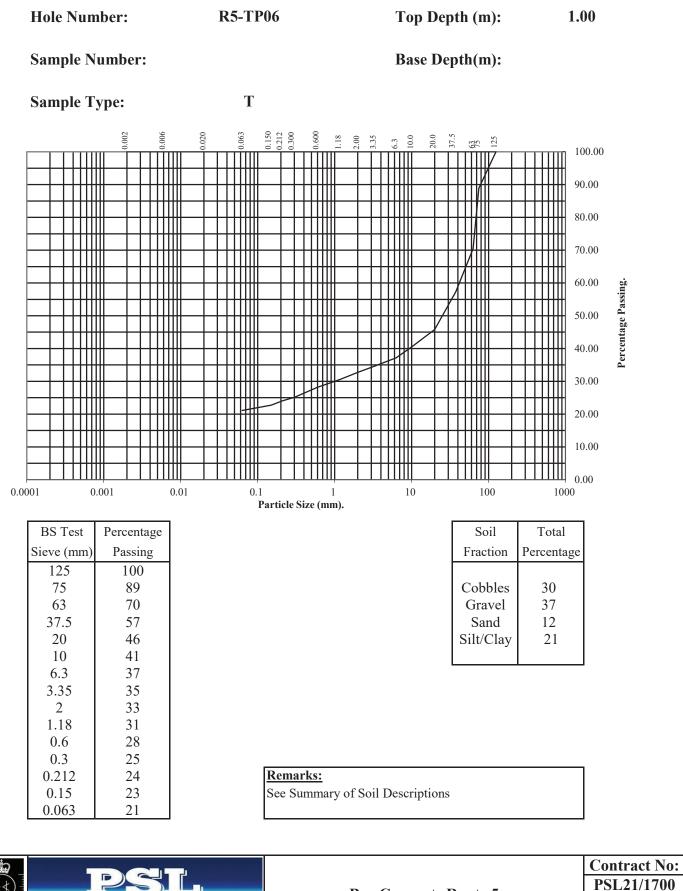
Bus Connects Route 5

Client Ref:



BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2



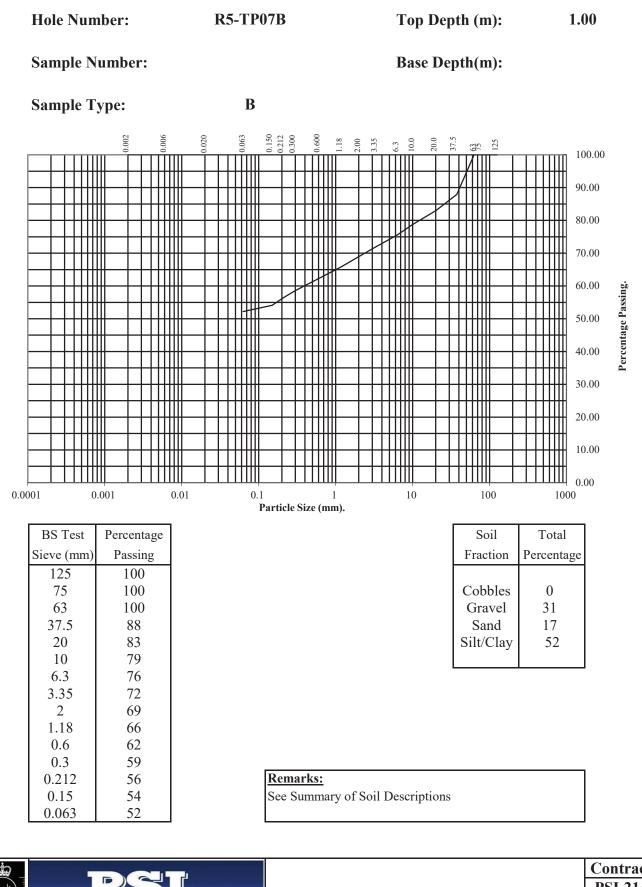
Bus Connects Route 5

Client Ref:



BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2



Professional Soils Laboratory





LABORATORY REPORT



4043

Contract Number: PSL21/1802

Report Date: 29 March 2021

Client's Reference: 9754-07-20

Client Name: Ground Investigations Ireland Ltd Catherinestown House Hazelhatch Road Newcastle Co Dublin D22 YD52

For the attention of: Patrick Cochran/John Duggan

Contract Title: Bus Connect Route 5

Date Received:	1/3/2021
Date Commenced:	1/3/2021
Date Completed:	29/3/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

A Watkins (Director) R Berriman (Quality Manager)

Ste

S Royle (Laboratory Manager)

L Knight (Senior Technician) S Eyre (Senior Technician) T Watkins (Senior Technician)

Page 1 of

5 – 7 Hexthorpe Road, Hexthorpe, Doncaster DN4 0AR tel: +44 (0)844 815 6641 fax: +44 (0)844 815 6642 e-mail: rberriman@prosoils.co.uk awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

R05-TP08A R05-TP08A		m	Depth m	Description of Sample
R05-TP08A	В	0.50		Grey slightly clayey very sandy GRAVEL.
	В	1.50		Brownish grey slightly sandy gravelly CLAY.
R05-TP09	В	0.50		Brown clayey slightly sandy GRAVEL.
R05-TP09	В	1.40		Brown clayey sandy GRAVEL.

			Contract No:
$(\diamond 4)$		Bus Connect Route 5	PSL21/1802
		Bus Connect Route 5	Client Ref:
4043	Professional Soils Laboratory		2868817

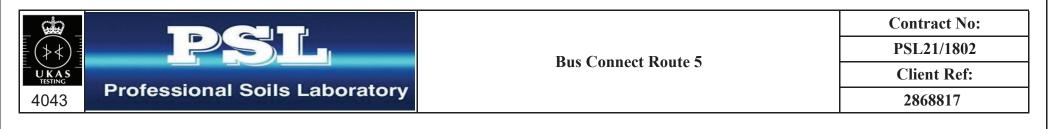
SUMMARY OF SOIL CLASSIFICATION TESTS

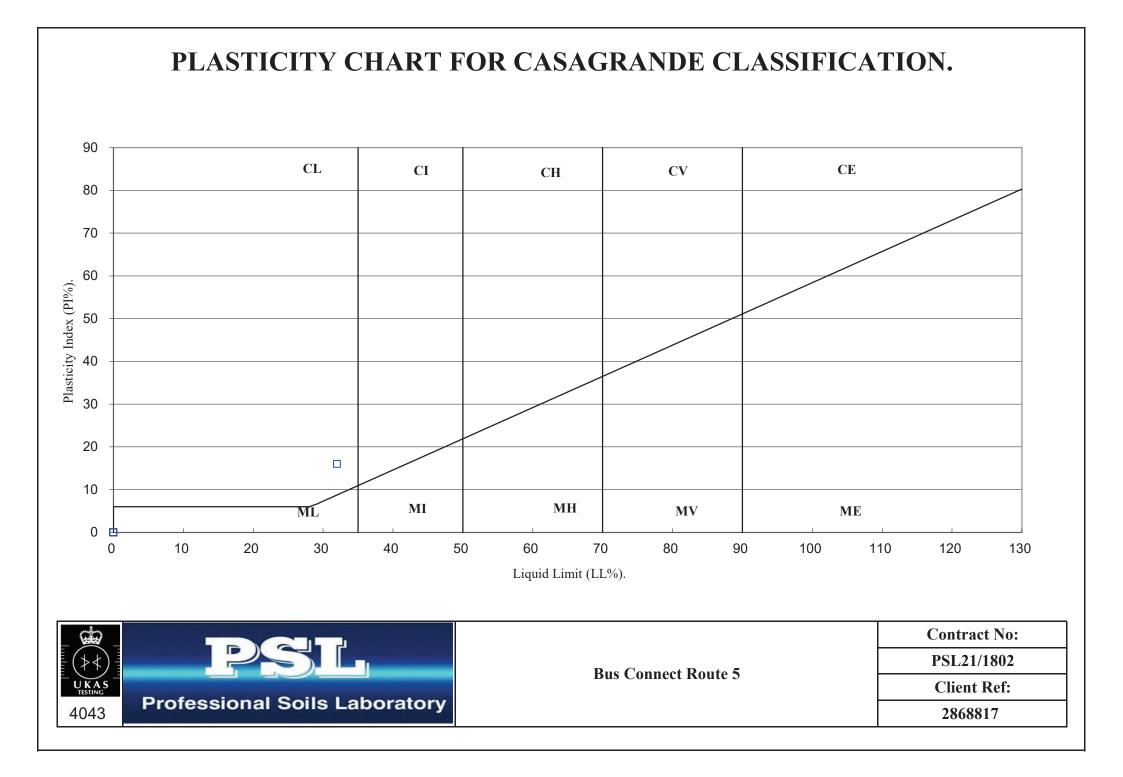
(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample	Top	Base	Moisture Content %	Particle Density Mg/m ³	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing .425mm %	Remarks
	Number	Туре	Depth m	Depth m	70 Clause 3.2	Clause 8.2	70 Clause 4.3/4	70 Clause 5.3	70 Clause 5.4	70	
R05-TP08A		В	0.50	m	7.5	Clause 0.2	Clause 4.5/4	NP	Clause 5.4		
R05-TP08A		В	1.50		10		32	16	16	38	Low Plasticity CL
R05-TP09		В	0.50		6.0			NP			
R05-TP09		В	1.40		10						

SYMBOLS : NP : Non Plastic

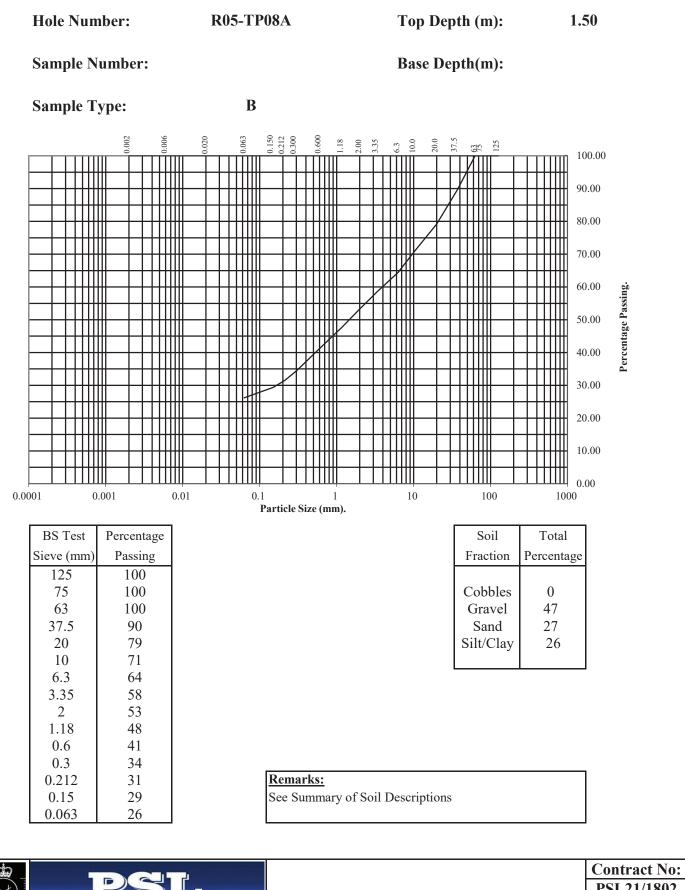
*: Liquid Limit and Plastic Limit Wet Sieved.





BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2



Professional Soils Laboratory

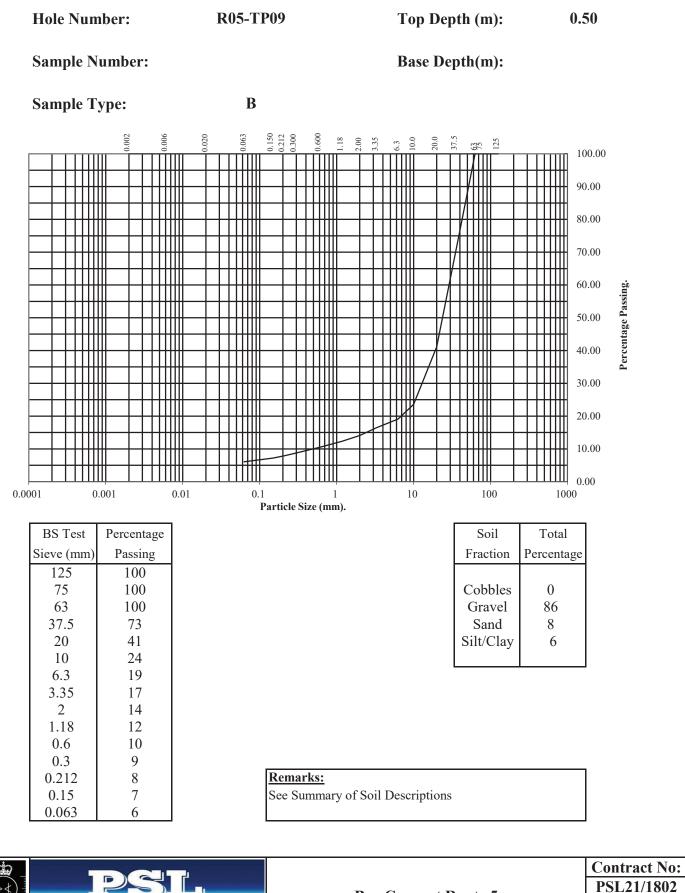
4043

PSL21/1802 Client Ref: 2868817

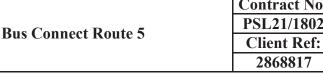
Bus Connect Route 5

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2



Professional Soils Laboratory







ANALYTICAL TEST REPORT

Contract no:	94161
Contract name:	Bus Connect Route 5
Client reference:	PSL21/1802
Clients name:	Professional Soils Laboratory
Clients address:	5/7 Hexthorpe Road
	Doncaster
	DN4 0AR

Samples received:	08	March	2021
Analysis started:	08	March	2021
Analysis completed:	10	March	2021
Report issued:	11	March	2021

Notes:

Opinions and interpretations expressed herein are outside the UKAS accreditation scope. Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling. All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing. Methods, procedures and performance data are available on request. Results reported herein relate only to the material supplied to the laboratory. This report shall not be reproduced except in full, without prior written approval. Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key:

U UKAS accredited test M MCERTS & UKAS accredited test \$ Test carried out by an approved subcontractor I/S Insufficient sample to carry out test N/S Sample not suitable for testing

Approved by:

Rachael Burton Customer Support Squad Leader

Chemtech Environmental Limited

SOILS

Lab number	94161-1	94161-2	94161-3		
Sample id	R05-TP08A	R05-TP08A	R05-TP09		
Depth (m)	0.50	1.50	0.50		
Date sampled	25/02/2021	25/02/2021	25/02/2021		
Test	Method	Units			
Total Organic Carbon (TOC)	CE197	% w/w C	1.1	1.0	0.5
Estimate of OMC (calculated from TOC)	CE197	% w/w	1.8	1.8	0.8

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

- N No (not deviating sample)
- Y Yes (deviating sample)
- NSD Sampling date not provided
- NST Sampling time not provided (waters only)
- EHT Sample exceeded holding time(s)
- IC Sample not received in appropriate containers
- HP Headspace present in sample container
- NCF Sample not chemically fixed (where appropriate)
- OR Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
94161-1	R05-TP08A	0.50	Ν	
94161-2	R05-TP08A	1.50	Ν	
94161-3	R05-TP09	0.50	N	



Issue :

Element Materials Technology Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA P: +44 (0) 1244 833780 F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland ac-MR Attention : John Duggan Date : 8th December, 2020 Your reference : 9754-07-20 Our reference : Test Report 20/16588 Batch 1 **BusConnects Route 5** Location : Date samples received : 26th November, 2020 Status : Final report

Two samples were received for analysis on 26th November, 2020 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

1

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

Authorised By:

b. June

Bruce Leslie Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/16588

Report : Solid

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

EMT Job No:	20/16588									
EMT Sample No.	1-3	4-6								
Sample ID	R5 TP02	R5 TP02								
Depth	0.50	1.10					Disses			
COC No / misc							Please see attached notes for all abbreviations and acronyms			
Containers	VJT	VJT								
Sample Date										
Sample Type	Soil	Soil							1	
Batch Number	1	1					LOD/LOR	Units	Method	
Date of Receipt	26/11/2020	26/11/2020							No.	
Antimony	2	<1					<1	mg/kg	TM30/PM15	
Arsenic [#]	9.5	7.9					<0.5	mg/kg	TM30/PM15	
Barium [#]	69	120					<1	mg/kg	TM30/PM15	
Cadmium [#]	1.6	1.5					<0.1	mg/kg	TM30/PM15	
Chromium [#]	33.6	39.1					<0.5	mg/kg	TM30/PM15	
Copper [#] Lead [#]	22	18 11					<1	mg/kg	TM30/PM15 TM30/PM15	
Lead Mercury [#]	12 <0.1	<0.1					<5 <0.1	mg/kg mg/kg	TM30/PM15	
Molybdenum [#]	4.0	3.4					<0.1	mg/kg	TM30/PM15	
Nickel [#]	31.5	26.4					<0.7	mg/kg	TM30/PM15	
Selenium [#]	2	2					<1	mg/kg	TM30/PM15	
Zinc [#]	74	56					<5	mg/kg	TM30/PM15	
PAH MS										
Naphthalene [#]	<0.04	<0.04					<0.04	mg/kg	TM4/PM8	
Acenaphthylene	<0.03	<0.03					<0.03	mg/kg	TM4/PM8	
Acenaphthene [#]	<0.05	<0.05					<0.05	mg/kg	TM4/PM8	
Fluorene [#]	<0.04	<0.04					<0.04	mg/kg	TM4/PM8	
Phenanthrene [#]	< 0.03	< 0.03					< 0.03	mg/kg	TM4/PM8	
Anthracene [#] Fluoranthene [#]	<0.04 <0.03	<0.04 <0.03					<0.04 <0.03	mg/kg	TM4/PM8 TM4/PM8	
Pluorantnene Pyrene [#]	< 0.03	<0.03					<0.03	mg/kg mg/kg	TM4/PM8	
Benzo(a)anthracene [#]	<0.05	<0.06					<0.06	mg/kg	TM4/PM8	
Chrysene #	<0.02	<0.02					<0.02	mg/kg	TM4/PM8	
Benzo(bk)fluoranthene [#]	<0.07	<0.07					<0.07	mg/kg	TM4/PM8	
Benzo(a)pyrene [#]	<0.04	<0.04					<0.04	mg/kg	TM4/PM8	
Indeno(123cd)pyrene	<0.04	<0.04					<0.04	mg/kg	TM4/PM8	
Dibenzo(ah)anthracene [#]	<0.04	<0.04					<0.04	mg/kg	TM4/PM8	
Benzo(ghi)perylene [#]	<0.04	<0.04					<0.04	mg/kg	TM4/PM8	
Coronene	<0.04	<0.04					<0.04	mg/kg	TM4/PM8	
PAH 17 Total	<0.64	<0.64					<0.64	mg/kg	TM4/PM8	
Benzo(b)fluoranthene	<0.05	< 0.05					< 0.05	mg/kg	TM4/PM8	
Benzo(k)fluoranthene	<0.02	<0.02					<0.02	mg/kg	TM4/PM8	
PAH Surrogate % Recovery	79	80					<0	%	TM4/PM8	
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	<30					<30	mg/kg	TM5/PM8/PM16	
	-50	-50					-00			



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/16588

Report : Solid

EMT Job No:	20/16588		 	 	 	 	_		
EMT Sample No.	1-3	4-6					1		
Sample ID	R5 TP02	R5 TP02							
Depth	0.50	1.10							
COC No / misc	0.50	1.10						e attached n ations and a	
	VIT	VIT							
Containers	VJT	VJT							
Sample Date	23/11/2020	23/11/2020							
Sample Type	Soil	Soil							
Batch Number	1	1					1.00/1.00		Method
Date of Receipt	26/11/2020	26/11/2020					LOD/LOR	Units	No.
TPH CWG									
Aliphatics									
>C5-C6 (HS_1D_AL) [#]	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) [#]	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_1D_AL) [#]	<0.2	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_1D_AL) [#]	<4	<4					<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_1D_AL) [#]	<7	<7					<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_1D_AL) [#]	<7	<7					<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	<7					<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	<26					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	< 0.1	< 0.1					< 0.1	mg/kg	TM36/PM12 TM5/PM8/PM16
>C10-C25 (EH_1D_AL)	<10 <10	<10 <10					<10 <10	mg/kg	TM5/PM8/PM16 TM5/PM8/PM16
>C25-C35 (EH_1D_AL) Aromatics	<10	<10					< 10	mg/kg	1100/P100/P1010
>C5-EC7 (HS_1D_AR) [#]	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)*	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)*	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_1D_AR)*	<0.2	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_1D_AR) [#]	<4	<4					<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_1D_AR) [#]	<7	<7					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_1D_AR)#	<7	<7					<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	<7					<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	<26					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	<52					<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR) [#]	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	<10					<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	<10					<10	mg/kg	TM5/PM8/PM16
MTBE [#]	<5	<5					<5	ug/kg	TM36/PM12
Benzene [#]	<5	<5 <5					<5	ug/kg	TM36/PM12 TM36/PM12
Toluene [#] Ethylbenzene [#]	<5 <5	<5					<5 <5	ug/kg ug/kg	TM36/PM12
m/p-Xylene #	<5	<5					<5	ug/kg	TM36/PM12
o-Xylene [#]	<5	<5					<5	ug/kg	TM36/PM12
								ughtg	
PCB 28 [#]	<5	<5					<5	ug/kg	TM17/PM8
PCB 52#	<5	<5					<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5					<5	ug/kg	TM17/PM8
PCB 118 [#]	<5	<5					<5	ug/kg	TM17/PM8
PCB 138 [#]	<5	<5					<5	ug/kg	TM17/PM8
PCB 153 [#]	<5	<5					<5	ug/kg	TM17/PM8
PCB 180 [#]	<5	<5					<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35	<35					<35	ug/kg	TM17/PM8



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/16588

Report : Solid

EMT Job No:	20/16588												
EMT Sample No.	1-3	4-6											
Sample ID	R5 TP02	R5 TP02											
Depth	0.50	1.10					Please see attached notes for all						
COC No / misc							Please see attached notes for all abbreviations and acronyms						
Containers	VJT	VJT											
Sample Date	23/11/2020	23/11/2020											
Sample Type	Soil	Soil											
Batch Number	1	1							Method				
Date of Receipt	26/11/2020	26/11/2020					LOD/LOR	Units	No.				
Natural Moisture Content	7.3	5.9					<0.1	%	PM4/PM0				
Moisture Content (% Wet Weight)	6.8	5.6					<0.1	%	PM4/PM0				
Hexavalent Chromium [#]	<0.3	<0.3					<0.3	mg/kg	TM38/PM20				
Chromium III	33.6	39.1					<0.5	mg/kg	NONE/NONE				
Total Cyanide [#]	<0.5	<0.5					<0.5	mg/kg	TM89/PM45				
Total Organic Carbon [#]	0.34	0.29					<0.02	%	TM21/PM24				
Loss on Ignition [#]	1.6	1.2					<1.0	%	TM22/PM0				
рН#	8.54	8.94					<0.01	pH units	TM73/PM11				
Mass of raw test portion	0.0974	0.0969						kg	NONE/PM17				
Mass of dried test portion	0.09	0.09						kg	NONE/PM17				



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/16588

Report: CEN 10:1 1 Batch

EMT Sample No.	1-3	4-6									
Sample ID	R5 TP02	R5 TP02									
Depth	0.50	1.10						e attached n			
COC No / misc							abbreviations and acronyms				
Containers	VJT	VJT									
Sample Date	23/11/2020	23/11/2020									
Sample Type	Soil	Soil									
Batch Number	1	1							Method		
Date of Receipt	26/11/2020	26/11/2020					LOD/LOR	Units	No.		
Dissolved Antimony [#]	<0.002	<0.002					<0.002	mg/l	TM30/PM17		
Dissolved Antimony (A10)#	<0.02	<0.02					<0.02	mg/kg	TM30/PM17		
Dissolved Arsenic [#]	<0.0025	<0.0025					<0.0025	mg/l	TM30/PM17		
Dissolved Arsenic (A10) [#]	<0.025	<0.025					<0.025	mg/kg	TM30/PM17		
Dissolved Barium [#]	0.009	0.003					<0.003	mg/l	TM30/PM17		
Dissolved Barium (A10) [#]	0.09	0.03					<0.03	mg/kg	TM30/PM17		
Dissolved Cadmium [#]	<0.0005	< 0.0005					<0.0005	mg/l	TM30/PM17		
Dissolved Cadmium (A10) [#]	<0.005	<0.005					<0.005	mg/kg	TM30/PM17		
Dissolved Chromium #	<0.0015	<0.0015					<0.0015	mg/l	TM30/PM17		
Dissolved Chromium (A10) [#]	<0.015	<0.015					<0.015	mg/kg	TM30/PM17		
Dissolved Copper [#]	<0.007	<0.007					<0.007	mg/l	TM30/PM17		
Dissolved Copper (A10) [#]	<0.07	<0.07					<0.07	mg/kg	TM30/PM17		
Dissolved Lead #	<0.005	<0.005					<0.005	mg/l	TM30/PM17		
Dissolved Lead (A10) #	<0.05	<0.05					<0.05	mg/kg	TM30/PM17		
Dissolved Molybdenum [#]	0.016	0.012					<0.002	mg/l	TM30/PM17		
Dissolved Molybdenum (A10) [#]	0.16	0.12					<0.02	mg/kg	TM30/PM17		
Dissolved Nickel [#]	<0.002	<0.002					<0.002	mg/l	TM30/PM17		
Dissolved Nickel (A10) [#]	<0.02	<0.02					<0.02	mg/kg	TM30/PM17		
Dissolved Selenium [#]	< 0.003	< 0.003					<0.003	mg/l	TM30/PM17		
Dissolved Selenium (A10) [#]	< 0.03	< 0.03					< 0.03	mg/kg	TM30/PM17		
Dissolved Zinc [#]	<0.003	0.003					<0.003	mg/l	TM30/PM17		
Dissolved Zinc (A10) [#]	< 0.03	0.03					<0.03	mg/kg	TM30/PM17		
Mercury Dissolved by CVAF [#]	<0.00001	< 0.00001					<0.00001	mg/l	TM61/PM0		
Mercury Dissolved by CVAF [#]	<0.0001	<0.0001					<0.0001	mg/kg	TM61/PM0		
Total Phenols HPLC	<0.05	<0.05					<0.05	mg/l	TM26/PM0		
Total Phenols HPLC	<0.5	<0.5					<0.5	mg/kg	TM26/PM0		
								5.5			
Fluoride	<0.3	<0.3					<0.3	mg/l	TM173/PM0		
Fluoride	<3	<3					<3	mg/kg	TM173/PM0		
Sulphate as SO4 [#]	21.7	7.5					<0.5	mg/l	TM38/PM0		
Sulphate as SO4	21.7	7.5					<0.5	mg/kg	TM38/PM0		
Chloride #	<0.3	< 0.3					<0.3	mg/l	TM38/PM0		
Chloride [#]	<3	<3					<3	mg/kg	TM38/PM0		
Dissolved Organic Carbon	2	3					<2	mg/l	TM60/PM0		
Dissolved Organic Carbon	20	30					<20	mg/kg	TM60/PM0		
Total Dissolved Solids #	64	47					<35	mg/l	TM20/PM0		
Total Dissolved Solids [#]	640	470					<350	mg/kg	TM20/PM0		

Element Material	s Tech	nology																	
Reference:	9754-07-2						Report : EN12457_2 Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub												
Contact:	BusConne John Dug 20/16588		5				Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=pl	lastic tub	stic tub							
					1					-									
EMT Sample No.	1-3	4-6																	
Sample ID	R5 TP02	R5 TP02																	
Depth	0.50	1.10												Disease as	e attached r	actor for all			
COC No / misc															ations and a				
Containers	VJT	VJT																	
Sample Date																			
-																			
Sample Type	Soil	Soil																	
Batch Number	1	1									Inert	Stable Non- reactive	Hazardous	LOD LOR	Units	Method			
Date of Receipt	26/11/2020	26/11/2020										reactive				No.			
Solid Waste Analysis																			
Total Organic Carbon #	0.34	0.29									3	5	6	<0.02	%	TM21/PM24			
Sum of BTEX	<0.025 <0.035	<0.025 <0.035									6	-	-	<0.025 <0.035	mg/kg	TM36/PM12 TM17/PM8			
Sum of 7 PCBs [#] Mineral Oil	<0.035	<0.035									500	-	-	<0.035	mg/kg mg/kg	TM5/PM8/PM16			
PAH Sum of 17	<0.64	<0.64									100	-	-	<0.64	mg/kg	TM4/PM8			
CEN 10:1 Leachate																			
Arsenic #	<0.025	<0.025									0.5	2	25	<0.025	mg/kg	TM30/PM17			
Barium [#]	0.09	0.03									20	100	300	<0.03	mg/kg	TM30/PM17			
Cadmium #	<0.005	<0.005									0.04	1	5	<0.005	mg/kg	TM30/PM17			
Chromium #	<0.015	<0.015									0.5	10	70	<0.015	mg/kg	TM30/PM17			
Copper [#] Mercury [#]	<0.07 <0.0001	<0.07 <0.0001									2 0.01	50 0.2	100 2	<0.07 <0.0001	mg/kg mg/kg	TM30/PM17 TM61/PM0			
Molybdenum #	0.16	0.12									0.5	10	30	<0.02	mg/kg	TM30/PM17			
Nickel [#]	<0.02	<0.02									0.4	10	40	<0.02	mg/kg	TM30/PM17			
Lead#	<0.05	<0.05									0.5	10	50	<0.05	mg/kg	TM30/PM17			
Antimony#	<0.02	<0.02									0.06	0.7	5	<0.02	mg/kg	TM30/PM17			
Selenium #	<0.03	<0.03									0.1	0.5	7	<0.03	mg/kg	TM30/PM17			
Zinc#	<0.03	0.03									4	50	200	<0.03	mg/kg	TM30/PM17			
Total Dissolved Solids#	640	470									4000	60000	100000	<350	mg/kg	TM20/PM0			
Dissolved Organic Carbon	20	30									500	800	1000	<20	mg/kg	TM60/PM0			
Mass of raw test portion	0.0974	0.0969										-	-		kg	NONE/PM17			
Dry Matter Content Ratio	92.7	93.4									-	-	-	<0.1	%	NONE/PM4			
Leachant Volume	0.893	0.894									-	-	-		I	NONE/PM17			
Eluate Volume	0.85	0.8									-	-	-		I	NONE/PM17			
рН#	8.54	8.94									-	-	-	<0.01	pH units	TM73/PM11			
F ()	-																		
Fluoride	<3	<3									-	-	-	<3	mg/kg	TM173/PM0			
Sulphate as SO4 #	217	75									1000	20000	50000	<5	mg/kg	TM38/PM0			
Chloride #	<3	<3									800	15000	25000	<3	mg/kg	TM38/PM0			
-																			
																1			
																-			
																-			
	L		l				l			1	L		I	1		1			

Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	BusConnects Route 5
Contact:	John Duggan

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/16588	1	R5 TP02	0.50	2	03/12/2020	General Description (Bulk Analysis)	Soil/Stones
					03/12/2020	Asbestos Fibres	NAD
					03/12/2020	Asbestos ACM	NAD
					03/12/2020	Asbestos Type	NAD
					03/12/2020	Asbestos Level Screen	NAD
20/16588	1	R5 TP02	1.10	5	03/12/2020	General Description (Bulk Analysis)	Soil/Stones
					03/12/2020	Asbestos Fibres	NAD
					03/12/2020	Asbestos ACM	NAD
					03/12/2020	Asbestos Type	NAD
						Asbestos Level Screen	NAD

Client Name:Ground Investigations IrelandReference:9754-07-20Location:BusConnects Route 5Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/16588	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/16588

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

EMT Job No.: 20/16588

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C- 440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
ТМЗО	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
ТМ30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377- 3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Issue :

Element Materials Technology Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA P: +44 (0) 1244 833780 F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland ac-MR Attention : John Duggan Date : 16th December, 2020 Your reference : 9754-07-20 Our reference : Test Report 20/17312 Batch 1 **BusConnects Route 5** Location : Date samples received : 8th December, 2020 Status : Final report

One sample was received for analysis on 8th December, 2020 of which one was scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

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

1

Authorised By:

b. June

Bruce Leslie Project Manager

Please include all sections of this report if it is reproduced



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/17312

Report : Solid

EMT Job No:	20/17312											
EMT Sample No.	1-3											
Sample ID	R5-CP05											
	0.50											
Depth							Please see attached notes for al abbreviations and acronyms					
COC No / misc												
Containers	V J T											
Sample Date												
Sample Type							ļ					
Batch Number	1						LOD/LOR	Units	Method			
Date of Receipt	08/12/2020								No.			
Antimony	2						<1	mg/kg	TM30/PM15			
Arsenic [#]	14.4						<0.5	mg/kg	TM30/PM15			
Barium [#]	96						<1	mg/kg	TM30/PM15			
Cadmium [#]	1.3						<0.1	mg/kg	TM30/PM15			
Chromium [#]	49.6						<0.5	mg/kg	TM30/PM15			
Copper [#] Lead [#]	43 45						<1	mg/kg	TM30/PM15 TM30/PM15			
Lead Mercury [#]	45 <0.1						<5 <0.1	mg/kg mg/kg	TM30/PM15			
Molybdenum [#]	3.2						<0.1	mg/kg	TM30/PM15			
Nickel [#]	43.7						<0.7	mg/kg	TM30/PM15			
Selenium [#]	2						<1	mg/kg	TM30/PM15			
Zinc [#]	- 111						<5	mg/kg	TM30/PM15			
PAH MS												
Naphthalene [#]	<0.04						<0.04	mg/kg	TM4/PM8			
Acenaphthylene	0.06						<0.03	mg/kg	TM4/PM8			
Acenaphthene #	<0.05						<0.05	mg/kg	TM4/PM8			
Fluorene #	<0.04						<0.04	mg/kg	TM4/PM8			
Phenanthrene [#]	0.28						<0.03	mg/kg	TM4/PM8			
Anthracene #	0.12						<0.04	mg/kg	TM4/PM8			
Fluoranthene [#]	1.01						< 0.03	mg/kg	TM4/PM8			
Pyrene#	0.92						< 0.03	mg/kg	TM4/PM8			
Benzo(a)anthracene [#]	0.59						< 0.06	mg/kg	TM4/PM8			
Chrysene [#]	0.62 1.43						<0.02 <0.07	mg/kg	TM4/PM8 TM4/PM8			
Benzo(bk)fluoranthene [#] Benzo(a)pyrene [#]	0.68						<0.07	mg/kg mg/kg	TM4/PM8			
Indeno(123cd)pyrene	0.52						<0.04	mg/kg	TM4/PM8			
Dibenzo(ah)anthracene [#]	0.08						<0.04	mg/kg	TM4/PM8			
Benzo(ghi)perylene [#]	0.52						<0.04	mg/kg	TM4/PM8			
Coronene	0.08						<0.04	mg/kg	TM4/PM8			
PAH 17 Total	6.91						<0.64	mg/kg	TM4/PM8			
Benzo(b)fluoranthene	1.03						<0.05	mg/kg	TM4/PM8			
Benzo(k)fluoranthene	0.40						<0.02	mg/kg	TM4/PM8			
PAH Surrogate % Recovery	98						<0	%	TM4/PM8			
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30						<30	ma/ka	TM5/PM8/PM16			
(010-040) (EII_00_ID_I0(8))	~30						~30	mg/kg	. WG/FW10			



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/17312

Report : Solid

EMI JOD NO:	20/17312					_		
EMT Sample No.	1-3							
Sample ID	R5-CP05							
Depth	0.50						e attached n ations and a	
COC No / misc						abbievi		sionyma
Containers	VJT							
Sample Date	04/12/2020					Ì		
Sample Type	Soil							
Batch Number	1					LOD/LOR	Units	Method No.
Date of Receipt	08/12/2020							INO.
TPH CWG								
Aliphatics								
>C5-C6 (HS_1D_AL) [#]	<0.1					<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) [#]	<0.1					<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1					<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)*	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) [#]	<4					<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) [#]	<7					<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7					<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL) Total aliphatics C5-40 (EH+HS_1D_AL)	<7					<7	mg/kg	TM5/PM8/PM16
	<26 <0.1					<26	mg/kg	
>C6-C10 (HS_1D_AL) >C10-C25 (EH_1D_AL)	<10					<0.1 <10	mg/kg mg/kg	TM36/PM12 TM5/PM8/PM16
>C10-C23 (EH_1D_AL)	<10					<10	mg/kg	TM5/PM8/PM16
Aromatics	10					10	ilig/kg	
>C5-EC7 (HS_1D_AR) [#]	<0.1					<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) [#]	<0.1					<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)*	<0.1					<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)*	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) #	<4					<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) *	<7					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) *	77					<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	20					<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	97					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	97					<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR) [#]	<0.1					<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	20					<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	71					<10	mg/kg	TM5/PM8/PM16
MTBE [#]	<5					<5	ug/kg	TM36/PM12
Benzene [#]	<5					<5	ug/kg	TM36/PM12
Toluene#	<5					<5	ug/kg	TM36/PM12
Ethylbenzene [#]	<5					<5	ug/kg	TM36/PM12 TM36/PM12
m/p-Xylene #	<5					<5	ug/kg	TM36/PM12 TM36/PM12
o-Xylene [#]	<5					<5	ug/kg	110130/1910112
PCB 28 [#]	<5					<5	ug/kg	TM17/PM8
PCB 28 PCB 52 [#]	<5					<5	ug/kg	TM17/PM8
PCB 101 [#]	<5					<5	ug/kg	TM17/PM8
PCB 118 [#]	<5					<5	ug/kg	TM17/PM8
PCB 138 [#]	<5					<5	ug/kg	TM17/PM8
PCB 153 [#]	<5					<5	ug/kg	TM17/PM8
PCB 180 [#]	<5					<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35					<35	ug/kg	TM17/PM8

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/17312

Report : Solid

EMI JOD NO:	20/17312					_		
EMT Sample No.	1-3							
Sample ID	R5-CP05							
Depth	0.50					 Ploase se	e attached n	otos for all
COC No / misc						abbrevi	ations and a	cronyms
Containers								
Sample Date	04/12/2020							
Sample Type								
Batch Number								Method
Date of Receipt	08/12/2020					LOD/LOR	Units	No.
Natural Moisture Content	17.9					<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	15.2					<0.1	%	PM4/PM0
Hexavalent Chromium [#]	<0.3					<0.3	mg/kg	TM38/PM20
Chromium III	49.6					<0.5	mg/kg	NONE/NONE
Total Cyanide [#]	<0.5					<0.5	malka	TM89/PM45
rotar Cyanide	~ 0.0					~ 0.0	mg/kg	1109/111145
Total Organic Carbon *	1.31					<0.02	%	TM21/PM24
Loss on Ignition [#]	3.7					<1.0	%	TM22/PM0
рН#	8.41					<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1064						kg	NONE/PM17
Mass of dried test portion	0.09						kg	NONE/PM17



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/17312

Report : CEN 10:1 1 Batch

EMT Sample No.	1-3							
Sample ID	R5-CP05							
Depth	0.50					Please se	e attached n	otes for all
COC No / misc							ations and a	
Containers	VJT							
Sample Date	04/12/2020							
Sample Type								
Batch Number	1							
						LOD/LOR	Units	Method No.
Date of Receipt						-0.000		TM20/DM47
Dissolved Antimony#	<0.002					< 0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) [#]	<0.02					< 0.02	mg/kg	TM30/PM17
Dissolved Arsenic [#]	<0.0025					< 0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) [#]	<0.025					 < 0.025	mg/kg	TM30/PM17 TM30/PM17
Dissolved Barium [#]	0.009					<0.003 <0.03	mg/l	TM30/PM17 TM30/PM17
Dissolved Barium (A10) [#] Dissolved Cadmium [#]	<0.009					<0.03	mg/kg mg/l	TM30/PM17 TM30/PM17
	< 0.0005					< 0.0005	mg/kg	TM30/PM17
Dissolved Cadmium (A10) [#] Dissolved Chromium [#]	0.0017					<0.003	mg/l	TM30/PM17
Dissolved Chromium (A10) [#]	0.0017					<0.0015	mg/kg	TM30/PM17
Dissolved Copper [#]	<0.007					 < 0.007	mg/l	TM30/PM17
Dissolved Copper (A10) [#]	<0.07					<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005					<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) [#]	<0.05					< 0.05	mg/kg	TM30/PM17
Dissolved Molybdenum [#]	0.008					<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) [#]	0.08					<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<0.002					<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) [#]	<0.02					<0.02	mg/kg	TM30/PM17
Dissolved Selenium [#]	<0.003					< 0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) [#]	<0.03					<0.03	mg/kg	TM30/PM17
Dissolved Zinc [#]	0.004					<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.04					<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001					<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001					<0.0001	mg/kg	TM61/PM0
Total Phenols HPLC	<0.05					<0.05	mg/l	TM26/PM0
Total Phenols HPLC	<0.5					<0.5	mg/kg	TM26/PM0
Fluoride	0.3					<0.3	mg/l	TM173/PM0
Fluoride	<3					<3	mg/kg	TM173/PM0
Sulphate as SO4 [#]	6.0					<0.5	mg/l	TM38/PM0
Sulphate as SO4 [#]	60					<5	mg/kg	TM38/PM0
Chloride #	0.8					<0.3	mg/l	TM38/PM0
Chloride [#]	8					<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	3					<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30					<20	mg/kg	TM60/PM0
Total Dissolved Solids [#]	86					<35	mg/l	TM20/PM0
Total Dissolved Solids [#]	860					<350	mg/kg	TM20/PM0

Element Material	s Tech	nology												
Client Name:	Ground In	vestigation	s Ireland		Report :	EN12457	2							
Reference:	9754-07-2	20												
Location:	BusConne	ects Route	5		Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=pl	lastic tub					
Contact:	John Dug	gan												
EMT Job No:	20/17312													
EMT Sample No.	1-3													
Sample ID	R5-CP05													
Depth	0.50											Diagon on	e attached n	untana far all
COC No / misc													ations and a	
Containers	VJT													
Sample Date	04/12/2020													
Sample Type	Soil													
Batch Number	1									Stable Non-		LOD LOR	Units	Method
Date of Receipt	08/12/2020								Inert	reactive	Hazardous	LOD LOR	Units	No.
Solid Waste Analysis														
Total Organic Carbon [#]	1.31								3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025								6	-	-	<0.025	mg/kg	TM36/PM12 TM17/PM8
Sum of 7 PCBs# Mineral Oil	<0.035 <30								1 500	-	-	<0.035 <30	mg/kg mg/kg	TM17/PM8 TM5/PM8/PM16
PAH Sum of 17	6.91								100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate														
Arsenic [#]	<0.025								0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium [#] Cadmium [#]	0.09 <0.005								20 0.04	100	300 5	<0.03 <0.005	mg/kg mg/kg	TM30/PM17 TM30/PM17
Cadmium #	0.003								0.04	10	70	<0.005	mg/kg	TM30/PM17
Copper [#]	<0.07								2	50	100	<0.07	mg/kg	TM30/PM17
Mercury#	<0.0001								0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.08								0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel [#]	<0.02								0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05								0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony#	<0.02								0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium [#] Zinc [#]	<0.03 0.04								0.1	0.5	7 200	<0.03 <0.03	mg/kg	TM30/PM17 TM30/PM17
Zinc" Total Dissolved Solids [#]	860								4000	60000	100000	<350	mg/kg mg/kg	TM20/PM0
Dissolved Organic Carbon	30								500	800	10000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	84.3								-	-	-	<0.1	%	NONE/PM4
рН#	8.41								-	-	-	<0.01	pH units	TM73/PM11
Fluoride	<3								-	-		<3	mg/kg	TM173/PM0
	-0									_	-	-0	mg/ng	11011071000
Sulphate as SO4 #	60								1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	8								800	15000	25000	<3	mg/kg	TM38/PM0
			1											

Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	BusConnects Route 5
Contact:	John Duggan

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/17312	1	R5-CP05	0.50	2	12/12/2020	General Description (Bulk Analysis)	soil.stones
						Asbestos Fibres	NAD
					12/12/2020	Asbestos ACM	NAD
						Asbestos Type	NAD
						Asbestos Level Screen	NAD

Client Name:Ground Investigations IrelandReference:9754-07-20Location:BusConnects Route 5Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/17312	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/17312

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

EMT Job No.: 20/17312

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

# ISO17025 (UKAS Ref No. 10729) accredited - UK. SA ISO17025 (SANAS Ref No. 10729) accredited - South Africa B Indicates analyte found in associated method blank. DR Dilution required. M MCERTS accredited. NA Not applicable NAD No Asbestos Detected. ND None Detected (usually refers to VOC and/SVOC TICs). NDP No Determination Possible SS Calibrated against a single substance SV Surogate recovery outside performance criteria. This may be due to a matrix effect. W Results expressed on as received basis. + AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. . Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected		
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DR Dilution required. M MCERTS accredited. NA Not applicable NAD No Asbestos Detected. ND None Detected (usually refers to VOC and/SVOC TICs). NDP No Determination Possible SS Calibrated against a single substance SV Surrogate recovery outside performance criteria. This may be due to a matrix effect. W Results expressed on as received basis. + AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results expressed on as received basis. + AQC failure, accredited to an Element Materials Technology approved laboratory. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. • Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LODLOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS	SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
M MCERTS accredited. NA Not applicable NAD No Asbestos Detected. ND None Detected (usually refers to VOC and/SVOC TICs). NDP No Determination Possible SS Calibrated against a single substance SV Surrogate recovery outside performance criteria. This may be due to a matrix effect. W Results expressed on as received basis. + AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	В	Indicates analyte found in associated method blank.
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NAD No Asbestos Detected. ND None Detected (usually refers to VOC and/SVOC TICs). NDP No Determination Possible SS Calibrated against a single substance SV Surrogate recovery outside performance criteria. This may be due to a matrix effect. W Results expressed on as received basis. + AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	М	MCERTS accredited.
ND None Detected (usually refers to VOC and/SVOC TICs). NDP No Determination Possible SS Calibrated against a single substance SV Surrogate recovery outside performance criteria. This may be due to a matrix effect. W Results expressed on as received basis. + AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	NA	Not applicable
NDP No Determination Possible SS Calibrated against a single substance SV Surrogate recovery outside performance criteria. This may be due to a matrix effect. W Results expressed on as received basis. + AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	NAD	No Asbestos Detected.
SS Calibrated against a single substance SV Surrogate recovery outside performance criteria. This may be due to a matrix effect. W Results expressed on as received basis. + AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	ND	None Detected (usually refers to VOC and/SVOC TICs).
SV Surrogate recovery outside performance criteria. This may be due to a matrix effect. W Results expressed on as received basis. + AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	NDP	No Determination Possible
W Results expressed on as received basis. + AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	SS	Calibrated against a single substance
+ AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
>> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	W	Results expressed on as received basis.
>> higher, this result is not accredited. * Analysis subcontracted to an Element Materials Technology approved laboratory. AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
AD Samples are dried at 35°C ±5°C CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	>>	
CO Suspected carry over LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	*	Analysis subcontracted to an Element Materials Technology approved laboratory.
LOD/LOR Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	AD	Samples are dried at 35°C ±5°C
ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample	со	Suspected carry over
NFD No Fibres Detected BS AQC Sample LB Blank Sample	LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
BS AQC Sample LB Blank Sample	ME	Matrix Effect
LB Blank Sample	NFD	No Fibres Detected
	BS	AQC Sample
N Client Sample	LB	Blank Sample
	N	Client Sample
TB Trip Blank Sample	ТВ	Trip Blank Sample
OC Outside Calibration Range	OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

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

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C- 440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
ТМ73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377- 3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Issue :

Element Materials Technology Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA P: +44 (0) 1244 833780 F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland ac-MR Attention : John Duggan Date : 21st December, 2020 Your reference : 9754-07-20 Our reference : Test Report 20/17435 Batch 1 Bus Connects Route 5 Location : Date samples received : 9th December, 2020 Status : Final report

Five samples were received for analysis on 9th December, 2020 of which five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

1

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

Authorised By:

illaumud.

Lucas Halliwell Project Co-ordinator

Please include all sections of this report if it is reproduced

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connects Route 5 John Duggan 20/17435

Report : Solid

EMT Job No:	20/17435					 	 	 _		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15					
Sample ID	R5-CP05	R5-CP05	R5-CP05	R5-CP05	R5-CP05					
Depth	0.50	1.50	2.50	3.50	4.50			Please se	e attached r	otes for all
COC No / misc									ations and a	
Containers	VJT	VJT	VJT	VJT	VJT					
Sample Date	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1					
								LOD/LOR	Units	Method No.
Date of Receipt	1	09/12/2020	09/12/2020 2	09/12/2020	09/12/2020 2			<1	ma/ka	TM30/PM15
Arsenic [#]	7.1	13.7	11.8	12.7	8.9			<0.5	mg/kg mg/kg	TM30/PM15
Barium [#]	73	366	289	299	237			<1	mg/kg	TM30/PM15
Cadmium [#]	1.6	5.0	3.9	4.1	2.9			<0.1	mg/kg	TM30/PM15
Chromium [#]	36.7	64.1	58.9	67.2	53.3			<0.5	mg/kg	TM30/PM15
Copper [#]	20	31	32	32	25			<1	mg/kg	TM30/PM15
Lead [#]	13	25	24	26	15			 <5	mg/kg	TM30/PM15
Mercury [#]	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM30/PM15
Molybdenum [#]	3.1	4.5	4.9	4.2	5.3			<0.1	mg/kg	TM30/PM15
Nickel [#]	27.2	59.2	54.8	51.8	47.5			<0.7	mg/kg	TM30/PM15
Selenium [#]	1	4	4	3	3			<1	mg/kg	TM30/PM15
Zinc [#]	76	171	163	209	109			<5	mg/kg	TM30/PM15
PAH MS										
Naphthalene [#]	<0.04	< 0.04	<0.04	< 0.04	<0.04			<0.04	mg/kg	TM4/PM8
Acenaphthylene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03			< 0.03	mg/kg	TM4/PM8
Acenaphthene #	< 0.05	< 0.05	< 0.05	< 0.05	<0.05			<0.05	mg/kg	TM4/PM8
Fluorene [#]	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Phenanthrene [#]	0.05	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Anthracene [#]	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.07	<0.03	<0.03	<0.03	0.04			<0.03	mg/kg	TM4/PM8
Pyrene [#]	0.06	<0.03	<0.03	<0.03	0.04			<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene [#]	0.07	<0.06	<0.06	<0.06	<0.06			<0.06	mg/kg	TM4/PM8
Chrysene [#]	0.04	<0.02	<0.02	<0.02	0.02			<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07			<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Coronene	<0.04	< 0.04	< 0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	< 0.64	< 0.64	<0.64			<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05 <0.02	< 0.05	<0.05 <0.02	<0.05 <0.02	<0.05 <0.02			<0.05 <0.02	mg/kg	TM4/PM8 TM4/PM8
Benzo(k)fluoranthene PAH Surrogate % Recovery	<0.02 101	<0.02 98	102	<0.02 72	<0.02 87			 <0.02	mg/kg %	TM4/PM8
PAR Sundgate // Recovery	101	30	102	12	07			~0	70	11014/17 1010
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	<30	<30	<30	<30			<30	mg/kg	TM5/PM8/PM16



Ground Investigations Ireland 9754-07-20 Bus Connects Route 5 John Duggan 20/17435

Report : Solid

EMT Sample No. 1-3 4-6 7-9 10-12 13-15 Image: Constraint of the second s	Acconyms Method No. TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM16 TM5/PM8/PM16
Image: constraint of the second of the se	Acconyms Method No. TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM16 TM5/PM8/PM16
COC No / miscVJTVJTVJTVJTVJTVJTVJTVJTVJT VJT <td>Acconyms Method No. TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM16 TM5/PM8/PM16</td>	Acconyms Method No. TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM16 TM5/PM8/PM16
COC No / misc VJT <	Acconyms Method No. TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM12 TM36/PM16 TM5/PM8/PM16
Sample Date $07/12/2020$ $09/12/2020$ <	No. TM36/PM12 TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
Sample Date $07/12/2020$ $09/12/2020$ <	No. TM36/PM12 TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
Sample Type Soil	No. TM36/PM12 TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
Batch Number 1 <t< td=""><td>No. TM36/PM12 TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16</td></t<>	No. TM36/PM12 TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
Date of Receipt 09/12/2020 09	No. TM36/PM12 TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
TPH CWG Image: Constraint of the second	TM36/PM12 TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
Aliphatics -C5-C6 (HS_1D_AL) [#] <0.1	TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
>C5-C6 (HS_1D_AL) [#] <0.1 <0.1 <0.1 <0.1 <0.1 mg/kg	TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
	TM36/PM12 TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
	TM36/PM12 TM5/PM8/PM16 TM5/PM8/PM16
>C8-C10 (HS_1D_AL) <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <td>TM5/PM8/PM16 TM5/PM8/PM16</td>	TM5/PM8/PM16 TM5/PM8/PM16
>C10-C12 (EH_CU_1D_AL) [#] <0.2 <0.2 <0.2 <0.2 <0.2 <0.2 <0.2 <0.2	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) [#] <4 <4 <4 <4 <4 <4 <4	
>C16-C21 (EH_CU_1D_AL) [#] <7 <7 <7 <7 <7 <7 <7 <7	
>C21-C35 (EH_CU_1D_AL) [#] <7 <7 <7 <7 <7 <7 <7 mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL) <7 <7 <7 <7 <7 <7 mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL) <26 <26 <26 <26 <26 <26 <26 <26 <26	TM5/TM38/PM8/PM12/PM18
>C6-C10 (HS_1D_AL) <0.1 0.1 <0.1 <0.1 <0.1 <0.1 <0.1 mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL) <10 <10 <10 <10 <10 <10 <10 mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL) <10 <10 <10 <10 <10 <10 <10 <10 <10 <10	TM5/PM8/PM16
Aromatics	
>C5-EC7 (HS_1D_AR)# <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 mg/kg	
>EC7-EC8 (HS_1D_AR) [#] <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 mg/kg	
>EC8-EC10 (HS_1D_AR) [#] <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 mg/kg	
>EC10-EC12 (EH_CU_1D_AR) [#] <0.2 <0.2 <0.2 <0.2 <0.2 <0.2 <0.2 <0.2	
>EC12-EC16 (EH_CU_1D_AR) [#] <4 <4 <4 <4 <4 <4 <4 <4 mg/kg	TM5/PM8/PM16 TM5/PM8/PM16
	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)* <7 <7 <7 <7 <7 <7 >EC35-EC40 (EH_1D_AR) <7 <7 <7 <7 <7 <7 <7 <7 <7 <7 mg/kg	
Total aromatics C5-40 (EH+HS_ID_AR) <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 <26	
Total alphatics and anomalics(CS-40) (EH-HS, CU, 10, Total) <52 <52 <52 <52 <52 <52 mg/kg	
>EC6-EC10 (HS_1D_AR) [#] <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1	
>EC10-EC25 (EH_1D_AR) <10 <10 <10 <10 <10 <10	
>EC25-EC35 (EH_1D_AR) <10 <10 <10 <10 <10 <10 <10 <10 <10 <10	TM5/PM8/PM16
MTBE [#] <5 <5 <5 <5 <5 <5 ug/kg	TM36/PM12
Benzene [#] <5 <5 <5 <5 <5 <5 ug/kg	TM36/PM12
Toluene [#] <5 12 <5 <5 <5 <5 <5 ug/kg	TM36/PM12
Ethylbenzene# <5 <5 <5 <5 <5 <5 ug/kg	TM36/PM12
m/p-Xylene # <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5	TM36/PM12
o-Xylene [#] <5 <5 <5 <5 <5 <5 <5 <5 <5 vg/kg	TM36/PM12
	Th (47/D) (0
PCB 28 [#] <5 <5 <5 <5 <5 <5 <5 ug/kg	TM17/PM8
PCB 52* <5 <5 <5 <5 ug/kg PCB 101** <5	TM17/PM8 TM17/PM8
PCB 118 [#] <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5	TM17/PM8
PCB 138 # <5 <5 <5 <5 <5 <5 <5 <5 <5	TM17/PM8
PCB 153 # <5 <5 <5 <5 <5 <5 <5 <5	TM17/PM8
PCB 180 # <5 <5 <5 <5 <5 <5 <5 <5	TM17/PM8
Total 7 PCBs [#] <35 <35 <35 <35 <35 <35 <35 <35 <35 <35	TM17/PM8

Client Name:
Reference:
Location:
Contact:

Ground Investigations Ireland 9754-07-20 Bus Connects Route 5 John Duggan 20/17435

Report : Solid

EMT Job No:	20/17435									
EMT Sample No.	1-3	4-6	7-9	10-12	13-15					
Sample ID	R5-CP05	R5-CP05	R5-CP05	R5-CP05	R5-CP05					
Depth	0.50	1.50	2.50	3.50	4.50			Please se	e attached n	otes for all
COC No / misc									ations and a	
Containers	VJT	VJT	VJT	VJT	VJT					
Sample Date	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1					Method
Date of Receipt	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020			LOD/LOR	Units	No.
Natural Moisture Content	17.7	22.6	30.9	35.5	24.4			<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	15.0	18.5	23.6	26.2	19.6			<0.1	%	PM4/PM0
Hexavalent Chromium [#]	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3			<0.3	mg/kg	TM38/PM20
Chromium III	36.7	64.1	58.9	67.2	53.3			<0.5	mg/kg	NONE/NONE
Total Cyanide [#]	<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	mg/kg	TM89/PM45
Total Organic Carbon [#]	0.60	0.91	0.93	0.84	0.62			<0.02	%	TM21/PM24
Total Organic Carbon	0.00	0.91	0.93	0.04	0.02			<0.02	70	110121/110124
Loss on Ignition [#]	2.4	6.3	6.5	6.2	3.2			<1.0	%	TM22/PM0
рН #	7.88	7.77	7.50	7.62	8.05			<0.01	pH units	TM73/PM11
	0.400.4	0.4400	0.4045	0.4054						
Mass of raw test portion Mass of dried test portion	0.1034	0.1128	0.1215	0.1251	0.1144				kg kg	NONE/PM17 NONE/PM17
Mass of thet test portion	0.03	0.03	0.03	0.03	0.00				ĸġ	



Ground Investigations Ireland 9754-07-20 Bus Connects Route 5 John Duggan 20/17435

Report : CEN 10:1 1 Batch

EMT Job No:	20/17435							-		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15					
Sample ID	R5-CP05	R5-CP05	R5-CP05	R5-CP05	R5-CP05					
Depth	0.50	1.50	2.50	3.50	4.50			Please se	e attached r	otes for all
COC No / misc									ations and a	
Containers	VJT	VJT	VJT	VJT	VJT					
Sample Date					07/12/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil					1
Batch Number	1	1	1	1	1			LOD/LOR	Units	Method
Date of Receipt	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020					No.
Dissolved Antimony [#]	<0.002	<0.002	<0.002	0.002	<0.002			<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) [#]	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM30/PM17
Dissolved Arsenic [#]	<0.0025	<0.0025	0.0031	<0.0025	<0.0025			<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10)#	<0.025	<0.025	0.031	<0.025	<0.025			<0.025	mg/kg	TM30/PM17
Dissolved Barium [#]	0.016	0.017	0.039	0.007	0.006			<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) [#]	0.16	0.17	0.39	0.07	0.06			< 0.03	mg/kg	TM30/PM17
Dissolved Cadmium [#]	< 0.0005	<0.0005	<0.0005	< 0.0005	< 0.0005			< 0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) [#]	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005			< 0.005	mg/kg	TM30/PM17 TM30/PM17
Dissolved Chromium #	<0.0015 <0.015	<0.0015 <0.015	<0.0015 <0.015	<0.0015 <0.015	<0.0015 <0.015			<0.0015 <0.015	mg/l	TM30/PM17 TM30/PM17
Dissolved Chromium (A10) [#] Dissolved Copper [#]	<0.013	<0.007	< 0.013	<0.013	<0.013			< 0.013	mg/kg mg/l	TM30/PM17
Dissolved Copper (A10) [#]	<0.07	<0.007	<0.07	<0.007	<0.07			<0.007	mg/kg	TM30/PM17
Dissolved Lead #	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005			< 0.005	mg/l	TM30/PM17
Dissolved Lead (A10)#	<0.05	< 0.05	<0.05	< 0.05	< 0.05			< 0.05	mg/kg	TM30/PM17
Dissolved Molybdenum#	0.008	0.003	0.003	<0.002	0.014			<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) [#]	0.08	0.03	0.03	<0.02	0.14			<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<0.002	<0.002	0.003	0.002	<0.002			<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) [#]	<0.02	<0.02	0.03	<0.02	<0.02			<0.02	mg/kg	TM30/PM17
Dissolved Selenium [#]	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) [#]	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM30/PM17
Dissolved Zinc [#]	<0.003	0.004	0.005	0.004	<0.003			<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) [#]	<0.03	0.04	0.05	0.04	<0.03			<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001			<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF [#]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	mg/kg	TM61/PM0
Total Phenols HPLC	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/l	TM26/PM0
Total Phenols HPLC	<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	mg/kg	TM26/PM0
Fluoride	0.4	0.5	<0.3	<0.3	<0.3			<0.3	mg/l	TM173/PM0
Fluoride	4	5	<3	<3	<3			<3	mg/kg	TM173/PM0
Sulphate as SO4 [#]	23.2	38.9	9.3	12.1	13.3			<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	232	389	93	121	133			<5	mg/kg	TM38/PM0
Chloride [#]	<0.3	0.7	5.2	1.7	1.2			<0.3	mg/l	TM38/PM0
Chloride [#]	<3	7	52	17	12			<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	5	7	<2	2			<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	50	70	<20	<20			<20	mg/kg	TM60/PM0
Total Dissolved Solids [#]	96	158	133	126	99			<35	mg/l	TM20/PM0
Total Dissolved Solids [#]	960	1579	1330	1260	990			<350	mg/kg	TM20/PM0

Element Materials Technology Client Name: Ground Investigations Ireland Report : EN12457_2 Reference: 9754-07-20 Location: Bus Connects Route 5 Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub Contact: John Duggan EMT Job No: 20/17435 10-12 13-15 EMT Sample No. 1-3 4-6 7-9 Sample ID R5-CP05 R5-CP05 R5-CP05 R5-CP05 R5-CP05 Depth 0.50 1.50 2.50 3.50 4.50 COC No / misc

Containers	VJT	VJT	VJT	VJT	VJT								
Sample Date	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1			Inert	Stable Non-	Hazardous	LOD LOR	Units	Method
Date of Receipt	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020				reactive				No.
Solid Waste Analysis													
Total Organic Carbon #	0.60	0.91	0.93	0.84	0.62			3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<0.025			6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs#	<0.035	<0.035	<0.035	<0.035	<0.035			1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30			500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	<0.64	 		100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate													
Arsenic [#]	<0.025	<0.025	0.031	<0.025	<0.025			0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium [#]	0.16	0.17	0.39	0.07	0.06			20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005			0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015			0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper [#]	<0.07	<0.07	<0.07	<0.07	<0.07			2	50	100	<0.07	mg/kg	TM30/PM17
Mercury#	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.08	0.03	0.03	<0.02	0.14			0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel [#]	<0.02	<0.02	0.03	<0.02	<0.02			0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05			0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony [#]	<0.02	<0.02	<0.02	<0.02	<0.02			0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03			0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc#	<0.03	0.04	0.05	0.04	<0.03			4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids#	960	1579	1330	1260	990			4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	50	70	<20	<20			500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	87.3	79.8	73.8	72.2	78.4			-	-	-	<0.1	%	NONE/PM4
рН#	7.88	7.77	7.50	7.62	8.05			-	-		<0.01	pH units	TM73/PM11
Fluoride	4	5	<3	<3	<3			-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	232	389	93	121	133			1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	7	52	17	12			800	15000	25000	<3	mg/kg	TM38/PM0

Please see attached notes for all abbreviations and acronyms

Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	Bus Connects Route 5
Contact:	John Duggan

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

Job Batch Sample ID Depth Sample ID Name of Analysis Analysis Analysis Result 20117435 1 R5-CP05 0.50 2 15/12/2020 General Description (Bulk Analysis) Sol/Stones 20117435 1 R5-CP05 0.50 2 15/12/2020 Asbestos Fibres NAD 20117435 1 R5-CP05 1.50 5 15/12/2020 Asbestos Fibres NAD 20117435 1 R5-CP05 1.50 5 15/12/2020 Asbestos Fibres NAD 20117435 1 R5-CP05 1.50 5 15/12/2020 Asbestos Fibres NAD 20117435 1 R5-CP05 2.50 8 15/12/2020 Asbestos Fibres NAD 20117435 1 R5-CP05 2.50 8 15/12/2020 Asbestos Fibres NAD 20117435 1 R5-CP05 2.50 8 15/12/2020 Asbestos Fibres NAD 20/17435 1 R5-CP			Date Of	EMT				EMT	
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	NAD	Asbestos Level Screen	15/12/2020						

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connects Route 5Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/17435	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/17435

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

EMT Job No.: 20/17435

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

HWOL ACRONYMS AND OPERATORS USED

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

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C- 440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
ТМ30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
ТМ73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377- 3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
ТМ89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Issue :

Element Materials Technology Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA P: +44 (0) 1244 833780 F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland ac-MR Attention : Mike Sutton Date : 11th March, 2021 Your reference : 9754-07-20 Our reference : Test Report 21/2952 Batch 1 **Busconnects Route 5** Location : Date samples received : 25th February, 2021 Status : Final report

Five samples were received for analysis on 25th February, 2021 of which five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

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

Authorised By:

Phil Sommerton BSc Senior Project Manager

Please include all sections of this report if it is reproduced



Ground Investigations Ireland 9754-07-20 Busconnects Route 5 Mike Sutton 21/2952

Report : Solid

EMT Job No:	21/2952									
EMT Sample No.	1-3	4-6	7-9	10-12	13-15					
Sample ID	R5 - TP09	R5 - TP09	R5 - TP08A	R5 - TP08A	R5 - TP08A					
Depth	0.50	1.40	0.50	1.50	2.20			Ploase se	e attached r	otos for all
COC No / misc									ations and a	
Containers	VJT	VJT	VJT	VJT	VJT					
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021					
Sample Type	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1					Method
Date of Receipt	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021	 		 LOD/LOR	Units	No.
Antimony	1	2	1	<1	1	 		 <1	mg/kg	TM30/PM15
Arsenic [#]	25.3	15.6	9.3	10.6	18.1			<0.5	mg/kg	TM30/PM15
Barium [#]	52	62	177	159	92			<1	mg/kg	TM30/PM15
Cadmium [#]	0.2	0.7	1.3	0.6	0.5			<0.1	mg/kg	TM30/PM15
Chromium #	46.1	64.8	28.3	17.4	18.2			<0.5	mg/kg	TM30/PM15
Copper [#]	22	24	18	16	15			<1	mg/kg	TM30/PM15
Lead [#]	15	11	31	22	24			<5	mg/kg	TM30/PM15
Mercury [#]	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM30/PM15
Molybdenum [#]	1.4	3.6	2.2	1.1	1.7			<0.1	mg/kg	TM30/PM15
Nickel [#]	29.3	34.9	16.6	11.4	19.2			<0.7	mg/kg	TM30/PM15
Selenium [#]	<1	1	<1	<1	<1			<1	mg/kg	TM30/PM15
Zinc [#]	79	79	90	56	78			<5	mg/kg	TM30/PM15
PAH MS										
Naphthalene [#]	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/kg	TM4/PM8
Fluorene [#]	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Phenanthrene [#]	<0.03	<0.03	0.04	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Fluoranthene [#]	<0.03	<0.03	0.04	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Pyrene [#]	<0.03	<0.03	0.04	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06			<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	< 0.02	0.03	<0.02	< 0.02			<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene [#]	<0.07	< 0.07	<0.07	<0.07	<0.07			<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	<0.04	< 0.04	<0.04	<0.04	< 0.04			<0.04	mg/kg	TM4/PM8 TM4/PM8
Indeno(123cd)pyrene [#] Dibenzo(ah)anthracene [#]	<0.04 <0.04	<0.04 <0.04	<0.04 <0.04	<0.04 <0.04	<0.04 <0.04			<0.04 <0.04	mg/kg mg/kg	TM4/PM8
Dibenzo(an)antnracene Benzo(ghi)perylene [#]	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64			<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	< 0.05	<0.05	<0.05	<0.05			<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	91	92	90	87	86			<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	<30	<30	<30	<30			<30	mg/kg	TM5/PM8/PM16



Ground Investigations Ireland 9754-07-20 Busconnects Route 5 Mike Sutton 21/2952

Report : Solid

EMT Job No:	21/2952											
EMT Sample No.	1-3	4-6	7-9	10-12	13-15							
Sample ID	R5 - TP09	R5 - TP09	R5 - TP08A	R5 - TP08A	R5 - TP08A							
Depth	0.50	1.40	0.50	1.50	2.20					Please se	e attached r	notos for all
COC No / misc											ations and a	
Containers	VJT	VJT	VJT	VJT	VJT							
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1							Method
Date of Receipt	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021					LOD/LOR	Units	No.
TPH CWG												
Aliphatics												
>C5-C6 (HS_1D_AL) [#]	<0.1	<0.1	<0.1 ^{sv}	<0.1	<0.1 ^{SV}					<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) [#]	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}					<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}					<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2	<0.2	<0.2	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4	<4					<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7	11	<7	<7					<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	<26	<26	<26	<26					<26	mg/kg	TM5/TM38/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}					<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	<10	<10	<10	<10					<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	<10	12	<10	<10					<10	mg/kg	TM5/PM8/PM16
Aromatics												
>C5-EC7 (HS_1D_AR) [#]	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}					<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) [#]	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}					<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)*	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}					<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR) *	<0.2	<0.2	<0.2	<0.2	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) [#]	<4	<4	<4	<4	<4					<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) [#]	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)*	<7	<7	30	19	<7					<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	<7	13	12	<7					<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	<26	43	31	<26					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	<52	<52	<52	<52					<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)*	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{\$V}					<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	<10	<10	<10	<10					<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	<10	36	31	<10					<10	mg/kg	TM5/PM8/PM16
	.5		sv	.5	sv					.5		TM00/DM40
MTBE [#]	<5	<5	<5 ^{sv}	<5	<5 ^{SV}					<5	ug/kg	TM36/PM12
Benzene [#]	<5	<5	<5 ^{SV}	<5	<5 ^{sv} <5 ^{sv}					<5	ug/kg	TM36/PM12
Toluene [#]	<5	<5	<5 ^{sv}	<5						<5	ug/kg	TM36/PM12
Ethylbenzene [#]	<5	<5	<5 ^{SV}	<5	<5 ^{\$V}					<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	<5 <5	<5 ^{\$V}	<5 <5	<5 ^{sv}					<5	ug/kg	TM36/PM12 TM36/PM12
o-Xylene [#]	<5	<0	<5	<0	<5					<5	ug/kg	110130/P10112
PCB 28 [#]	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 28 PCB 52 [#]	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 52 PCB 101 [#]	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 101	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 138 [#]	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 138 PCB 153 [#]	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 180 [#]	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35	<35	<35	<35	<35					<3		TM17/PM8
IUIAI / FUDS	~30	~30	~30	~30	~00					 ~00	ug/kg	11111//1710

Client Name:
Reference:
Location:
Contact:
CMT Lab Mar

Ground Investigations Ireland 9754-07-20 Busconnects Route 5 Mike Sutton 24/2052

Report : Solid

EMT Job No:	21/2952											
EMT Sample No.	1-3	4-6	7-9	10-12	13-15							
Sample ID	R5 - TP09	R5 - TP09	R5 - TP08A	R5 - TP08A	R5 - TP08A							
Depth	0.50	1.40	0.50	1.50	2.20					Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT	VJT	VJT	VJT	VJT							
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1							
Date of Receipt										LOD/LOR	Units	Method No.
Natural Moisture Content	10.2	13.7	10.2	11.2	7.9					<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)		12.1	9.2	10.1	7.3					<0.1	%	PM4/PM0
Hexavalent Chromium [#]	<0.3	<0.3	<0.3	<0.3	<0.3					<0.3	mg/kg	TM38/PM20
Chromium III	46.1	64.8	28.3	17.4	18.2					<0.5	mg/kg	NONE/NONE
Total Cyanide [#]	<0.5	<0.5	<0.5	<0.5	<0.5					<0.5	mg/kg	TM89/PM45
rotal Oyaniue	-0.0	-0.0	-0.0	-0.0	-0.0					-0.0	шу/ку	. 1000/1 10140
Total Organic Carbon [#]	0.07	0.20	0.32	0.50	0.53					<0.02	%	TM21/PM24
Loss on Ignition [#]	<1.0	1.4	1.3	1.2	1.0					<1.0	%	TM22/PM0
рН#	9.12	8.89	8.43	8.52	8.43					<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1004	0.1081	0.1035	0.098	0.0991						kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09						kg	NONE/PM17
]
			I	I		 l	I	I	l			



Ground Investigations Ireland 9754-07-20 Busconnects Route 5 Mike Sutton 21/2952

Report : CEN 10:1 1 Batch

EMT Job No:	21/2952									
EMT Sample No.	1-3	4-6	7-9	10-12	13-15]		
Sample ID	R5 - TP09	R5 - TP09	R5 - TP08A	R5 - TP08A	R5 - TP08A					
Depth	0.50	1.40	0.50	1.50	2.20			Please se	e attached r	otes for all
COC No / misc									ations and a	
Containers	VJT	VJT	VJT	VJT	VJT					
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021					
Sample Type	Soil	Soil	Soil	Soil	Soil					1
Batch Number	1	1	1	1	1		 	LOD/LOR	Units	Method
Date of Receipt	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021					No.
Dissolved Antimony [#]	<0.002	<0.002	<0.002	<0.002	<0.002			<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10)#	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM30/PM17
Dissolved Arsenic [#]	0.0107	<0.0025	<0.0025	<0.0025	<0.0025			<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) [#]	0.107	<0.025	<0.025	<0.025	<0.025			<0.025	mg/kg	TM30/PM17
Dissolved Barium [#]	0.003	0.008	0.058	0.069	0.008			< 0.003	mg/l	TM30/PM17
Dissolved Barium (A10) [#]	<0.03	0.08	0.58	0.69	0.08			<0.03	mg/kg	TM30/PM17 TM30/PM17
Dissolved Cadmium [#] Dissolved Cadmium (A10) [#]	<0.0005 <0.005	<0.0005 <0.005	<0.0005 <0.005	<0.0005 <0.005	<0.0005 <0.005			<0.0005 <0.005	mg/l mg/kg	TM30/PM17 TM30/PM17
Dissolved Cadmium (ATO)	<0.0015	<0.0015	<0.003	<0.003	0.0015			<0.003	mg/l	TM30/PM17
Dissolved Chromium (A10) [#]	< 0.015	<0.015	<0.015	< 0.015	0.015			<0.015	mg/kg	TM30/PM17
Dissolved Copper [#]	< 0.007	<0.007	< 0.007	< 0.007	< 0.007			<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) [#]	<0.07	< 0.07	< 0.07	<0.07	<0.07			<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	< 0.005	< 0.005	< 0.005	< 0.005			<0.005	mg/l	TM30/PM17
Dissolved Lead (A10)#	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum [#]	0.003	0.009	0.006	0.006	0.009			<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) [#]	0.03	0.09	0.06	0.06	0.09			<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<0.002	<0.002	<0.002	<0.002	<0.002			<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) [#]	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM30/PM17
Dissolved Selenium [#]	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10)#	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM30/PM17
Dissolved Zinc [#]	<0.003	<0.003	<0.003	<0.003	< 0.003			<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) [#]	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03			<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF*	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001			< 0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF *	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	mg/kg	TM61/PM0
Total Phenols HPLC	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/l	TM26/PM0
Total Phenols HPLC	<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	mg/kg	TM26/PM0
Fluoride	<0.3	<0.3	<0.3	<0.3	<0.3			<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	<3			<3	mg/kg	TM173/PM0
Sulphate as SO4 [#]	1.6	6.2	13.9	12.6	24.7			<0.5	mg/l	TM38/PM0
Sulphate as SO4	1.6	62	13.9	12.6	24.7			<0.5	mg/kg	TM38/PM0
Chloride #	1.3	3.0	0.5	0.6	0.5			<0.3	mg/l	TM38/PM0
Chloride [#]	13	30	5	6	5			<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	2	3	2	<2	<2			<2	ma/l	TM60/PM0
Dissolved Organic Carbon	2 <20	3 30	2	<2 <20	<2 <20			<2 <20	mg/l mg/kg	TM60/PM0 TM60/PM0
Total Dissolved Solids [#]	40	61	54	<20 51	<20 82			<20	mg/l	TM80/PM0 TM20/PM0
Total Dissolved Solids	40	610	540	510	820			<35	mg/kg	TM20/PM0
		010	0.10	010	520					

Element Material	s Tech	nology	,												
Client Name: Reference:	9754-07-2	nvestigatior 20 ects Route					EN12457			-plastic tub					
Location: Contact: EMT Job No:	Mike Sutt 21/2952		5			Solids: V=	oug voc ja	r, J=250g gl	ass jar, 1=p	astic tud					
EMT Sample No.	1-3	4-6	7-9	10-12	13-15										
Sample ID	R5 - TP09	R5 - TP09	R5 - TP08A	R5 - TP08A	R5 - TP08A										
Depth	0.50	1.40	0.50	1.50	2.20								5		
COC No / misc														e attached n ations and a	
Containers	VJT	VJT	VJT	VJT	VJT										
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021										
Sample Type	Soil	Soil	Soil	Soil	Soil										
Batch Number	1	1	1	1	1						Chable New				Method
Date of Receipt	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021					Inert	Stable Non- reactive	Hazardous	LOD LOR	Units	No.
Solid Waste Analysis															
Total Organic Carbon [#]	0.07	0.20	0.32	0.50	0.53					3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025 ^{sv}	<0.025	<0.025 ^{sv}					6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs#	< 0.035	< 0.035	< 0.035	< 0.035	< 0.035					1	-	-	< 0.035	mg/kg	TM17/PM8
Mineral Oil PAH Sum of 17	<30 <0.64	<30 <0.64	<30 <0.64	<30 <0.64	<30 <0.64					500 100	-	-	<30 <0.64	mg/kg mg/kg	TM5/PM8/PM16 TM4/PM8
CEN 10:1 Leachate															
Arsenic#	0.107	<0.025	<0.025	<0.025	<0.025					0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium [#]	<0.03 <0.005	0.08	0.58	0.69	0.08					20 0.04	100	300 5	<0.03 <0.005	mg/kg	TM30/PM17 TM30/PM17
Cadmium # Chromium #	<0.005	<0.005	<0.005	<0.005	<0.005					0.04	10	70	<0.005	mg/kg mg/kg	TM30/PM17 TM30/PM17
Copper [#]	<0.07	<0.07	<0.07	<0.07	<0.07					2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.03	0.09	0.06	0.06	0.09					0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel [#]	<0.02	<0.02	<0.02	<0.02	<0.02					0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead [#]	<0.05	<0.05 <0.02	<0.05	<0.05	< 0.05					0.5	10	50 E	< 0.05	mg/kg	TM30/PM17 TM30/PM17
Antimony [#] Selenium [#]	<0.02 <0.03	<0.02	<0.02 <0.03	<0.02	<0.02 <0.03					0.06	0.7	5	<0.02 <0.03	mg/kg mg/kg	TM30/PM17 TM30/PM17
Zinc#	< 0.03	<0.03	<0.03	<0.03	< 0.03					4	50	200	< 0.03	mg/kg	TM30/PM17
Total Dissolved Solids#	400	610	540	510	820					4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	30	20	<20	<20					500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	89.2	83.0	86.5	92.1	90.6					-	-	-	<0.1	%	NONE/PM4
pH#	9.12	8.89	8.43	8.52	8.43					-	-	-	<0.01	pH units	TM73/PM11
Fluoride	<3	<3	<3	<3	<3					-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	16	62	139	126	247					1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride [#]	13	30	5	6	5					800	15000	25000	<3	mg/kg	TM38/PM0

Ground Investigations Ireland
20/07/9754
Busconnects Route 5
Mike Sutton

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
	1	R5 - TP09	0.50	2	0.4/00/0004		
21/2952	1	N3 - 1F 09	0.50	2	04/03/2021	General Description (Bulk Analysis)	soil/stones
					04/03/2021	Asbestos Fibres	NAD
					04/03/2021	Asbestos ACM	NAD
					04/03/2021	Asbestos Type	NAD
					04/03/2021	Asbestos Level Screen	NAD
04/0050	4		4.40	-	04/00/0004		0.1100.000
21/2952	1	R5 - TP09	1.40	5	04/03/2021	General Description (Bulk Analysis)	Soil/Stones
					04/03/2021	Asbestos Fibres	NAD
					04/03/2021	Asbestos ACM	NAD
					04/03/2021	Asbestos Type	NAD
					04/03/2021	Asbestos Level Screen	NAD
21/2952	1	R5 - TP08A	0.50	8	05/03/2021	General Description (Bulk Analysis)	Soil/Stones
					05/03/2021	Asbestos Fibres	NAD
					05/03/2021	Asbestos ACM	NAD
					05/03/2021	Asbestos Type	NAD
					05/03/2021	Asbestos Level Screen	NAD
21/2952	1	R5 - TP08A	1.50	11	04/03/2021	General Description (Bulk Analysis)	Soil/Stones
					04/03/2021	Asbestos Fibres	NAD
					04/03/2021	Asbestos ACM	NAD
					04/03/2021	Asbestos Type	NAD
					04/03/2021	Asbestos Level Screen	NAD
21/2952	1	R5 - TP08A	2.20	14	05/03/2021	General Description (Bulk Analysis)	Soil/Stones
					05/03/2021	Asbestos Fibres	NAD
					05/03/2021	Asbestos ACM	NAD
					05/03/2021	Asbestos Type	NAD
					05/03/2021	Asbestos Level Screen	NAD

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Busconnects Route 5Contact:Mike Sutton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 21/2952	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 21/2952

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

EMT Job No.: 21/2952

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

HWOL ACRONYMS AND OPERATORS USED

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

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C- 440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
ТМЗО	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377- 3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Issue :

Element Materials Technology Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA P: +44 (0) 1244 833780 F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland ac-MR Attention : John Duggan Date : 3rd December, 2020 Your reference : 9754-07-20 Our reference : Test Report 20/16404 Batch 1 **BusConnects Route 5** Location : Date samples received : 23rd November, 2020 Status : Final report

Nine samples were received for analysis on 23rd November, 2020 of which nine were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

1

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

Authorised By:

b. June

Bruce Leslie Project Manager

Please include all sections of this report if it is reproduced



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/16404

Report : Solid

EMT Job No:	20/16404									_		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27			
Sample ID	R5 TP01	R5 TP01	R5 TP05	R5 TP05	R5 TP05B	R5 TP06	R5 TP06	R5 TP07B	R5 TP07B			
Depth	0.50	1.50	0.50	1.50	0.90	0.50	1.50	0.50	1.50	Please se	e attached r	otes for all
COC No / misc											ations and a	
Containers	VJT											
Sample Date	17/11/2020	17/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	i		
Sample Type	Soil											
Batch Number	1	1	1	1	1	1	1	1	1			
										LOD/LOR	Units	Method No.
Date of Receipt	23/11/2020			23/11/2020		23/11/2020		23/11/2020	23/11/2020	- 1		TM30/PM15
Antimony Arsenic [#]	2	2 11.3	1 9.2	<1 4.7	<1 3.6	<1 7.8	1 8.5	<1 4.9	1 13.0	 <1 <0.5	mg/kg mg/kg	TM30/PM15
Barium [#]	75	73	98	70	46	53	64	4.9 65	104	<0.5	mg/kg	TM30/PM15
Cadmium [#]	2.5	2.7	0.9	0.9	0.2	0.3	0.8	0.8	1.1	<0.1	mg/kg	TM30/PM15
Cadmium Chromium [#]	39.8	34.0	53.4	71.4	40.8	43.4	47.0	36.4	48.0	<0.1		TM30/PM15
Corpor [#]	39.8	34.0	34	15	23	43.4 24	27	15	23	<0.5	mg/kg mg/kg	TM30/PM15
Copper	37 19	16	34	15	10	24	27	47	23	<5	mg/kg	TM30/PM15
Lead Mercury [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum [#]	4.7	5.4	2.2	3.2	0.6	0.8	2.4	2.2	3.0	<0.1	mg/kg	TM30/PM15
Nickel [#]	44.7	42.1	64.6	45.5	60.7	70.2	49.2	30.6	42.4	<0.7	mg/kg	TM30/PM15
Selenium [#]	2	4	2	<1	<1	1	<1	<1	<1	<1	mg/kg	TM30/PM15
Zinc [#]	101	95	140	109	127	119	84	60	135	<5	mg/kg	TM30/PM15
										-		
PAH MS												
Naphthalene [#]	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene [#]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene [#]	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene [#]	<0.03	<0.03	0.11	<0.03	<0.03	<0.03	0.10	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene [#]	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene [#]	<0.03	<0.03	0.18	<0.03	<0.03	0.08	0.36	<0.03	0.06	<0.03	mg/kg	TM4/PM8
Pyrene [#]	<0.03	<0.03	0.17	<0.03	<0.03	0.07	0.35	<0.03	0.04	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene [#]	<0.06	<0.06	0.12	<0.06	<0.06	0.07	0.27	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene [#]	<0.02	<0.02	0.13	<0.02	<0.02	0.06	0.30	<0.02	0.03	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene [#]	<0.07	<0.07	0.26	<0.07	<0.07	0.09	0.66	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	<0.04	<0.04	0.14	<0.04	<0.04	0.04	0.37	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	<0.04	0.10	<0.04	<0.04	<0.04	0.30	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	0.10	<0.04	<0.04	<0.04	0.31	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.07	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	1.31	<0.64	<0.64	<0.64	3.18	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	0.19	<0.05	<0.05	0.06	0.48	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	0.07	<0.02	<0.02	0.03	0.18	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	78	88	83	74	75	85	80	75	80	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/16404

Report : Solid

EMT Job No:	20/16404									_		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27			
Sample ID	R5 TP01	R5 TP01	R5 TP05	R5 TP05	R5 TP05B	R5 TP06	R5 TP06	R5 TP07B	R5 TP07B			
Depth	0.50	1.50	0.50	1.50	0.90	0.50	1.50	0.50	1.50	Please se	e attached r	otes for all
COC No / misc											ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT			
Sample Date	17/11/2020	17/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	1		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1			
Date of Receipt										LOD/LOR	Units	Method No.
TPH CWG	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020			
Aliphatics												
>C5-C6 (HS_1D_AL) [#]	<0.1 ^{SV}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>C5-C8 (HS_1D_AL) >C6-C8 (HS_1D_AL) [#]	<0.1 <0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 <0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C8 (HS_1D_AL) >C8-C10 (HS_1D_AL)	<0.1 <0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 <0.1	<0.1	<0.1	mg/kg	TM36/PM12
				<0.1		<0.1	<0.1					TM5/PM8/PM16
>C10-C12 (EH_1D_AL)*	<0.2 <4	<0.2 <4	<0.2 <4	<0.2	<0.2 <4	<0.2	<0.2	<0.2 <4	<0.2 <4	<0.2 <4	mg/kg	TM5/PM8/PM16 TM5/PM8/PM16
>C12-C16 (EH_1D_AL) [#] >C16-C21 (EH 1D AL) [#]	<7	<7	<7	<4	<7	<7	<7	<7	<7	<4	mg/kg mg/kg	TM5/PM8/PM16
>C10-C21 (EH_1D_AL) >C21-C35 (EH_1D_AL) [#]	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1 ^{SV}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<20	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
Aromatics		<10	<10	<10	<10	<10	<10		<10	<10	ilig/kg	
>C5-EC7 (HS_1D_AR) [#]	<0.1 ^{SV}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) [#]	<0.1 ^{SV}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) [#]	<0.1 ^{SV}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_1D_AR) [#]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_1D_AR) [#]	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_1D_AR) [#]	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_1D_AR)#	<7	<7	79	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	<26	79	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	<52	79	<52	<52	<52	<52	<52	<52	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)*	<0.1 ^{SV}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	<10	26	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	<10	53	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
MTBE [#]	<5 ^{8V}	<5	<5	<5	<5	<5	<5	<5 ^{SV}	<5	<5	ug/kg	TM36/PM12
Benzene [#]	<5 ^{sv}	<5	<5	<5	<5	<5	<5	<5 ^{SV}	<5	<5	ug/kg	TM36/PM12
Toluene [#]	<5 ^{SV}	<5	<5	<5	<5	<5	<5	<5 ^{SV}	<5	<5	ug/kg	TM36/PM12
Ethylbenzene [#]	<5 ^{\$V}	<5	<5	<5	<5	<5	<5	<5 ^{\$V}	<5	<5	ug/kg	TM36/PM12
m/p-Xylene [#]	<5 ^{\$V}	<5	<5	<5	<5	<5	<5	<5 ^{\$V}	<5	<5	ug/kg	TM36/PM12
o-Xylene [#]	<5 ^{8V}	<5	<5	<5	<5	<5	<5	<5 ^{SV}	<5	<5	ug/kg	TM36/PM12
PCB 28 [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52 [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101 [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118 [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138 [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153 [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180 [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/16404

Report : Solid

	20/16404											
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27			
Sample ID	R5 TP01	R5 TP01	R5 TP05	R5 TP05	R5 TP05B	R5 TP06	R5 TP06	R5 TP07B	R5 TP07B			
Depth	0.50	1.50	0.50	1.50	0.90	0.50	1.50	0.50	1.50	Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT	İ										
Sample Date	17/11/2020	17/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	İ		
Sample Type	Soil	İ										
Batch Number	1	1	1	1	1	1	1	1	1			Method
Date of Receipt	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	LOD/LOR	Units	No.
Natural Moisture Content	14.6	11.7	19.6	14.6	9.8	10.3	9.6	8.5	11.2	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.7	10.5	16.4	12.8	8.9	9.4	8.8	7.9	10.1	<0.1	%	PM4/PM0
Hexavalent Chromium [#] Chromium III	<0.3 39.8	<0.3 34.0	<0.3 53.4	<0.3 71.4	<0.3 40.8	<0.3 43.4	<0.3 47.0	<0.3 36.4	<0.3 48.0	<0.3 <0.5	mg/kg	TM38/PM20 NONE/NONE
	39.0	34.0	55.4	/ 1.4	40.8	43.4	41.0	30.4	40.0	~ 0.0	mg/kg	INGINE/NUNE
Total Cyanide [#]	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	TM89/PM45
Total Organic Carbon [#]	0.76	0.70	1.01	0.32	0.23	0.30	0.60	0.50	0.54	<0.02	%	TM21/PM24
Loss on Ignition [#]	3.1	2.2	4.0	1.7	1.5	1.9	2.3	1.4	2.2	<1.0	%	TM22/PM0
рН#	8.22	8.47	8.36	8.44	8.66	8.63	8.52	8.38	8.59	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.101	0.102	0.0998	0.0984	0.1012	0.1001	0.095	0.101	0.1022		kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17



Ground Investigations Ireland 9754-07-20 BusConnects Route 5 John Duggan 20/16404

Report : CEN 10:1 1 Batch

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27			
							-		-			
Sample ID	R5 TP01	R5 TP01	R5 TP05	R5 TP05	R5 TP05B	R5 TP06	R5 TP06	R5 TP07B	R5 TP07B			
Depth	0.50	1.50	0.50	1.50	0.90	0.50	1.50	0.50	1.50	Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT											
Sample Date	17/11/2020	17/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020			
Sample Type	Soil											
						1						
Batch Number	1	1	1	1	1		1	1	1	LOD/LOR	Units	Method No.
Date of Receipt		23/11/2020	23/11/2020		23/11/2020	23/11/2020	23/11/2020		23/11/2020	 0.000		
Dissolved Antimony [#]	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	<0.002	< 0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) [#] Dissolved Arsenic [#]	<0.02 <0.0025	<0.02 <0.0025	<0.02 <0.0025	<0.02 <0.0025	<0.02 <0.0025	<0.02 <0.0025	<0.02 <0.0025	<0.02 <0.0025	<0.02 <0.0025	<0.02 <0.0025	mg/kg mg/l	TM30/PM17 TM30/PM17
Dissolved Arsenic (A10) [#]	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	mg/kg	TM30/PM17
Dissolved Barium [#]	< 0.003	<0.003	<0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	<0.003	< 0.003	mg/l	TM30/PM17
Dissolved Barium (A10) [#]	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	mg/kg	TM30/PM17
Dissolved Cadmium [#]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) [#]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) [#]	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Copper [#]	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) [#]	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Lead [#]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum#	0.006	0.017	<0.002	<0.002	<0.002	0.003	0.003	0.003	0.005	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) [#]	0.06	0.17	<0.02	<0.02	<0.02	0.03	0.03	0.03	0.05	<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) [#]	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	< 0.02	<0.02	< 0.02	mg/kg	TM30/PM17
Dissolved Selenium [#]	<0.003 <0.03	<0.003 <0.03	<0.003 <0.03	<0.003 <0.03	<0.003 <0.03	<0.003 <0.03	<0.003 <0.03	<0.003 <0.03	<0.003 <0.03	<0.003 <0.03	mg/l	TM30/PM17 TM30/PM17
Dissolved Selenium (A10) [#] Dissolved Zinc [#]	0.004	< 0.003	< 0.003	< 0.003	< 0.003	0.003	< 0.003	< 0.003	0.003	< 0.003	mg/kg mg/l	TM30/PM17
Dissolved Zinc (A10) [#]	0.04	< 0.03	<0.03	<0.03	< 0.03	0.03	<0.03	< 0.03	0.03	< 0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF [#]	<0.00001	< 0.00001	<0.00001	< 0.00001	< 0.00001	<0.00001	<0.00001	< 0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	mg/kg	TM61/PM0
Total Phenols HPLC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/l	TM26/PM0
Total Phenols HPLC	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	TM26/PM0
Fluoride	0.3	<0.3	<0.3	<0.3	<0.3	0.3	<0.3	<0.3	0.3	<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	<3	3	<3	<3	3	<3	mg/kg	TM173/PM0
Sulphate as SO4 [#]	1.3	14.5	<0.5	<0.5	<0.5	1.3	1.3	0.9	3.8	<0.5	mg/l	TM38/PM0
Sulphate as SO4 [#]	13	145	<5	<5	<5	13	13	9	38	<5	mg/kg	TM38/PM0
Chloride #	1.6	<0.3	<0.3	<0.3	<0.3	0.5	0.5	<0.3	<0.3	<0.3	mg/l	TM38/PM0
Chloride [#]	16	<3	<3	<3	<3	5	5	<3	<3	<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	4	2	<2	<2	<2	<2	<2	<2	2	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	40	<20	<20	<20	<20	<20	<20	<20	20	<20	mg/kg	TM60/PM0
Total Dissolved Solids [#]	72	48	65	49	39	56	62	42	49	<35	mg/l	TM20/PM0
Total Dissolved Solids [#]	720	480	650	490	390	560	620	420	490	<350	mg/kg	TM20/PM0

Client Name:Ground InvestReference:9754-07-20Location:BusConnectsContact:John Duggan

Ground Investigations Ireland 9754-07-20 BusConnects Route 5

Report : EN12457_2

Contact: EMT Job No:	John Dug 20/16404	gan														
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27							
Sample ID	R5 TP01	R5 TP01	R5 TP05	R5 TP05	R5 TP05B	R5 TP06	R5 TP06	R5 TP07B	R5 TP07B							
Depth	0.50	1.50	0.50	1.50	0.90	0.50	1.50	0.50	1.50						e attached r	
COC No / misc														abbrevi	ations and a	cronyms
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT							
Sample Date	17/11/2020	17/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1	1	1	1		lanat	Stable Non-	Linner	LOD LOR	Units	Method
Date of Receipt	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020		Inert	reactive	Hazardous	LOD LOR	UTIIIS	No.
Solid Waste Analysis																
Total Organic Carbon [#]	0.76	0.70	1.01	0.32	0.23	0.30	0.60	0.50	0.54		3	5	6	<0.02	%	TM21/PM24
Sum of BTEX Sum of 7 PCBs [#]	<0.025 ^{sv} <0.035	<0.025 <0.035	<0.025 <0.035	<0.025 <0.035	<0.025 <0.035	<0.025 <0.035	<0.025 <0.035	<0.025 ^{sv} <0.035	<0.025 <0.035		6	-	-	<0.025 <0.035	mg/kg mg/kg	TM36/PM12 TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30	<30	<30	<30	<30		500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	<0.64	<0.64	1.31	<0.64	<0.64	<0.64	3.18	<0.64	<0.64		100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025		0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium [#]	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07		0.5	10 50	70 100	<0.015 <0.07	mg/kg mg/kg	TM30/PM17 TM30/PM17
Copper # Mercury #	<0.0001	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.0001	<0.001		0.01	0.2	2	<0.001	mg/kg	TM61/PM0
Molybdenum #	0.06	0.17	<0.02	<0.02	<0.02	0.03	0.03	0.03	0.05		0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel [#]	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony#	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 <0.03	<0.02	<0.02		0.06	0.7	5	<0.02	mg/kg	TM30/PM17 TM30/PM17
Selenium [#] Zinc [#]	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		4	50	200	<0.03	mg/kg mg/kg	TM30/PM17 TM30/PM17
Total Dissolved Solids#	720	480	650	490	390	560	620	420	490		4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	40	<20	<20	<20	<20	<20	<20	<20	20		500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.101	0.102	0.0998	0.0984	0.1012	0.1001	0.095	0.101	0.1022		-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	89.1	88.5	90.2	91.8	89.0	89.9	94.8	89.2	87.9		-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.889	0.888	0.89	0.892	0.889	0.89	0.895	0.889	0.888		-	-	-		I	NONE/PM17
Eluate Volume	0.8	0.4	0.8	0.8	0.8	0.8	0.8	0.8	0.8		-	-	-		I	NONE/PM17
рН#	8.22	8.47	8.36	8.44	8.66	8.63	8.52	8.38	8.59		-	-	-	<0.01	pH units	TM73/PM11
Fluoride	<3	<3	<3	<3	<3	3	<3	<3	3		-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	13	145	<5	<5	<5	13	13	9	38		1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	16	<3	<3	<3	<3	5	5	<3	<3		800	15000	25000	<3	mg/kg	TM38/PM0
		I	I	1			1	1	1			1	1			1

Ground Investigations Ireland
20/07/9754
BusConnects Route 5
John Duggan

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/16404	1	R5 TP01	0.50	2	30/11/2020	General Description (Bulk Analysis)	soil/stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP01	1.50	5	30/11/2020	General Description (Bulk Analysis)	soil/stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP05	0.50	8	30/11/2020	General Description (Bulk Analysis)	soil/stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP05	1.50	11	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP05B	0.90	14	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP06	0.50	17	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP06	1.50	20	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD

Client Name:
Reference:
Location:

Ground Investigations Ireland 20/07/9754 BusConnects Route 5

Contact	ntact: John Duggan						
EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/16404	1	R5 TP06	1.50	20	30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP07B	0.50	23	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
						Asbestos ACM	NAD
						Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP07B	1.50	26		General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020 30/11/2020	Asbestos ACM Asbestos Type	NAD NAD
						Asbestos Level Screen	NAD
					50/11/2020		

Client Name:Ground Investigations IrelandReference:9754-07-20Location:BusConnects Route 5Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/16404	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/16404

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C- 440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
ТМ30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377- 3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Element Materials Technology Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA P: +44 (0) 1244 833780 F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland



Attention :	Mike Sutton
Date :	17th June, 2021
Your reference :	9754-07-20
Our reference :	Test Report 21/8443 Batch 1
Location :	Bus Connections Route 5
Date samples received :	4th June, 2021
Status :	Final report
Issue :	1

Seven samples were received for analysis on 4th June, 2021 of which seven were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

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

Authorised By:

HAPman

Hayley Prowse Project Manager

Please include all sections of this report if it is reproduced



Ground Investigations Ireland 9754-07-20 Bus Connections Route 5 Mike Sutton 21/8443

Report : Solid

EMT SOD NO.	21/0440							 			
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21				
Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A				
Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80		 Bloaso so	e attached r	atos for all
COC No / misc										ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT				
Sample Date		28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1		LOD/LOR	Units	Method
Date of Receipt	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021				No.
Antimony	3	2	2	3	1	<1	2		<1	mg/kg	TM30/PM15
Arsenic [#]	16.2	17.4	14.1	22.9	12.7	4.6	14.1		<0.5	mg/kg	TM30/PM15
Barium [#]	131	118	131	147	125	54	84		<1	mg/kg	TM30/PM15
Cadmium [#]	1.1 43.7	1.5	1.2	2.5	0.2	0.7	1.3		<0.1	mg/kg	TM30/PM15 TM30/PM15
Chromium [#] Copper [#]	43.7 33	52.3 32	71.2 28	64.6 35	19.8 7	35.7 10	29.1 45		<0.5 <1	mg/kg mg/kg	TM30/PM15 TM30/PM15
Lead [#]	33	39	39	46	11	6	43 24		<5	mg/kg	TM30/PM15
Mercury [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM30/PM15
Molybdenum [#]	2.9	3.7	4.6	2.3	1.2	2.7	3.8		<0.1	mg/kg	TM30/PM15
Nickel [#]	76.7	69.9	56.9	144.4	12.0	17.2	35.9		<0.7	mg/kg	TM30/PM15
Selenium [#]	1	2	3	3	<1	<1	3		<1	mg/kg	TM30/PM15
Zinc [#]	95	128	136	114	26	35	67		<5	mg/kg	TM30/PM15
PAH MS											
Naphthalene [#]	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	mg/kg	TM4/PM8
Fluorene [#]	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Phenanthrene #	< 0.03	0.04	0.09	<0.03	0.31	0.13	0.14		<0.03	mg/kg	TM4/PM8
Anthracene#	< 0.04	< 0.04	<0.04	<0.04	0.14	0.04	< 0.04		<0.04	mg/kg	TM4/PM8
Fluoranthene [#]	<0.03 <0.03	0.07	0.15	< 0.03	1.32 1.18	0.27	0.27		<0.03 <0.03	mg/kg mg/kg	TM4/PM8 TM4/PM8
Benzo(a)anthracene #	<0.05	< 0.06	0.13	<0.06	0.87	0.14	0.16		<0.06	mg/kg	TM4/PM8
Chrysene [#]	<0.02	0.04	0.09	<0.02	0.85	0.14	0.15		<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene [#]	<0.07	<0.07	0.13	<0.07	1.88	0.26	0.25		<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	<0.04	<0.04	0.07	<0.04	1.04	0.14	0.12		<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene [#]	<0.04	<0.04	<0.04	<0.04	0.73	0.11	0.07		<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	<0.04	<0.04	<0.04	<0.04	0.13	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	<0.04	<0.04	<0.04	<0.04	0.74	0.11	0.09		<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	0.13	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	0.78	<0.64	9.36	1.55	1.47		<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	0.09	<0.05	1.35	0.19	0.18		<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	0.04	<0.02	0.53	0.07	0.07		<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	79	90	98	86	95	93	90		<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	<30	<30	<30	157	<30	<30		<30	mg/kg	TM5/PM8/PM16



Ground Investigations Ireland 9754-07-20 Bus Connections Route 5 Mike Sutton 21/8443

Report : Solid

Date of Receips 04082021 0408201 0401 0	EMIT JOD NO.	21/0443							 			
Dep Dep <th>EMT Sample No.</th> <th>1-3</th> <th>4-6</th> <th>7-9</th> <th>10-12</th> <th>13-15</th> <th>16-18</th> <th>19-21</th> <th></th> <th></th> <th></th> <th></th>	EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21				
COC Mo / miss V.T .T V.T <t< th=""><th>Sample ID</th><th>R5-CP01A</th><th>R5-CP01A</th><th>R5-CP01A</th><th>R5-CP01A</th><th>R5-CP03A</th><th>R5-CP03A</th><th>R5-CP03A</th><th></th><th></th><th></th><th></th></t<>	Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A				
COC Normal No. Gendamine 2000000 200000 2000000 2000000 2000000 2000000 2000000 2000000 20000000 20000000 20000000 200000000 200000000 2000000000 20000000000 200000000000 2000000000000 2000000000000000000000000000000000000	Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80		Please se	e attached r	otes for all
Sample ba 20000 20000 20000 20000 20000 2000000 2000000 2000000 2000000 2000000 20000000 20000000 20000000 2000000000 20000000000 200000000000 2000000000000000000000000000000000000	COC No / misc											
Sample Date 200200 200	Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT				
Sample Type Sol Sol <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>												
Bach Number 1 <th< td=""><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	-											
Date of Receip DUBLOCC												
Date of Receint 90048021 0004801 0004801 0004801 0004801 0004801 0004801 0004801 0004801 0004801 00041 00041 00041 00041 00041 0011 0011 0011 0011 0011 0011 0011 0011 0011 0011 0011 0011 0011 0011 0011 0011 0011 0011 <	Batch Number	1	1	1	1	1	1	1		LOD/LOR	Units	Method
AlphanicsImageImageImageImageImageImageImageImageImageCGC2 (GR, ID, L)"40.1	Date of Receipt	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021				140.
School (M.S. 10, A). (a).1												
See Graph Sign A.1endendendendendendendendendendendendendendendCach Cink Sign A.1Gal <t< td=""><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	-											
CGC 019: 10 A.J 40.1	>C5-C6 (HS_1D_AL) [#]	<0.1	<0.1	<0.1	<0.1		<0.1			<0.1	mg/kg	TM36/PM12
CC102 (EH, CU, DD, AU ¹ 40 40 40 44 47 mg/g Monsee 48 48 48 48 48 48 48 48 48 48 4	>C6-C8 (HS_1D_AL) [#]	<0.1	<0.1	<0.1	<0.1		<0.1			<0.1	mg/kg	TM36/PM12
Chi Carlon Ca												TM36/PM12
C616-C21 (EH_CU_1D_AL) <7												TM5/PM8/PM16
C21-C33 (EH_CU_10_A) C7												TM5/PM8/PM16
SC35 C40 (EH 10, AL) ···· <												TM5/PM8/PM16
Tatal adjundation Calle (DHH-B) DAL) 428 428 428 140 40.1 40.												TM5/PM8/PM16
CDC-010 (HS_1D_AL) du1												
>C10-C25 (EH_1D_AL) <10					-							
>2625.35 (EH_1D_AL) <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10												
Aromatics Image: Constraint of the second of t												
CCS_EC7 (MS_1D_AR)* <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01<		<10	<10	<10	<10	119	<10	<10		<10	ilig/kg	
SECF-EG8 (HS_1D_AR)* 40.1 <td< td=""><td></td><td><0.1</td><td><0.1</td><td><0.1</td><td><0.1</td><td>_{<01}sv</td><td><0.1</td><td><0 1SV</td><td></td><td><0.1</td><td>ma/ka</td><td>TM36/PM12</td></td<>		<0.1	<0.1	<0.1	<0.1	_{<01} sv	<0.1	<0 1SV		<0.1	ma/ka	TM36/PM12
SECE EC10 (HS_1D_AR)* <0.1												TM36/PM12
>>EC10-EC12 (EH_CU_1D_AR)* <0.2												TM36/PM12
besch2eEct6 (EH_CU_ID_AR)* 44 44 44 44 44 44 44 44 44 44 44 44 mghg MBMPARP besch2eEct2 (EH_CU_ID_AR)* 47 47 47 47 47 47 47 47 47 47 47 mghg MBMPARP besch2eCt2 (EL_CU_ID_AR)* 47 47 47 47 47 47 47 47 47 47 mghg MBMPARP besch2eCt2 (EH_LD_LAR)* 47	, ,											TM5/PM8/PM16
besche Eccle (EH_CU_1D_AR)* <7		<4	<4	<4	<4	<4	<4	<4		<4		TM5/PM8/PM16
bec21+EC35 (EH_CU_10_AR) <7		<7	<7	<7	<7	12	<7	<7		<7		TM5/PM8/PM16
Total aromatics CS-40 (EHHS_1D_AR) <26 <26 <26 <26 <26 <26 <26 <26 <26 <26 mg/kg mmg/kg bet data aromatics CS-40 (EHHS_1D_AR)* <52	>EC21-EC35 (EH_CU_1D_AR)#	<7	<7	<7	<7	324	<7	<7		<7	mg/kg	TM5/PM8/PM16
Interference	>EC35-EC40 (EH_1D_AR)	<7	<7	<7	<7	108	<7	<7		<7	mg/kg	TM5/PM8/PM16
SeCG-EC10 (HS_1D_AR)* <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1	Total aromatics C5-40 (EH+HS_1D_AR)	<26	<26	<26	<26	444	<26	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC10-EC25 (EH_1D_AR) <10	Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	<52	<52	<52		<52	<52		<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC10-EC25 (EH_1D_AR) <10	>EC6-EC10 (HS_1D_AR) [#]	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{sv}		<0.1	mg/kg	TM36/PM12
MTBE f 1	>EC10-EC25 (EH_1D_AR)	<10	<10	<10	<10		<10			<10	mg/kg	TM5/PM8/PM16
Benzene* < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1 < 1	>EC25-EC35 (EH_1D_AR)	<10	<10	<10	<10	284	<10	<10		<10	mg/kg	TM5/PM8/PM16
Benzene* 												
Toluene < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 $< 100 / M_{\odot}$ $M / M_{\odot} / M_{\odot}$ Ethylbenzene < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 $< 100 / M_{\odot}$ $M / M_{\odot} / M_{\odot}$ $m/p-Xylene$ < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5 < 5	MTBE [#]	<5	<5	<5	<5		<5			<5	ug/kg	TM36/PM12
Ethylbenzene # <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5	Benzene [#]	<5	<5				<5			<5	ug/kg	TM36/PM12
m/p-Xylene # <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 </td <td></td> <td><5</td> <td><5</td> <td><5</td> <td></td> <td></td> <td><5</td> <td></td> <td></td> <td><5</td> <td>ug/kg</td> <td>TM36/PM12</td>		<5	<5	<5			<5			<5	ug/kg	TM36/PM12
o-Xylene # <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5	Ethylbenzene #							<5 ^{SV}			ug/kg	TM36/PM12
PCB 28 [#] <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><5^{SV}</td><td></td><td></td><td></td><td>TM36/PM12</td></t<>								<5 ^{SV}				TM36/PM12
PCB 52* <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5	o-Xylene *	<5	<5	<5	<5	<5°V	<5	<5 ^{°V}		<5	ug/kg	TM36/PM12
PCB 52* <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5		_				-						
PCB 101# <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 <												TM17/PM8
PCB 118# <5 <5 <5 <5 <5 <5 <5 ug/kg TM17/P PCB 138# <5												TM17/PM8
PCB 138# <5 <5 <5 <5 <5 <5 ug/kg TM17/P PCB 153# <5												TM17/PM8
PCB 153 [#] <5 <5 <5 <5 <5 <5 <5 <5 <5 <5 Ug/kg TM17/PL												
PUBINU" I SEL SEL SEL SEL SEL SEL SEL SEL SEL SEL	PCB 153	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8 TM17/PM8
												TM17/PM8 TM17/PM8

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connections Route 5 Mike Sutton 21/8443

Report : Solid

EMT Job No:	21/8443									_		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21					
Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A					
Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80			Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT											
Sample Date	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021					
Sample Type	Soil											
Batch Number	1	1	1	1	1	1	1				Linite	Method
Date of Receipt	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021			LOD/LOR	Units	No.
Natural Moisture Content	18.9	36.6	46.4	31.6	8.4	7.0	24.1			<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	15.9	26.8	31.7	24.0	7.7	6.5	19.4			<0.1	%	PM4/PM0
Hexavalent Chromium [#]	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3			<0.3	mg/kg	TM38/PM20
Chromium III	43.7	52.3	71.2	64.6	19.8	35.7	29.1			<0.5	mg/kg	NONE/NONE
Total Cyanide [#]	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	mg/kg	TM89/PM45
Total Organic Carbon [#]	0.37	1.30	1.99	0.33	0.32	0.23	1.01			<0.02	%	TM21/PM24
Loss on Ignition [#]	3.9	6.5	8.8	5.1	<1.0	<1.0	1.9			<1.0	%	TM22/PM0
рН [#]	8.54	7.44	7.47	7.52	9.48	10.13	8.23			<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1061	0.1241	0.1307	0.1172	0.1002	0.0952	0.0974				kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09				kg	NONE/PM17
	l							l		L		



Ground Investigations Ireland 9754-07-20 Bus Connections Route 5 Mike Sutton 21/8443

Report : CEN 10:1 1 Batch

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21						
Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A						
Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80						
COC No / misc		1.00	2.00	0.00	0.50	1.00	1.00					e attached n ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT						
Sample Date	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1				LOD/LOR	Units	Method
Date of Receipt	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021				LOD/LOR	Units	No.
Dissolved Antimony [#]	<0.002	<0.002	<0.002	<0.002	0.005	0.004	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) [#]	<0.02	<0.02	<0.02	<0.02	0.05	0.04	<0.02				<0.02	mg/kg	TM30/PM17
Dissolved Arsenic [#]	<0.0025	<0.0025	<0.0025	<0.0025	0.0027	<0.0025	0.0025				<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) [#]	<0.025	<0.025	<0.025	<0.025	0.027	<0.025	0.025				<0.025	mg/kg	TM30/PM17
Dissolved Barium [#]	<0.003	0.035	0.034	0.012	0.005	0.007	0.004				<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) [#]	<0.03	0.35	0.34	0.12	0.05	0.07	0.04				<0.03	mg/kg	TM30/PM17
Dissolved Cadmium [#]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005				<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) *	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	mg/kg	TM30/PM17
Dissolved Chromium [#]	< 0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	< 0.0015				<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) [#]	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015				< 0.015	mg/kg	TM30/PM17 TM30/PM17
Dissolved Copper [#]	<0.007	<0.007 <0.07	<0.007 <0.07	<0.007 <0.07	<0.007 <0.07	<0.007 <0.07	<0.007 <0.07				<0.007	mg/l	TM30/PM17 TM30/PM17
Dissolved Copper (A10) [#]	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007				<0.07 <0.005	mg/kg mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	< 0.005				<0.003	mg/kg	TM30/PM17
Dissolved Molybdenum [#]	0.003	0.011	0.003	< 0.002	0.005	0.006	0.006				< 0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10)#	0.03	0.11	0.03	<0.02	0.05	0.06	0.06				<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) [#]	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02				<0.02	mg/kg	TM30/PM17
Dissolved Selenium#	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003				<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) [#]	<0.03	<0.03	< 0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM30/PM17
Dissolved Zinc [#]	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003				<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001				<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	mg/kg	TM61/PM0
Total Phenols HPLC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	mg/l	TM26/PM0
Total Phenols HPLC	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5	mg/kg	TM26/PM0
Fluoride	0.4	<0.3	0.3	<0.3	<0.3	<0.3	<0.3				<0.3	mg/l	TM173/PM0
Fluoride	4	<3	3	<3	<3	<3	<3				<3	mg/kg	TM173/PM0
Sulphate as SO4 [#]	<0.5	18.8	<0.5	<0.5	19.4	12.0	20.9				<0.5	mg/l	TM38/PM0
Sulphate as SO4 [#]	<5	188	<5	<5	194	120	209				<5	mg/kg	TM38/PM0
Chloride [#]	<0.3	0.7	1.1	1.0	0.9	0.4	0.7				<0.3	mg/l	TM38/PM0
Chloride [#]	<3	7	11	10	9	4	7				<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	7	12	4	<2	<2	<2				<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	70	120	40	<20	<20	<20				<20	mg/kg	TM60/PM0
Total Dissolved Solids [#]	58	201	176	120	66	42	53				<35	mg/l	TM20/PM0
Total Dissolved Solids [#]	580	2010	1760	1201	660	420	530				<350	mg/kg	TM20/PM0
	1	I	I	I	1	I	1	1	1	1	1		

Client Name:							
Reference:							
Location:							
Contact:							
EMT Job No:							

Ground Investigations Ireland 9754-07-20 Bus Connections Route 5 Report : EN12457_2

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

Location:		nections Ro	oute 5				Solids: V=	60g VOC ja	r, J=250g g	lass jar, T=p	plastic tub					
Contact:	Mike Sutt	on														
EMT Job No:	21/8443															
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21									
Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A									
Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80							Please se	e attached r	notes for all
COC No / misc															iations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT									
Sample Date		28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021									
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1	1	1	1									
Date of Receipt	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021				Inert	Stable Non- reactive	Hazardous	LOD LOR	Units	Method No.
Solid Waste Analysis	04/00/2021	04/00/2021	04/00/2021	04/00/2021	04/00/2021	04/00/2021	04/00/2021									
Total Organic Carbon [#]	0.37	1.30	1.99	0.33	0.32	0.23	1.01				3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<0.025 ^{sv}	<0.025	<0.025 ^{sv}				6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs [#]	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035				1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	157	<30	<30				500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	<0.64	<0.64	0.78	<0.64	9.36	1.55	1.47				100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic [#]	<0.025	<0.025	<0.025	<0.025	0.027	<0.025	0.025				0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	< 0.03	0.35	0.34	0.12	0.05	0.07	0.04				20	100	300 5	< 0.03	mg/kg	TM30/PM17
Cadmium #	<0.005 <0.015	<0.005 <0.015	<0.005	<0.005 <0.015	<0.005 <0.015	<0.005 <0.015	<0.005 <0.015				0.04	10	70	<0.005 <0.015	mg/kg mg/kg	TM30/PM17 TM30/PM17
Chromium [#] Copper [#]	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013				2	50	100	<0.013	mg/kg	TM30/PM17
Mercury [#]	<0.0001	< 0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.03	0.11	0.03	<0.02	0.05	0.06	0.06				0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel [#]	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02				0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony [#]	<0.02	<0.02	<0.02	<0.02	0.05	0.04	<0.02				0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium [#]	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc#	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids	580	2010	1760	1201	660	420	530				4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	70	120	40	<20	<20	<20				500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	85.1	72.6	69.1	76.6	89.9	94.3	91.9					-	-	<0.1	%	NONE/PM4
рН#	8.54	7.44	7.47	7.52	9.48	10.13	8.23					-	-	<0.01	pH units	TM73/PM11
Fluoride	4	<3	3	<3	<3	<3	<3					-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	<5	188	<5	<5	194	120	209				1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride [#]	<3	7	11	10	9	4	7				800	15000	25000	<3	mg/kg	TM38/PM0
								1								
		1							1			1		I	I	I

Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	Bus Connections Route 5
Contact:	Mike Sutton

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/8443	1	R5-CP01A	0.50	2	11/06/2021	General Description (Bulk Analysis)	Soil/Stone
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP01A	1.50	5	11/06/2021	General Description (Bulk Analysis)	Soil/Stone
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP01A	2.50	8	11/06/2021	General Description (Bulk Analysis)	Soil/Stone
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP01A	3.50	11	11/06/2021	General Description (Bulk Analysis)	soil
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP03A	0.50	14	11/06/2021	General Description (Bulk Analysis)	soil
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP03A	1.00	17	11/06/2021	General Description (Bulk Analysis)	soil
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP03A	1.80	20	11/06/2021	General Description (Bulk Analysis)	Soil/Stones
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD

Client Name: Reference:	Ground Investigations Ireland 20/07/9754
Location:	Bus Connections Route 5
Contact:	Mike Sutton

Contac	••		wike Sut				
EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/8443	1	R5-CP03A	1.80	20	11/06/2021	Asbestos Type	NAD
							NAD
					11/00/2021		
						1	

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connections Route 5

Contact: Mike Sutton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 21/8443	
					and in this report. If no complex are listed it is because none were deviating	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 21/8443

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

HWOL ACRONYMS AND OPERATORS USED

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

EMT Job No: 21/8443

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C 440C)	PM0	No preparation is required.	Yes		AD	Yes

EMT Job No: 21/8443

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

EMT Job No: 21/8443

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377- 3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



LABORATORY REPORT



4043

Contract Number: PSL21/1998

Report Date: 12 April 2021

Client's Reference: 2868817

Client Name: Ground Investigations Ireland Ltd Catherinestown House Hazelhatch Road Newcastle Co Dublin D22 YD52

For the attention of: Patrick Cochran

Contract Title: Bus Connect Route 5

Date Received:	10/3/2021
Date Commenced:	10/3/2021
Date Completed:	12/4/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

A Watkins (Director) R Berriman (Quality Manager) S Royle (Laboratory Manager)

L Knight (Senior Technician) S Eyre (Senior Technician)

H Daniels (Senior Technician)

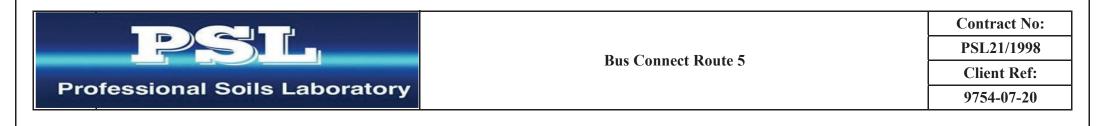
Page 1 of

5 – 7 Hexthorpe Road, Hexthorpe, Doncaster DN4 0AR tel: +44 (0)844 815 6641 fax: +44 (0)844 815 6642 e-mail: rberriman@prosoils.co.uk awatkins@prosoils.co.uk

DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH

ISRM Suggested Methods, pp 111 –116, 1981.

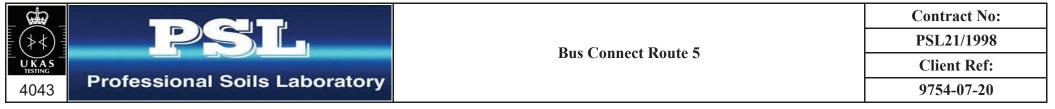
Hole Number	Sample Number	Sample Type	Top Depth	Base Depth	Sample Diameter	Sample Length	Height Ratio	Initial Mass	Bulk Density	Moisture Content	Dry Density	Load Failure	UCS	Failure Mode	Date Tested	Remarks
1 (unit) et	1 (unit) er	1,000	(m)	(m)	(mm)	(mm)	itutio	(g)	(Mg/m)	(%)	(Mg/m)	(kN)	(MPa)	litout	1 corea	
R05-CP03		С	10.67	10.90	64	128	2.0	1094	2.66	0.4	2.65	190.3	59.1	Brittle	06/04/21	
R05-RC04		С	2.25	2.50	64	128	2.0	1072	2.60	1.5	2.56	68. 7	21.4	Brittle	06/04/21	
R05-RC04		С	2.50	2.76	64	128	2.0	1104	2.68	0.8	2.66	71.5	22.2	Brittle	06/04/21	
R05-RC04		С	5.00	5.19	64	118	1.8	1011	2.66	0.7	2.64	91.9	28.6	Brittle	06/04/21	
R05-RC04		С	5.29	5.54	64	98	1.5	838	2.66	0.7	2.64	67.9	21.1	Brittle	06/04/21	
R05-RC04		С	7.33	7.52	64	128	2.0	1100	2.67	0.7	2.65	67.1	20.9	Brittle	06/04/21	
R05-RC04		С	8.16	8.44	64	133	2.1	1131	2.64	1.6	2.60	49.0	15.2	Brittle	06/04/21	
R05-RC04		С	9.80	10.00	64	131	2.0	1101	2.61	2.4	2.55	51.8	16.1	Brittle	06/04/21	



SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	epth (m) Sample T Ref T		Orientation	Dimer (m		Area	D _e ²	D _e	Failure	Load (P)	Is	Corr Fac	I _{s50}	Failure Type	Remarks
rumber		Kei	Туре	Par / Perp	W	D	(mm2)		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)	Type	
R05-CP01	5.90		Α	Perp	64	31	1984	2526.11	50.26	-	14.02	5.55	1.002	5.56	Valid	
R05-CP01	7.65		Α	Perp	64	46	2944	3748.42	61.22	-	27.47	7.33	1.095	8.03	Valid	
R05-CP03	8.80		Α	Perp	64	35	2240	2852.06	53.40	-	15.99	5.61	1.030	5.78	Valid	
R05-CP03	10.10		Α	Perp	64	37	2368	3015.03	54.91	-	17.51	5.81	1.043	6.06	Valid	
R05-RC04	2.76		Α	Perp	64	55	3520	4481.80	66.95	-	10.57	2.36	1.140	2.69	Valid	
R05-RC04	3.50		Α	Perp	64	48	3072	3911.39	62.54	-	25.11	6.42	1.106	7.10	Valid	
R05-RC04	5.69		Α	Perp	64	30	1920	2444.62	49.44	-	3.79	1.55	0.995	1.54	Valid	
R05-RC04	7.17		Α	Perp	64	29	1856	2363.13	48.61	-	17.29	7.32	0.987	7.22	Valid	
R05-RC04	8.00		Α	Perp	64	32	2048	2607.59	51.06	-	15.46	5.93	1.010	5.99	Valid	
*Note	All testing c	arried out or	n samples a	at as received wa	ater conte	ent		Par =	parallel, Per	p = perpendi	cular, U = R	andom	1	A = Axial, D	= Diametral	I = Irregular



SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	(m	·	D _e ²	D _e		e Load	Is	Corr Fac	I _{s50}	Failure Type	Remarks
D05 (D01	(02			Par / Perp	L	D	1007	(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)	X 7 1 • 1	
R05-CP01 R05-RC04	6.93 3.94		D D	Par Par	-	64 64	4096 4096	64.00 64.00	-	9.12 10.65	2.227 2.600	1.117 1.117	2.49 2.91	Valid Valid	
R05-RC04	6.65		D	Par	-	64	4096	64.00	-	10.03	3.018	1.117	3.37	Valid	
R05-RC04	6.85		D	Par	-	64	4096	64.00	-	14.96	3.652	1.117	4.08	Valid	
	_														
*Note	All testing	carried out or	n samples a	at as received wa	ater conto	ent		Par =	parallel, Per	p = perpendi	cular, U = R	andom			
ġ.															Contract No:
$(\diamond \langle)$							Bus Connect Route 5								PSL21/1998
UKAS TESTING	Dre					0.724								Client Ref:	
4043 Professional Soils Laboratory						975						9754-07-20			



LABORATORY REPORT



4043

Contract Number: PSL21/2671

Report Date: 20 April 2021

Client's Reference: 2868817

Client Name: Ground Investigations Ireland Ltd Catherinestown House Hazelhatch Road Newcastle Co Dublin D22 YD52

For the attention of: Patrick Cochran

Contract Title: Bus Connect Route 5

Date Received:	31/3/2021
Date Commenced:	31/3/2021
Date Completed:	20/4/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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Checked and Approved Signatories:

A Watkins (Director) R Berriman (Quality Manager) S Royle (Laboratory Manager)

L Knight (Senior Technician) S Eyre (Senior Technician)

H Daniels (Senior Technician)

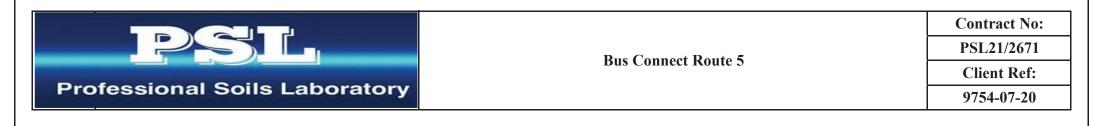
Page 1 of

5 – 7 Hexthorpe Road, Hexthorpe, Doncaster DN4 0AR tel: +44 (0)844 815 6641 fax: +44 (0)844 815 6642 e-mail: rberriman@prosoils.co.uk awatkins@prosoils.co.uk

DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH

ISRM Suggested Methods, pp 111 –116, 1981.

Hole Number	Sample Number		Top Depth (m)	Base Depth (m)	Sample Diameter (mm)		Height Ratio	Initial Mass (g)	Bulk Density (Mg/m)	Moisture Content (%)	Dry Density (Mg/m)	Load Failure (kN)	UCS (MPa)	Failure Mode	Date Tested	Remarks
R05-RC06		С	8.00	8.35	63	125	2.0	1071	2.75	0.9	2.72	95.4	30.6	Brittle	15/04/21	
R05-RC06		С	9.90	10.17	63	126	2.0	1090	2.77	0.8	2.75	131.1	42.1	Brittle	15/04/21	
R05-RC06		С	11.67	11.86	63	124	2.0	1071	2.77	0.8	2.75	148.1	47.5	Brittle	15/04/21	
									ļ							



SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation Par / Perp	Dimer (m W	nsions m) D	Area (mm2)	D _e ²	D _e (mm)	Failure	Load (P) (kN)	I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
R05-RC06	8.35		Α	Perp	63	51	3213	4090.92	63.96	-	9.38	2.29	1.117	2.56	Valid	
R05-RC06			Α	Perp	63	31	1953	2486.64	49.87	-	8.88	3.57	0.999	3.57	Valid	
R05-RC06	11.55		Α	Perp	63	48	3024	3850.28	62.05	-	10.48	2.72	1.102	3.00	Valid	
R05-RC07	15.50		Α	Perp	63	59	3717	4732.63	68.79	-	3.68	0.78	1.154	0.90	Valid	
R05-RC07	16.03		Α	Perp	63	38	2394	3048.14	55.21	-	2.33	0.76	1.046	0.80	Valid	
R05-RC07	16.63		Α	Perp	63	46	2898	3689.85	60.74	-	5.11	1.38	1.092	1.51	Valid	
*Note	All testing (arried out o	l 1 samples a	at as received wa	ater cont	ent	<u> </u>	Par =	narallel Per	o = perpendi	cular II = R	andom	<u> </u>	A = Axial D) = Diametral	, I = Irregular
1.000	i in cooring (annea out of	. sumples t					1 41	Paranon, 1 01	perpendi			1		Brannettal	,
â		- 11													С	ontract No:
							Deer Constant Deerta 5								PSL21/2671	
							Bus Connect Route 5							Client Ref:		
4043	4043 Professional Soils Laboratory							ory 9754-6						754-07-20		

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation Par / Perp	Dime (m L	nsions m) D	D _e ²	D _e (mm)	Failur (Mpa)	e Load (kN)	I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
R05-RC06	4.80		D	Par	-	63	3969	63.00	-	5.46	1.376	1.110	1.53	Valid	
R05-RC06	5.89		D	Par	-	63	3969	63.00	-	3.53	0.889	1.110	0.99	Valid	
R05-RC07	10.95		D	Par	-	63	3969	63.00	-	4.47	1.126	1.110	1.25	Valid	
*Note	All testing of	carried out or	n samples a	at as received wa	ater cont	ent		Par =	parallel, Per	p = perpendi	cular, $U = R$	andom		<u> </u>	<u> </u>
Ś															Contract No:
															PSL21/2671
				and the second second		Lesson and	Bus Connect Route 5								Client Ref:
4043	4043 Professional Soils Laboratory														9754-07-20

APPENDIX 5 – Groundwater Monitoring





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

 Tel:
 01 601 5175 / 5176

 Email:
 info@gii.ie

 Web:
 www.gii.ie

GROUNDWATER MONITORING

Bus Connects Stage 1 Lot 1 - Route 5

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
R5-RC01	09/04/2021	16:10	5.69	
R5-CP04	09/04/2021	16:35	3.02	Possible water sitting at base of hole

Appendix E

Historical Ground Investigation Data

	<u>K0/</u>		INV IN	503	378		
IRIS	H SOIL LABO	RATORIES	LTD.	BOREH	IOLE No	b. 40	
CONTRACT	BLAKESTOWN	SECTION	"2A"	L	RE	PORT No.	s. 372/
Bored for	DUBLIN CON	PORA LTON			Gro	ound Level	
Site Address	BLANCHARDS	STORN, DUE	ILIN		Bor Bor	ing Comming Comple	enced 7.9. eted 8.9.
Type and Dia of Boring	• MECHANICAL	EXCAVATO	R				
Water Strike	s		Water Levels	Recorded Du	ring Boring		
1.	Hole Depth						
2. 3.	Casing Depth Water Level						
Remarks	Pit stable,	no seepa	ge				
	Description		Scale			Samp	les & S.P.T.
Topsoi			Depth	Legenc	Ref. No.	Туре	Depth
	h brown sil	ty CLAY	0.30				
boulde Dense 1	r cobbles an rs below 1.7 prownish gro GRAVEL	75m.	2.00				

UNE AHUP & PARTNERS

RECORD OF TRIAL PIT

102

INV 10 51 971



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TRIAL PIT

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Greater Dublin Drainage Scheme

LAYERS FOR BOREHOLE 58814 (Company Name: 2B)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
5881401	0	6.86				Boulder Clay	Boulder Clay
5881402	6.86	8.08		Black		Boulder Clay	Boulder Clay
5881403	8.08	9.91				Bedrock	Bedrock

Greater Dublin Drainage Scheme

LAYERS FOR BOREHOLE 58836 (Company Name: 1J)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
5883601	0	1.22		Brown		Boulder Clay	Boulder Clay
5883602	1.22	2.9		Grey	Gravelly	Clay	Clay
5883603	2.9	4.72				Bedrock	Bedrock

North Eastern Gas Pipeline (NEP1)

LAYERS FOR BOREHOLE 61121 (Company Name: T7/365)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6112101	0	.3				Top Soil	Top Soil
6112102	.3	1.3	Soft to Firm	Orangish Brown	Silty	Clay	Clay
6112103	1.3	3.3	Loose	Grey Brown	Silty Sandy Gravelly	Clay	Clay

North Eastern Gas Pipeline (NEP1)

LAYERS FOR BOREHOLE 61166 (Company Name: B7/368)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6116601	0	.5				Top Soil	Top Soil
6116602	.5	1.6	Firm	Red Brown	Sandy	Clay	Clay
6116603	1.6	2	Firm	Grey	Gravelly	Clay	Clay
6116604	2	3.8		Grey	Gravelly	Clay	Clay
6116605	3.8	10				Bedrock	Bedrock

North Eastern Gas Pipeline (NEP1)

LAYERS FOR BOREHOLE 61167 (Company Name: B7/412)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6116701	0	.1				Top Soil	Top Soil
6116702	.1	2	Firm to Stiff		Silty Sandy Gravelly	Clay	Clay
6116703	2	4	Medium		Gravelly	Silt	Silt
			Dense				
6116704	4	5.15				Gravel And Cobbles	Gravel And Cobbles
6116705	0	10				Bedrock	Bedrock

SITE INVESTIGATIONS LTD. **BOREHOLE RECORD** D717

CONTRACT Redevelopment a	t Benburb Street.	RORFEREN No. 7	K/4Z
Bored for J. McCullough & Pa	artners.		·
Site Address Dublin.			61367
Boring Commenced 31/5/85		Boring Completed 31/5	0-
Type of Boring J.C.B.		Diameter of Borehole	
Ground Level -	O .D.		******
Water Struck (1) 2.40m BGL.	(2)	(3)	
Standing Water Level -			

Remarks All levels are related to ground level. Slight seepage at 2.40m BGL.

Depth in	Meters			Sar	nples	
From	To	Thickness	Ref. No.	Туре	Depth	Description of Strata
0.00	0.10	0.10				Concrete,
0.10	2.40	2.00				Fill of grey brown sandy silt and some rubble.
	3.50	1.10	31502	D	2.40	Very compact black sandy silt with large gravel and small boul- ders.(Possible Fill)(Rock breaker
3.50						needed to excavate). Final Level.
				-		
					·	

Code U — Undisturbed Sample

n.

D — Disturbed Sample

SITE INVESTIGATIONS LTD. **BOREHOLE RECORD** R742

CONTRACT Redevelopment at Benburb Street. Bored for J. McCullough & Partners. Site Address Dublin.

Boring Commenced 31/5/85

Type of Boring J.C.B.

Ground Level -

Water Struck (1) 2.40m BGL.

Standing Water Level 3.85m BGL after 2 hours.

Remarks All levels are related to ground level.

O.D.

(2)

Depth in	Meters		1	Sar	nples	
From	То	Thickness	Rel. No.	Туре	Depth	Description of Strata
0.00	1.70	1,70				Grey brown sandy silt and
1.70		0.15				rubble. Concrete.
1.85	1.85					
	2.55	0.70				Rubble fill.
2.55	3.20	0.00				Very compact grey sandy silt with coarse gravel (Possible Fill (Rock breaker needed to excavate)
3.20	4.00	0.80	31501	D	3.20	Fine to coarse sandy silty gravel with boulders.
4.00						Final Level.

ROBERICKE No. T.P. B.

61362

Boring Completed 31/5/85

Diameter of Borehole

(3)

mm.

Code

SITE INVESTIGATIONS LTD. R742

BOREHOLE RECORD

CONTRACT Redevelopme	nt at Benburb Street.	ROPERIO KENO.		
Bored for J. McCullough	& Partners.			
Site Address Dublin.				
Boring Commenced 31/5/8	5	Boring Completed 31,		
Type of Boring J.C.B.		Diameter of Borehole		
Ground Level -	O.D.			
Water Struck (1) Nil.	(2)	(3)		
Standing Water Level –				

31/5/85

T.P. D.

-

Remarks All levels are related to ground level.

3

Depth is	n Meters			Sar	nples		
From	To	Thickness	Ref. No.	Туре	Depth	Description of Strata	
0.00		2,00				Fill of grey brown sandy silt	1
	2.00					and rubble.	-
2.00		1.20				Very compact sandy silt with	1
	3.20					large gravel.(Possible Fill). (Rock breaker needed to excavate)	
3.20							1
						Final Level.	ł
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SITE INVESTIGATIONS LTD. **BOREHOLE RECORD** т.р. _{А.}R742

CONTRACT Redevelopment at Benburb Street. Bored for J. McCullough & Partners. Site Address Dublin. _

BORLINGER No.

61361

Boring Commenced 3/5/85		Boring Completed 31/5/85	
Type of Boring J.C.B.		Diameter of Borehole – n	nm.
Ground Level -	O .Ď.		
Water Struck (1) N11.	(2)	(3)	•

Standing Water Level -

Code

U — Undisturbed Sample

Remarks All levels are related to ground level. Concrete block wall on North and South sides of Pit.

Depth in Meters			Samples				
	From	To	Thickness	Ref. No.	Туре	Depth	Description of Strata
	0.00	1.70	1.70				Fill of grey brown sandy silt and rubble.
┡	1.70	1.85	0.15	•	·		Concrete.
	1.85	2.55	0.70				Rubble fill.
	2.55	3.20	0.65				Very compact grey sandy silt with coarse gravel (Possible Fill). (Rock breaker needed to excavate)
	3.20	4.00	0.80				Medium dense brown very silty gravelly sand with boulders.
	4.00						Final Level.
-							
						·	

D — Disturbed Sample

P - Piston Sample

W --- Water Sample.

SITE INVESTIGATIONS LTD. **R742 BOREHOLE RECORD**

CONTRACT Redevelopment at Benburb Street.

O.D.

Bored for J.McCullough & Partners. Site Address Dublin. Boring Commenced 27/5/85 Type of Boring J.C.B.

Ground Level -

Water Struck (1) 2.40m BGL. (2)

Standing Water Level 3.30m BGL.

BORBHOLENO. T.P. 1A.

61358

Boring Completed 27/5/85 **Diameter of Borehole** _

mm.

(3)

Remarks All levels are related to ground level. Concrete broken out out with Rock Breaker.

Depin ii	Meters		Samples				
From	То	Thickness	Ref. No.	Type	Depth	Description of Strata	
		1,90				Fill of loose brown sandy clay	
						with red brick etc.	•
		0.85				Concrete.	
							,
2.75	2.90	0.15				Firm grey silt.	
2.90		1.40				Fine to coarse silty gravel with	
						cobbles and boulders.	
						Final Level.	
	1::::::::						
				 			
					· · ·		
	<u> </u>						
	From 0.00 1.90 2.75 2.75 1.90 4.30 1.91 4.30 1.91 1.91 1.90 1.91 1.91 1.92 1.90 <t< td=""><td>From To 0.00 1.90 1.90 2.75 2.75 2.75 2.75 2.90 2.90 4.30 4.30 1.90 1.90</td><td>From To Thickness 0.00 1.90 1.90 1.90 2.75 0.85 2.75 2.75 0.15 2.75 1.90 0.15 2.90 1.40 4.30 1.40 4.30 1.40 4.30 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.11111 1.40 1.11111 1.40 1.11111 1.40 1.11111 1.40 1.11111 1.40 1.111111 1.40 1.111111 1.40 1.11111111 1.40 1.11111111 1.40 1.11111111111111111111111111111111111</td><td>From To Thickness Ref. No. 0.00 1.90 1.90 1.90 1.90 1.90 0.85 </td><td>From To Thickness Ref. No. Type 0.00 1,90 1,90 1,90 </td><td>From To Thickness Rel No. Type Depth 0.00 1.90 1,90 1,90 1 1.90 <t< td=""><td>TomToThicknessRei NoTypeDepthDescription of Strate0.00$$</td></t<></td></t<>	From To 0.00 1.90 1.90 2.75 2.75 2.75 2.75 2.90 2.90 4.30 4.30 1.90 1.90	From To Thickness 0.00 1.90 1.90 1.90 2.75 0.85 2.75 2.75 0.15 2.75 1.90 0.15 2.90 1.40 4.30 1.40 4.30 1.40 4.30 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.1111 1.40 1.11111 1.40 1.11111 1.40 1.11111 1.40 1.11111 1.40 1.11111 1.40 1.111111 1.40 1.111111 1.40 1.11111111 1.40 1.11111111 1.40 1.11111111111111111111111111111111111	From To Thickness Ref. No. 0.00 1.90 1.90 1.90 1.90 1.90 0.85	From To Thickness Ref. No. Type 0.00 1,90 1,90 1,90	From To Thickness Rel No. Type Depth 0.00 1.90 1,90 1,90 1 1.90 <t< td=""><td>TomToThicknessRei NoTypeDepthDescription of Strate0.00$$</td></t<>	TomToThicknessRei NoTypeDepthDescription of Strate0.00 $ $

D. Disturbed Sample

SITE INVESTIGATIONS LTD. BOREHOLE RECORD R742

CONTRACT Redevelopment at Benburb Street.
Bored for J.McCullough & Partners.
Site Address Dublin.
Boring Commenced 27/5/85
Type of Boring J.C.B.
Ground Level O.D.
Water Struck (1) – (2)
Standing Water Level 3, 20m BGL

BOREHOLE No. T.P. 3A.

61360

mm.

Boring Completed 27/5/85 Diameter of Borehole –

Standing Water Level 3.20m BGL.

Code

U — Undisturbed Sample

Remarks All levels are related to ground level. Concrete broken out with Rock Breaker.

(3)

Depth in Meters			Samples					
	From	To	Thickness	Ref. No.	Туре	Depth	Description of Strata	
_	0.00	1.50					Fill of loose brown sandy clay . with red brick.	
	1.50	1.80	0.30				Concrete slab.	
	1.80	3.00	1.20				Fill of brown sandy clay, red brick etc.	
	3.00	3.30	0.30				Fine to coarse silty gravel with large boulders.	
	3.30	4.40	1.10				Final Level.	
	4.40							
								•
\ /								
								-
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								-
							·	-
								-

D – Disturbed Sample

P - Piston Sample

W - Water Sample.

SITE INVESTIGATIONS LTD. **BOREHOLE RECORD R742**

CONTRACT	Redevelopment at	Benburb	Street.
Bored for J	. McCullough & Par	tners.	

O.D.

(2)

ROBEHQLENO. T.P. 2A.

61359

Site Address Dublin. Boring Commenced 27/5/85

Type of Boring J.C.B.

Ground Level -

Water Struck (1) 3.50m BGL.

Standing Water Level -

Boring Completed 27/5/85 **Diameter of Borehole**

7	n	••	•

(3)

Remarks All levels are related to ground level. Concrete broken out with Rock Breaker.

Depth in	Meters			Sar	nples	
From	To	Thickness	Ref. No.	Туре	Depth	Description of Strata
0.00	1.88					Fill of loose brown sandy clay with red brick etc.
1.88	2.10	0.22		-		Concrete slab.
2.10	3.10	1.00				Fill of loose brown sandy clay •red brick etc.
3.10	3.50	0.40				Cobbles with hard grey silt. (Rock breaker needed).
3.50	4.50	1.00				Silty sand.
4.50	5.00	0.50				Presumed silty sand.
5.00						Presumed hard material. Final Level.

U — Undisturbed Sample Code[.]

D – Disturbed Sample

P - Piston Sample

SITE INVESTIGATIONS LTD.

BOREHOLE RECORD

Trial Pit. ROBELIGIERIO No: 4 R745

61379

CONTRACT	Queen	Street.
Bored for	J. McCu	llough & Partners.
Site Address	Dublin.	
Boring Commer	nced	24 / 2 / 84
Type of Boring		J.C.B.
Ground Level		zi i i i i i i i i i i i i i i i i i i
Water Struck (1)	N11.
Standing Water	Level	Nil.

Boring Completed 24 / 2 / 84. **Diameter of Borehole** _ mm.

Remarks All levels are related to ground level.

	Depth in	Meters			San	nples	<u> </u>	٦
	From	To	Thickness	Rel. No.	Туре	Depth	Description of Strata	
)	0.00	2.65	2.65				Locse fill of rubble, brick, stone, etc.	
	2.65						Fine to coarse sandy gravel.	
								-
				· ·				-
							· · · · · · · · · · · · · · · · · · ·	-
								-1
								-

Code:

U — Undisturbed Sample

D — Disturbed Sample

P — Piston Sample

W — Water Sample.

SITE INVESTIGATIONS LTD.

BOREHOLE RECORD

CONTRACT Queen Street. BOREHOLE No. 1.

Boring Completed 27 / 2 / 84

Diameter of Borehole 200 mm.

IO 61375

FNEST 6ATO

R745

Dublin. Site Address

Boring Commenced 23 / 2 / 84

J. McCullough & Partners.

Type of Boring Shell & Auger.

Ground Level

Water Struck (1) 5.50 m BGL.

Standing Water Level 5.50 m BGL.

Remarks

Bored for

1

All levels are related to ground level. Chiselling $5\frac{3}{4}$ hours.

Depth in Meters		i	Sar	nples	
From To	Thickness	Ref. No.	Туре	Depth	Description of Strata
0.00 0.15	0.15		_	,	Concrete slab. (Chiselling 🕈 hour).
0.15	2.50	33191	D	1.00	Very loose fill of rubble, brick, ash, silty clay etc.
2.65	<u> </u>	33192	D	2.00	
2.65	0.20	33193	D	2.60	Medium dense fine to coarse silty sandy.gravel.
2.85	0.40	33194	D	3.00	Medium dense fine to coarse sandy gravel.
3.25	2.25	33195 33196	D D	4.50	Dense fine to coarse gravel with cobbles and boulders.(Chiselling 3 hours),
5.50 5.85	0.35	33197 33199	D W	5.50 5.50	Dense brown coarse sand.
5.85	0.65	33198	D	6.00	Dense fine to coarse gravel with cobbles and boulders. (Chiselling 2 hours).
6.50					Final Level. Standard Penatration Tests:
					At 1.15 3 blows to 12" At 2.00 2 blows to 17"
]				At 3.15 112 blows to 12" At 4.65 62 blows to 12". At 6.20 620 blows to 12".
				· .	

Code:

D – Disturbed Sample

P — Piston Sample

SITE INVESTIGATIONS LTD.

BOREHOLE RECORD

Boring Completed 24 / 2 / 84.

Diameter of Borehole _ mm.

613+7

CONTRACT Queen Street.

Bored for J. McCullough & Partners.

Nil.

Site Address Dublin.

Boring Commenced 24 / 2 / 84

Type of Boring J.C.B.

Ground Level -

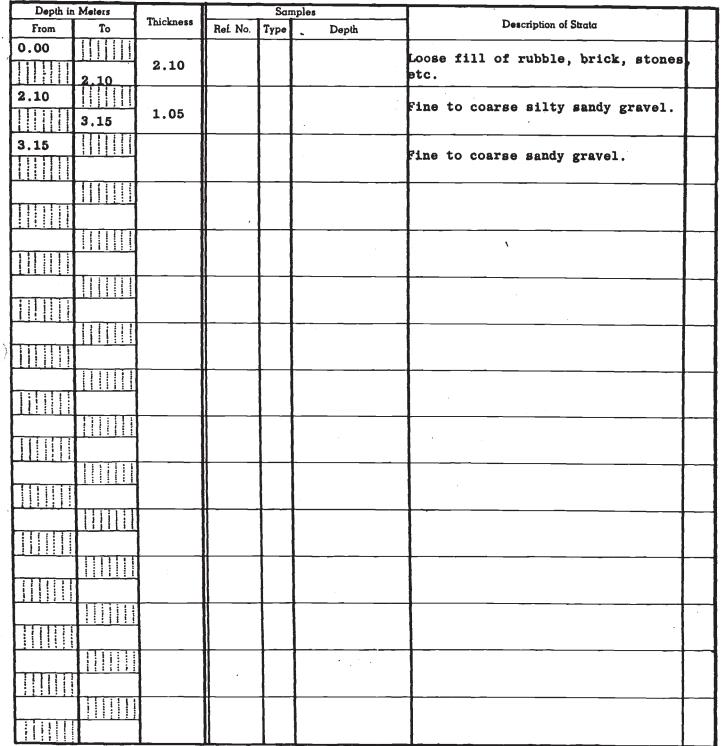
Water Struck (1)

Standing Water Level Nil.

Remarks

The Boot Commita

All levels are related to ground level.



D -- Disturbed Sample

P — Piston Sample

W -- Water Sample.

Report No. 1452	BORIN	G RECO	RD					IG	S
Contract ²	UAY DEVELOP	PEMENT			1	Boreho Sheet	le No. 1	1	
Location ELLIS QU	AY, DUBLIN	<u></u>			Ind Diam				
Client	·				d Level		200mm		
LARK HOME	S			Date	13.2.	90 -	15.2	.90	
			egend	•	11	Sample		Field Rec	ord
Description		Reduced Level	Lege	Depth	Ref. No.	Туре	Depth	And Tests	
<u>Concrete</u> floors			11111	0.75					N
FILL : Brick rub timber et				-	5731	. D	1.50	(1,5)	(*)
				3.20	5733	D	3.20	(3.1)	1
V.soft dark grey SILT Firm brown grey			**X * * * *	4.00 4.70	5734			(4.5)	1
Medium dense fine to coarse s	to dense andy GRAVEL		0		5735		5.00 6.00	(6.0)	2
					5736	D	8.00	(7.5)	2
Compact fine to with boulders	coarse grave	əl		9.30	5737	D	9.50	(9.0)	2
with Sourcers) ? O					(11.0)	6
					5738 5739		12.00 Water	(12.5)	5
			· · · ·	4	5740	D	14.00	(14.0)	6
Coarse GRAVEL wi layers of grey b	Construction and a construction of a construction of a			16.00 17.00	5741 5742		16.00(16.50	(16.0)	5
Water Level ObservatiDateHole DepthCasing Depth13.2.904.704.70	ons during Boring Depth to F Water	Remarks er note		neavy	fill =	= 2hrs	5	boring	
				Sample/T J-Tube S D-Disturb V-Water S	ample ² ed Samp	ole			

.

Report No. 1452			BORIN	IG RECO	DRD-	Continua	ation		1		
Contract	ELLIS QUA	Y DEVELOPE	MENT					Boreho Sheet	le No 2	1	
	Descri	ption		Reduced Level	Legend	Depth	Ref.	Sample	s Depth	Field R And Te	
Compact with bo	fine to oulders) coarse GR	AVEL		°0° °0°	17.00	5743	D	18.00	(17.5)	3(
Hard Bla of grey	ck silty LIMESTO	CLAY with NE	fragmen	ts	0 × °°°	19.50	5744	D	20.00	(19.5)	40
Grey blac Refusal a		one fragmen	nts	-		21.50 22.00				(21.5)	R€
									- - - -		
* Blowi	ng in sa	nd and grav	vels								
from	7.00 – 9	.00									
						_					
						-					
						-					
	latar Lavel C	shaarussi	ing Deview		111111111111111111111111111111111111111	-					
Date 15.2.90	Hole Depth	Deservations durCasing DepthDept Wat21.005.5Nil3.0	h to er 50 End	Remarks of bori 1 level	ng					1.50 = 1	

Report No.			C.8 1948, 1999			0	<u> </u>		
1452	BORIN	G REC	RD						SL
Contract *	5 QUAY DEVELOR	PEMENI			1	Boreho Sheet	ole No.	3	
Location	QUAY, DUBLIN	•		Туре	and Diam	eter			
Client					ble To	ool	200mm		
LARK HO	MES			Groun Date	d Level	.2.9	90 - 1	9.2.90	
				<u>_</u>	•	Sample		Field Red	
Description		Reduced Level	Legend	Depth	Ref. No.	Туре	Depth	And Test	-
FILL : Brick,b concrete,glass		τ,	$\left \right\rangle$						<u>N</u>
clay			$ \rangle$					(2.0)	23
			$ \chi\rangle$						20
			\mathbb{N}		3848	D	3.50		
			$\left \right\rangle$	E 4.50				(4.0)	2
Soft grey black silt with bones			XUX		3849	D	5.00	(5.0)	2
Fine to medium			4 × 4	5.50				(6.0)	10
	-				3850	D	6.50		1.6
Fine to coarse			• • •	7.00	3851	D	7.50	(7.0)	16
a little sand a & boulders	and cobbles		· 0 · 0	-				(8.0)	32
			ر ں	-	3852	D	9.00	(9.0)	45
** Boulder con 9.00 - 10.5		m	ن. ن						
			-		3853	D	10.50	(10.5)	61
			$\dot{\bigcirc}$						
					3854	D	12.00	(12.0)	58
			' д С				-		
			\mathcal{T}		3855	D	13.50	(13.5)	32
					3856	D	15.00	(15.0)	48
·			Ŏ°	16.50	3857	D	16.50	(16.5)	R
Fragments of g	rey limestone		V _q °	17.00					
Water Level Obser	vations during Boring			Remarks					
Date Hole Casi Depth Dep		Remarks		Chis	elling	g in	fill	$= 2\frac{1}{2}$ h	rs
	50 3.50 Wate	er not	ed	Chis	elling	y in y in	limes	ders = stone =	4 n r 2 h
17.00 Ni		al lev	el	Sample/T U-Tube S D-Disturt W-Water	ample bed Samp Sample		N-Blov R-Refu V-Van		
				S-Standar	d Penetra	ition T	est		

Report No.	BORIN	G RECC	ORD					1G	<u>e</u> n
1452 Contract *	QUAY DEVELO						le No.		
· · ·		:*			1	heet 1			
Location ELLIS	QUAY, DUBLIN				nd Diame		200mm		
Client		,		Ground					
LARK HO	MES			Date	20.2	.90	- 22.	2.90	
			g		17	ample		Field Re	corde
Description		Reduced Level	Legend	Depth	Ref. No.	Туре	Depth	And Tes	
FILL : Demolit:			X						N
brick,boulders, tin,steel etc.	,wood,glass,		X						
			$ \chi \lambda $					(1.5)	7
			$\langle X \rangle$						
Grey black orga	anic SILT	1	$\frac{X \land}{x \land}$	3.00				(3.0)	2
with glass, pott		}	××	-	3858	D	3.50	(4.0)	3
Fine to medium	Sandy CPAUET		X	4.50	3859	D	4.50		
with some thin			0 0					(5.0)	11
sandy silt			U X	- 6 00	3860	D	6.00	(6.0)	17
Fine to coarse			· · ·					(7.0)	28
some coarse sar cobbles & bould			·		3861	D	7.50	(7.0)	20
			· ;; ;;;	-				(8.0)	34
			ت د ر ت						
** (Some blowin - 9.00)	ig from 7.00		\overline{Q}	-	3862	D	9.00	(9.0)	48
-			° 0.	-	3863	П	10.50	10 5)	49
				_	5505		10.50	10.57	77
			<i>Q</i> .						
			- 1 - E	-	3864	D	12.00	12.0)	57
			¢ ,						
			о · · ·		3365	D	13.50(13.5)	49
			n E						
			V _o		3866	D	15.00(15.0)	64
			C · J						
	,				3867	D	16.50(16.5)	58
Missor Laural OL	utions d i - D			17.00					
Date Hole Casir Depth Dept	rations during Boring ng Depth to f h Water	Remarks						= 3 hr	
20.2.90 4.00 4.		er no	ted	Chise	lling	in at	bould	ers& g = 2 h	rave
22.2.9020.00 19.	50 4.50						27.50	د 11	- U
20_00Ni	1 <u>3_75</u> Fin	al le		Sample/Te U-Tube Sa	est key			Penetratio	
					imple ed Sample		N-Blow R-Refu	s/0.3 metr	es

Report No.	× .	BORIN	G RECO	BD-	Continua	<u>R8</u>			<u> </u>	7
1452 Contract	<u> </u>					<u> </u>				
	ELLIS QUAY	, DEVELC	PEMENI	2		- F		le No.	4	2
3						<u> </u>	heet			
	Description		Reduced Level	Legend	Depth	Ref. No.	Type	s Depth	Field Reco And Tests	rds
Fine to some sa	coarse GRAN	/EL with		• a • 0	17.00	3868	D	18.00	(18,00)	64
Coarse g	RAVEL with f broken limes	ragments	_	1000 1000 000	19.50 20.00	3869 3870		19.50 Water	(19.5)	R
or grey							-			a de la companya de la compa
					- II					
						· -			r	
					-					
Wate	er Level Observations	during Boring			Remarks	+				
Date D	ole Casing D epth Depth N	epth to Water	Remarks		NOTE from - slo	: PVC G.L. tted	to to from	pe ins 20.00n n 0.00	stalled n) - 4.00	

Report No.	1452	BORIN	G RECO	RD					IG	SL
Contract ²		S QUAY DEVELO	PEMENT					le No. v		
Location	ELLIS	QUAY, DUBLIN	;	· ·		and Diam				
Client .		2011/000011				ble To	200	200mm	·	
	LARK HO	MES				d Level 21.2.	90		23.2.9	0
	;		T	- g	<u> </u>		Sample		Field Re	
	Description		Reduced Level	Legend	Depth	Ref. No.	Type	Depth	And Test	
FILL : F	Brick,clay	,stones		$ X\rangle $						N
				$ X\rangle $					(1.5)	22
				\mathbf{X}	-	5757	D	2.00		
		·	Ļ	XX	2.90					
BOULDERS		/	-		3.50	5758	D	4.00	(4.0)	28
Fine t GRAVEL	o coarse	very sandy		00						
				0						
			4	00	-	5759	D	6.00	(6.0)	32
					6.10	5760	D	7.00		
Coarse o	gravels wi	th boulders		0.0			0	,	(7.5)	49
and so	me coarse	e sand			- 1					
	•				-	5761	D	9.00	(9.0)	41
				2	10.50				(10.5)	45
				=		5762		Water		
			•		-					
				9				2		
				11111						ł
				nie m						
Wa	ter Level Obser	vations during Boring			Remarks	l				
Date	Hole Cas Depth Dep	ng Depth to oth Water	Remarks				8.00	- 10.0)0 = 1½hr	s
					Chisa	elling	j in	Fill	& conci	rete
					Sample/1 J-Tube S D-Disturt V-Water	Sample bed Samp	le	C-Con N-Blov R-Refi V-Van		n Test es

								F	8	38		•
Report No.	1452	ВО		G RECC	RD						IG	iSL
Contract ⁴	ELLI	S QUAY DEVE	LOP	EMENT	1				Boreh Sheet	ole No.	2	
Location	ELLIS	QUAY, DUBLI	N		·	ľ		and Diam		200mm		
Client .								d Level	001			
<u>. </u>	LARK H	OMES			_	Ī	Date	16.2.	.90	2	0-2.90	<i>्</i> , ५
	Descriptio	n		Reduced	Legend	D	epth	Ref. No.	Sampl	es e Depth	Field Re And Tes	
FILL :		osits of brick stones & clay			\mathbf{X}	1	.80	5745	D	1.60	(1.5)	<u>N</u> R
FILL :	Brick,glas CLAY	ss,black ston	Y		X	<u>dumuh</u>		5746	D	3.00	(3.0)	R
					X	111111		5748	D	4.00		
		ravel with sor	ne		So XX	4.	.70	5749	D	5.00	(5.0)	35
boulder * Some	cs	al cobbles &			· () • · · · • · · · • · ·	<u>a huna buru</u>		5750	D	7.00	(6.5)	26
12.00								5751	D	9,00	(8.0)	31
					, 0	1111111111111111					(10.0)	03
					:4] .] .	13	3.00	5752	D	12.00	(12.0)	33
Compact & boul		avel with cob	bles		, 	a multana		5753	D	15.00	(14.0)	47
Coarse	sand with	boulders	-		······································	- T0	.00				(16.0)	29
Fragmen	ts of lime	stone		Ş	704		.00 .50				(17.5)	R
Date 16.2.90 20.2.901	Hole Cas Depth Dep 4.70 4.	70 4.70 V 50 5.50	Re Wate	emarks er not		Ch Ch In Sam U-T D-D W-W	nise nise nsta nple/Te ube Sa isturb /ater S	llin; lling	001 at 100m	11ders 17.00 nm PVC C.Cond N.Blov R.Refu V.Vand		nrs rs in ho n Test

R2158

81329

REE	PORT	NO			1			GEOTECHN	ICAL	C	OR	ELOC	REC	CORD I.G.S.
	TRACT:			y Teri	race					286 - 2				DRILLHOLE NO .: RC1
CLIEN	<u>π</u> .	Luco	Light	Rail	Syste			OPENHOLE		G:		76mm /	ODEX	SHEET: 2 of 2 DATE STARTED: 27.7.00
								GROUND LE	EVEL (m):			DATE COMPLETED: 28.7.00
LOCA	TION:	Arran	n Qua	y Teri	race,	Dublin		INCLINATIO	N:			Vertical		DRILLED BY: IGSL
				Γ	F	racture	e	FLUSH:				Water	ľ –	LOGGED BY: IGSL
(L)	(L					cing (r			dW					
HLd	TH ((20)		18			
Ш Ш	DEF							DISCONTINUITIES	AD A		LOO	L) N		GEOTECHNICAL DESCRIPTION
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	*	%	8		250	500		POINT LOAD Is(50) MPa		SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	
M	ORE	T.C.R.%	S.C.R.%	R.O.D.%	0	-26	ũ		NIC		YMB	LEV	EPT	a.
	<u>ŏ</u>	<u>F</u>	Ś	α.	<u> </u>					+	S	ш		
-		}												Overburden - Returns of sands a
.														gravel material (fragments of
-								SPT @ 11.00 N = 49 (7, 9, 10) 9, 11,	19)			sub rouned and sub angular cob and boulder size material)
.														
:													1	
								SPT @ 12.00 N = Ref (25,30)						
12														
							Ì					10.05 0		
13								SPT @ 13.00 N = 54 for 225m	1 m (10,	9,	10,	19,25 H)	
-														
14							-	SPT @ 14.00 N = 70 (5,9,11,	12,24,23	<u>s)</u>	+		14.00	
-														Drillhole Terminated
-														
15	8													
-														
-													~	
16														
-														
.									ł					
17														
.	8													
	1													
18														
.														
-														
19														
													ļ	
-														
20														
REMA	RKS:							with BS 5930 except for defini	tion of s	olic	d co			KEY TO SYMBOLIC LOG
						Test		ned by Norbury et al 1986 ple						MADE GROUND OVERBURDEN
														LIMESTONE

R2158 81330

REPOR	RT NO	•		I	_		GE	OTECHNIC	AL C	OR	ELOG	REC	ORD	1.G.S.L
CONTRAC	CT: Arra	n Qua	y Terr	ace									DRILLHOLE NO .: SHEET:	RC2
CLIENT:		s Light			_			OPENHOLE DRI GROUND LEVE			76mm /	ODEX	DATE STARTED: DATE COMPLETED: DRILLED BY:	1 of 2 25.7.00 26.7.00 IGSL
LOCATIO	N: Arra	n Qua	y ien					FLUSH:	·	-	Water		LOGGED BY:	IGSL
DOWNHOLE DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%		racture cing (n 520		DISCONTI	NUITIES	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	GEOTECHNICAL	DESCRIPTION
0												0.40	MADE GROUND (some imported sta	one and tar)
- -1 - - - - - - - - - -													MADE GROUND (Brick, clay, gravel	
- - - -3 -														
-												3.90		
-4 - - - - -5							SPT @ 4.50m N ≃	30 (4, 5, 5, 5, 6,	6, 14)				Overburden - Returr gravel material (fra sub rouned and sub and boulder size ma	igments of angular cobble
- - -6 - -							SPT @ 6.00m N =	36 (4, 4, 7, 8,	11, 11)				
- 7 - 7 							SPT @ 6.50m N ≈	44 (5, 6, 5, 12,	10, 1	7)				
- - - 9 -							SPT @ 9.00m N ≠	52 (8, 9, 7, 12,	. 20, 16	6)				
- 10														
REMARKS	S:		n is ta	iken a		def	e with BS 5930 exc ined by Norbury et ple		of soli	d co	re		KEY TO SYMBOLI MADE GROUND OVERBURDEN LIMESTONE	C LOG

REP	PORTNO.	GEOTEC	HNI	CALE	BORIN	G RECC	RD		I.G.S.I
CON	NTRACT: Proposed	Liffey Brdge					BOREHO	LE NO.:	4 (N) L
CLIE	ENT: Dublin Co		1				SHEET: DATE ST	ARTED	1 of 2 26.6.99
		& O'Donovan				mm) 200		MPLETED:	27.6.99
LOC	ATION: River Liffe	ey (Blackhall Place), Dublin		REHOLE		11.40	BORED B		I.G.S.L
Ê				SING DE	<u>ртн (m)</u> Т	11.40	LOGGED		I.G.S.L
DOWNHOLE DEPTH (m)		DESCRIPTION	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	REFERENCE NUMBER	SAMPLETYPE	DEPTH RECOVERED	FIELD TEST RESULTS
3			0	3.60			0		
	Tarmacadam		_	3.30					Depth
1	MADE GROUND (Co	emprised of imported stone)							
				1.60	1.80	2443	D	1.50	1.50
	MADE GROUND (Co timber, pottery, rope,	mprised of red brick, silt , gravel glass and cobbles)		F .00	1.00	,			
3						2444	D	3.00	3.00
					1				
4									
						2445	D	4.50	4.50
5									
°							5		
						а. С			
6						2446	D	6.00	6.00
7									
		<u> </u>		-7,00	7.40				
		(predominantly coarse) sandy cobbles and boulders				2447	D	7.50	7.50 4
ema	arks.					2448 Water level	D	9.00 ns durina ba	9.00 6 pring
	•				DATE	HOLE	CASING	DEPTH TO	REMARKS
hise	elling					DEPTH	DEPTH	WATER	
	From 0 - 1.	50 for 3.25hrs			27.6	3.20	3.20	3.20	seepage
		- 2.30 for 1hr				3.20	3.20	3.00	20 mins
	Fom 8.40 -	8.70 for 1.5hrs				7.50	7.50	7.50	strike 20 mins

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R2161 81466

REP	ORTNO.			ECHN	ICAL E	BORIN	G RECO	RD		I.G.S.L
CON	TRACT:	Proposed	Liffey Brdge					BOREHO	LE NO.:	4 (N) L
	ENT:	Dublin Co				10	·	SHEET: DATE ST/		2 of 2 26.6.99
	IS. ENG:		O'Donovan	вс	REHOLE	E DIAM. (r	nm) 200	1	MPLETED:	25.6.99
	ATION:		(Blackhall Place), Dublin	BC	REHOLE	DEPTH	11.40	BORED B	Y:	I.G.S.L
	T				SING DE	PTH (m) T	11.40	LOGGED		I.G.S.L
DOWNHOLE DEPTH (m)							۲. C			- 2
EPT					ELEVATION (mOD)		REFERENCE NUMBER		DEPTH RECOVERED	FIELD TEST RESULTS
ED			DESCRIPTION	9			N.	Щ	N N	, B
HOL					0Ľ	E H	N N	ET	REC	EST
NN				SYMBOLIC LOG	EVA	DEPTH (m)	l H	SAMPLE TYPE	HE	9
				کل الک	E	<u>ط</u>	<u> </u>	8		
•			(predominantly coarse) sandy cobbles and boulders	y						Depth
								-		
0							2449	D	10.00	
ĺ									1	10.50
					·					for225m then re
1										
					-9,00	11.40	2450	D	11.40	
ſ	Refusal									
2	reiusdi									
3										1
~										
4									1	
5										
6										
7							5			
3										
ema	irks.					DATE	HOLE	observation CASING	DEPTH TO	REMARKS
- 1			,				DEPTH	DEPTH	WATER	
IISE	elling	From 11.00	- 11.40 for 2hrs			27.6	11.40	nil	3.20	Bh End
									2 (1 - 7	
			D TEST KEY: U-U100, Db-Distu	tod Com			ter Semale	D. Defined		

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Development

LAYERS FOR BOREHOLE 116225 (Company Name: 1)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1162250	0	2.7				Fill - Made Ground	Fill - Made Ground
1							
1162250	2.7	3.6	Firm	Brown	Very Sandy, Very	Silt	Silt
2					Gravelly		
1162250	3.6	8.8		Brown	Silty Sandy	Gravel	Gravel
3							

Development

LAYERS FOR BOREHOLE 116226 (Company Name: 2)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1162260	0	2.2				Fill - Made Ground	Fill - Made Ground
1							
1162260	2.2	3.8	Stiff	Brown	Silty Gravelly	Clay	Clay
2							
1162260	3.8	5.5	Dense	Brown	Clayey	Gravel	Gravel
3							
1162260	5.5	12	Dense	Brown	Slightly silty sandy	Gravel	Gravel
4							

Law Society Premises

LAYERS FOR BOREHOLE 117742 (Company Name: 1)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1177420	0	.2				Fill - Made Ground	Fill - Made Ground
1							
1177420	.2	2.3				Fill - Made Ground	Fill - Made Ground
2							
1177420	2.3	9.7			Fine to Coarse	Gravel	Gravel
3					Sandy		

Law Society Premises

LAYERS FOR BOREHOLE 117743 (Company Name: 2)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1177430	0	.2				Fill - Made Ground	Fill - Made Ground
1							
1177430	.2	2.9				Fill - Made Ground	Fill - Made Ground
2							
1177430	2.9	9.1			Fine to Coarse	Gravel	Gravel
3					Sandy		

Law Society Premises

LAYERS FOR BOREHOLE 117744 (Company Name: 3)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1177440	0	.2				Fill - Made Ground	Fill - Made Ground
1							
1177440	.2	1.7				Fill - Made Ground	Fill - Made Ground
2							
1177440	1.7	2.1	Dense	Brown	Sandy Clayey	Gravel	Gravel
3							
1177440	2.1	8.7			Fine to Coarse	Gravel	Gravel
4							

Law Society Premises

LAYERS FOR BOREHOLE 117745 (Company Name: 4)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1177450	0	.2				Fill - Made Ground	Fill - Made Ground
1							
1177450	.2	1.6				Fill - Made Ground	Fill - Made Ground
2							
1177450	1.6	2	Dense	Brown Grey	Very Clayey Sandy	Gravel	Gravel
3							
1177450	2	9			Fine to Coarse	Gravel	Gravel
4					Sandy		

R3919

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					71		·		
	RT NO.	GEOTECH	INIC	AL B	ORIN	G RECO			G.S.L.
:ON	TRACT: Proposed	d Residential Development				-	BOREHOLE SHEET:	NO.:	1 1 of 1
:LIE1		orporation					DATE STAP		4.6.99
	S. ENG: Thorburn	1 Colquhoun		EHOLE D		n) 200 7.20	DATE COM		4.6.99 I.G.S.L.
.0Ç4	ATION: Queen S	treet, Dublin		ING DEPT		7.20	LOGGED BY		I.G.S.L.
Ê					, ,		SAMPLES		
Ξ				(Q		reference number		GE D	FIELD TEST RESULTS
DOWNHOLE DEPTH			8	Ĕ		NUN	н	DVEI	RES
ы СЕ		DESCRIPTION		NOI	E	VCE	Σ	REC	EST
ĤN			SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	EREI	SAMPLE TYPE	DEPTH RECOVERED	D T D
<u>N</u>			SYN	ELE	DEP	REF	SAN	DEP	FIEL
)	Tarmacadam / Imp	orted Stone							Depth
					0.30				- Sebui
		omprised of red brick, clay, gravel							
	ash, clinkers and so					1004	D	1.00	1.00 3
2					2.00	1005	D	2.00	2.00 5
		14 g . 5 19. 5 aligned a second							
	Dense fine to coars with frequent cobb	e slightly silty sandy GRAVEL les and boulders							
						1000		2.00	200
3						1006	D	3.00	3.00 4
4					4.10	1007	D	4.00	4.00 5
	Very stiff brown sil	ty gravelly CLAY with some	+		4.10	1008	D	4.30	
	cobbles				4.50				
S		silty gravelly CLAY with frequent							5.00 7
	cobbles and boulde	rs				1009	D	5.50	
								5.50	
6									6.00 7
U I									
			-			1010	D	6.50	
									-
7					7.20				7.00 Re
	Refusal								
8									
Э									
	harks.	on and off site each chift			DATE	Water leve HOLE	l observatio CASING	ns during bo DEPTH TO	
) on and off site each shift.				DEPTH	DEPTH	WATER	
Chi	selling From 0	20 - 0.90 for 1.5hrs			8.6	7.20	nil	Dry	Bh End
		40 - 3.50 for 1hr			0.0	1.20			
		40 - 4.60 for 0.75hrs							
	Erom 7.	00 - 7.20 for 2hrs			1	1	1		1

REPO	ORT NO.	GEOTECI	HNIC	AL B	ÓRING	RECO	RD	1.0	G.S.L [.]
	TRACT:	Proposed Residential Development			- 2		BOREHOLE N SHEET: DATE STAR	E 1	of 1 .6.99
	NT: S. ENG: ATION:	Dublin Corporation Thorburn Colquhoun Queen Street, Dublin	BORI	ehole d Ehole d Ng dep') 200 7.10	DATE COMP BORED BY: LOGGED BY:	LETED: 9 I.	.6.99 G.S.L. G.S.L.
DOWNHOLE DEPTH (m)		DESCRIPTION	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	REFERENCE NUMBER	SAMPLES	DEPTH RECOVERED	
0 -	Tarmaca	dam / Imported Stone			0.20				Depth N
- - -1 -	MADE G ash, cor	ROUND (Comprised of red brick, clay, gravel crete, timber, steel and some cobbles)				1011	D	1.00	1.00 11
- - -2					1.80	1012	D	2.00	2.00 55
- - -3 -	Dense f with fre	ine to coarse slightly silty sandy GRAVEL quent cobbles and boulders				1013	D	3.50	3.00 64
-4 -4					4.30				4.00 48
- -5 -	Hard bl cobbles	ack slightly silty gravelly CLAY with frequent and boulders				1014	D	5.00	5.00 79
- -6 -									6.00 3 for150mr then Ref
- - -7 -					7.10	1015	D	6.50	7.00 Re
	Refusa	I							
9 Re	emarks.	Move rig on and off site each shift.			DATE	HOLE	CASING	ons during bo	oring REMARK
C	hiselling	-			9.6	DEPTH 7.10	DEPTH	Dry	Bh End

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EDC	GEOTECH	INIC	AL BO	91 DRING	RECO	RD.	1.0	S.S.L.
	TRACT: Proposed Residential Development					BOREHOLE N		
						SHEET: DATE STAR		of 1
LIE				IAM.(mm		DATE COMP		.6.99
	S. ENG: Thorburn Colquhoun		EHOLE D			BORED BY:	Ι.	G.S.L.
		CAS	NG DEP1	<u>[H (m)</u>	6.30	LOGGED BY:	1.	G.S.L.
Ξ					Ľ.	SAMPLES		TS
Ξ			(Q		MBE		EREI	SUL
Ы		8	E_		NN	БЕ ГРЕ	No l	T RE
С Г Г	DESCRIPTION	9	NOL NOL	Ē	NC	Г Ш	REC	TES.
HN		SYMBOLIC LOG	ELEVATION (mOD)	DЕРТН (m)	REFERENCE NUMBER	SAMPLE TYPE	DEPTH RECOVERED	FIELD TEST RESULTS
DOWNHOLE DEPTH (m)		SYN	ELE		REF	SAI	E E	<u> </u>
<u> </u>				0.20				Depth N
•	Tarmacadam / Imported Stone			0.20				Deptil i
	MADE GROUND (Comprised of red brick, clay, gravel							
	ash, concrete, steel and some cobbles)				1000	D	1.00	1.00 1
-1			1					
		_		1.30				
-								
-2	Dense fine to coarse slightly silty sandy GRAVEL							2.00 39
-	with frequent cobbles and boulders				1001	D	2.50	
-								
-								3.00 3
-3								for150m
-			1	1				then Re
-								
-4				4.00	1002	D	4.00	4.00 5
-	Very stiff brown silty gravely CLAY			4.40				
-	Hard black slightly silty gravelly CLAY with frequent							
-5	cobbles and boulders				1003	D	5.00	5.00 8
-						1		
-								
-					1006		6.00	6.00 5
-6								for150m
				6.30				then Re
-	Potural				1			
-7	Refusal	1						
-						1		
-							1	
-								
-8								
-					l			
-								
9					Monator		ons during b	
	emarks. Move rig on and off site each shift.			DATE	HOLE	CASING	DEPTH TO	REMAR
	move ng on and on site each shirt.				DEPTH	DEPTH	WATER	<u> </u>
C	hiselling			3.6	6.30	nil	Dry	Bh En
	From 0.30 - 0.90 for 1hr From 3.40 - 3.60 for 1hr				1			
	From 5.40 - 5.60 for 0.75hrs							
1	From 6.10 - 6.30 for 2hrs				1	ple, R-Refusa		

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	NO.	GEOTE	CHNIC	AL B	91 ORING	RECOF	RD	1.0	S.S.L.
		ed Residential Development					BOREHOLE N SHEET: DATE START	<u> </u>	of-10.6.99
	S. ENG: Thorbu	Corporation Im Colquhoun Street, Dublin	BOR	EHOLE D EHOLE D		200 6.20	DATE COMPL BORED BY: LOGGED BY:	<u>ETED: 1</u> I.	0.6.99 G.S.L. G.S.L.
DOWNHOLE DEPTH (m)		DESCRIPTION	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	REFERENCE NUMBER	SAMPLES	DEPTH RECOVERED	FIELD TEST RESULTS
)	Tarmacadam / In	nported Stone			0.15				Depth N
-1	MADE GROUND (Comprised of red brick, clay, grave nber, steel and some cobbles)	el			1022	D	1.00	1.00 22
-2									2.00 Re
-3 -3						1023	D	3.00	3.00 1
- -4				<u> </u>	4.00	1024	D	4.00	4.00 2
- - -5 -	Medium dense t GRAVEL with fre	o dense fine to coarse silty sandy equent cobbles and boulders				1025	D	5.00	5.00 6
-6					6.20	1026	D	6.00	6.00 R
- -7 - - - -8 -8	Refusal								
						Water lev	vel observatio	ons during b	oring
R	emarks. Mov	ve rig on and off site each shift.			DATE	HOLE	CASING	DEPTH TO WATER	REMAR
С	Fro	m 0.40 - 0.90 for 0.50hrs m 3.30 - 3.50 for 0.75hrs m 6.00 - 6.20 for 2hrs			10.6		nil	Dry	Bh En

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EPC	DRT NO. GEOTECH	INIC	AL B	ORING	RECO	RD	<u> </u>	.G.S.L.
ON LIEI	TRACT: Proposed Residential Development					BOREHOLE SHEET: DATE STAR		5 1 of 1 11.6.99
ON: .0C/	S. ENG: Thorburn Colquhoun ATION: Queen Street, Dublin	BOR	EHOLE D EHOLE D ING DEPT		6.60 6.60	DATE COMI BORED BY: LOGGED BY SAMPLES	PLETED:	11.6.99 I.G.S.L. I.G.S.L.
DOWNHOLE DEPTH (m)	DESCRIPTION	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	REFERENCE NUMBER	SAMPLE TYPE	DEPTH RECOVERED	FIELD TEST RESULTS
)	Tarmacadam / Imported Stone		-	0.15	_			Depth I
1	MADE GROUND (Comprised of red brick, clay, gravel ash, concrete, timber, glass and some cobbles)				1016	D	1.00	1.00 2
2								2.00 4
3				3.80	1017	D	3.00	3.00 2
4	Medium dense to dense fine to coarse silty sandy GRAVEL with frequent cobbles and boulders				1018	D	4.00	4.00 5
5					1019	D	5.00	5.00 6
6					1020	D	6.00	6.00 3 for150m then Re
-7-8-8-	Refusal			6.60				
- 9								
Rer	Move rig on and off site each shift.			DATE	Water lev HOLE DEPTH	el observatio CASING DEPTH	DEPTH TO WATER	oring REMARK
Chi	iselling From 2.30 - 2.50 for 1hr From 3.50 -3.80 for 1hr From 6.30 - 6.60 for 2hrs			11.6	6.60	nil	Dry	Bh End

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R	REPORT NO: 9540	G	EOTECH	INIC	ALB	ORIN	G RE(IGSL L	.td.
С	ONTRACT : Tolka River Flooding							BOR Shee	EHOLE N t 1 of 1	O: BH B	1
	LIENT : Fingal County Council		GROUND LI		•		1.65		E STARTE		05/20
-	NGINEER : RPS MCOS		BOREHOLE				00			ETED: 12/	
Ç	O-ORDINATES : E 307159.75 N 239888.33		CASING DE				00		ED BY:	T McCarth	
					N	Ē	œ	SAMPLES		SEST	STAND PIPE
	DESCRIPTION			EGEND	ELEVATION (mOD)	DEPTH (m)	REF. NUMBER	SAMPLE TYPE	DEPTH (m)	FIELD TEST	AND
_	FILL comprising of soft to firm brown	eliabtly				۳ ۲	문 로 5172	ъ́́́Р В	<u>ک</u> کے 0.00		5
	sandy slightly gravelly CLAY	Silgenty					0112		0.00		
	Chiff or a line of the second	01.434		- XXXX	60.85	0.80					1
	Stiff grey brown slightly sandy gravell (possible fill)	Y CLAY									
							5173	В	1.50	N=22	
							5174	В	2,50	N=34	
				日本語			2177		2.00	11=34	
							5175	В	3.50	N=16	
				음료 음료 음							
							5176	B	4.50	N=25	
							5177	в	5.50	N=78/	i
										190mm	
							5178	В	6.50	N=26	
						ł					
							5179	В	7.50	N=18	
					53.85	7.80	0173		7.50	in=19	
	Medium dense brown slightly sandy fir medium GRAVEL	ie to			53.65	8.00					
	End of Borehole at 8.00 m										
					ļ						
											ļ
				i l		1		1			
				· i		1					
	Hard Strata Boring / Chis				I	i		r Strike Det.	! ails		
	rom (m) To (m) Hours	Comr	nents	ſ	Water Strike 7.80	Casing Depth		Rise Tin		Comments	
	2.90 3.10 0.50 . 5.70 6.00 0.75 . 7.10 7.30 0.50 .				7.80		-	6.30 20	D Mediu	m	
			ĺ								
					Date	Hale	Ground	water Obse Depth to			
	Standpipe Installation De Date Tip Depth RZ Top RZ	tails Base	Туре	-	Jace	Hole Depth	Depth	Depth to Water		nments	
						1					

יתכ												
	PORT NO. 9540	TRIAL PIT /	DYN	AM	IC P	-		EC	ORL)	IGS	SL Lt
ONI	IRACT: Tolka River Flooding	5				-	l Pit No.:			TP17		
LIE	NT: Fingal County Count					Shee				Sheet 1		
	NEER: RPS MCOS					<u> </u>	avation M	ethod:		CAT432 03/03/20		
	E 208160.11	HAMMER M	ASS (kg) :	50.0	+	-	Complet	ed		03/03/20		
0-0	RDINATES: N 238753.49	INCREMENT	SIZE (mm): 100 500			ind Level			44.30		
						<u> </u>						
							: 	Sample	·s		Type:DPH	
	Geotechnical Desc	ription	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Ref. No.	Type	Depth (m)	Probe Readings (blows / increment)	Re (>25 blow	ic Probe cord ws is refusal 15 20 2
0.0	MADE GROUND comprising gravelly CLAY with many cold and occasional pieces of plastic Soft black peaty sandy SILT/ C	bles some boulders		0.70	43.60		J2961	В	0.60	0032112		
.0 -	Stiff grey very sandy slightly gr	2		1.00	43.30							
	Stiff orange brown sandy gravel some cobbles and some boulders	ly CLAY with		1.40	42.90					12 10 6 20 25		<u>200</u>
0	OBSTRUCTION - possible bou Final depth, 1.60 m	der		1.80 1.85	42.50 42.45							
5												
ound	Iwater Observations: Rapid flow at	0.4m										
	Remarks: Pit collapsing											
nerai	I Remarks:											

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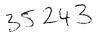
	REPORT NO: 9253	GEOTECH	INIC	AL E	BORIN	IG REC	ORD		IGSL	Ltd.] .
_	CONTRACT : Pheonix Park Development			-00)			Sheel	1 of 1	O: BH1		
	CLIENT : Flynn & O'Flaherty ENGINEER : OMS Architects	GROUND L			- nm) 2	00		STARTE	ED: 28 ETED: 28	/11/2003	.
¢	CO-ORDINATES : E - N -	BOREHOLE	DEPTH	i (m)	3	.00			J.O'Hara		-
Γ	<u>N-</u>	CASING DE	PTH (m)		T	.60	SAMPLES				
	DESCRIPTION		LEGEND	ELEVATION (mOD)	DEPTH (m)	REF.	SAMPLE	(m)	FIELD TEST	STAND PIPE DETAILS	
	MADE GROUND consisting of day, gravel a cobbles	Ind			0.40]
	Very soft to soft dark brown sandy gravelly CLAY with cobbles					7123	в	1.00	N⊭5	R5	61
	Criff brown can be once the OL AND by				1.70						
	Stiff brown sandy gravelly CLAY with cobble and boulders	3				7124	8	2.00	N=32		
	Very stiff to hard black/grey sandy gravely CLAY with cobbles and boulders	/		,	2.50 2.60						
•••	Obsruction - Possible rock/boulder End of Borehole at 3.00 m		0,0,0		3.00	7125	в	3.00	N=R		
							*		-		
	· ·										
	Hard Strata Boring / Chiselling					Water 9	trike Detail	Ĺ			
	rom (m) To (m) Hours Comm 2.60 3.00 2.00	nents	Z	Vater trike	Casing	Sealed Ri		-	omments		
-				2.50	2.50			Moderat			
	Standpipe Installation Details		[Date	Hole Depth	Groundwa Casing De Depth W	ter Observa	tions Comr			
				- C & A & A				1.000	- 1/3 0170		

			135	218	5					. /	
		EOTECHN	ICAL BO	ORIN	G REC	ORD		GSL L	td.] [^] .	
╞	CONTRACT : Pheonix Park Development CLIENT : Flynn & O'Flaherty	GROUND LEVE	L (mOD)			Sheet	HOLE NO 1 of 1 STARTE		1/2003		
	ENGINEER : OMS Architects	BOREHOLE DIA	METER (mr					TED: 29/1			
	CO-ORDINATES : E - N -	BOREHOLE DE CASING DEPTH		2.8 2.6		BORE	DBY: J	l.O'Hara			
DEPTH (M	DESCRIPTION		LEGEND ELEVATION (mOD)	DЕРТН (m)	REF.	AMPLES BILLING	DEPTH (m)	FIELD TEST RESULTS	STAND PIPE DETAILS		
f	TOPSOIL										
- 1	Soft brown slightly peaty sandy gravelly CLAY woth cobbles and boulders			0.40	7126	В	1.00	N =6	R	5619	9
-2	Stiff dark brown sandy gravelly CLAY with cobbles and boulders			1.50	7127	в	2.00	N≂28			
	· ·										
	Obsruction - Possible rock/boulder		000	2.50 2.80	7128	B	2.80	N=R			
-3	End of Borehole at 2.80 m			2.00	7120	D	2.00	N=R		-	
									•		
- <u>*</u> -	Hard Strata Boring / Chiselling From (m) To (m) Hours Comm	ients	Water	Casing		trike Deta		comments			
	2.50 2.80 2.00		Strike 2.50		Sealed Ri At T - 2. Groundwa	ter Observ	Slow				
	Standpipe Installation Details Date Tip Depth RZ Top RZ Base	Туре	Date 29/11/2003 29/11/2003	Hole Depth 2.80 2.80	Casing Do Depth V 0.00 (opth to Vater	Соп	i, BH end.			
_	Remarks:										

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	EOTEC	INIC	AL B	ORIN	G REC	CORD		IGSL L	<u>td.</u>	
······································	GROUND	EVEL	(mOD)	•				· · · · · · · · · · · · · · · · · · ·	2/2003	
	BOREHOLE	DIAM	ETER (mr	m) 20						
CO-ORDINATES : E - N -						BORE	ED BY:	J.O'Hara		
D5000/07.011		0	NOL	E	 	SAMPLES		IS EST	PIPE S	
DESCRIPTION		EGEN	mOD)	EPTH (NUMBE	AMPL	HL E	TUL T	ETAIL	
TOPSOIL										
Stiff brown/black sandy gravelly CLAY with				0.30						
								-		
	•				7141	В	1.00	N=38	\mathbf{R}^{4}	56
		i Set								
Obstruction - Possible rock/boulder		0,0	10 24	1.60	7142	в	1.80	N≖B		
End of Borehole at 1.80 m										
·						5				
				Ĭ				ι		
				·						
							•			
		i I		Ì						
]				
Hard Strate Roring / Chippling					Moto	r Strika Date	·			
From (m) To (m) Hours Comn	nents	[Water	Casing	Sealed			Comments		
1.80 2.00							Dry			
Standpipe Installation Details]	Γ	Date	Hole Depth	Casina)	Depth to		nments		
		1		Luchal	_IQPull	114401			1	
	CONTRACT : Pheonix Park Development CLIENT : Flynn & O'Flaherty NOINEER : OMS Architects CO-ORDINATES : E - N - DESCRIPTION TOPSOIL Stiff brown/black sandy gravelly CLAY with cobbles and boulders Obstruction - Possible rock/boulder End of Borehole at 1.80 m Hard Strata Boring / Chiselling From (m) To (m) Hours 1.60 1.80 2.00	CONTRACT : Pheonix Park Development CULENT : Flynn & O'Flaherty GROUND LI ENGINEER : OMS Architects BOREHOLE CO-ORDINATES : E - BOREHOLE DESCRIPTION TOPSOIL Stiff brown/black sandy gravelly CLAY with cobbles and boulders Obstruction - Possible rock/boulder End of Borehole at 1.80 m End of Borehole at 1.80 m Hard Strate Boring / Chiselling From (m) To(m) Hours 1.60 1.80 2.00	CONTRACT : Pheonix Park Development CLIENT : Flynn & O'Flaherty GROUND LEVEL I SOUND LEVEL : BOREHOLE DIAM DOSTRUCTOR CASING DEPTH (DESCRIPTION g TOPSOIL Stiff Drown/black sandy gravelly CLAY with cobbles and boulders Obstruction - Possible rock/boulder 0,0 End of Borehole at 1.80 m - Hard Strate Boring / Chiselling From (m) To(m) 1.60 1.80 2.00 Comments	CONTRACT : Phenolik Park Development CLIENT : Flym & O'Flaherty GROUND LEVEL (mOD) SNGINEER : OMS Architects BOREHOLE DEPTH (m) CO-ORDINATES : E Co-ORDINATES : E DESCRIPTION gg gg gg gg TOPSOIL Stiff brown/black sandy gravelly CLAY with cobbles and boulders GROUND I EVEL (mOD) gg Obstruction - Possible rock/boulder 0,000 0,000 GG End of Borehole at 1.80 m Siff brown/black sandy gravelly CLAY with cobbles and boulders GG Obstruction - Possible rock/boulder 0,000 0,000 End of Borehole at 1.80 m Siff brown/black sandy gravelly CLAY with cobbles and boulders Siff brown/black sandy gravelly CLAY with cobbles and boulders Obstruction - Possible rock/boulder 0,000 0,000 Siff brown/black sandy gravelly character and boulders End of Borehole at 1.80 m Siff brown/black sandy gravelly character and boulders Siff brown/black sandy gravelly character and boulders Siff brown/black sandy gravelly character and boulders Siff brown/black sandy gravelly character and boulders Siff brown/black sandy gravelly character and boulders Siff brown/black sandy gravelly character and boulders Siff brown	20NTRACT : Phenk Park Development GROUND LEVEL (mOD) BOREHOLE DIAMETER (mm) 2 BOREHOLE DIAMETER (mm) 2 BOREHOLE DEPTH (m) 2 CASING DEPTH (m) 2 CASING DEPTH (m) 1 CASING DEPTH (m) 0 CASING DEPTH (m) 0 CASING DEPTH (m) 1 CASING DEPTH (m) 1 CASING DEPTH (m) 0 CASING DEPTH (m) <	20NTRACT : Phone Archiberary GROUND LEVEL (mOD) 200 SNGINEER : OMS Archinecia GROUND LEVEL (mOD) 200 BOREHOLE DIAMETER (m) 1.80 200 SO-ORDINATES : E	CONTRACT: Phenix Park Development: OROUND LEVEL (mOD) BORE Control Date Stress ULENT: Flym & OFlaheny DORENCLE DAMETER (mn) 1.80 DATE BORENCLE DAMETER (mn) 1.80 DATE BORENCLE DAMETER (mn) 1.80 BORE DO-ORDINATES : E CASING DEPTH (m) 1.80 BORE DATE BORENCLE DAMETER (mn) 1.80 BORE TOPSOIL BESCRIPTION g </td <td>DONTRACT : Phank Park Development GROUND LEVEL (mOD) Development Select 1 of 1 Date strate 00REHOLE DOMETTI (m) 00REHOLE DOPTH (m) 1.80 Date strate 00REHOLE DOMETTI DATE STRATE 00RED DSV: DESCRIPTION g g g g g g g g g g g g g g g g g g g</td> <td>DONTRACT: Phanok Park Development DOREHOLE IMPO Bener 101 DOREHOLE IMPO 200 DATE SUMPTION DOREHOLE DAMETER (mm) 200 BOREHOLE DEPTH (m) 1.80 DATE SUMPTIE DATE SUMPTIE DATE SUMPTION DESCRIPTION DESCRIPT</td> <td>CONTRACT: Phanix Park Development CPROVID LEVEL (nOD) DORENCEST: Control Difference <thdifference< th=""> <thdifference< th=""> Differen</thdifference<></thdifference<></td>	DONTRACT : Phank Park Development GROUND LEVEL (mOD) Development Select 1 of 1 Date strate 00REHOLE DOMETTI (m) 00REHOLE DOPTH (m) 1.80 Date strate 00REHOLE DOMETTI DATE STRATE 00RED DSV: DESCRIPTION g g g g g g g g g g g g g g g g g g g	DONTRACT: Phanok Park Development DOREHOLE IMPO Bener 101 DOREHOLE IMPO 200 DATE SUMPTION DOREHOLE DAMETER (mm) 200 BOREHOLE DEPTH (m) 1.80 DATE SUMPTIE DATE SUMPTIE DATE SUMPTION DESCRIPTION DESCRIPT	CONTRACT: Phanix Park Development CPROVID LEVEL (nOD) DORENCEST: Control Difference Difference <thdifference< th=""> <thdifference< th=""> Differen</thdifference<></thdifference<>

)	35	22	20					. J
1	REPORT NO: 9253 G	EOTEC					ORD		GSL L	td.	
(CONTRACT : Pheonix Park Development						BORE	HOLE NO	D: BH6		
	CLIENT : Flynn & O'Flaherty	GROUND L			- n) 20	vo ,			D: 03/1 ETED: 03/1	12/2003	
	ENGINEER : OMS Architects	BOREHOLE				90				2/2003	
(CO-ORDINATES : E - N -	CASING DE		 	1.	90		ED BY:	J.O'Hara		
E			6	ELEVATION (mOD)	Ê		SAMPLES 4		TEST TS	STAND PIPE DETAILS	
N HIG	DESCRIPTION		LEGEND	OD FEV	DEPTH (m)	REF. NUMBER	SAMPLE	DEPTH (m)	RELD TEST	TANC	
빙	TOPSOIL		3	<u> </u>		<u> </u>	- 20			0	
	Soft to firm brown slightly sandy, peaty CLA	Y			0.20			1			
		r			~						
	Vone stiff dark brown sandy gravely CLAY w	ith			0.80		_				
- 1	Very stiff dark brown sandy gravelly CLAY w cobbles and boulders	,	1000			7143	В	1.00	N=54		R5619
			175 - 37 176 - 176								
	Obsruction - Possible rock/boulder		000		1.60						
	End of Borehole at 1.90 m		0000		1.90	7144	В	1.90	N=R		
-4	EIN OF DOTATION AL 1.50 III										
									ė		
									ſ		
-3									1		
									l		
-4											
							•				
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-5						5					
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-7					ĺ						
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-8	*						1				
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										1	
-9											1
			ļ								
ł											
Ľ	p Hard Strata Boring / Chiselling			<u> </u>	<u> </u>	Wat	er Strike Di	etails			-
	From (m) To (m) Hours Co	mments	_	Wate Strike	r Casi	ng Sealed thAt	Rise T	Time	Commen	ts	
	1.80 1.90 2.00				,	wi					
					1					-	
				·		Groun	dwater Obs	servations			
	Standpipe Installation Details	Tues	-	Date			Depth to Water		comments		
	Date Tip Depth RZ Top RZ Base	е Туре		03/12/20	03 1.5	0 1.50	-	BH dry, ei	הסיט אח		
-	Remarks: Water added to assist drilling	·····									-]
IL.	nomana, made autou to doalat unimity										-





REPORT NO. 9253 TR	UAL	PIT	REC	CORD)			IGSL	Ltd.
				Trial Pit	No.:	Т	PRC1		
CONTRACT: Pheonix Park Development	•			Sheet:		S	heet 1 of 1	l	
CLIENT:				Excavati	on Method:](СВ		
ENGINEER:				Date Star	ted:	1;	3/11/2003		
				Date Cor	npleted:	1	3/11/2003		
CO-ORDINATES: C - N -	•			Ground I	cvel (mOD): -			
						Sample	s		(Pa)
Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Ref. No.	Type	Depth (m)	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.20							
Loose brown gravelly SAND									c
Firm brown sandy gravelly CLAY with occasional cobbles and boulders		0.60			K2763 K2764	в	1.00		
Stiff brown sandy gravelly CLAY with cobbles, boulders and rock slabs		1.50							
2.0 Obstruction End of Trial Pit at 2.05 m		2.00			K2765	B .	2.00		-
-3.0					-				
-4.0									
Groundwater Conditions: No groundwater encountered		۰							_
Stability: Stable									
Remarks:					Ŷ				

		13:	521	- 4	-	R 5	61	9		Ľ
REPORT NO. 9253	TR	IAL	PIT	REG	CORD				IGSL	Ltd.
					Trial Pit	No.:	-	TPRC2		
CONTRACT: Pheonix Park Deve	opment				Sheet:		5	Sheet 1 of 1		
CLIENT:					Excavati	on Method:	J	CB		
ENGINEER:					Date Star	rted:	1	4/11/2003		
CO-ORDINATES: E -				-uq. <u></u>	Date Cor	npleted:	1	4/11/2003		
N					Ground I	.evel (mOD): -	-		
							Sample	es		Pa)
Geotechnical Des	cription	p	(m)	Elevation (mOD)	Water Strike (m)	.o		(iii)	Vane Test (KPa)	Hand Penetrometer (KPa)
Depth (m)		Legend	Depth (m)	Eleva	Water	Ref. No.	Type	Depth (m)	/ane 1	fand I
-0.0 TOPSOIL	AV with occasional		0.60		-					
Firm brown sandy gravelly CI cobbles and boulders. From 2 present.	m rock fragments					K2768 K2769	В	1.00		
2.0 Obstruction End of Trial Pit at 2.20 m			2.20			K2770	В	2.00		
3.0 .					-					
4.0	dwater encountered									
Stability: Stable										
Remarks:						ņ				

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R5709

Appendix I – Cable Tool Borehole Records

	REPORT NO: 9638 CONTRACT : Blackhall Place						BOI	REHOLE N et 1 of 2			
<u> </u>	ENGINEER : Barrett Mahony BOREHOLE CO-ORDINATES : E - BOREHOLE			DIAMETER (mm) 200 DEPTH (m) 14.30				DATE STARTED: 06/04/20 DATE COMPLETED: 07/04/20 BORED BY: J. O'Hara			
F	N -	CASING DE	PTH (m	ŕ – – –	1	4.30		NEU BT:	J. U'Hara		
OEPTH (M)	DESCRIPTION		LEGEND	ELEVATION (mOD)	OEPTH (m)	number	SAMPLES BIJ BANK	(m)	RELD TEST RESULTS	STAND PIPE	
	MADE GROUND containing reinfo hardcore MADE GROUND containing loose				0.40			:			
-1				2		3985	в	1.00	N=4		
- 2	×					3986	в	2.00	N=5		
-3						3987	в'	3.00	N≓8 [°]		
-4		5			8	3988	в	4.00	N=4		
-5	Dense/very dense grey brown coar	SB GRAVEL			4.60	3989	в	5.00	N=61/ 225mm		
•6						3990	в	6.00	N=45		
7						3991	в	7.00	N≈40		
8						3992	в	8,00	N≖38		
9						3993	в	9.00	N=45		
10	Continued next sheet Hard Strata Boring / C	hisellino				3994	B	10.00	N≃R		
P	From (m) To (m) Hours	Comments	Г	Water	Casing	Sealed	Strike De Rise Ti		Comments		
	0.00 0.40 2.00 4 4.60 4.80 0.50 5 5.40 5.70 0.75 5 10.30 10.50 0.75 1 12.20 12.50 1.00 1 4.10 14.30 2.00			Strike 7.80	Depth 7.80		6.80	Slow/k	Adderate		
L.,				Data	Hole	Groundy Casing	vater Obse				
	Standplpe Installation Date Tip Depth RZ Top F	Details 12 Base Type		Date /04/2004	Depth	Depth	Water	Con End of BH	nments		

_	REPORT NO: 9638	GEOTECH	INIC	ALA	OPH	IG RE	R	7		IGSL L	td		
	CONTRACT : Blackhall Place							BORE	IOLE N		-LUI-		
	CLIENT : ENGINEER : Barrott Mahamu	GROUND L			-		1	DATES	TARTE	D: 06/0	04/2004		
-			LE DIAMETER (mm) 200 LE DEPTH (m) 14.30					DATE COMPLETED: 07/04/2004					
J	N.	CASING DE	PTH (m			4.30			BY:	J. O'Hara			
	DESCRIPTION		LECEND	ELEVATION (mOD)	Ш. Н	5	SAMPL		I	RELD TEST RESULTS	STAND PIPE		
			ğ	ELE M	DEPTH	REF. NUMBER	SAMPLE	34YT	DEPTH (m)	REDTER	STAN		
ĺ	Dense/very dense grey brown coarse GRAV	/EL		1									
l													
ļ	I					3995	В	12		hi and			
ł						3333			11.00	N=63/ 225mm			
2						3996	в		10.00				
				5		3890	8		12.00	N=R			
ß						3997	В		13.00				
						2391			13.00	N=65/ 225mm			
						3998	8		14.00	N=50/			
	End of Borehole at 14.30 m				14.30					N=50/ 150mm	9		
	TIMM III								-				
5													
								2					
9	33							8					
,								1					
		8											
	Hard Strata Boring / Chiselling From (m) To (m) Hours Com	ments	Г	Water	Casino	Wate	Il Strike			l			
0.00 0.40 2.00 · 4.60 4.80 0.50 ·		-	Strike 7.80	Depth 7.80	Sealed At	Filse To 6.80	Hse Time Comments To Slow/Moderate						
	10.30 10.60 0.75 12.20 12.50 1.00 14.10 14.30 2.00												
_				Date	Hole	Ground	water O Depth t	bserva o		mente			
Standpipe Installation Details Date Tip Depth RZ Top RZ Base Type		-	/04/2004	0.00	Water	Depth to Comments Water 11.50 End of BH							

			AL D	Unir	IG RE				<u>IGSL I</u>	_tc	
CONTRACT : Blackhall Place								HOLE N			
CLIENT :	GROUND LE	•					DATE	START			
BOBEHOLED								DATE COMPLETED: 02/04/			
LUU-URUINATES: 5							BORED BY: J. O'Hara				
			ð	Ē					- 5	Τ	
- DESCRIPTION		LEGEND	ELEVATI (mOD)	рертн (REF.	SAMPLE	TYPE	HLLADO (W)	FIELD TE RESULT		
MADE GROUND (consisting of reinforced cor	ncrete)			0.20							
									1		
MADE GROUND (consisting of loose brick rul	bble)										
					3968	6	- 57	1.00	N=9		
				ļ		1	- 39				
					3969	в	¥3	2.00	N=7	[
									ĺ		
14 <u>1</u> .1	9 ₂₂										
					2070			0.00			
					3370	1.		3.00	IN=0		
									-		
			- 1		3971	в		4.00	N=20	Ł	
	6							3			
	- B										
	R				2020		Ì				
	8				3915	B		5.00	N=8		
MADE CROINIR (manifester of the state				5.50							
clay)											
					3973	в	ž	6.00	N=9		
Very dense, grey/ brown slightly sandy GRAVE	il i			6.50							
manuadaeur connigs					2074						
			Ì		39/4	6		7.00	N=64/ 225mm		
									Í		
	100					1					
					3975	в		8.00	N=55		
									`		
					3070						
					2310			9.00	N=R		
									ļ		
Continued next sheet											
		1.3.5			3977	в		10.00	N=45/		
Hard Strata Boring / Chiselling From (m) To (m) Hours Comme	ants	[Vater	Caeinel				-			
0.00 0.20 1.00 12.16m Castle		s	trike	Depth 5.50	AL	T0 550	Тіле				
7.10 7.50 1.25 9.20 9.40 1.50			0.00	8.00	-	6.60	2	Modera	nse Ite		
13.00 16.00 3.00					Ground	water O					
Standpipe Installation Details			Date	Hole	Casing	Depth t	0		ments	_	
Date Tip Depth RZ Top RZ Base	Туре	05/0	4/2004	16.60	0.00	13.80		of BH		_	
	ENGINEER : Barrett Mahony CO-ORDINATES : N - DESCRIPTION MADE GROUND (consisting of reinforced co MADE GROUND (consisting of hard core) MADE GROUND (consisting of hard core) MADE GROUND (consisting of loose brick ru MADE GROUND (consisting of black organic s Group of the second s	ENGINEER : Barrett Mahony BOREHOLE BOREHOLE CO-ORDINATES : BOREHOLE E CO-ORDINATES : E - MADE GROUND (consisting of reinforced concrete) MADE GROUND (consisting of loose brick rubble) MADE GROUND (consisting of black organic sitt/ clay) MADE GROUND (consisting of black organic sitt/ clay) Very dense, grey/ brown slightly sandy GRAVEL With frequent cobbles Continued next sheet Ending To (m) Hours Continued next sheet Continued next sheet Standpipe Installation Details	ENGINEER: Barrett Mahony BOREHOLE DIAME DOREHOLE DEPTH- CASING DEPTH (m) CO-ORDINATES: E - DESCRIPTION 000000000000000000000000000000000000	ENGINEER : Barret Mahony BOREHOLE DIAMETER (m) CO-ORDINATES : E : CORENOLE DEPTH (m) CASING DEPTH (m) CASING DEPTH (m) MADE GROUND (consisting of reinforced concrete) MADE GROUND (consisting of hard core) MADE GROUND (consisting of leack organic sit/ clay) MADE GROUND (consisting of black organic sit/ clay) MADE GROUND (consisting of black organic sit/ clay) MADE GROUND (consisting of black organic sit/ clay) Very dense, gray/ brown slightly sandy GRAVEL with frequent cobbles Value Continued next sheet Value Hard Strata Boring / Chiselling Value From (m) To (m) Hours Continued next sheet Value Standpice Installation Details Date	ENGINEER : Barrett Mahony BOREHOLE DIAMETER (mm) 2 CO-ORDINATES : E CASING DEPTH (m) 1 CASING DEPTH (m) 1 CASING DEPTH (m) 1 MADE GROUND (consisting of reinforcad concrete) MADE GROUND (consisting of hard core) 0.20 MADE GROUND (consisting of hard core) 0.50 0.50 MADE GROUND (consisting of loose brick rubble) 0.50 MADE GROUND (consisting of black organic sitt/ clay) 5.50 Very dense, grey/brown slightty sandy GRAVEL 6.50 Very dense, grey/brown slightty sandy GRAVEL 6.50 Continued next sheet 5.50 Standpice Installalion Details Date	ENGINEER : BOREHOLE DUANTEER (m) 200 BOREHOLE DEPTH (m) 200 IO.50 CO-ORDINATES : E CASING DEPTH (m) 10.50 CASING DEPTH (m) 10.50 10.50 10.50 MADE GROUND (consisting of reinforced concrete) 0 0.20 0.20 MADE GROUND (consisting of lead core) 0	ENGINEER : Barret Mahony BOREHOLE DIAMETER (m) 200 CO-ORDINATES : E : Consisting of reinforced concrete() 0.50 0.50 MADE GROUND (consisting of reinforced concrete() 0.50 0.50 0.50 MADE GROUND (consisting of hard core) 0.50 0.50 0.50 0.50 MADE GROUND (consisting of hard core) 0.50 0.50 0.50 0.50 0.50 MADE GROUND (consisting of loose brick rubble) 0.50 <td>ENGINEER: Barret Mahony DORE-IOLE DUAMETER: (m) 200 DATE CO-ORDINATES: - CO-ORDINATES: - 0.50 DORE CO-ORDINATES: - CO-ORDINATES: - 0.50 DORE MADE GROUND (consisting of reinforcad concrute) MADE GROUND (consisting of hard core) 0.50 3968 B. MADE GROUND (consisting of lack organic sit/ 0.50 3969 B. 3970 B. MADE GROUND (consisting of black organic sit/ -</td> <td>BOREHOLE DUMETER (m) DOD DATE COMPL CO-ORDINATES : N · CO-ORDINATES : N · DATE COMPL DATE COMPL CO-ORDINATES : N · CO-ORDINATES : N · DATE COMPL DATE COMPL MADE GROUND (consisting of reinfurced concrete) MADE GROUND (consisting of hard core) 0.50 DATE COMPL MADE GROUND (consisting of hard core) 0.50 0.50 0.50 0.50 MADE GROUND (consisting of hard core) 0.50 0.50 0.50 0.50 MADE GROUND (consisting of hard core) 0.50 0.50 0.50 0.50 0.50 MADE GROUND (consisting of black organic silt/ dey) 0.50 <td< td=""><td>BACINEER: Burnet Mahony BOREHOLE DUMATTER (mn) 200 10.50 DATE COMPLETED: <thdate completed:<="" th=""> DATE COMPLETED:</thdate></td></td<></td>	ENGINEER: Barret Mahony DORE-IOLE DUAMETER: (m) 200 DATE CO-ORDINATES: - CO-ORDINATES: - 0.50 DORE CO-ORDINATES: - CO-ORDINATES: - 0.50 DORE MADE GROUND (consisting of reinforcad concrute) MADE GROUND (consisting of hard core) 0.50 3968 B. MADE GROUND (consisting of lack organic sit/ 0.50 3969 B. 3970 B. MADE GROUND (consisting of black organic sit/ -	BOREHOLE DUMETER (m) DOD DATE COMPL CO-ORDINATES : N · CO-ORDINATES : N · DATE COMPL DATE COMPL CO-ORDINATES : N · CO-ORDINATES : N · DATE COMPL DATE COMPL MADE GROUND (consisting of reinfurced concrete) MADE GROUND (consisting of hard core) 0.50 DATE COMPL MADE GROUND (consisting of hard core) 0.50 0.50 0.50 0.50 MADE GROUND (consisting of hard core) 0.50 0.50 0.50 0.50 MADE GROUND (consisting of hard core) 0.50 0.50 0.50 0.50 0.50 MADE GROUND (consisting of black organic silt/ dey) 0.50 <td< td=""><td>BACINEER: Burnet Mahony BOREHOLE DUMATTER (mn) 200 10.50 DATE COMPLETED: <thdate completed:<="" th=""> DATE COMPLETED:</thdate></td></td<>	BACINEER: Burnet Mahony BOREHOLE DUMATTER (mn) 200 10.50 DATE COMPLETED: DATE COMPLETED: <thdate completed:<="" th=""> DATE COMPLETED:</thdate>	

REPORT NO: 9638	GEOTECHN		LB	ORI	IG RI	ECO			IGSL I	td.
	GROUND LEVE		יחר				Sheet	HOLE N 2 of 2		
CLIENT : ENGINEER : Barrett Mahony	BOREHOLE DI	AMET	ER (m	m) 2	200 /			COMPL	ED: 01/ ETED: 02/	04/200 04/200
CO-ORDINATES : E · N ·	BOREHOLE DE		(m)		0.50	ं		D BY:	J. O'Hara	
DESCRIPTION		LEGEND	ELEVATION (mOD)	DEPTH (m)	REF. NUMBER	SAMP		HL-BO	FIELD TEST RESULTS	STAND PIPE
Very dense, grey/ brown slightly sandy GR/ with frequent cobbles	AVEL				3979		B	11.00	N=59	
2				3	3980	E	3	12.00	N=63/ 275mm	
					3981	E	3	13.00	N=66/ 190mm	
					3982	E		14.00	N=80/ 170mm	
					3983	B		15.00	N≖R	
			2		3984	в		16.00	N≂R	
End of Borehole at 1050 m				16.60						
16.6"	55		2							
			a							
Hard Strate Boring / Chiselling From (m) To (m) Hours Comm 0.00 0.20 1.00 13-16m Cont 0.20 0.50 1.00 13-16m Cont 7.10 7.50 1.25 9.20 9.40 1.50 13.00 16.00 3.00 16.00 1.00 1.00 1.00		Wa Str 5.5 8.0	iter (lke l io io	Casing Depth 5.50 8.00	Wate Sealed At	r Strike Rise To 5.50 6.60	Details		omments Ise e	
Standpipe Installation Details Date Tip Depth RZ Top RZ Base	Туре	Da 05/04/	ate 2004	Hole Depth 16.60	Ground Casing Depth 0.00	wator O Depth I Water 13.80		tions Com of BH	nents	

R5709

Appendix II – Laboratory Test Records

AB	
IGSL	

7	A	GEOTEC					prR	66	17	REPORT NUMBER	
	IGSL	GEOTEC	INICAL	. DUNI	NG F	iego		00	`⊥ /	11836	
С	ONTRACT	Blanchardstown S.C.							REHOLE NO		
c	o-ordinat	ES()	GROUND	LEVEL (n	n)			SHE DAT	EET FE STARTE	Sheet 1 of 1 D 02/06/2006	
_			BOREHOL		•		00				
	LIENT NGINEER	McAleer & Rushe Ian Black Consulting Ltd.	BOREHOL CASING D		• •		.10 .10		red by Dcessed b	IGSL IY Z. Knotkova	
íe						(îr		Sample	s	-	e
Denth (m)		Description		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe Details
- 0		ROUND (consisting of tarmac) ROUND (consisting of compact ang	ular 🕅	***		0.20]	
	\gravel - s	ub-base) vn CLAY/SILT with occasional fine (1-			0.40	W7852	В	0.40		
	Stiff brow	n gravelly CLAY with cobbles				1.10	W7853	В	1.00	N = 13 (1, 2, 3, 4, 3, 3)	
2							W7854	В	2.00	N = 17 (1, 2, 4, 4, 4, 5)	
3							W7855	В	3.00	N = 19 (2, 3, 4, 4, 5, 6)	
- 4							W7856	В	4.00	N = 32 (1, 3, 5, 7, 10, 10)	
- 5	Hard gre	y gravelly CLAY with cobbles				5.00	W7857	В	5.00	N = 81 (2, 7, 15, 20, 22, 24)	
6							W7858 W7859	B B	5.70 6.00	N = 43 (2, 5, 7, 10, 12, 14)	
- 7	Obstructi	on orehole at 7.10 m				7.10	-			N = 75/150 mm (25, 50)	·
- 8											
19	ł		2			ı					
		TA BORING/CHISELLING			ם פדסיי	KE DET		_			
\vdash	om (m) To	August		Water Strike		sing S	Bealed At	Rise To	Time (min)	Comments	
	3.6 3. 5.5 5. 6.8 7.	8 0.75 7 0.5								BH Dry	
SSLGD				GROUN		ER DET	AILS				
		DN DETAILS		Date		Hole Depth	Casing Depth	Depth Wate			
0 11836.	Date Ti 6/06/2006		/pe m SP	02-06-0	06	7.10	0.00		BH Dry	,	
	EMARKS			<u> </u>					1		
GSLE											

ED	
IGSL	

GEOTECHNICAL BORING RECORT R6617

REPORT NUMBER

100			ardsto								SHI	ET	Sheet 1 of 1	
:0-	ORDINAT	ES(_)) LEVEL (I)LE DIAMI	-	(mm) 2	200		TE START		
	ENT	McAlee))le depti Depth (n			5.90 5.90	1	RED BY DCESSED	IGSL BY Z. Knotkova	
INC	AINEER	lan Blac		nsulting Ltd.	CA	SING		Ŋ		5.90	Sample			
			De	escription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Field Test Results	Standpipe
	MADE G gravel - s MADE G	ROUND ub-base) ROUND	(cons	isting of bro	nac) npact angular wn clay with tra	aces			0.20	- W7816	В	0.50		
1	of roots a	ind fill ma	terial	ine to coars	-				1.20	_ W7817	В	1.00	N = 10 (1, 1, 2, 3, 3, 2)	
2										W7818 W7819	B B	1.80 2.00	N = 18 (1, 2, 4, 4, 5, 5)	
1	Stiff to ve	ery stiff da	irk gre	ey gravelly C	CLAY with cobb	oles		•	2.70	W7820	В	2.70		
3		,		- , 						W7821	В	3.00	N = 28 (2, 4, 7, 10, 5, 6)	
1										W7822	В	4.00	N = 35 (2, 4, 6, 9, 10, 10)	
5										W7823	В	5.00	N = 82 (2, 5, 15, 20, 22, 25)	
6			-	_					0.70	W7824	В	6.00	N = 49 (3, 6, 8, 10, 15, 16)	
7	Obstruct End of B	orehole a	t 6.90) m					6.70 6.90		-		N = 75/150 mm (25, 50)	
8														
9									j.					
HÆ	ARD STRA			HISELLING										
	m (m) To	(11) (me h)	Comments	; 		Wate	e (Casing Depth	Sealed At	Rise To	Time (min)	Comments	
5	5.4 5	.7 0 .6 0	.75 .75 2										BH Dry	
							GROU	WDW,	ATER DE			·		_
				on P7 Do-	el Type		Dat		Hole Depth	Casing Depth	Depth Wate		ments	
	Date T	ip Deptri	<u> הג </u>	op RZ Bas	e iype		31-05	9-06	6.90	0.00		BH D	n y	

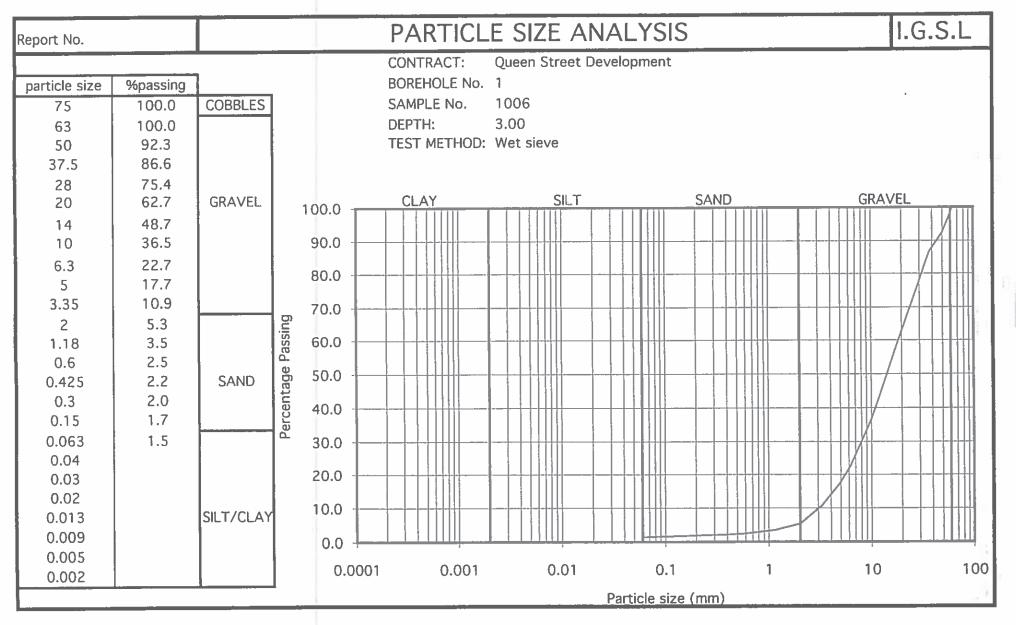
со	NTRAC	T Blan	chardsto	wn S.C.							BORE SHEE	EHOLE N	O. BH3 Sheet 1 of 1
со	-ORDIN	ATES())				D LEVEL (-			DATE	STARTE	D 06/06/2006
										200		COMPLI	
	ient Gineer		leer & Ru Black Con	ushe sulting Ltd.			depth (1 Depth	• •		7.90 7.90		ed by Cessed i	IGSL BY Z. Knotkova
				outing Ltd.		ononta		,			Samples		
Depth (m)			Des	scription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Field Test Results
0		GROUN	ID (consis	sting of tarm sting of comp	ac)	or			0.20	-			
:	gravel	- sub-ba	se)	CLAY with fin					0.60				
1	gravel		n sandy C						0.00	W7860 W7861	B	0.60 1.00	N = 18 (1, 2, 4, 4, 5, 5)
2										W7862	В	2.00	N = 20 (2, 3, 5, 7, 4, 4)
3	Very s	tiff dark b	prown/gre	y gravelly C	LAY with c	obbles		_	3.20	_ W7863	В	3.00	N = 23 (2, 2, 4, 5, 7, 7)
4										W7864	В	4.00	N = 38 (2, 4, 7, 9, 10, 12)
5										W7865	В	5.00	N = 82 (3, 7, 15, 20, 22, 25)
6										W7866	в	6.00	N = 42 (2, 4, 7, 9, 12, 14)
7	Obstri								7.70	W7867	в	7.00	N = 45 (3, 5, 8, 10, 12, 15
9	Obstru End o		e at 7.90	m					7.90				
			Time	ISELLING			WAT		RIKE DET	TAILS Sealed	Rise	Time	
	m (m) 3.4 4.8 5.5 7.7	To (m) 3.6 5 5.7 7.9	(h) 0.75 1.25 0.75 2	Comments			Strik		Depth	At	To	(min)	Comments BH Dry
			-				GROL						
INS	STALLA	TION DE					Da	te	Hole Depth	Casing Depth	Depth to Water		
INS	Date	Tip Dep	th RZ To	p RZ Base	Typ	e	06-06	6-06	7.90	0.00		BH Dr	у

					GEC	TECHNIC	AL B	30RI	NG	REÇO	RR	66	17	REPORT NUMBER	
	2	VTRACT	Blanch	nardstown											
-			Biditor									SHEE	ат	Sheet 1 of 1	
•	0-	ORDINA	res(_)			GROUN		-	-	(m m) 2	.00		STARTE		
-	CLI	ent –	McAle	er & Rush	1e	BORE					.70		ED BY	IGSL	
1	ENG	AINEER	lan Bla	ack Consu	ting Ltd.	CASIN	GDE	PTH (m)	3	.70	PRO Samples	CESSED	BY Z. Knotkova	
	Ē						1	-	ы	(E)	4			Field Test	oipe
	Depth (m)			Descr	iption			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Results	Standpipe Details
	0	MADE	ROUND	(consistir	ng of tarma	c)									
+		MADE (ROUND sub-base	(consistir	ng of comp	act angular	Æ			0.20	W7825	в	0.40		
		Firm to a	stiff brown	n sandy gi	ravelly CLA	Y	í <u> </u>	·				_			
-	1						<u> </u>	·			W7826	в	1.00	N = 21 (1, 2, 4, 4, 6, 7)	
														(., _, ., ., ., ., .,	
							-0-								
Ē	2										W7827	в	2.00	N = 22 (1, 3, 4, 5, 7, 6)	
-								ē							
Ē	3						<u>.</u> .	·						N = 63	
-	3	Manuati	ite hord		brown ara			· ē		3.25	W7828	В	3.00	(2, 4, 7, 14, 20, 22))
È		cobbles		grey/grey	brown gra	velly CLAY with				0.20	14/7000		0.00		
-											W7829	В	3.60	N = 44	
Ę	4										W7830	В	4.00	(2, 5, 8, 10, 12, 14)	X
							<u> </u>					Ì			
È	5						[14/7004		5.00	N = 51	
	5										W7831	В	5.00	(3, 7, 10, 11, 14, 16)	
F														10)	
	6										W7832	в	6.00	N = 42	
-							_0.				111002		0.00	(2, 4, 8, 10, 12, 12)	X
Ē							E								
Ę	7										W7833	в	7.00	N = 46	J
														(2, 3, 7, 10, 14, 15	1
	8							- <u> </u>		1	W7834	в	8.00	N = 60 (3, 5, 9, 14, 17, 20	1
														(0, 0, 9, 14, 17, 20	1
Ē		End of I	Borehole	at 8.70 m						8.70	-				
	9														
Ē															
							Ì								
ļ	H	ARD STR			SELLING					RIKE DET		Rise	Time		
) (III)	(n)	omments			Wate Strike		Casing Depth	Sealed At	To	(min)	Comments	
90/9/				0.75										BH Dry	
NT 15,			8.7	2										-	
SLGD								GROU		ATER DE				<u> </u>	
1 165	INS		ION DET					Dat		Hole	Casing Depth	Depth t Water	o Comn	nents	
36.GF					RZ Base	Туре		01-06		Depth 8.70	0.00	- wald	BH D	ry	
3 118	_														
Н ГОС	RE	MARKS		I	<u> </u>			L			·				
IGSL BH LOG 11836.GPJ IGSL GDT 15/6/06															
잌									_						

		GEOT	ECHNIC		ING	RECO	RD -			REPORT NUMBER	
IGSL	· ·							<u>R6</u>	<u>61</u>	7 11836	
CONTRACT	Blanchardstown S	.C.							REHOLE N	2110	
			GROUI	ND LEVEL (m)			SHE		Sheet 1 of 1	
CO-ORDINA1	'ES(_)					(mm) 2	200		'E STARTE 'E COMPLI		
CLIENT	McAleer & Rushe		BOREI	IOLE DEPT	H (m)	8	3.50	BOF	RED BY	IGSL	
ENGINEER	lan Black Consulting	g Ltd.	CASIN	G DEPTH (n	n)	8	3,50		CESSED I	BY Z. Knotkova	
Ē					-	Ê		Samples	3	_	9
5	Descript	ion		pus	atio	Depth (m)	per	e ble	÷	Field Test Results	Standpipe
Depth				Legend	Elevation	Dep	Ref. Number	Sample Type	(m)	Tiosulta	Star
• MADE G	ROUND (consisting)	of tarmac)					<u>} </u>				
	ROUND (consisting sub-base)	of compac	t angular			0.20	W7835	в	0.40		
Firm bro	wn sandy CLAY with	fine to coa	arse gravel				1000	D	0.40		
1							W7836	в	1.00	N = 16	
										(1, 2, 5, 4, 4, 3)	
2							W7837	в	2.00	N = 19	
								-		(1, 2, 4, 4, 5, 6)	
					-				l		
Very stiff 3 gravelly	to hard dark brown/g CLAY with cobbles	grey brown	sandy			2.80	W7838 W7839	B B	2.80 3.00	N = 38	
								-		(2, 4, 7, 9, 10, 12)	
4							W7840	в	4.00	N = 42	
										(2, 5, 8, 10, 12, 12)	
				<u> </u>							
5							W7841	в	5.00	N = 72	
Ĩ				<u> </u>			VV704 I	В	5.00	(2, 4, 10, 18, 20, 24)	
						ŀ				2-47	
6							14/79.40	В	6.00	N = 43	
							W7842	В	6.00	(1, 4, 7, 10, 12, 14)	X
-										N = 53	
7							W7843	В	7.00	(2, 5, 9, 12, 15, 17)	X
				<u> </u>							
				<u> </u>					ſ	N = 49/85 mm	
8							W7844	В	8.00	(2, 15, 24, 25)	
End of E	orehole at 8.50 m					8.50	-				
9											
						L.					
	TA DODINO/OU HOT				CD OT					, <u> </u>	
	(m) Time Com	ments		Wate	ər C	asing	Sealed	Rise	Time	Comments	
	(m) (h) Com .9 1			Strik		Depth	At	To	(min)		
4.8 4	.9 0.5									BH Dry	
	0.75 0.5 2										
				GROU		TER DE	AILS		·	· · · · · · · · · · · · · · · · · · ·	
INSTALLATI	ON DETAILS			Dat	te	Hole Depth	Casing Depth	Depth Wate	ro Comm	nents	
	ip Depth RZ Top R	Z Base	Туре	01-06	6-06	8.50	0.00		BH Dr	γ	
Date 1	I I						1				
Date 1			=								_

ETA		CEOT	ECUNICA			DECO	חח			REPORT NUMBER	
IGSL	· ·	GEOT	ECHNICA	AL BUR	ING	RECC		$\mathbf{R6}$	61	7 11836	
CONTRACT	Blanchardst	own S.C.						BOR SHE		O. BH6 Sheet 1 of 1	1
CO-ORDINA	ATES(_)			id level (1 Ole diami		(mm) 2	200	DAT	E STARTI E COMPL	ED 02/06/2006	
CLIENT ENGINEER	McAleer & F Ian Black Co			OLE DEPTI	• •		5.80 5.80	PRO	ED BY	IGSL BY Z. Knotkova	3
Ê					c	(F		Samples	6	_	
Depth (m)	De	escription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Field Test Results	
MADE	GROUND (cons GROUND (cons - sub-base) rown sandy grave	isting of tarmac) isting of compac	t angular			0.20	W7845	в	0.40		
- 1	own sandy grav						W7846	в	1.00	N = 15 (1, 2, 4, 4, 3, 4)	
2							W7847	в	2.00	N = 18 (1, 3, 5, 7, 3, 3)	
3							W7848	В	3.00	N = 12 (1, 1, 2, 3, 3, 4)	
4 Stiff are	ey brown gravell	V CLAY				4.50	W7849	В	4.00	N = 14 (1, 1, 4, 3, 3, 4)	
	y brown gravon						W7850	в	5.00	N = 24 (1, 2, 3, 5, 7, 9)	
End of	Borehole at 5.80) m		<u> </u>		5.80		:			
7									x		
- 8											
- 9											
						\				-	
	ATA BORING/C	Comments		Wate	r (Sealed	Rise	Time	Comments	
2.5	0 (iii) (h) 2.6 0.75 5.8 2			Strike	•	Depth	At	To	(min)	BH Dry	
				GROU							
INSTALLAT	TION DETAILS			Dat		Hole Depth	Casing Depth	Depth 1 Water	to Comn	nents	
Date 02/06/2006	Tip Depth RZ T	- i I	Type 50mm SP	02-06	-06	5.80	0.00		BH Di	ry	

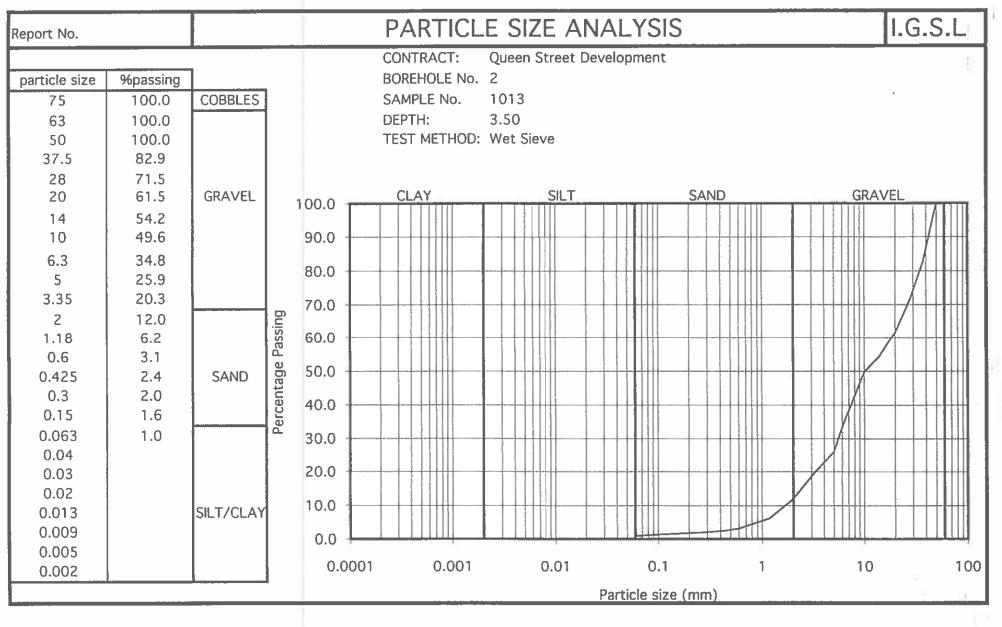
Queen St. Bh1/1006/3m



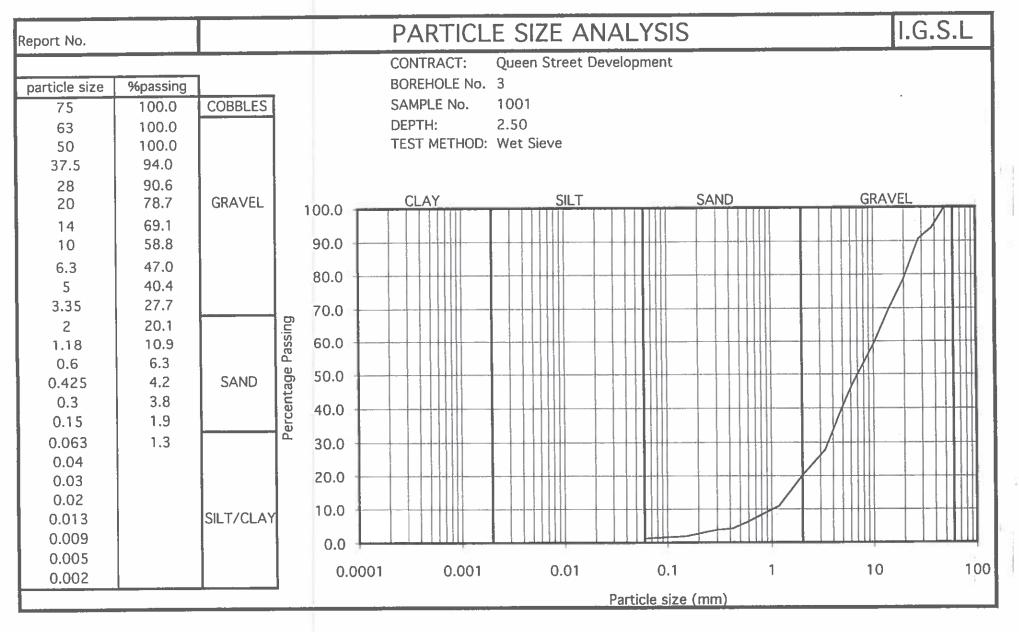
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Queen St. Bh2/1013/3.5m

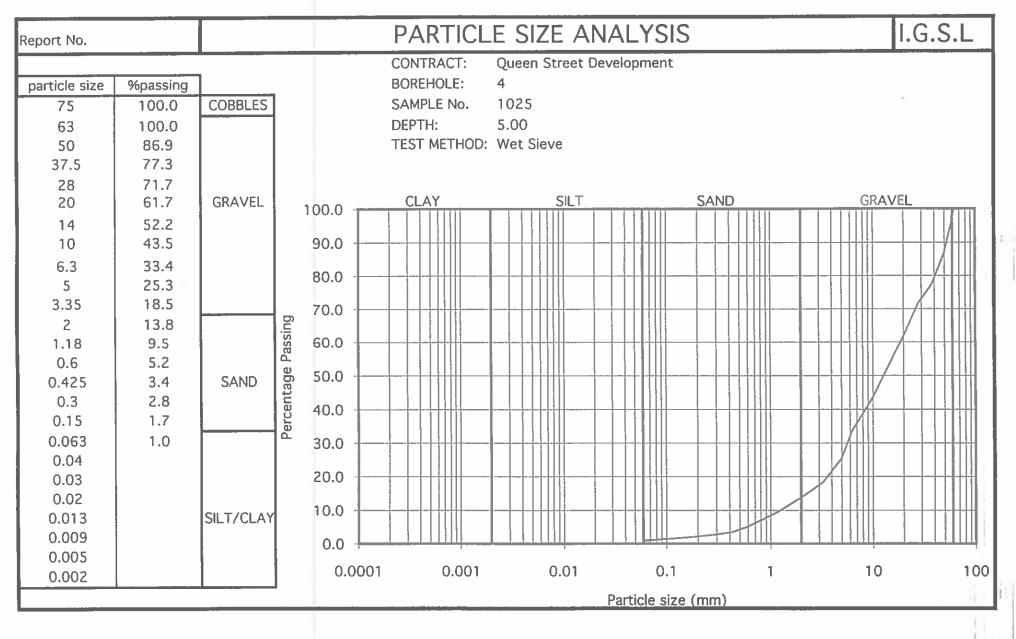
R3919



Queen St. Bh3/1001/2.5m

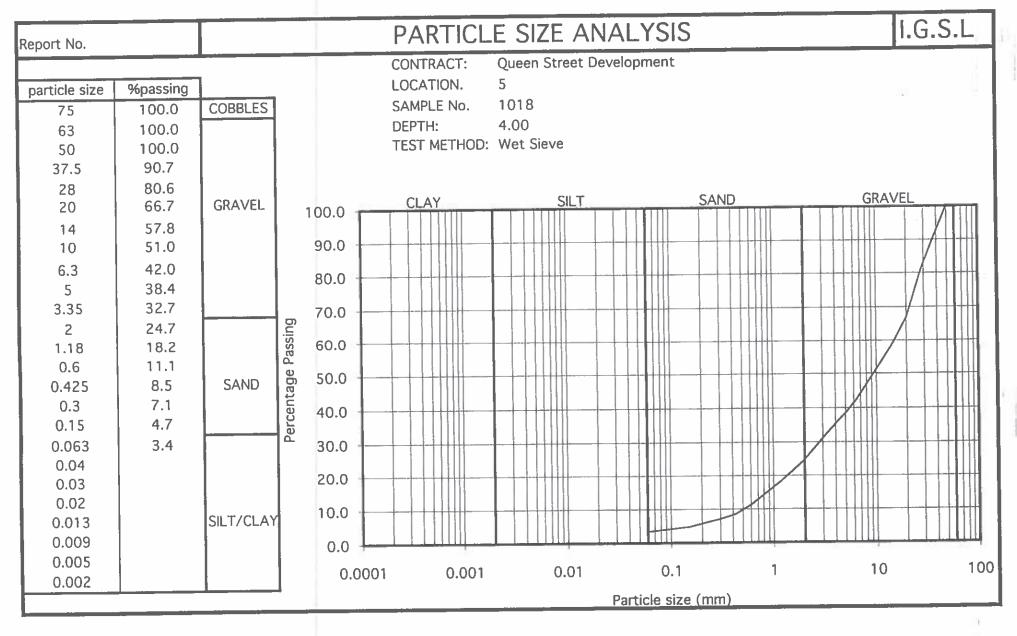


Queen St.Bh4/1025/5m



Queen St Bh5/1018 /4m

R3919

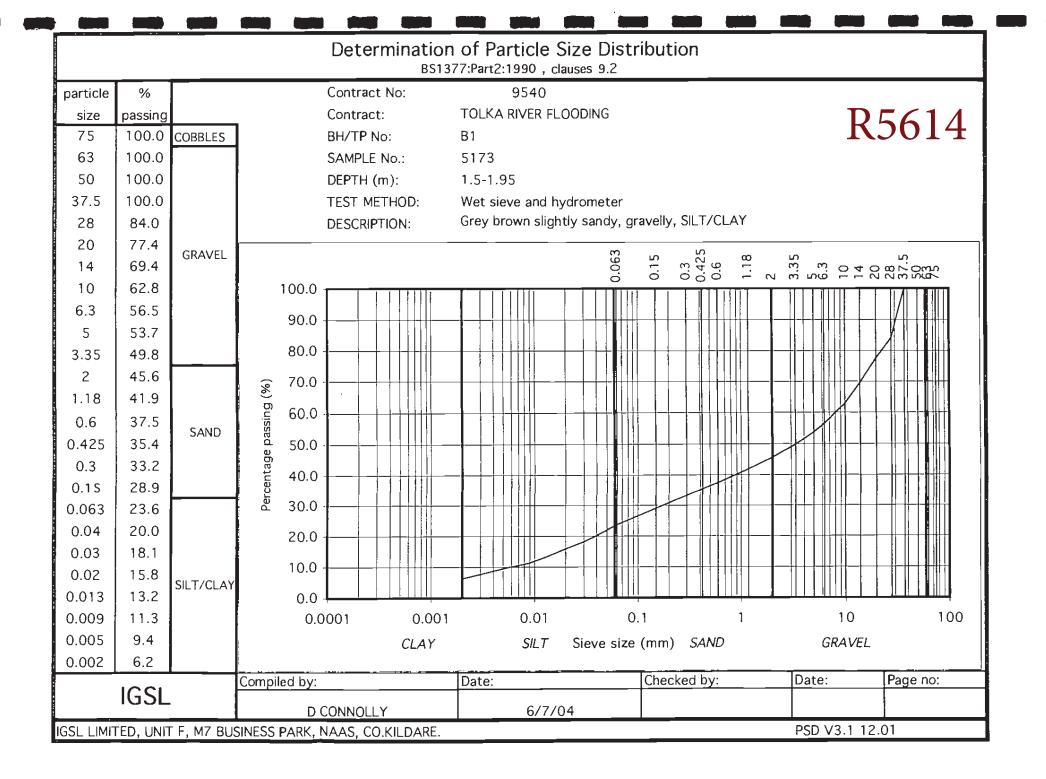


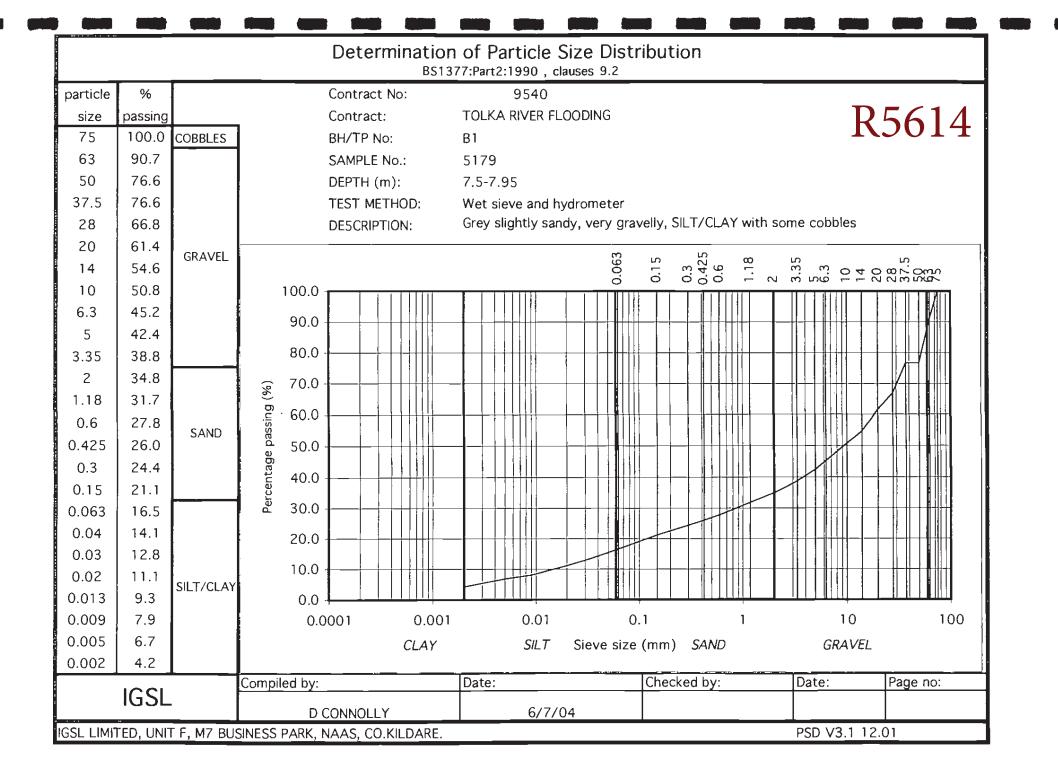
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R3919

							I	R 391	9	i i
Down and Alle				CLASSIFICATION	TEST RESULTS					IGSL
Report No Contract:		Queen Str	eet, Dublin							1
Borehole No.	Depth (M)	Reference No.		Description	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Water Content %	pН	Sulphate Content %
1	5.50	1009	Black slightly sil	ty gravelly CLAY with cobbles	33	21	12	10.45		
3	5.00	1003	Black slightly sil	ty gravelly CLAY with cobbles	23	14	9	11.89		di di
							=			sa.
										SI
										3
										9
									<u> </u>	

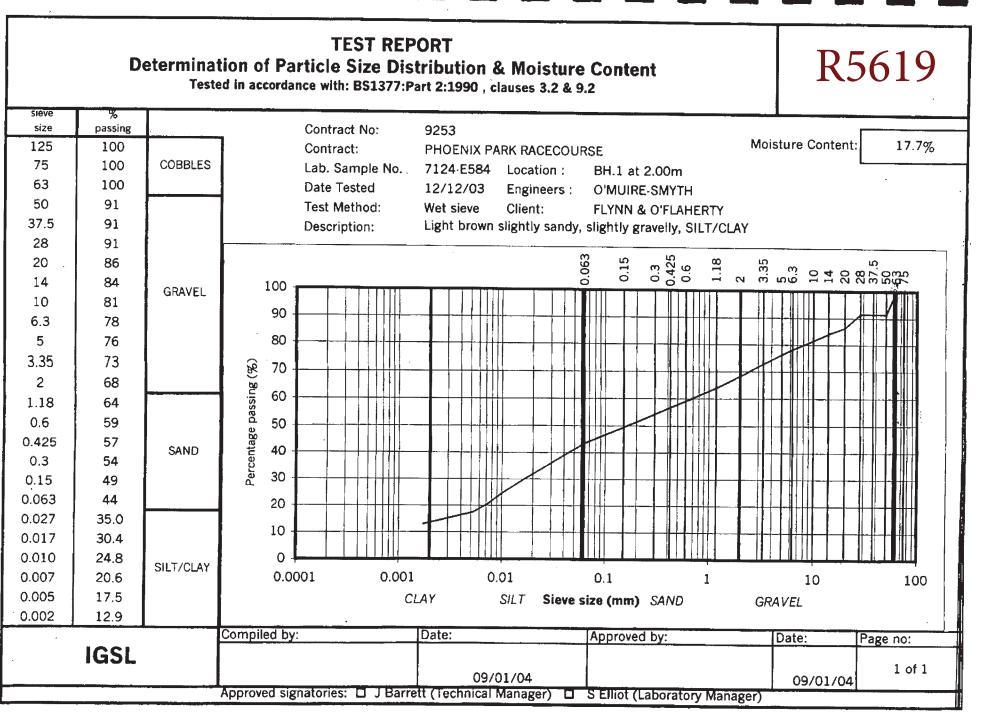
	<u>0</u>											
					(3), 101, 101,	Summary of						
		r	1			1377:Part 2:1						
BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	<425µm %	Preparation	Description	1	Classificat
A2	5150	2.50	В	8.2	26	16	10	44.5	ws	Grey brown s	lightly sandy slightly gravelly CLAY	CL
A2	5154	6.50	В	19.9	27	16	11	52.7	WS	Grey brown s	lightly sandy slightly gravelly CLAY	CL
A1	5157	1.50	В	8.5	24	15	9.	45	WS	Grey brown s	lightly sandy slightly gravelly CLAY	CL
A1	5160	4.50	В	9.8	27	16	11	51.5	ws	Grey brown s	lightly sandy slightly gravelly CLAY	CL
A1	5161	5.50	В	18.5	40	22	18	45.5	WS	Grey brown s	lightly sandy slightly gravelly CLAY	СІ
B2	5166	2.50	В	14.7	39	22	17	29	WS	Grey brown s	lightly sandy slightly gravelly CLAY	СІ
B2	5170	6.50	В	13.4	30	19	11	42.2	WS	Brown slightly	sandy slightly gravelly CLAY	CL
B2	5171	7.50	В	10.5	23	16	7	35.3	WS	Grey slightly s	sandy gravelly CLAY	CL
B1	5175	3.50	В	14	30	18	12	47.4	WS	Brown slightly	sandy slightly gravelly CLAY	CL
B1	5177	5.50	В	11.8	36	21	15	23.8	WS	Grey brown s	ightly sandy gravelly CLAY	CI
												_
		_										
			_									
												_
												_
				-								
otes:	NAT - teste			et sieved (425)	um)NP-N	on Plastic						
	1001		Contract					DING			Contract No. 9540	
	IGSL		Compiled B	у		Date	Checked By		20-	Date	Page	
			D CONNOL	LY		6/7/04					of	



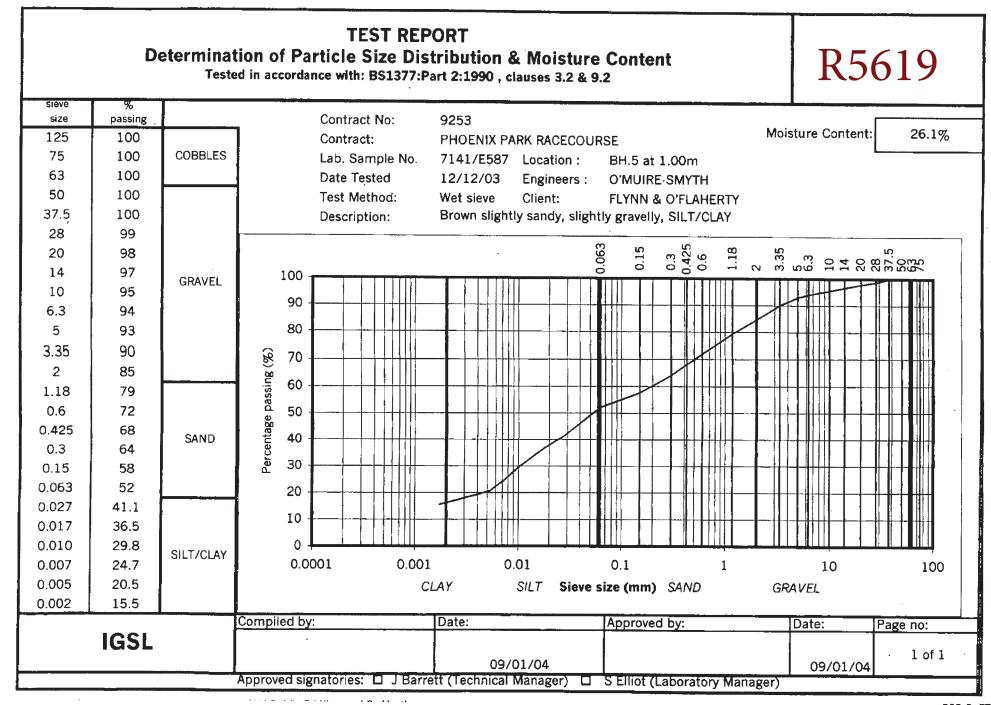


9253			CLASSIFICATION TEST	RESULTS	S		TO BS 1377:1	990:PART2:CL	4&5	IGSL
Contra	act:		PHOENIX PARK DEVELOPMENT					DE	610	
BH/TP No.	Depth (M)	Ref No.	Description	Passing 425um %	Test Code	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	classification	Water Content %
BH G2	2.00	7135	Brown sandy gravelly CLAY	. 54	A	24	12	12	CL	12.4
BH G3	2.00	7130	Brown sandy gravelly CLAY	51	А	22	11	11	CL	10.9
BH1	2.00	7124	Brown sandy gravelly CLAY	.48	A	20	11	9	CL	10.6
BH 2	1.00	7126	Brown sandy CLAY with roots	68	A	24	15	. 9	CL	19.8
BH 5	1.00	7141	Grey brown sandy gravelly CLAY	42	А	21	13	8	CL	10.3
BH 6	1.00	7143	Dark brown sandy gravelly CLAY	38	A	20	10	10	CL	9.8
TP 1	2.00	2747	Brown sandy gravelly CLAY	49	A	21	11	10	CL	10.4
	3.00	2748	Black gravelly CLAY	55	A	23	12	11	CL	8.6
TP 4	1.00	2717	Brown sandy gravelly CLAY	52	А	24	13	11	CL	14.5
	3.00	2720	Black gravelly CLAY	49	А	22	13	9	CL	9. 0
									•	

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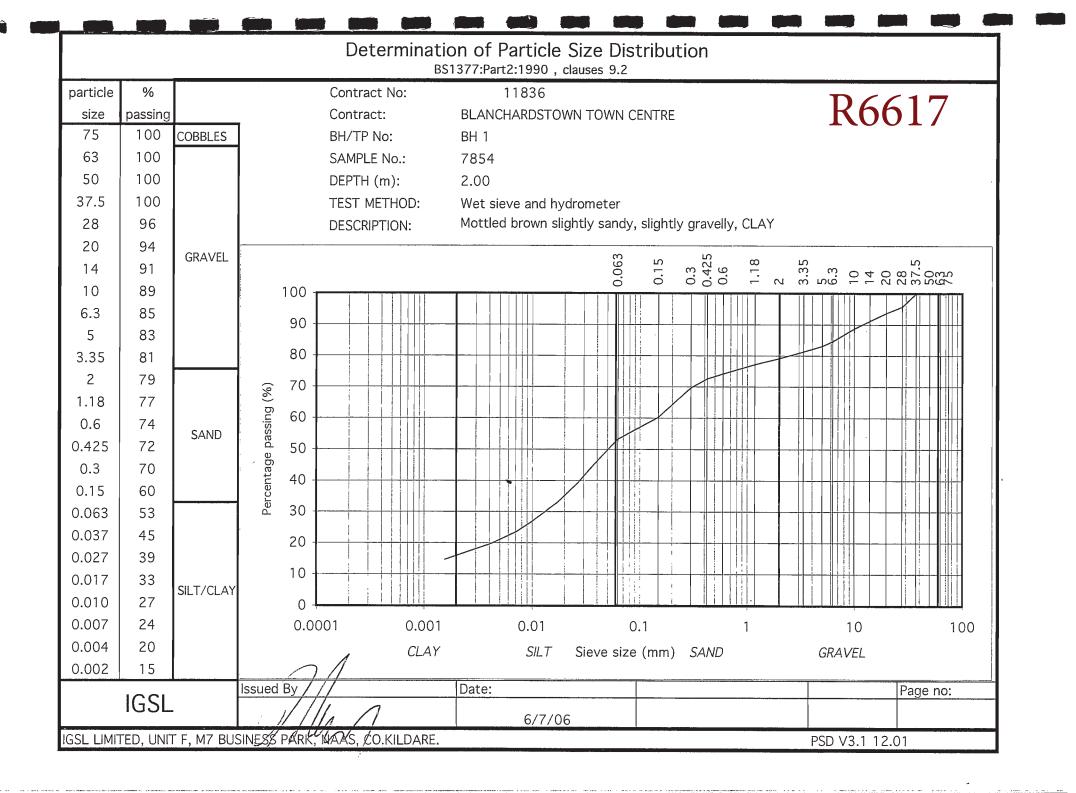


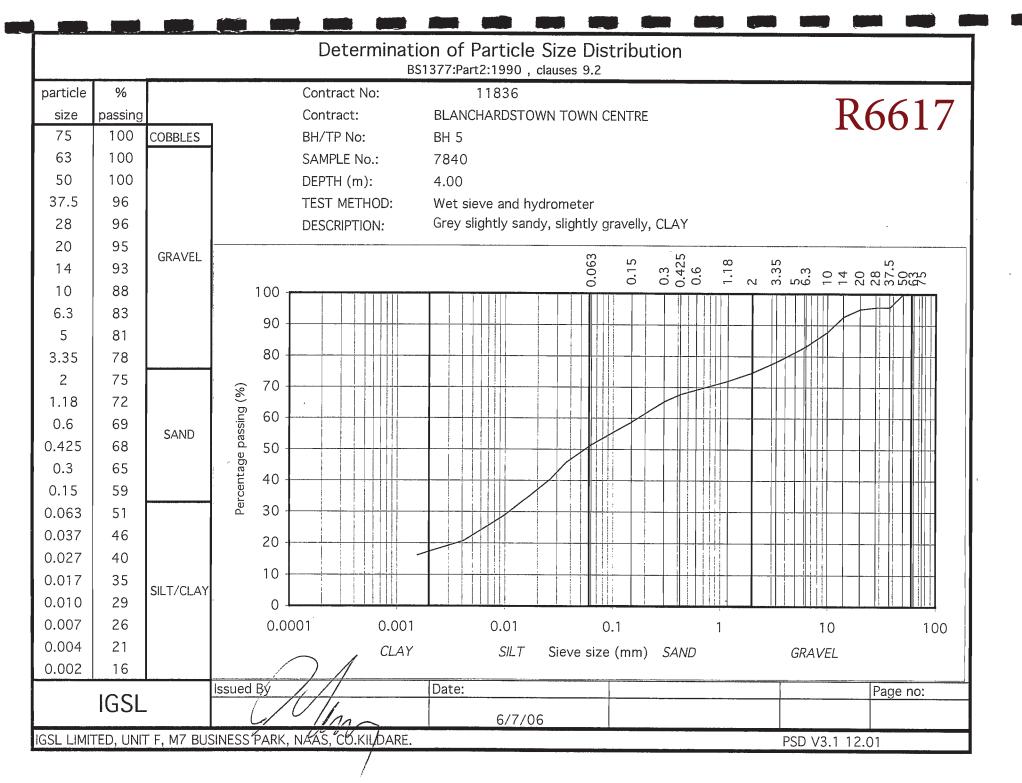
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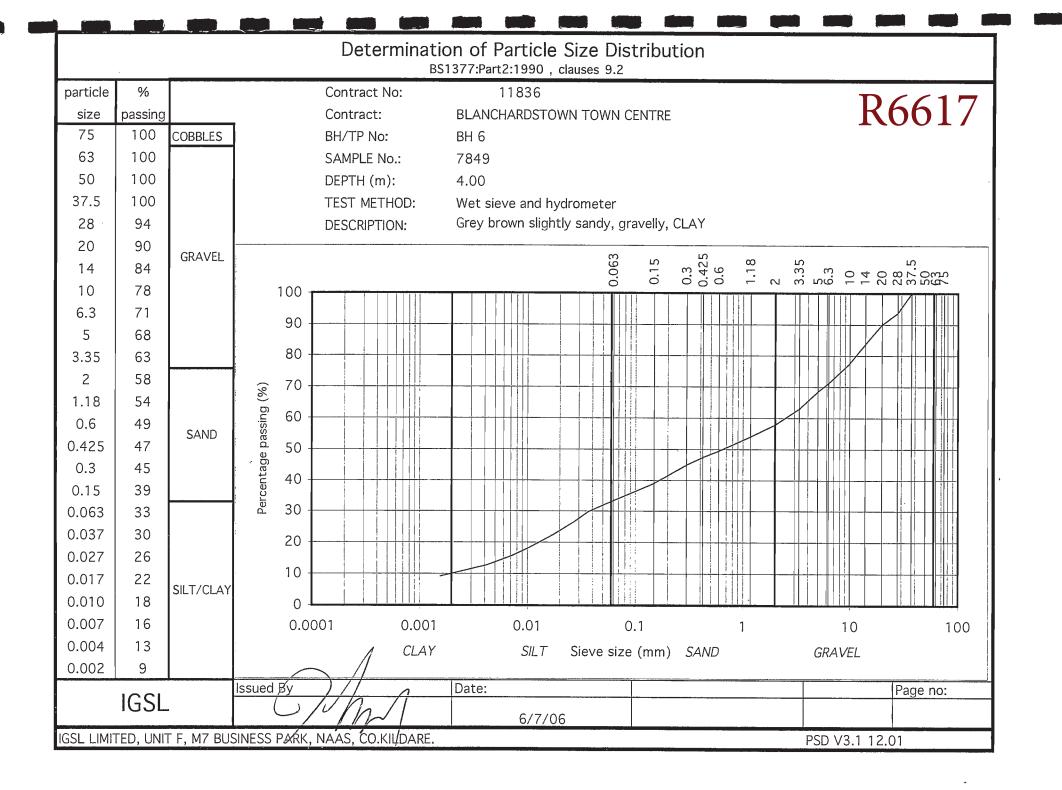


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PSD Radia







	Summary of Classification Tests BS1377:Part 2:1990, clauses 3.2, 4.3, 5.3 & 5.4													
	<u> </u>										······································			
BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	<425µm %	Preparation	Descriptio	n	Classification		
BH 1	7854	2.00	D	14.6	33	16	17	72.0	WS	Mottled brow	wn slightly sandy slightly gravelly CLAY	CL		
BH 2	7281	3.00	D	11.7	28	16	12	61.7	WS	Mottled grey	y slightly sandy slightly gravelly CLAY	CL		
BH 3	7862	2.00	D	11.9	31	15	16	75.1	WS	Brown slight	tly sandy slightly gravelly CLAY	CL		
BH 3	7866	6.00	D	12.2	31	15	16	72.5	WS	Mottled grey	/ brown slightly sandy slightly gravelly CLAY	CL		
BH 4	7826	1.00	D	10.5	32	15	17	75.3	WS	Mottled brow	wn slightly sandy slightly gravelly CLAY	CL		
BH 5	7840	4.00	D	11.1	29	14	15	68.0	WS	Grey slightly	/ sandy slightly gravelly CLAY	CL		
BH 6	7846	1.00	D	21	51	26	25	66.9	WS	Brown slight	tly sandy slightly gravelly CLAY	СН		
BH 6	7849	4.00	D	14.7	30	16	14	47.0	WS	Grey brown	slightly sandy slightly gravelly CLAY	CL		
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 					····									
Notes:	NAT - teste	ed as receiv		et sieved (425	um) NP - N	on Plastic		· · · · · · · · · · · · · · · · · · ·						
Contract BLANCHARD								/N CENTRI	E		Contract No. 11836			
	IGSL		Issued By			Date				Date	Page			
	·			/////n	~ 1	6/7/06					of			

Appendix F

Geotechnical Risk Register

ARUP

JOB TITLE	Blanchardstown to City Centre Core Bus Corridor
JOB NUMBER	268401-00
MADE BY	Ozgur Alper
CHECKED BY	Geoff Petelka
DATE	30/06/021
Description of spreadsheet	Geotechnical Risk Register
Member/Location	
Filename	Geotechnical Risk Register

CONTENTS OF SPREADSHEET

Sheet	Description
Cover	
Notes	
Geotechnical Risk Register	
Hide	Hidden

AUTHORISATION OF LATEST VERSION

Type and method of check		
Signatures & dates:	Made by	
	Checked	

REVISION	IS	Curre	nt Revision	
		Cur	rent Status	
Rev.	Date	Made by	Checked	Description
1	08/07/021	OA	GP	JoC

(1) Purpose of spreadsheet

1. The Geotechnical Risk Register should be utilised as a live document throughout the life cycle of the design process (*i.e. from desk study stage through to construction*)

2. The RR has been designed for the user to initially identify the hazard and subsequently identify the associated risks.

3. While in the past the hazard and associated risk may have been amalgamated into a single input, this suggested method forces the users to think about the specific hazard which may exists and additional risks which could arise.

(2) Key Notes of Guidance

1. This is a risk register. As such each item should be developed around a particular risk. In some situations, a single hazard may present two or more different risks. If this is the case, each risk should be identified and itemised in the register.

2. The sub-ref should be used in situations where a risk evolves over the life-cycle of the project. i.e. a subseugent aspect of the risk has been identified even after the prescribed mitigation control.

(3) Risk Analysis Matrix

Risk Table		Severity							
Likelihood	н	H M							
Н	н	н	М						
М	н	L							
L	м	L	L						

(4) Sources of data & Links to other spreadsheets

on

(5) Special features

(6) Diary of development, including checking

(if supplement is needed to Cover page)

Date	Who	Description

Best Practice Guide

1. Don't duplicate raw data in the spreadsheet i.e. use cell references where possible.

- 2. Use colours to distinguish between fixed data, user-variable data, calculations and results.
- 3. Explicitly define constants to be used in equations, using named cells where appropriate.
- 4. Avoid password use unless essential and documented (to avoid loss of work with loss of password).
- 5. Ensure extracts copied to other documents can be traced back to the spreadsheet.
- 6. Plot to engineering scale whenever sensible to do so, and make units obvious.
- 7. For charts, use colours/patterns which will be distinguishable if printed or photocopied in black & white.
- 8. Give sheets & workbooks descriptive names.
- 9. Use comments to describe the purpose of individual cells and ranges of cells.
- 10. Use the revision facility on the cover page and maintain the diary where further details required.

GEOTECHNICAL RISK REGISTER

Please refer to notes for more information
Rev.

Particular Definitions

JOB TITLE: Blanchardstown to City Centre Core Bus Corridor JOB NO: 268401-00

Hazard: Ground conditions and geotechnical related elements which have the potential to adversely impact on the project. Risk: The consequence if a particular hazard was to occur or was left untreated.



Ref.	Sub	Created	Ву	Phase of Works		Hazard		Risk		Risk /		Pre-Mitigatior Risk Analysis	1	Risk Control Mitiga	sk Control Mitigation Measures				I	Status	
Kei.	Ref.	Date	Initials	and/or Source	and/or Source	Hazard	Observation / Cause	Location of Hazard	Risk Exposure	Risk Impact Category	Opportunity	Likelihood L/M/H	Severity L/M/H	Risk L/M/H	Mitigation Measures	Phase of Application	Required by	Likelihood L/M/H	Severity L/M/H	Risk L/M/H	Status
1	(i)	30/06/2016	OA	Preliminary Design	Contamination	Encountering unexpected contaminated ground during construction.	Site Extent	Material present may be contaminated. This presents a health and safety risk during the construction.	Health & Safety	R	м	м	м	Further GI to be scheduled at detailed Design	Ground Investigation	Client	L	L	L	Active	
2	(i)	30/06/2016	OA	Preliminary Design	Contamination	Presence of made ground	Site Extent	Material excavated during the works may not be suitable for reuse on site and require disposal to a licenced landfill.	Commercial	R	м	М	м	Further GI to be scheduled at detailed Design	Ground Investigation	Client	м	L	L	Active	
3	(ii)	30/06/2016	OA	Preliminary Design	Unforeseen ground conditions	Less favourable ground material properties.	Geology	More excavation and replacement or ground treatment required.	Design	R	м	м	М	The detailed design should assess the proposed scheme elements and local ground conditions in accordance with Eurocode 7.		Client	L	L	L	Active	
4	(iii)	30/06/2016	OA	Preliminary Design	Settlement	Presence of very soft to soft material at Tolka River Bridge Widening	Geology	Material present may cause settlement and bearing resistance problems.	Design	R	н	н	н	The detailed design should consider the soft material.	Detailed Design	Client	L	L	L	Active	
5	(iii)	30/06/2016	OA	Preliminary Design	Settlement	Presence of very soft to soft material at old Phoenix Park Racecourse based on historical ground investigation data	Geology	Material present may cause settlement and bearing resistance problems.	Design	R	м	М	м	Further GI to be scheduled at detailed Design	Detailed Design	Client	L	L	L	Active	
6	(ii)	30/06/2016	OA	Preliminary Design	Unforeseen ground conditions	Low undrained shear strength and effective parameters of Made Ground	Geology	Material present may cause settlement and bearing resistance problems.	Design	R	н	М	н	Strength and physical properties of made ground should be investigated at site before the construction	Detailed Design	Contractor	L	L	L	Active	
7	(iv)	30/06/2016	OA	Preliminary Design	Chemically reactive ground	Aggressive ground conditions	Geology	Chemical attack on buried concrete due to acid and/or sulphate in the soil or ground water.	Design	R	м	м	М	Limited sulphate and pH level testing indicates that aggressive ground is not present. Concrete class shall be chosen to ensure required durability.	Detailed Design	Contractor	L	L	L	Active	
8	(i)	30/06/2016	OA	Preliminary Design	Contamination	Re-useability of the material	Geology	Material excavated during the works may not be suitable for reuse on site and require disposal to a licenced landfill or require suitable material to be imported.	Design	R	М	М	м	Further GI to be scheduled at detailed Design	Ground Investigation	Client	L	L	L	Active	
9	(iii)	30/06/2016	OA	Preliminary Design	Settlement	Insufficient characterisation of the ground materials.	Geology	Unexpected or poor ground materials could lead to excessive deformation of the retaining walls if it is not assessed and considered during detailed design.	Design	R	м	м	М	Further GI to be scheduled at detailed Design	Detailed Design	Client	L	L	L	Active	